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Vaginal Birth After Cesarean (VBAC)

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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. 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 written comments on this evidence report. They may be sent to: Director, Center for Practice and Technology Assessment, Agency for Healthcare Research and Quality, 6010 Executive Blvd., Suite 300, Rockville, MD 20852.

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We also thank the representatives from the American College of Obstetricians and Gynecologists and the American Academy of Family Physicians, our technical expert panel, our peer reviewers, and those on the uterine rupture terminology conference call for their invaluable contributions.

Structured Abstract

Objectives. The literature was systematically reviewed to compare the benefits and harms of a trial of labor (TOL) and an elective repeat cesarean delivery (ERCD), and to examine factors that influence decisionmaking.

Search strategy. Published literature on all vaginal birth after cesarean (VBAC) topics was identified by multiple searches of MEDLINE® (1966 to 2002) and HealthSTAR (1975 to 2002), from reference lists of systematic reviews, and from local and national experts. Online searches were performed on Cochrane systematic reviews and controlled trials registry, Centre for Reviews and Dissemination sites, and EMBASE databases. For topics related to patient preferences and satisfaction, PsycINFO and CINAHL® databases were also searched.

Selection criteria. Studies begun or published before 1980 and studies that focused on patients with specific conditions such as gestational diabetes, human immunodeficiency virus, preeclampsia, and so on were excluded. Studies that exclusively focused on nulliparous women; vertical, lower vertical, "classical" or "classic" cesarean incisions; vaginal breech delivery; preterm delivery; multiple gestation; or low birth weight were also excluded.

Data Collection and Analysis. A technical advisory panel provided input from obstetricians, family physicians, nurse midwives, payers, and patients to ensure that the project addressed clinical questions and issues. An analytic framework was developed and later refined with input from national experts and members of the technical panel. The framework relates the 10 topics reviewed on clinical decision-making for pregnant women with prior cesarean delivery. The strength and suitability of the evidence regarding the risks of major maternal and infant morbidity and mortality associated with TOL and ERCD is the main focus of this report. Studies were rated for quality. We included 180 articles with original data about maternal and infant outcomes relevant to a key question in one or more topic areas.

Main Results. The literature concerning TOL and ERCD is flawed in several ways: imprecise measurement of outcomes (e.g., maternal infection, perinatal death), making it difficult to determine the portion of events directly attributable to maternal choice of delivery route; lack of standards for terminology (e.g., no standard classification for severity of uterine rupture, nor attribution specifically to the disruption of the cesarean scar); and limited attention to comparability between groups (e.g., studies of ERCD where it is unclear whether patients were eligible for TOL). Similarly, important definitional confounding prevents determination of whether signs, such as prolonged fetal bradycardia, have any predictive premonitory value.

There is no direct evidence regarding the benefits and harms of TOL relative to ERCD in women who are similar in every respect except choice of delivery route. Several large cohort studies provide indirect evidence about relative benefits and harms of TOL versus ERCD. Overall, these studies report an increased risk of perinatal death and symptomatic uterine rupture of a cesarean scar with TOL, no increased risk of asymptomatic uterine rupture (dehiscence), maternal death or hysterectomy from either route, and increased risk of infection from ERCD. However, the magnitude of risk is uncertain due to methodologic deficiencies of the studies.

Further studies are needed to test the reliability and usefulness of economic models and predictive tools.

The literature concerning factors that influence patient decisionmaking and satisfaction with childbirth was poor, giving us little insights into patient's priorities.

Conclusions. The deficiencies in the literature about the relative benefits and harms of TOL versus ERCD are striking. Patients, clinicians, insurers, and policymakers do not have the data they need to make truly informed decisions about appropriate delivery choices following one of the most common surgical procedures performed on women. Given the rising prevalence of this condition, and potential for devastating consequences for thousands of women and children each year, obtaining accurate data should be a high research priority.

Agency for Healthcare Research and Quality

Evidence Report/Technology Assessment

Number 71

Vaginal Birth After Cesarean (VBAC)

Summary

Purpose of Report and Target Audience

This report provides a framework for comparing the harms and benefits of delivery options for women with prior cesarean delivery (CD). The information is designed to help consumers, providers, payers, and policymakers in decisionmaking about repeat cesarean or trial of labor (TOL).

Overview

In 2000, 22.9 percent of all births in the United States occurred by CD. This rate is the highest total CD rate reported since data collection began in 1989. The vaginal birth after cesarean (VBAC) rate, defined as the proportion of women with a prior CD who delivered vaginally, steadily increased from 1989 to 1996. As allowing TOL became more common, practice variation became a larger concern, e.g., expanding criteria for eligibility and medical induction, and for augmentation of labor. In parallel with this liberalization of criteria and management, highly publicized articles suggested that maternal and fetal risks were perceived to be increasing. Subsequently, the VBAC rate has decreased 27 percent from 1996 to 2000. Currently, a crisis in malpractice rates is decreasing the availability of maternity care providers and raising concerns that patients may have limited options, less access to care, and perhaps be at increased risk for complications.

Reporting the Evidence

The strength and suitability of the evidence regarding the risks of major maternal and infant morbidity and mortality associated with TOL or elective repeat cesarean delivery (ERCD) in women with prior low transverse of unknown scar. The scope of the review was to examine events that were specifically related to having had a prior CD. Comparisons purely about vaginal versus cesarean delivery such as incontinence, pelvic support disorders, and respiratory consequences but not specifically about VBAC or repeat cesarean, were not considered, though these topics are important to consider when deciding upon route of delivery. In judging the suitability of evidence, we took the perspective that the first thing a decision-maker would want to know is whether the risk of these complications is higher for a trial of labor, versus an elective cesarean delivery, under optimal conditions of care. That is, the most relevant evidence would compare the outcomes and risks of a properly managed trial of labor to that of a properly conducted elective cesarean delivery. Some components of obstetric care, as well as some aspects of the setting of this care, might increase the risks of TOL or ERCD. For example, it has been hypothesized that the use (or misuse) of drugs for induction and augmentation might increase the risk of uterine rupture in patients who have had a prior cesarean delivery. We examined the strength of evidence that these factors influence these outcomes and adverse effects and to what extent these factors can explain the results of observational studies of VBAC complications.

Methodology

Key Questions

Two types of key questions were addressed. The first group (Questions 1- 7) compares the outcomes of a TOL and an ERCD:

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1. What is the frequency of vaginal delivery in women who undergo a TOL (spontaneous onset, induced, and augmented) after prior low transverse cesarean or unknown scar?
2. How accurate are risk assessment tools for identifying patients who will have a vaginal delivery after a TOL?
3. What are the relative harms associated with a TOL (spontaneous onset, induced, and augmented) and repeat cesarean?
4. What is the incidence of uterine rupture, and are there methods for preventing major morbidity and mortality due to uterine rupture?
5. What are the health status and health-related quality of life for VBAC and repeat cesarean patients?
6. Regarding VBAC and repeat cesarean, what factors influence patient satisfaction/dissatisfaction with their childbirth experience?
7. How are economic outcomes related to VBAC, repeat CD, and their respective complications?

The second group (Questions 8-10) address factors influencing the decision to have a TOL:

8. What individual factors influence route of delivery?
9. What factors influence a patient's decisionmaking regarding VBAC or ERCD?
10. How do legislation, policy, guidelines, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?

Relevant studies were identified from multiple searches of MEDLINE® (1966 to 2002) and HealthSTAR (1975 to 2002), from the reference lists of systematic reviews and from local and national experts. The online Cochrane systematic reviews and controlled trials registries, DARE, National Centre for Reviews and Dissemination, and EMBASE databases were searched for relevant literature on specific topics as well. For topics related to patient preferences and satisfaction, PsycINFO and CINAHL® databases were searched. Databases were searched twice during the course of the project, with the final search in March 2002. For all VBAC topics combined, 14,449 citations were retrieved, including 4,867 about spontaneous labor and uterine rupture, 2,528 about ERCD, 2,416 about induction of labor, 2,945 citations about predictors, 1,257 about patient satisfaction, preference and health status, and 436 about cost and access.

All searches were limited to English-language articles published since 1980 (the date of the NIH Consensus Conference on VBAC) in developed countries. The report focused on studies that identified a group of patients with prior cesarean. For patient preferences and satisfaction, studies of the general birthing population, were considered if there were no studies that identified patients with prior cesarean. Studies were excluded if they focused on patients with particular conditions such as gestational diabetes, HIV, preeclampsia, and so on. Exclusions were also made for studies that focused primarily on the following: nulliparous women, vertical, lower vertical, "classical" or "classic" cesarean, vaginal breech delivery, preterm delivery, multiple gestation, or low birth weight.

Two investigators reviewed a random set of titles and abstracts for each topic to select articles for full-text review. When an appropriate level of reliability was reached for inclusion and exclusion of studies, the primary investigator reviewed the remaining titles and abstracts on the topic. Investigators read the full-text version of the retrieved papers and reapplied the initial eligibility criteria. Data from 224 studies were abstracted and included in the evidence tables described in the results section of this report.

Data Abstraction

Included study designs were determined by topic area. Study designs of included articles consisted of randomized controlled trials, cohort studies, case-control studies, cross-sectional studies, large case series (more than 10 subjects), and economic or decision models. All data were abstracted by the lead investigator for the topic. If the lead investigator encountered difficulty in finding or interpreting information in the published report, a second investigator reviewed the article and a consensus was reached.

Assessment of Study Quality

To assess the internal validity of individual studies, we applied a set of design-specific criteria developed by the current U.S. Preventive Services Task Force and additional criteria developed by the NHS Centre for Reviews and Dissemination, based at the University of York in England. In general, studies were rated good if they met all criteria, fair if they addressed some but not all criteria, and poor if they had a "fatal flaw." Investigators were asked to use the study quality ratings as previously described to determine for their topic which quality components were most important in assessing internal validity. This process allowed for some individual topic fit for fatal flaws, etc. A second investigator independently rated all included articles, and disagreements were resolved by consensus.

Data Synthesis

Where appropriate, meta-analysis was performed using WinBugs® or StatsDirect® software. To reduce potential bias, only studies of fair or good quality were included in the analyses.

Findings

Question 1. Likelihood of Vaginal Delivery

- Rates of vaginal delivery when attempting TOL ranged from 60 to 82 percent. The largest population-based

study reported a rate of 60.4 percent. The combined vaginal delivery rate for all prospective cohort studies, largely conducted in tertiary care centers and University settings, was 75.9 percent.

- There are limited data on the effect of medical induction and augmentation of labor.
- There was a 10-percent reduction in the likelihood of vaginal delivery when oxytocin was used for ether induction or augmentation. There was a similar trend in reduced likelihood of vaginal delivery with prostaglandins.

Question 2. Predictive Tools

- Two validated scoring systems categorized women into groups with likelihoods of vaginal delivery ranging from roughly 45 to 95 percent.
- One tool was able to stratify more of the population (up to 50 percent of women choosing TOL) into high and low probability subgroups, with a relatively low false-positive rate.
- By using a prospective cohort design and the largest study population, the best scoring system created a 10-point score based on the presence or absence of five variables commonly available for most patient admissions.
- An RCT clearly demonstrated the inability of X-ray pelvimetry (XRP) to predict route of delivery reliably.
- Imaging studies that combined the measurements of the pelvis and fetus showed promising results, but were limited by their lack of control for confounding and biases.

Question 3. Maternal and Infant Outcomes

General

- In the absence of RCTs of TOL versus repeat cesarean, evidence that is most generalizable comes from large country, State, or regional population-based studies (referred to as population-based studies) followed by large multicenter cohort studies, large single-institution or single-practice cohort studies, then smaller cohort studies, respectively.
- There is no direct evidence regarding the benefits and harms of TOL relative to ECRD in women who are similar in every respect except choice of delivery route.
- Several fair and good quality studies provide indirect evidence about relative benefits and harms of each route.

Maternal

- Maternal death rates did not differ between TOL and ERCD.
- The best evidence suggests that hysterectomy rates do not differ between TOL and ERCD.
- No studies examined specifically the risks of incontinence or pelvic support disorders in women with prior cesarean.
- Rates of infection were increased in ERCD versus TOL overall. Studies that performed subgroup analyses for TOL with and without vaginal delivery consistently found increased rates of infection for women who attempted TOL but ultimately had a cesarean delivery.
- There is conflicting evidence regarding whether induction of labor affects infection rates.

Infant

- There is insufficient evidence regarding the effect of selected route of delivery and Apgar score or respiratory morbidity.
- No study measured infant death directly attributable to a mother's choice of TOL or repeat CD.
- There is uncertainty about the magnitude of risk of perinatal death due to TOL. Results from two large studies differ in the magnitude of increased risk from TOL versus ERCD (90/1,000 TOL versus 50/1,000 ERCD compared with 12.9/1,000 TOL versus 1.1/1,000 ERCD). Neither study provides direct evidence of risk.

Question 4. Uterine Rupture

- The use of terms among studies is inconsistent.
- Definitions among studies for similar terms are ambiguous.
- There is no difference in asymptomatic uterine rupture rates in TOL versus ERCD.
- Symptomatic uterine rupture is significantly more common in TOL versus ERCD, with an increased risk of 2.7/1000.
- Based on the frequency and severity of symptomatic uterine rupture, the risk of perinatal death due to a rupture of a uterine scar is 1.5/10,000 and the risk of maternal hysterectomy is 4.8/10,000. These rates of serious complications such as perinatal death are probably more precise than overall risks from studies measuring death directly.
- The definition of uterine rupture as an outcome is confounded by a definition that includes the potential predictor of fetal heart rate (FHR) tracing abnormality.
- Measurement of frequency of occurrence, predictors for what population is at greatest risk, and predictors for poor outcomes are not possible, because of the lack of standard case definition.

Question 5. Health Status

- There were no studies of health status or health-related quality of life for VBAC or repeat CD patients.

Question 6. Patient Satisfaction

- Studies of patient satisfaction largely consisted of the patient's own provider obtaining information about patient satisfaction, introducing the possibility of measurement bias.
- Only two cross-sectional studies used methods other than the patient's own provider to obtain satisfaction information.
- No study measured satisfaction for the three types of delivery outcomes that could be experienced by women with prior CDs (VBAC, TOL followed by CD, or ERCD).

Question 7. Cost and Health Care Resources

- For a TOL success probability of 76 percent or greater, TOL is more cost-effective and provides higher quality of life.
- Further evaluation is needed of the sensitivity of the probability cut point of 76 percent to other potential predictor variables.

Question 8. Individual Factors

- The vast majority of studies looking at individual factors that influence the route of delivery were of poor quality due to the lack of control for confounding factors.
- The factors that were significantly associated with an increased likelihood of vaginal delivery (i.e., successful TOL) were maternal age less than 40 years, prior vaginal delivery (particularly vaginal delivery after cesarean), a nonrecurrent indication for the prior CD, and favorable cervical factors.
- The factors that were significantly associated with a decreased likelihood of vaginal delivery (i.e., failed TOL) were an increasing number of prior CD, gestational age greater than 40 weeks, birthweight greater than 4000 g, and augmentation of labor.

Question 9. Patient Preferences

- Patient preferences for birth choice are unclear because of the heterogeneity of the 11 included studies.
- Several factors appear related to choice for TOL (White race, prior vaginal delivery, lower levels of anxiety during the pregnancy).
- Lack of medical information along with cultural ideologies might account for minority women being less likely to attempt a TOL when compared with White women.
- A woman's choice for delivery was often based on social motives (e.g., easier recovery, so she can care for baby and children at home).
- Only four of 11 studies cited safety for mother or baby as important reasons for delivery choice.
- It remains unclear whether VBAC education increases the proportion of women who choose TOL.

Question 10. Legal, Provider, Hospital, Insurance Characteristics

General

- Studies of legislation, policy, guidelines, hospital characteristics, provider characteristics, insurance type, or access to care focus exclusively on VBAC rates rather than safety.

Legal

- No study provides direct evidence for the impact of malpractice issues on VBAC or ERCD.
- One study reported that VBAC rates increased when legislation was enacted that standardized VBAC guidelines had to be provided to obstetric providers.
- The best evidence suggests that use of opinion leaders provides a greater likelihood of changing practice compared with audit and feedback.

Provider

- Studies of provider characteristics failed to control for important variables such as patient selection bias.

Hospital

- VBAC rates were higher in teaching hospitals compared to private, community, regional, or non-teaching hospitals.
- Three studies conflicted over the effect of hospitals containing a neonatal intensive care unit (NICU).

Insurance

- There was conflicting evidence regarding whether insurance status predicts VBAC.

Summary of Evidence

The following summarizes the type of study design, the quality of the evidence from studies, and the suitability of the study design to answer the particular question for each key question.

Summary of Evidence of Key Questions

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 1			
What is the frequency of vaginal delivery in women who undergo a TOL (spontaneous onset, induced, and augmented) after prior low transverse cesarean or unknown scar?	II-2	Fair-Good: Several large prospective and retrospective studies; mostly consistent findings.	Greatest
Question 2			
How accurate are risk assessment tools for identifying patients who will have a vaginal delivery after a TOL?			
Predictive tools	II-2	Fair-Good: Large fair and good quality cohort studies suggest tools can provide additional information to predict likelihood of vaginal delivery.	Greatest
Imaging modalities	I	Good: Good quality RCT demonstrated that imaging was ineffective to predict vaginal birth.	Greatest
Question 3			
What are the relative harms associated with a TOL (spontaneous onset, induced and augmented) and repeat cesarean?	II-2	Fair-Poor: Several large cohort studies were inconsistent in their definitions for important health outcomes.	Moderate
Maternal Death		Fair: Studies consistently found no increased risk of maternal death from TOL versus ERCD.	Least
Hysterectomy		Fair-Poor: Many studies failed to report indication for hysterectomy.	Moderate
Transfusion		Fair: Two studies with consistent findings of slightly increased risk for transfusion in TOL although not significant in one.	Moderate
Infection		Poor: Definitions were inconsistent among studies.	Moderate
Incontinence/Pelvic Floor		No studies.	Moderate
Infant Death		Poor: Most studies found increased risk of perinatal death for TOL versus ERCD, but the magnitude of the increase varied greatly.	Least
Neurologic impairment		Poor: Few studies of poor quality.	Least
Respiratory impairment		No studies.	Moderate

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 4 What is the incidence of uterine rupture of a cesarean scar, and are there methods for preventing poor clinical outcomes?			
Incidence	II-2	Fair-Poor: Several large cohort studies which were inconsistent in terminology; many with consistent findings of increased risk of symptomatic uterine rupture in TOL versus ERCD.	Moderate
Methods for preventing poor outcomes	II-3	Poor: Few studies, variation in case definition. Fetal bradycardia was frequently associated with uterine rupture; however, inclusion of fetal tracing findings in the definition of uterine rupture makes it difficult to assess the true value.	Least
Question 5 What are the health status and health related quality of life for VBAC and repeat cesarean patients?	None	No studies of women with prior CD.	NA
Question 6 Regarding VBAC and repeat cesarean, what factors influence patient satisfaction/dissatisfaction with their childbirth experience?	III	Fair: Two cross-sectional studies with varied findings.	Least
Question 7 How are economic outcomes related to VBAC, repeat CD, and their respective complications?	Econ	Fair-Good: One good economic model suggests VBAC is cost-effective and provides higher quality of life when chance of vaginal delivery is 76 percent or greater.	Greatest
Question 8 What individual factors influence route of delivery?	II-2	Fair-Poor: Several retrospective cohort studies conducted; all vary in items considered, each with limited adjustment for confounders.	Moderate
Question 9 What factors influence a patient's decisionmaking regarding VBAC or ERCD?	I, II, III	Fair: One good RCT and eight fair quality cohort or cross-sectional studies found women who preferred TOL were more likely to be White, valued the process of labor, and valued social motives such as ease of recovery.	Moderate

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 10 How do legislation, policy, guidelines, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?			
Legislation	II-3	Poor: Few studies that examined only the impact onVBAC rates not safety. None examined the impact of the crisis in malpractice rates on access or safety.	Moderate
Guidelines	I, II	Fair-Good: Several studies with consistent findings that provision of guidelines especially with recommendations of opinion leaders increased VBAC rates; no studies on safety.	Moderate
Provider Characteristics	II	Poor: Several studies, none of which adjusted for differences in baseline risk or potential confounders.	Moderate
Hospital	II	Fair: Consistent findings that teaching hospitals had higher VBAC rates; no comparisons for safety.	Moderate
Insurance	II	Fair: Several studies with conflicting findings.	Moderate

*Study design categories—I: randomized, controlled trials; II-1: controlled trials without randomization; II-2: cohort or case-control; II-3: multiple time series; III: opinions, descriptive epidemiology. U.S. Preventive Services Task Force (1996).

†Suitability of study design categories—Greatest: For comparison studies: Concurrent comparison groups and prospective measurement of exposure and outcome; For rates: population-based or multicenter prospective cohort studies. Moderate: All retrospective designs or multiple pre or post measurements but no concurrent comparison group; Least: Single pre and post measurements and no concurrent comparison group or exposure and outcome measured in a single group at the same point in time. Community Preventive Services Task Force (2000).

Limitations

- Data are insufficient to allow conclusions about the most appropriate delivery choice for a given patient.
- Studies suffered from inconsistent and imprecise definitions for important outcomes.
- Studies frequently failed to ensure comparability between TOL and ERCD groups.
- No study or collection of studies, provide data about the impact of practice variation, provider characteristics, legal considerations such as the effect of rising malpractice rates on the safety of TOL or ERCD.
- The degree to which the association between fetal bradycardia and poor perinatal outcome from uterine rupture rather than confounding by factors detection bias is unclear.
- The degree to which the association between TOL and perinatal death reflects causation rather than confounding by factors such as misclassification of cases, lethal conditions of the fetus, or detection bias is unclear.

Future Research

Future research should focus on conducting methodologically rigorous studies to provide direct evidence regarding the relative benefits and harms of TOL and ERCD. If randomized trials are not done, good-quality studies of TOL versus ERCD must pay attention to the following:

Population. Studies should be conducted in populations of women who are similar in every respect except choice of delivery route (comparability of groups).

Specificity of intervention. Studies should pay close attention to and account for the importance of co-interventions such as use of oxytocin and other medical agents for augmentation or induction of labor.

Precise and standard outcome measures. Variations in reporting of important clinical outcomes were striking.

Studies should consider the following factors in developing outcome measures:

- Etiology. Outcomes such as hysterectomy, infection, maternal mortality, and perinatal mortality must pay specific attention to explicitly identifying the etiology. Lack of precision in this regard allows for both under and overreporting of cases due to misclassification. Examples include whether hysterectomy was performed due to maternal hemorrhage secondary to clinically significant uterine rupture versus hemorrhage due to abruption, uterine rupture through the uterine fundus in a woman with a low transverse incision either due to trauma or other non-incisional causes, and perinatal death due to lethal anomaly versus intolerance or management of labor.
- Standard terminology. In order to accurately measure outcomes, there must be a consistent terminology. Lack of this prevents accurate and meaningful comparisons of risks for each delivery choice. Outcomes such as infection, hemorrhage, and uterine rupture were not consistently defined.
- Separating prevention/prediction strategies from outcomes. As long as potentially important predictors of events such as prolonged fetal bradycardia as a predictor for clinically significant uterine rupture are included in the definition of uterine rupture, their true value as a predictor rather than a confounder will remain unknown.

Predictive Tools

Additional studies are needed to measure the accuracy and yields of existing predictive tools.

Future studies of predictive tools should include measurements of the consequences of false-positive screens and false-negative screens to determine whether there are clinically important harms that result from screening.

Cost

The costs (rather than charges) of labor and delivery and of the surgical processes are poorly understood. Detailed time-in-motion studies would help to estimate these costs.

Availability of the Full Report

The full evidence report from which this summary was taken was prepared for the Agency for Healthcare Research and Quality (AHRQ) by the Oregon Health & Science University Evidence-based Practice Center (EPC), Portland, OR, under Contract No. 290-97-0018. It is expected to be available in the winter 2003. At that time, printed copies may be obtained free of charge from the AHRQ Publications Clearinghouse by calling 800-358-9295. Requesters should ask for Evidence Report/Technology Assessment No. 71, *Vaginal Birth After Cesarean* (VBAC). In addition, Internet users will be able to access the report and this summary online through AHRQ's Web site at www.ahrq.gov.

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Evidence Report

Chapter 1. Introduction

Purpose of Report and Target Audience

This report provides a framework for comparing the harms and benefits of delivery options for women with prior cesarean delivery (CD). The information is designed to help consumers, providers, payers, and policymakers in decision-making about repeat cesarean or trial of labor (TOL).

Evidence-based Approach

An evidence report focuses attention on the strengths and limits of evidence from published studies about the effectiveness and/or harms of a clinical intervention. The development of an evidence report begins with a careful formulation of the problem. In this phase, a preliminary review of the literature and input from patients, clinicians, experts, and payers ensures that the scope of the project addresses clinical questions and issues that arise in everyday practice. An analytic framework is developed and used to identify the patient populations, interventions, health outcomes, and harms. Studies that measure health outcomes (such as maternal and infant mortality) are emphasized over studies of intermediate outcomes (such as nonreassuring fetal tracing). Studies providing evidence of a direct association between an intervention (elective repeat cesarean delivery [ERCD]) and health outcome (such as infant death) are said to provide direct evidence and are given greater weight than studies that provide indirect evidence.

An evidence report also emphasizes the quality of the evidence, giving weight to studies that are appropriately designed to answer a question and meet high methodologic standards that reduce the likelihood of biased results. To compare two different treatments or management strategies, the results of well-done, randomized controlled trials (RCTs) are regarded as better evidence than results of cohort, case-control, or cross-sectional studies. These designs, in turn, are considered better evidence than uncontrolled trials or case series. On the other hand, to assess a diagnostic test or prediction tool, certain observational study designs can provide the highest-quality evidence.

An evidence report pays particular attention to the generalizability of efficacy studies performed in controlled or academic settings. Observational studies that reflect actual clinical effectiveness in unselected patients and community settings can provide information that is more generally applicable than studies of highly selected subjects. In the context of developing clinical guidelines, evidence reports are useful because they define the limits of the evidence and clarify when the assertions about the value of the intervention are based on strong evidence from clinical studies. The quality of the evidence on effectiveness is a key component, but not the only component, in decisionmaking about clinical policies. Additional criteria include acceptability to physicians or patients, the potential for unrecognized harms, and cost-effectiveness.

Background and Significance

Discussions about vaginal delivery after prior CD first appeared in the literature in 1916. Cragin, who is attributed with coining the phrase "once a cesarean, always a cesarean," described cases of women surviving vaginal birth after cesarean (VBAC).[1]

With the development of safer surgical techniques and ancillary services (e.g., blood typing and transfusion, antibiotic therapy), the risk of CD decreased. By 1980, 16.5 percent of deliveries were conducted by cesarean. This was a marked increase from the rate of 5.5 percent in 1970.[2] As cesarean rates increased, national interest arose in reducing the rate of repeat cesarean, the leading indication for CD.[3] The National Institute of Child Health and Human Development (NICHD) convened a Consensus Development Conference in 1980 to assess why cesarean rates were rising and to determine whether CD resulted in improved fetal outcomes. It was determined that TOL after prior low transverse cesarean posed low risk to fetus and mother, but more data with larger numbers were needed. After 1980, VBAC rates rose. A series of highly publicized articles suggested that VBAC was associated with higher risks of uterine rupture[4] and maternal[5] and perinatal morbidity.[6] Currently, a crisis in malpractice rates is decreasing the availability of maternity care providers and potentially limiting options for patients.

Burden of Condition

In 2000, 22.9 percent of all births in the United States occurred by CD.[2] This rate is the highest total CD rate reported since data collection began in 1989.

The VBAC rate, defined as the proportion of women who delivered who have prior CD, steadily increased from 1989 to 1996, but it has been decreasing each year thereafter (Table 1). After 1996, rates of VBAC decreased within each reported race and ethnicity group, and decreased with increasing maternal age.[2, 7] Regional differences are evident: VBAC rates are highest in the Northeast (27.3 per 100 births to women who had a prior CD, in 1999), followed by the Midwest (26.8), the West (25.4), and the South (20.3).[8]

Table 1. Total primary cesarean rates and VBAC rates: United States, 1989-2000

Year	Total[1]	Primary[2]	VBAC rate[3]
2000	22.9	16.0	20.7
1999	22.0	15.5	23.4
1998	21.2	14.9	26.3
1997	20.8	14.6	27.4
1996	20.7	14.6	28.3
1995	20.8	14.7	27.5
1994	21.2	14.9	26.3
1993	21.8	15.3	24.3
1992	22.3	15.6	22.6
1991	22.6	15.9	21.3
1990[4]	22.7	16.0	19.9
1989[5]	22.8	16.1	18.9

Adapted from Menacker, 2001.[7] Trends in Cesarean Birth and Vaginal Birth After Previous Cesarean, 1991-1999. National Vital Statistics Report, V49, #13, p2.

[1]Percent of all live births by CD.

[2]Number of primary cesarean per 100 live births to women who have not had a prior CD.

[3]Number of VBAC deliveries per 100 live births to women with a prior CD.

[4]Excludes data for Oklahoma, which did not report method of delivery on the birth certificate. The reporting area comprised 99 percent of births in 1999.

[5]Excludes data for Louisiana, Maryland, Nebraska, Nevada, and Oklahoma, which did not report method of delivery on the birth certificate. The reporting area comprised 94 percent of births in 1989.

As allowing TOL became more common, practice variation became a larger concern, e.g., expanding criteria for eligibility and medical induction, and for augmentation of labor. In parallel

with this liberalization of criteria and management, maternal and fetal risks were perceived to be increasing. Patterns of care provision began to be explored as potential explanations for perceptions of increasing risks.

For most women who have had a prior CD, obstetric care is provided by nurse midwives, family practitioners or obstetrician-gynecologists. In 2000, physicians attended 91.6 percent of all deliveries and midwives attended 7.8 percent.[2] Ninety-nine percent of all births were delivered in a hospital.[2] As of 1994, 13 percent of all deliveries attended by a physician were performed by family practice and general practice physicians, and 85 percent were performed by obstetrician-gynecologists.[9] Among obstetrician-gynecologists, 18 percent of all deliveries were by cesarean.[10] According to 2001 survey data from the American Academy of Family Physicians, 29.8 percent of family physicians perform obstetrics.[11] Of family physicians who do perform cesareans, 4.7 percent perform them within a hospital practice and 2.5 percent perform them only with consultation. Sixty-seven percent report that they would not desire to perform them; however, 3.9 percent report that they do not perform cesareans because the liability is prohibitive or because of fear of a liability suit.[11] Though 22.5 percent of both urban and rural family physicians report performing routine deliveries, differences by geographic location are evident. Of rural family physicians, 5.7 percent report performing cesareans, and 18.6 percent report caring for patients undergoing VBAC; the comparable figures for urban family physicians are 4.9 percent and 15.5 percent, respectively.

Chapter 2. Methodology

Technical Advisory Panel

A technical advisory panel (Appendix A) was assembled to provide input from patients, clinicians, and payers to ensure that the scope of the project addressed clinical questions and issues that arise in everyday practice. The panel included obstetricians, family physicians, nurse midwives, payers, and patients. This panel and our national experts and partners provided ongoing assistance throughout the project.

Analytic Framework and Key Questions

Analytic Framework

The analytic framework (Figure 1) represents the strategy we used to organize topic areas and guide the literature search. We developed this framework after a preliminary review of the literature, discussion with local experts, and discussion with national experts.

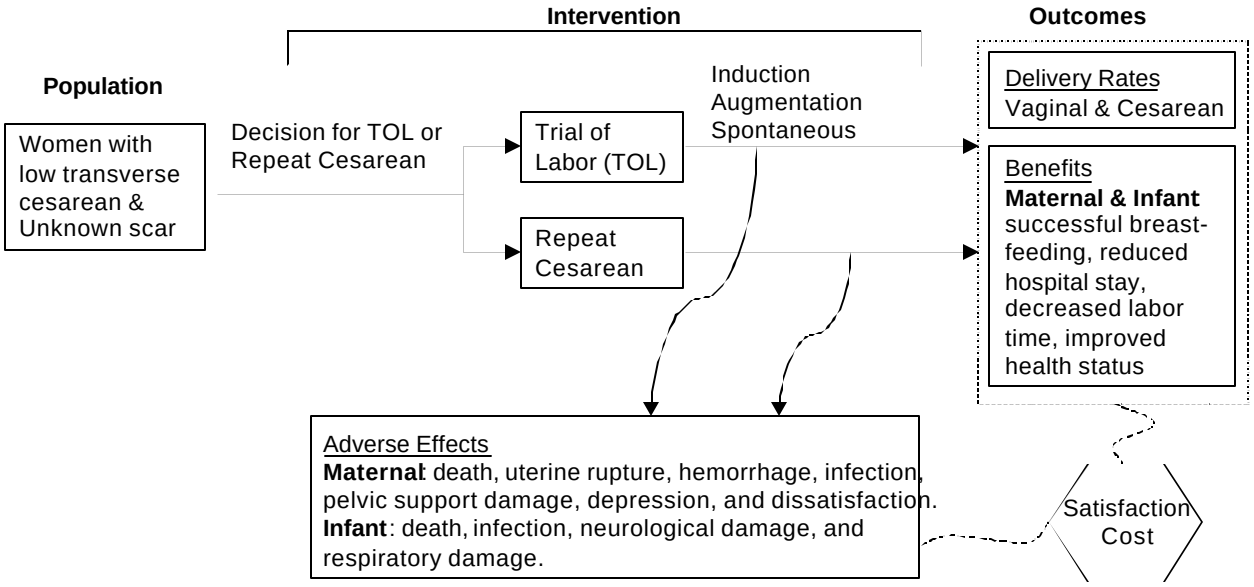
The patients of interest in this report are women with a low transverse cesarean or unknown scar (Figure 1). A woman deciding between having a trial of labor and a cesarean delivery may weigh the benefits and risks, for the mother and the infant, of each approach. A patient who attaches some intrinsic value on the experience of a vaginal birth will be interested in knowing the rate of vaginal delivery. Figure 1 also lists other outcomes and risks ("Adverse Effects") that may be affected by the route of delivery.

All of the benefits and risks listed in the figure may be affected by the method of delivery. However, only some of the risks, such as uterine rupture and, possibly, infant death and damage, are thought to be influenced by having had a prior cesarean section. In defining the scope for this review, we emphasized the benefits and risks that have been reported in studies that included women who have had a previous cesarean delivery. Comparisons of outcomes purely between vaginal and cesarean delivery, but not specifically about VBAC or repeat cesarean delivery, such as breastfeeding, incontinence[12, 13] pelvic support disorders, or infant respiratory sequelae[14] were not considered. Though these are outside the scope of this report, they are certainly important to a woman in deciding between attempted vaginal or cesarean delivery.

The strength and suitability of the evidence regarding the risks of major maternal and infant morbidity and mortality associated with VBAC is the main focus of this report. In judging the suitability of evidence, we took the perspective that the first thing a decisionmaker would want to know is whether the risk of these complications is higher for a trial of labor versus an elective cesarean delivery, *under optimal conditions of care.* That is, the most relevant evidence would compare the outcomes and risks of a properly managed trial of labor to that of a properly conducted elective cesarean delivery. From this perspective, a study comparing the results of VBAC and ERCD that provided little or no information about the quality or content of obstetric care, or that occurred so long ago that the quality of care would be considered poor by today's standards, has little value for patients who are cared for by clinicians who are capable of providing high-quality, up-to-date care.

Some components of obstretric care, as well as some aspects of the setting of this care, might increase the risks of TOL or ERCD. For example, it has been hypothesized that the use (or misuse) or drugs for induction and augmentation might increase the risk of uterine rupture in patients who have had a prior cesarean delivery.[4, 15] Various factors that might affect the outcomes and adverse effects of a trial of labor or an ERCD are listed in Figure 1. We examined the strength of evidence that these factors influence these outcomes and adverse effects and to what extent these factors can explain the results of observational studies of VBAC complications.

Figure 1. Vaginal Birth After Cesarean (VBAC) - Analytic Framework



Factors

The following will be considered for each question:

Health system characteristics: teaching/community hospital, metropolitan/rural setting, and access to surgical and anesthesiology serv
Health care coverage/insurance: fee for service, HMO, Medicaid, none
Provider characteristics/training: midwife, naturopath, family medicine, general OB/GYN, maternal fetal medicine, other fellowship tra
Medications: analgesics, anesthetics such as epidurals and induction and augmentation agents
Obstetric factors: gestational age, multiple gestation, fetal presentation and size, indication for previous cesarean, vaginal parity, pre scar type, previous delivery experience
Patient: Support: doula, friends, family; Values: psyche, belief, attitudes; Demographics: age, race, ethnicity

Key Questions

We addressed two types of key questions. The first group (Questions 1- 7) compares the outcomes of a TOL and an ERCD:

Question 1. What is the frequency of vaginal delivery in women who undergo a TOL (spontaneous onset, induced, and augmented) after prior low transverse cesarean or unknown scar?

Question 2. How accurate are risk assessment tools for identifying patients who will have a vaginal delivery after a TOL?

Question 3. What are the relative harms associated with a TOL (spontaneous onset, induced and augmented) and repeat cesarean?

Question 4. What is the incidence of uterine rupture, and are there methods for preventing major maternal and infant morbidity or mortality due to uterine rupture?
Question 5. What are the health status and health-related quality of life for VBAC and repeat cesarean patients?
Question 6. Regarding VBAC and repeat cesarean, what factors influence patient satisfaction/dissatisfaction with their childbirth experience?
Question 7. How are economic outcomes related to VBAC, repeat CD, and their respective complications?

The second group (Questions 8-10) concern factors influencing the decision to have a TOL:

Question 8. What individual factors influence route of delivery?
Question 9. What factors influence a patient's decisionmaking regarding VBAC or ERCD?
Question 10. How do legislation, policy, guidelines, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?

Literature Search and Selection of Articles

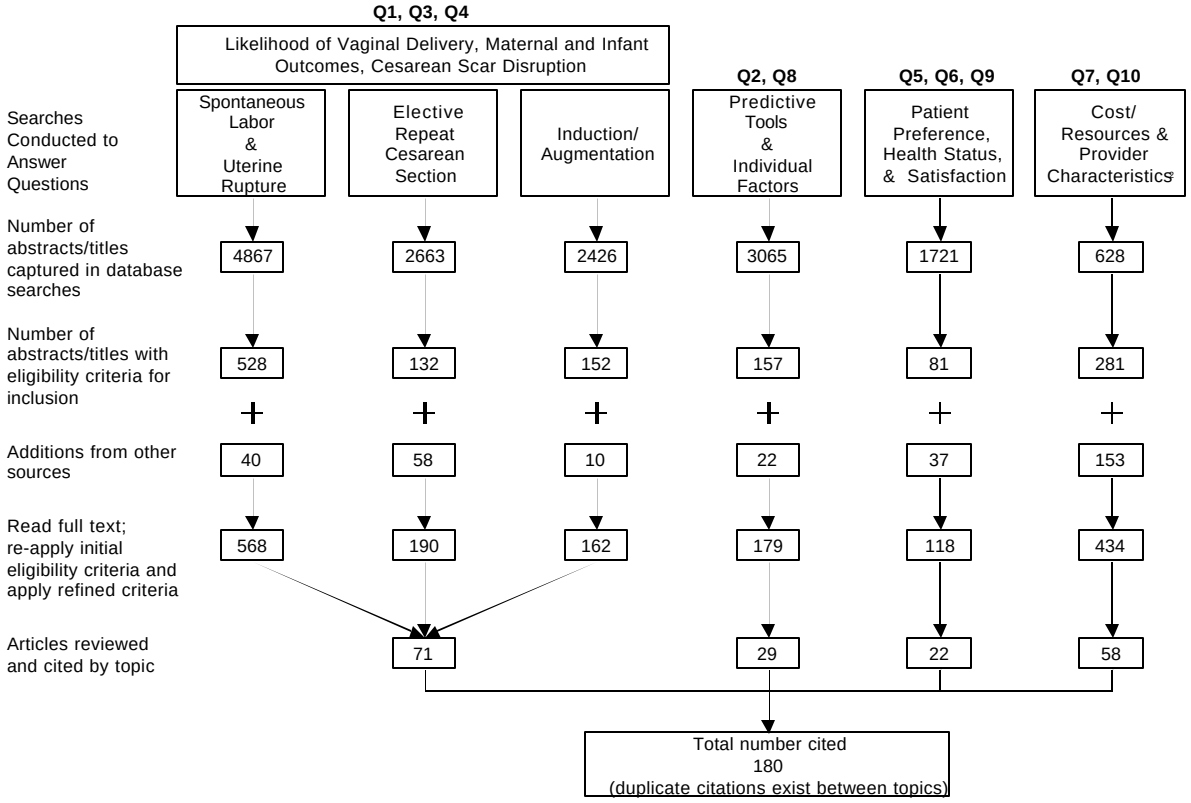
Relevant studies were identified from multiple searches of MEDLINE (1966 to 2002) and HealthSTAR (1975 to 2002), from the reference lists of systematic reviews, and from local and national experts (Appendix A). For relevant literature on specific topics, we also searched the online Cochrane systematic reviews and controlled trials registries, DARE, National Centre for Reviews and Dissemination, and EMBASE databases (Appendix B, search strategies and characteristics).

Databases were searched twice during the course of the project, with the final search in March 2002. Retrieved abstracts were entered into an electronic database (EndNote®). Figure 2 indicates the numbers of abstracts and full-text articles reviewed for all topics in each stage of the review. For all VBAC topics combined, we retrieved 15,370 citations, including 4,867 about spontaneous labor (SL) and uterine rupture; 2,663 about ERCD; 2,426 about induction of labor; 3,065 citations about predictors; 1,721 about patient satisfaction, preference, and health status; and 628 about cost and access.

A lead investigator was assigned for each topic. Two investigators reviewed a random set of titles and abstracts for each topic to select articles for full-text review. When an appropriate level of reliability was reached for inclusion and exclusion of studies, the primary investigator reviewed the rest of the titles and abstracts on the topic. A research assistant tracked the inclusion status and names of reviewers for each abstract reviewed. We retrieved the full text articles of citations that had original data about maternal and infant outcomes relevant to a key question in one or more topic areas.

Studies begun or published before the 1980 National Institute of Health, Consensus Conference on Vaginal Birth after Cesarean, were excluded. The report focused on studies that identified a group of patients with prior cesarean. Studies of the general birthing population were considered if there were no studies that identified patients with prior cesarean. Studies were excluded if they focused on patients with particular conditions such as gestational diabetes, human immunodeficiency virus (HIV), preeclampsia, etc.

Figure 2. Vaginal Birth After Cesarean Section (VBAC): Search and Selection of Citations by Topic



[1]All topics were searched on Medline, Embase , and HealthSTAR . Searches for Induction and Augmentation were also conducted on Cochrane . Searches for Patient Satisfaction, Health Status, and Patient Preference were also conducted on PsychINFO and CINAHL

[2] Includes literature on Economics, Economic Models, Health Services Accessibility, Healthcare providers, Medicaid, Laws, and Guidelines

Exclusions at the title and abstract level were also made for studies that focused on the following: nulliparous patients, vertical, lower vertical, "classical" or "classic" cesarean incision, an inability to differentiate outcomes based upon scar type, vaginal breech delivery, preterm delivery, multiple gestation, or low birth weight. Animal studies, cadaver studies, and studies available exclusively in abstract form were also excluded.

Undeveloped or developing countries were excluded (Appendix C). If the authors described their country as "developing" in either the abstract or the article, it was excluded. Investigators noted this in either the text or evidence tables. Case reports with less than 10 subjects with prior CD were excluded. We also excluded editorials, letters, and nonEnglish language papers.

Case reports, case series, and general population studies (large: n = 100 or greater; small: n = less than 100), were identified but as a rule were not included in the review. Details on suspect or missing data are listed in Appendix D.

When two reviewers disagreed about eligibility, the lead investigator for the topic reexamined the abstract and determined whether the full text of the article should be retrieved. Investigators were encouraged to flag abstracts they believed could be relevant for other topics. Support staff maintained a database to refer these citations to the appropriate investigator if the citations were not already present in the topic-specific abstract database.

After this review, the following were retrieved for full text review: 157 articles about predictors; 528 about TOL and/or uterine rupture; 132 about ERCD; 152 about induction of labor; 81 about patient satisfaction, preference, and health status; and 281 about cost and access.

An additional 320 studies were retrieved after reviewing reference lists of studies and by suggestion of the expert panel or leading researchers in the field. The full texts of these 1,651 studies were retrieved from the library or ordered through inter-library loan. During the abstract review process, 10 VBAC-related systematic reviews were identified and retrieved for review.

Investigators read the full-text version of the retrieved papers and re-applied the initial eligibility criteria. For all topics, we excluded articles if they did not provide sufficient information to determine the methods for selecting subjects and for analyzing data. For some topics, additional criteria were applied to select studies that were systematically reviewed and included in evidence tables as follows.

Included Studies-Evidence Table Level

Data from 180 studies were abstracted and included in the evidence tables described in the results section of this report. Appendix E has details on studies excluded at the paper review level for reasons other than described in the methods section.

Data Extraction

The following information about the patient population, study design, study outcomes, and study quality was extracted from full-text, published studies of VBAC and TOL, induction of labor, ERCD, or uterine rupture, and was used to construct evidence tables: identifying information (study name, years of observation); setting (population-based, referral clinic-based, other); study design (randomized trial, prospective, etc.); interventions (induction, augmentation medications); outcomes studied (infant, maternal, cost, etc.); length of followup; statistical methods for handling confounders (statistical adjustment, stratification, none) and attrition; numbers of subjects recruited, included, and completing study; and characteristics of the sample (demographic variables, number of previous births, other risk factors). For economic evaluations, we also extracted the type of economic evaluation, the primary outcomes reported, data sources, cost unit, discount rate, and what characteristics were varied in the sensitivity analyses and results. Abbreviations and acronyms for study material can be found at the end of the report.

All data were abstracted by the lead investigator for the topic. If the lead investigator encountered difficulty in finding or interpreting information in the published report, a second investigator reviewed the article and a consensus was reached.

Assessment of Study Quality

To assess the internal validity of individual studies, we applied a set of criteria developed by the current United States Preventive Services Task Force and additional criteria developed by the NHS Centre for Reviews and Dissemination, based at the University of York in England. Appendix G shows a detailed description of the quality ratings and tables with quality-rated studies. A brief description of ratings with criteria by study design follows.

RCTs or cohort studies. A study was rated good-quality if it met all the following criteria: comparable groups were assembled initially and maintained throughout the study (followup at least 80 percent); reliable and valid measurement instruments were used and applied equally to the groups; interventions were spelled out clearly; important outcomes were considered;

appropriate attention was given to confounders in analysis; and intention-to-treat analysis was used in RCTs.

A study received a fair rating if any of the following problems were seen: generally comparable groups were assembled initially but some question remained whether some (although not major) differences occurred in followup; measurement instruments were acceptable (although not the best) and generally applied equally; some, but not all, important outcomes were considered; some, but not all, potential confounders were accounted for; and intention-to-treat analysis was used in RCTs.

Studies were given a poor rating if any of the following fatal flaws existed: groups assembled initially were not close to being comparable or were not maintained throughout the study; unreliable or invalid measurement instruments were used or instruments were not applied equally among groups (including not masking outcome assessment); key confounders were given little or no attention; and intention-to-treat analysis was lacking in RCTs.

Case-control studies. A study which met the following criteria was rated good-quality: appropriate ascertainment of cases and nonbiased selection of case and control participants; exclusion criteria applied equally to cases and controls; accurate diagnostic procedures and measurements applied equally to cases and controls; and appropriate attention to confounding variables.

Studies were rated fair if they were recent, relevant, without major apparent selection or diagnostic work-up bias, or accounted for some but not all important confounding variables.

A poor rating was given to a study in this category if it had major selection or diagnostic work-up biases, or inattention to confounding variables.

Economic or cost model studies. For the economic evaluations, Udvarhelyi's[16] ratings were given for six criteria: perspective, benefits, cost data, discounting, sensitivity, and incremental cost-effectiveness ratio (C/E). We assigned to each criterion ratings of good (fulfilled criterion), fair (addressed criterion but not completely or with minor flaw), poor (failed to either address criterion or had a fatal flaw relative to criterion), or not applicable (criterion was not relevant in the context of the evaluation).

Topic Specific Quality Considerations

Investigators were asked to use the study quality ratings as previously described to determine for their topic which quality components were most important in assessing internal validity. This process allowed for some individual topic fit for fatal flaws, etc.

Spontaneous labor and repeat cesarean. To identify which studies to include, we applied a "best evidence" approach.[17] For TOL (SL) and ERCD, we included large population-based and prospective cohort studies. Cohort studies were included because RCTs of delivery method have not been done.

Predictive tools. For this topic, we decided that three of the eight criteria for cohort studies were the most important in determining the quality of each study: (1) comparable groups, (2) clear definition of groups and sufficient description of the distribution of prognostic factors, and (3) consideration of and adjustment for important confounders. Quality was rated as good if all three criteria were met, fair if the groups were comparable and there was adjustment for confounders, and poor if the groups were not comparable or there was no adjustment for confounders.

In addition to the above-mentioned criteria, the evaluation of these diagnostic tests included

several of the factors presented by Reid[18] and Sox,[19] which were: (1) using a prospective study design, (2) avoiding workup or verification bias (i.e., applying the test to all of those eligible for a TOL), and (3) specifying test reproducibility.

Patient satisfaction and health status. Investigators put particular importance on whether the measures for patient health status and psychosocial outcomes were clearly described, including any validation or reliability testing of new health status tools. Specifically, for patient preferences and satisfaction, we put emphasis on methods used to assess patient preferences. Studies that used a method that was independent from the patient's own provider were rated higher than those where the provider assessed this information.

Cost or economic analysis. Specifically for this topic, a poor rating was given for lack of description of the perspective of the economic evaluation, lack of description of the benefits, inclusion of charge data rather than cost data, lack of inclusion of all relevant adverse events, lack of inclusion of discounting (for studies with a time horizon greater than 1 year), lack of sensitivity analyses, and lack of incremental comparisons of alternatives (use of an incremental C/E to compare a more costly alternative to a less costly one).

Access/resources. The studies evaluated were all either databases or cohort studies. The former were typically large national databases and were evaluated using the same criteria as for cohort studies. The main quality criteria used were whether the groups evaluated were comparable at baseline and were controlled for potential confounding variables (including risk adjustment if the groups were not comparable at baseline).

Data Synthesis

Meta-Analytic Methods

Where appropriate, meta-analysis was performed using WinBugs® or StatsDirect® software. To reduce potential bias, only studies of fair or good quality were included in analyses (Appendix G). StatsDirect® was used for comparative studies (e.g., TOL versus ERCD) and WinBugs® was used for noncomparative data (e.g., data for vaginal delivery rates in TOL).

Model estimation using WinBugs® was done using a Bayesian data analytic framework. WinBugs® uses a method of Markov chain Monte Carlo called Gibbs sampling to simulate posterior probability distributions. Noninformative prior probability distributions were used. Absolute risk differences were calculated for each study, and pooled using both random and fixed effects models. Only results from the random effects models are presented, unless these two methods produced significantly divergent results. Statistical heterogeneity was examined. Point estimates using the mean and 95 percent confidence intervals were calculated from 10,000 draws from five Markov chains.

Meta-analysis using StatsDirect® used DerSimonian and Laird random effects methods. The Q statistic tests whether it is reasonable to assume that the treatment effects in the studies to be combined are estimating a single underlying effect size. When the test is significant (e.g., $p < 0.05$) there is significant heterogeneity between the studies' effect sizes. This indicates that the variation seen is greater than that expected from random sampling error. The Q statistic, forest plots and any statistical pooling were done using the StatsDirect® software package (CamCode, England). Where statistically significant heterogeneity was found, pooling was not undertaken.

Individual Factors

Data extraction and data entry were performed using Microsoft Excel 2000®. Because of the nature of this topic and the need for confounding consideration, further analysis involving the calculation of summary estimates using random effects modeling was not considered. Adjusted odds ratios (ORs) for the likelihood of VBAC from each study formed the basis for evaluation. In the situation where the study provided adjusted OR for the likelihood of a failed TOL, the inverse ratio was taken, to approximate the OR for the likelihood of VBAC.

Chapter 3. Results

Outcome Comparisons

Question 1. Likelihood of Vaginal Delivery

What is the frequency of vaginal delivery in women who undergo a TOL (spontaneous onset, induced, and augmented) after prior low transverse cesarean or unknown scar?

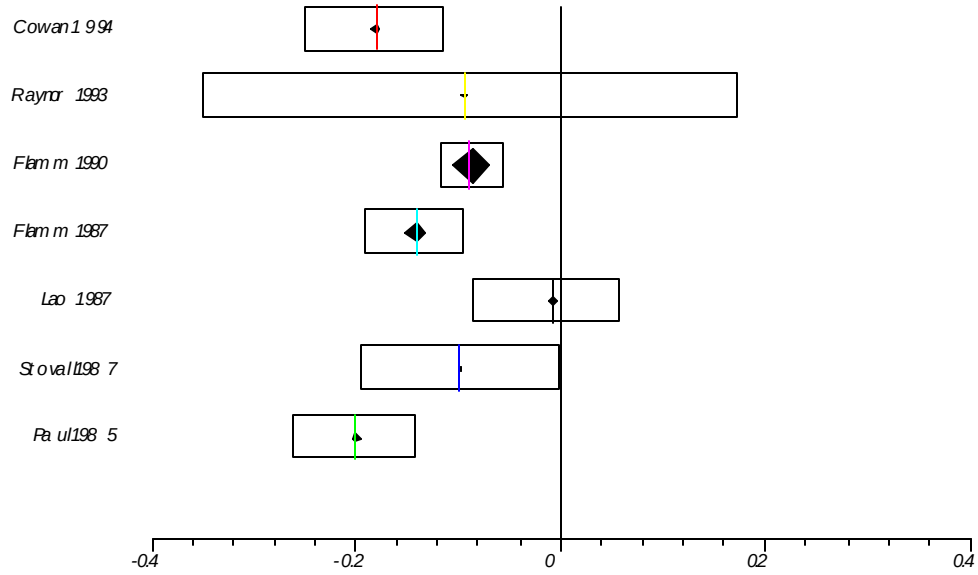
One large good-quality population-based study[5] and eight prospective cohort studies provided the best data on vaginal delivery rates for the general population of women with prior CD.[20-27](Evidence Tables 1 and 2).

In the population-based study, which was performed in Nova Scotia, 3,249 (52.9 percent) of 6,317 women with one prior nonvertical CD chose a TOL, and 1,962 of them (60.4 percent) delivered vaginally.[5] Women attending tertiary care hospitals were at least twice as likely to choose a TOL and more likely to deliver vaginally than women attending regional or community hospitals. The authors did not distinguish vaginal delivery rates for women requiring medical augmentation or induction versus women who did not require medical assistance in labor.

In the prospective cohort studies, largely conducted in university and tertiary care settings, vaginal delivery rates for all women attempting a TOL ranged from 62–82 percent, with a pooled rate of 75.9 (95 percent CI, 69.9 to 81.5).

Seven fair or good quality observational studies[22, 25, 27-31] provided comparisons of vaginal delivery rates for SL and induced or augmented labor. In all of these studies, women who received oxytocin for induction or augmentation were less likely to have a vaginal delivery (Figure 3). On average, 80 percent of women with spontaneous onset of labor delivered vaginally, versus 68 percent of women who received oxytocin.

Figure 3: Vaginal Delivery: Oxytocin versus Spontaneous Onset of Labor
Risk difference, 95% CI



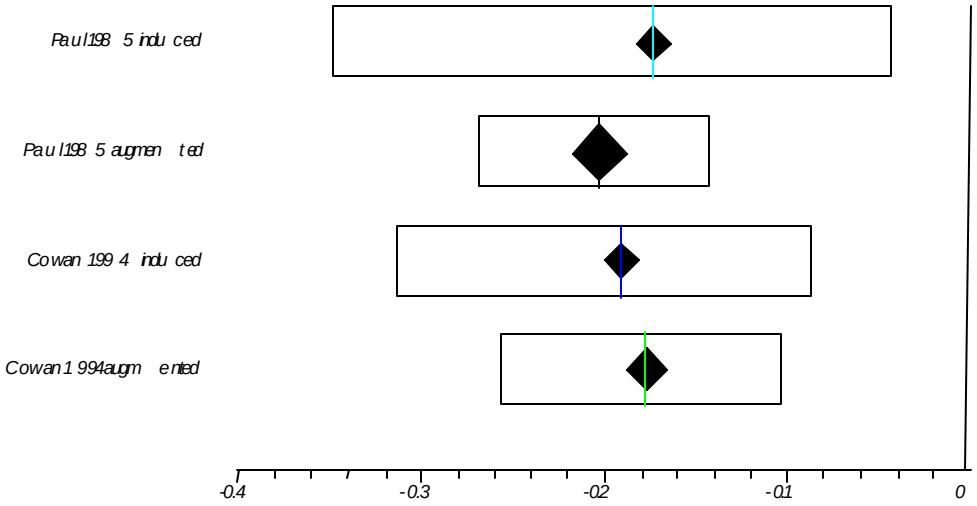
	# Oxytocin	# Oxytocin VBAC	# SL	# SL VBAC
Cowan 1994 [25]	234	163	359	315
Raynor 1993 [29]	25	14	26	17
Flamm 1990 [22]	1201	831	2756	2146
Flamm 1987 [28]	485	309	1291	1005
Lao 1987 [31]	137	112	529	436
Stovall1987 [27]	133	98	139	116
Paul 1985 [30]	289	200	443	395

*The vertical line, at "0", indicates no effect. The study mean is indicated by a vertical line surrounded by a diamond. The size of the diamond indicates sample size in relation to the other studies on the plot. The rectangle represents the 95 percent CIs around the study mean. If the rectangle is entirely to the left of the line the difference is statistically significant and oxytocin is associated with a decrease in achieving vaginal delivery compared to spontaneous onset of labor.

Two observational studies reported rates for induction and augmentation separately.[25, 30] In one of these studies the vaginal delivery rate of patients requiring oxytocin induction was lower than that of patients requiring only augmentation (risk difference 1.4 percent),[25] while in the other study the rate was slightly higher (risk difference 3 percent).[30] Neither finding was statistically significant (Figure 4).

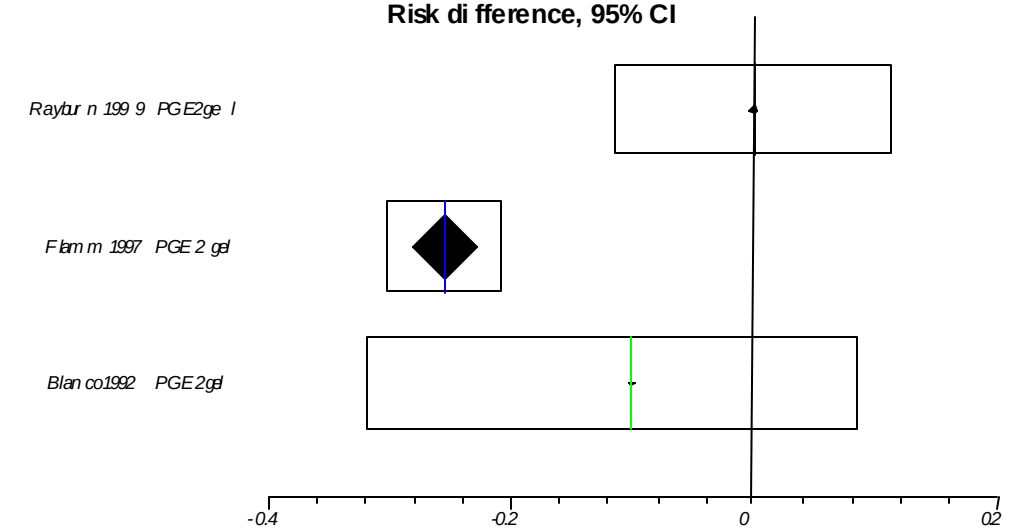
In comparing prostaglandins (any type) with spontaneous labor (Figure 5), the largest study found a significantly lower rate of success among patients induced with PGE2, than in those undergoing spontaneous labor, while two smaller studies did not find a significant effect.

Figure 4: Vaginal Delivery: Oxytocin (Induction or Augmentation) vs No Oxytocin
Risk difference, 95% CI



Study	# Induced	# Induced VBAC	# SL	# SL VBAC
Cowan 1994 induced [25]	67	46	359	315
Cowan 1994 augmented [25]	167	117	359	315
Paul 1985 induced [30]	32	23	443	395
Paul 1985 augmented [30]	257	177	443	395

Figure 5: Vaginal Delivery: Prostaglandins versus Spontaneous Onset of Labor
Risk difference, 95% CI



Study	# Induced	# Induced VBAC	# SL	# SL VBAC
Rayburn 1999 [32]	143	70	151	74
Flamm 1997 [33]	453	233	4569	3513
Blanco 1992 [34]	25	18	56	46

Although the results of the observational studies are generally consistent, these studies are inherently limited by confounding. Even in studies that controlled statistically for several potential confounders, the risk of requiring CD might be increased by the indications for medication for induction and augmentation, rather than the medication itself.

Two RCTs[32, 35] also provided information regarding vaginal delivery rates for medical augmentation or induction of labor. Neither RCT compared medicated to spontaneous nonmedicated labor because medical induction and augmentation of labor were allowed in both intervention and controls. One trial compared expectant management with administration of prostaglandin E2 (PGE2) gel for cervical ripening at weekly intervals from 39 to 41 weeks' gestation, for the same time period.[32] Oxytocin was used in both groups for augmentation or induction as needed. This study found a VBAC delivery rate of 49 percent in both intervention and expectant management. The second RCT compared mifepristone versus placebo for 2 days followed 2 days later by induction with prostaglandins, oxytocin, and/or artificial rupture of membranes as needed.[35] The VBAC delivery rates were 69 percent for the mifepristone group and 50 percent for controls.

Data were insufficient to determine whether there was a relationship between the dose of induction agents and the vaginal delivery rate. Only one fair-quality study reported data on the mean, range, or maximum doses.

Summary

- Rates of vaginal delivery when attempting TOL ranged from 60-82 percent. The largest population-based study reported a rate of 60.4 percent. The combined vaginal delivery rate for all prospective cohort studies, largely conducted in university or tertiary care settings, was 75.9 percent
- There was a 10 percent reduction in the likelihood of vaginal delivery when oxytocin was used for ether induction or augmentation. There was a similar trend for prostaglandins.

Question 2. Predictive Tools

How accurate are risk assessment tools for identifying patients who will have a vaginal delivery after a TOL?

It is important to know which patients are most likely to have an uncomplicated vaginal delivery. Several predictive tools attempt to identify groups of women at higher likelihood of vaginal delivery. Evidence Table 3 summarizes 14 studies that describe various methods for determining who will most likely succeed at a TOL and who will not. We divided these risk assessment tools into two categories: (1) tools involving a *scoring system* based on clinical or historical factors, and (2) tools involving various *imaging modalities.*

Scoring Systems

Seven studies[36-42] evaluated the use of various scoring systems in predicting the likelihood of VBAC with TOL. These studies included one prospective cohort,[36] four retrospective cohorts,[37, 40-42] and two case-controls.[38, 39] (Evidence Table 3a). All of these studies developed their scoring

systems by looking at a wide array of variables in their corresponding populations and then by combining into one model those variables significantly associated with TOL outcome. These variables were then assigned a score or point value based upon their ORs, regression model standardized beta coefficients, or simply by their presence or absence.

The only study of scoring evaluation that received a good-quality rating was the multicenter prospective cohort by Flamm.[36] The authors collected information on 5,003 women who attempted a TOL (69.2 percent of the 7,229 patients with prior CD). The sample was randomly split into a score development group (n = 2,502) and a score-testing group (n = 2,501), which were found to be similar with regard to age, race, and ethnicity. Information regarding ten different variables was collected from the score development group and possible associations with the TOL outcome were investigated using chi-square analysis for categorical variables and Student *t* tests for continuous variables. Those variables found to be significant at the $p < 0.05$ level in the univariate analyses were then entered into one of three logistic regression models, based on whether they were a historic, intrapartum, or perinatal factor. Those factors found to be significant at the $p < 0.05$ level in any of three models were subsequently entered into a final logistic regression model (3.5 percent of subjects were excluded due to missing data), which was used to identify the five predictor variables of the scoring system. Points ranging from 0 to 4 were assigned to each variable based on the Beta coefficient from the model (Table 2). The resulting scoring system was prospectively validated in the 2,501 women of the score-testing group. Patients with scores of 0 to 2 points had a VBAC delivery rate of 49.1 percent, while those who had scores of 8 to 10 points had a 94.9 percent chance of success (Table 3).

Table 2. Flamm Scoring System Tool: Included variables and point values

Variable	Beta Coefficient	Point Value
Age under 40 years	0.95	2
Vaginal birth history		
Before and after 1st cesarean	2.21	4
After 1st cesarean	1.22	2
Before 1st cesarean	0.43	1
None	Referent	0
Reason other than FTP for 1st cesarean	0.66	1
Cervical effacement at admission		
> 75%	1.00	2
25% - 75%	0.58	1
<25%	Referent	
Cervical dilation 4cm or more at admission	0.77	1

Taken from Flamm, 1997[36]

Table 3. Flamm Scoring System Tool: Performance of Admission Score in the score testing group

Score	# of subjects with score	% of subjects with VBAC
0 to 2	114	49.1
3	329	59.9
4	595	66.7
5	660	77.0
6	360	88.6
7	189	92.6
8 to 10	158	94.9
Total	2405	74.9

Taken from Flamm, 1997[36]

One other risk prediction tool was developed and validated in different populations.[40] This tool was created using a retrospective study design of ten different variables from 264 patients (46.6 percent of the 567 patients with a prior CD). Using Student *t* tests, chi-square analyses, and Wilcoxon rank sum tests, four variables were found to be significantly different (at the $p < 0.05$ level) between those with a successful TOL and those with an unsuccessful TOL. These four variables were subsequently selected for use in a scoring system tool after these patients were also found to have significantly lower VBAC rates when compared with the overall VBAC rate for the cohort. All four of these variables were weighted equally in the scoring process, where one point was given for every variable present. Patients with scores of 0 points had a VBAC delivery rate of 91.5 percent, while those with scores of 3 to 4 points had a 46.1 percent chance of success (Table 4). Success rates in a validation study using a separate sample of 263 patients are shown in Table 4. Subjects in the 0 point group had a success rate of 98 percent, versus 33 percent in the group with 3 to 4 points.[41]

Table 4. Scoring System Tools: Relationship of risk score to successful VBAC

	Troyer, 1992[40]			Vinueza, 2000[41]		
Score	Total # of subjects	% of subjects with VBAC	% False Positive/ Negative	Total # of subjects	% of subjects with VBAC	% False Positive/ Negative
0	59	91.5	2	56	98	0.4
1	92	73.9		106	69	
2	87	66.7		74	40	
3 to 4	26	46.1	5	27	33	3
Overall	264	74.9		263	63	

Other scoring systems were developed retrospectively and have not been validated in a second sample.

Would these prediction tools be useful in practice? The probability that a woman would have a vaginal delivery is likely to influence her enthusiasm about trial of labor. Additionally, women who have a cesarean after a lengthy trial of labor are more likely to sustain adverse events such as uterine rupture or infection. Therefore, a tool that could accurately predict a woman's likelihood of achieving vaginal delivery with minimal adverse sequelae would be of interest to

clinicians and patients. The value of a prediction tool depends on how it affects decisions about the likelihood of false positive and false negative tests (e.g., its accuracy), and the relative costs (harms) of false positive and/or negative results. The vaginal delivery rate in Flamm's population (e.g.. the overall rate of vaginal delivery), was 74.9 percent. Thirty percent of his population would be predicted to have a high probability of vaginal delivery (e.g., score or 6-10), and 18 percent were predicted to have a low likelihood of vaginal delivery (e.g., scores of 0-3). Slightly over half of the population would gain no additional information from using the predictive tool. Ten percent of the population or 253/2,405 may have been advised to have a cesarean, due to tool's prediction of low likelihood of vaginal delivery, when they would have been able to have a vaginal delivery. This may be acceptable as the harms of having a repeat cesarean may be low. What may be of higher concern is the false positive rate, or the chance that the tool would have encouraged TOL but the patient ended up with a cesarean. This is of higher concern because this group is of higher likelihood of sustaining complications from TOL such as infection and uterine rupture. This tool has a relatively low false positive rate of 2.6 percent (63/2405). Troyer's population had a similar vaginal delivery rate of 73 percent. The tool only provided additional information, to 32 percent of the population, with 22 percent predicted to have a high chance of vaginal delivery (e.g. score of 0), and 10 percent predicted to have a low chance (e.g. score of 3 or 4). This tool had a similar false positive rate of 2 percent (5/264), and slightly improved false negative rate at 4.5 percent (9/264). When this tool was used in a population with a lower pretest probability for vaginal delivery, both the false positive rate and false negative rate improved. Vinueza's population had a 63 percent vaginal delivery rate, 21 percent were predicted to have a high chance of vaginal delivery, and 10 percent a low chance. The false positive rate fell to 0.4 percent (1/263) and the false negative rate also fell to 3 percent (9/263). Thus, Flamm's tool may be preferred, from a diagnostic test perspective, due to an ability to stratify more of the population into high and low probability subgroups with a low false positive rate.

Imaging Modalities

Seven studies[43-49] examined the role of imaging modalities in predicting the outcome of a TOL after prior CD. In these studies a variety of imaging factors were considered, including the two fundamental aspects of labor: passage (pelvic dimensions) and passenger (fetal dimensions).

Four studies[44, 45, 47, 49] focused primarily on the imaging of the passage using X-ray pelvimetry (XRP). Of these studies, three were retrospective cohorts [44, 45, 49] that were given poor-quality ratings because of inadequate control of confounding or effect modifiers, unequal application of measurements, and unidentified patient spectrum composition. The fourth study was a good-quality RCT by Thubisi.[47] Half of the 288 subjects were assigned to receive an antepartum XRP evaluation; the remaining subjects were allocated to the postpartum XRP evaluation group. Of those in the antepartum group, 84 were considered to have an adequate pelvis and 23 of these delivered vaginally (27.7 percent). All of the patients considered on antepartum XRP to have an inadequate pelvis had an ERCD. Of those in the postpartum XRP group, 41.6 percent (60/144) delivered vaginally. In the postpartum XRP group considered to have an inadequate pelvis based on clinical examination, 60 percent (33/55) had a vaginal delivery, compared with 30 percent (27/89) of those considered to have an adequate pelvis. This study provides strong evidence that XRP is a poor predictor of TOL outcome and might unnecessarily increase CD rates.

Three poor-quality prospective cohort studies[43, 46, 48] examined the value of a scoring system based on a variety of fetal and maternal pelvic measurements and calculated circumferences (fetal head, fetal abdomen, pelvic inlet, and midpelvis), to predict vaginal delivery. Two[46, 48] of the three studies that focused on the fetal-pelvic index found that it was significantly associated with vaginal delivery; however, all three studies lacked adequate control for confounders and suffered from verification or workup bias.[18]

Summary

- Two validated scoring systems categorized women into groups with likelihoods of vaginal delivery ranging from roughly 45-95 percent.[36, 40]
- Flamm's tool was able to stratify more of the population into high and low probability subgroups, with a relatively low false-positive rate.[36]
- By using a prospective cohort design and the largest study population, the best scoring system created a 10-point score based on the presence or absence of five variables commonly available for most patient admissions.[36]
- An RCT clearly demonstrated the inability of XRP to predict route of delivery reliably.[47]
- Imaging studies that combined the measurements of the pelvis and fetus showed promising results, but were limited by their lack of control for confounding and biases.[46, 48]

Question 3. Maternal and Infant Outcomes

What are the relative harms associated with a TOL (spontaneous onset, induced, and augmented) and repeat CD?

No controlled trials directly compare the harms of a spontaneous TOL (without medical induction or augmentation), a medically augmented or induced TOL, and ERCD. The ideal study would compare the outcomes of women who were similar in every respect except that some had elected a TOL and others an ERCD. The ideal study would also determine whether, in the setting of VBAC, complications were associated with SL or only with labors in which oxytocin was used for induction or augmentation.

We examined 10 fair-or-better-quality observational studies that compared rates of maternal and/or infant complications with a TOL versus ERCD. Two of these were large, retrospective, population-based studies.[5, 6] The other eight were prospective cohort studies: three large multi-center studies,[20-22] one large single institution study,[23, 30] one small multi-center study,[24] and three small single institution studies.[25-27] These studies provide indirect rather than direct evidence because factors other than the women's preferences contributed to the decision to have an ERCD or a TOL (Evidence Tables 4a and 5a).

Characteristics of these studies are described in Evidence Table 1. In most of the studies, patients who received oxytocin and those who did not were not analyzed separately. Both large population-based studies reported that medical induction and/or augmentation of labor was performed in this population, but they did not separate these groups from SL. All 10 prospective studies reported that oxytocin was used for augmentation or induction in their TOL group; only three[22, 25, 27] looked separately at the effect of oxytocin when used for augmentation or induction

within this larger population. Demographic data reported were inconsistent, making comparisons difficult across studies, or even across groups within the studies.

Maternal Complications

Three maternal complications were investigated: major maternal hemorrhage (requiring transfusion or hysterectomy), maternal infection (as manifested by endomyometritis, wound infection, and/or postpartum/puerperal fever), and maternal death (uterine rupture is detailed in question 4). While not all articles addressed each maternal complication, several addressed key aspects of these sequelae.

Two good-quality studies[5, 20] provided information concerning both transfusion and hysterectomy rates. Rates of maternal hemorrhage requiring transfusion were 1.1 percent in the TOL group versus 1.3 percent for repeat CD in the large population-based study (NS)[5] and 0.72 percent versus 1.72 percent for the prospective cohort study (p=.0001).[20]

While several studies provided information concerning hysterectomy, none specifically documented the indication for hysterectomy. Comparisons between TOL and elective CD were reported in three studies.[5, 20, 30] The best evidence comes from the one large population-based study[5] that found no difference in hysterectomy rates in TOL (0.2 percent) versus ERCD (0.2 percent). Unlike the two prospective studies reporting this outcome, McMahon attempted to exclude "elective" repeat CDs for medical or obstetric indications such as placenta previa.

The two prospective cohort studies reported higher hysterectomy rates in repeat CD: 0.12 TOL versus 0.27 percent ERCD[20] and 0.27 TOL versus 3.2 percent in ERCD.[30] These provide weaker evidence because the cesarean group may have included women who had an indication for CD and would not have been candidates for a TOL. In fact, in the latter study, Paul mentions that only 62 of the 157 "elective" repeat CD group were considered to be eligible for TOL. Thus it is possible that the higher rates of hysterectomy could be due to medical or obstetric conditions such as hemorrhage secondary to placenta previa. Hysterectomy rates were reported in only one induction study, reporting 0.2 percent in induced and 0.08 percent in SL patients.[28] Overall, there was a trend toward increased risk for hysterectomy in induced labor (increased risk 0.12 percent) and ERCD (increased risk 0-3 percent). These studies did not specify whether hysterectomies were performed for hemorrhage or other indication (cervical cancer, myomatous uterus).

Studies reporting maternal infection rates are limited by lack of explicit definitions or by combining many sources of infection, which make specific clinical insights limited. No study provides data on the risk for spontaneous TOL that is free from medical augmentation. Two studies[5, 24] defined infection clearly and compared the incidence in TOL and ERCD groups. Both definitions combined puerperal infection and abdominal wound infection. In the larger study,[5] which defined maternal infection as puerperal fever (temperature >38 degrees C; uterine, urinary, pulmonary, or wound infection; or sepsis) or abdominal wound infection, the rates were 5.3 percent in TOL versus 6.4 percent in ERCD. Subgroup analyses found that women who had a TOL but did not delivery vaginally (e.g. failed TOL), had significantly higher infection rates than women who were able to deliver vaginally (failed TOL 8 percent versus successful TOL 3.5 percent). This finding was reported consistently among prospective cohort studies that performed similar subgroup analyses[23, 26, 30] (11 to 30 percent increased risk of infection for failed TOL). The other study, a fair-quality prospective cohort,[24] reported maternal infection rates (including endomyometritis and wound infection) of 6.79 percent in TOL versus 9.73 percent in ERCD.

Compared with spontaneous onset of labor, there appears to be a trend toward increasing risk of infection when labor is induced (1-4 percent increased risk) and with ERCD (2-3 percent increased risk). However, only one study of induction agents evaluated this outcome, and found zero in the induced group and 5 percent in the SL group.[34]

Six studies examined maternal death rates. The large population-based study found no maternal deaths in either TOL or ERCD groups totaling 6,138 women.[5] In five prospective cohort studies involving approximately 19,000 patients, there were two deaths among women having a TOL and two among women having a repeat CD.[20-23, 27] No maternal deaths were mentioned in any studies of induction of labor (n = 7,525).

Infant Outcomes

APGAR scores. There are insufficient data to compare infant Apgar scores for a TOL versus ERCD. In one fair-quality prospective cohort study,[20] more infants born from TOL had 5-minute Apgar less than 7 (1.47 percent versus 0.68 percent, p=.004).[20]

Infant death. No study has measured infant death directly attributable to a mother's choice of TOL or repeat CD. Two large, population-based studies provide information about whether TOL poses increased risk of infant death compared with ERCD.[5, 6] Each has important strengths and limitations. One study[5] (n = 6,138) reported perinatal death rates of 9/1,000 in the TOL group versus 5/1,000 in the repeat CD group for women with one prior CD. The strength of this study was its ability to identify a conceptual cohort of women with one prior low transverse CD who attempted TOL or repeat CD. However, no details were provided on these deaths (e.g., whether infants with lethal anomalies were included), so it is not possible to determine whether these deaths were attributable to labor or cesarean.

A more recent population-based study from Scotland[6] did exclude all perinatal deaths associated with lethal anomalies and medical conditions; however, they did not do a good job of classifying patients as TOL and ERCD. To ascertain the perinatal death rate attributable to delivery method, the authors excluded all deaths associated with congenital anomalies, antepartum stillbirth (intrauterine fetal death), multiple gestation, and noncephalic presentation. Additionally, they excluded all primary CDs. They divided all remaining deliveries into women with no prior CD who were nulliparous or multiparous, and women with prior CD who delivered by planned repeat CD or TOL. The TOL group was defined as any vaginal delivery or emergent CD regardless of intended delivery route.

There were 20 deaths in 15,515 TOLs for a rate of perinatal death of 12.9/10,000 (95 percent CI, 7.9 to 19.9) versus one in 9,014 repeat CDs for a rate of 1.1/10,000 (95 percent CI, 0.0 to 6.1), and 135 in 137,630 nulliparous women without prior CD for a rate of 9.8 (95 percent CI, 8.3 to 11.6), and 90 in 151,549 multiparous women without prior CD for a rate of 5.9/10,000 (95 percent CI, 4.8 to 7.3). This study is discussed in significant detail in this report because it has not been reviewed in the literature to date.

The authors emphasized that the infant death rate was 11 times higher in women choosing TOL than in those having a CD, corresponding to one additional infant death for every 849 patients. The rate of infant death in women choosing TOL was similar to primiparous women having a vaginal delivery. This would indicate that the woman choosing TOL is not assuming considerable additional risk for her infant in choosing TOL in the second pregnancy. However, the rate of infant death for repeat CD patients appears to be spuriously low. The cesarean group may be low due to misclassification because all emergent CDs and vaginal deliveries were

classified as TOL regardless of intended route of delivery. There were 20 perinatal deaths in the TOL group; eight were delivered vaginally and 12 were emergent CDs. If only three of these deaths were misclassified (e.g., women intending elective repeat who required emergent CD), there would not be a statistically significant difference between perinatal death rates in TOL and repeat CD groups. One study examined the rate of emergent CDs in each group.[30] They report that two of nine (22 percent) emergent cesareans performed for fetal distress were performed for women who desired repeat cesarean. If this proportion were applied to Smith's emergent cesarean perinatal deaths, three of the 12 would have been expected to occur in the planned repeat cesarean group and 9 in the TOL group. This small change would eliminate the statistically significant difference that was observed. Another potential source of misclassification that would decrease the risk of planned CD compared with TOL is in the antepartum stillbirth data, all of which were excluded.

Even though the authors went to great lengths to consider confounding, there is still substantial detail missing in understanding the context in which these perinatal deaths occurred. For example, the authors were unable to determine the type of prior CD scar (classical, vertical, etc.). To exclude women who might have had classical incisions, they excluded all births that occurred before 40 weeks' gestation, with the thought that women with known prior classical incisions are generally delivered by cesarean before 40 weeks. In confining their sample to those women who delivered at 40 weeks or greater, they might have introduced an additional confounder in that risk of perinatal death increases with higher gestational age, especially 42 weeks and greater. In fact, when they looked at gestation less than 39 weeks versus greater than 39 weeks, they found only three deaths between 37 and 39 weeks, all of which had PGE2 induction of labor. One question that arises is in the group that was greater than 39 weeks' gestation: what proportion of the perinatal deaths were in infants who were 42 weeks' gestation or greater? One of the greatest concerns for women with prior CD is the risk of uterine rupture, and the resulting potential for maternal or fetal morbidity and mortality.

This study did not specifically examine the subset of perinatal deaths attributable to uterine rupture. Uterine rupture was combined with cord compression/prolapse, birth trauma, and asphyxia associated with disproportion in a category called "mechanical" causes. These events are all limited to vaginal delivery; therefore, it is not surprising that the authors found seven perinatal deaths attributed to "mechanical" causes in TOL and none in CD. Additionally, it is not clear how TOL versus planned repeat CD were classified (post-hoc or intention).

Another potential confounder is the use of induction and augmentation agents. The study reports deaths from 1992 to 1997, but does not describe how often induction agents were used, or in what doses, across Scotland during those years. Fifteen percent of their population with prior CD had PGE2 induction of labor. There was no association between PGE2 induction and increased risk of infant death. Although oxytocin was used, the authors were not able to examine whether oxytocin posed any increased risk. Communication with the authors revealed that oxytocin would be used for women with prior CD and premature rupture of membranes, but is not frequently used to augment women for failure to progress during labor.

Importantly, the population-based studies do not describe the likely outcomes of high-quality obstetric care. Even if one accepts that the increased infant death rate in the TOL group is real, the studies do not suggest an answer to the question, "Is there an increased risk of infant death in a properly managed TOL?"

Fifteen studies of induction agents reported infant mortality. Of these, 11 found no deaths in any group studied.[22, 25, 27, 29, 30, 32, 34-36, 50, 51] In the other four, no consistent pattern emerged

favoring spontaneous or induced labor.[6, 28, 31, 52]

In summary, there appears to be a trend toward increased risk of fetal death for TOL versus ERCD. Although these studies attempted to account for some confounders, their retrospective nature makes it impossible to determine whether the method of delivery is responsible for any increased risk. The validity of the recent publication from Scotland is uncertain because the infant death rate in the CD group appears to be spuriously low, deaths were not directly linked to uterine rupture, some antepartum deaths could have been misclassified, and the TOL group included women who really intended to have an ERCD.

Summary

Maternal Complications

- Maternal death rates did not differ between TOL and ERCD.
- The best evidence suggests that hysterectomy rates do not differ between TOL and ERCD.[5]
- Rates of infection were increased in ERCD versus TOL (8.6–9.73 percent versus 6.6–6.79 percent).[5, 24]
- Studies consistently reported significantly increased risk of infection for women who had a TOL but ultimately ended with a cesarean delivery (e.g. failed TOL).
- There is conflicting evidence regarding whether induction of labor had any effect on infection rates.

Infant Outcomes

- There is insufficient evidence regarding the effect of selected route of delivery on APGAR scores.
- No study has measured infant death directly attributable to a mother's choice of TOL or repeat CD.
- Studies to date, consistently suggests that infant death may be increased by TOL versus ERCD. The degree of increased risk is uncertain (90/10,000 TOL versus 50/10,000 ERCD[5] compared with 12.9/10,000 TOL versus 1.1/10,000 ERCD.[6])

Question 4. Uterine Rupture

What is the incidence of uterine rupture, and are there methods for preventing major maternal and/or infant morbidity from uterine rupture?

One of the greatest concerns for patients, providers, hospitals, and policymakers regarding VBAC is the potential for devastating consequences from uterine rupture, such as infant death and maternal hemorrhage necessitating hysterectomy. To determine how frequently uterine rupture occurs, people must agree on what it is. Terminology and definitions vary in usage among studies (Evidence Table 6a). Terminology does not explictly differentiate uterine ruptures of the cesarean scar separation from those due to other causes.

Terms used to describe the severity of uterine ruptures are also used inconsistently. For

example, the term "dehiscence" is frequently thought to signify an incidental finding of a cesarean scar defect either at cesarean or uterine exploration after vaginal delivery. However, among the 10 studies that use this term, three[26, 30, 53] used the term to include symptomatic uterine rupture. The terms "complete" or "true," which were used to modify "uterine rupture" in 13 studies,[5, 6, 20-25, 27, 50, 54-56] had several inconsistent definitions, such as separation requiring operative intervention—e.g., emergent cesarean performed for maternal bleeding or FHR tracing abnormality associated with detecting a scar separation at cesarean; extrusion of fetus found at cesarean performed for failure to progress, scar with bleeding, hematoma formation, or extrusion of the fetus; scar rupture accompanied by intra-abdominal bleeding; or exclusively for separations associated with serious maternal or infant consequences such as death or hysterectomy.

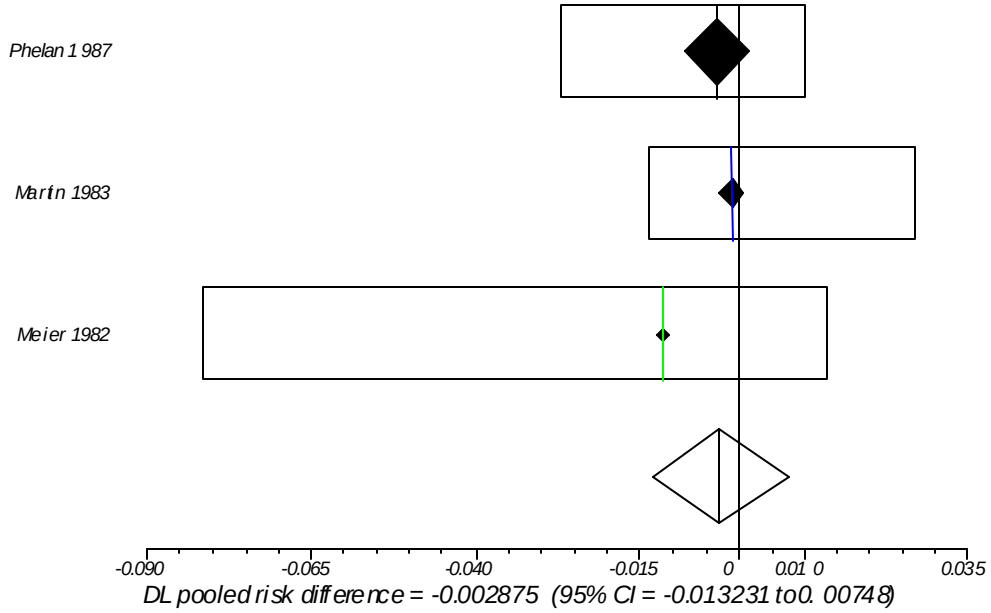
A more subtle problem occurs when uterine rupture is defined as one requiring operative intervention. Typically, a symptomatic rupture is defined as one that is discovered when an cesarean is performed because of maternal bleeding, fetal heart rate disturbances, or other clinical signs. Because uterine rupture is a rare event, finding a uterine wall defect in the context of a FHR abnormality does not necessarily signify that the defect was the cause of the fetal tracing abnormality or further that the infant would have significant morbidity attributable directly to uterine rupture of a cesarean scar. Suppose, for example, that persistent bradycardia occurs in 1 percent of labors, and is 100 percent sensitive and 99 percent specific for a clinically significant rupture of a cesarean scar. If the risk of a symptomatic rupture is 1/100, then classifying all ruptures associated with bradycardia as "symptomatic" would inflate the apparent risk of "symptomatic rupture" by 100 percent (from 1 in 100 to 2 in 100). If the true risk of a symptomatic rupture is only 1/1000, the bradycardia would be due to the rupture in only 1 of 11 cases, and classifying all ruptures associated with bradycardia as symptomatic would inflate the apparent risk of symptomatic rupture by 1100 percent (from 1 in 1000 to 11 in 1000).

What we are most interested in quantifying and aiming to reduce is *major maternal or infant morbidity attributable to uterine rupture* of a cesarean scar.

This report uses the term *"asymptomatic uterine rupture of a cesarean scar"*to indicate the opening of a prior cesarean incision with no signs or symptoms; *"symptomatic uterine rupture of a cesarean scar"* is used for uterine separation diagnosed at laparotomy performed because of FHR disturbances, maternal bleeding, or other signs of potential maternal or neonatal consequences; *major maternal or infant morbidity from a uterine rupture of a cesarean scar* cesarean scar separation leading to significant neonatal or maternal mortality or morbidity (e.g., neonatal neurologic injury, neonatal asphyxia, or maternal hysterectomy).

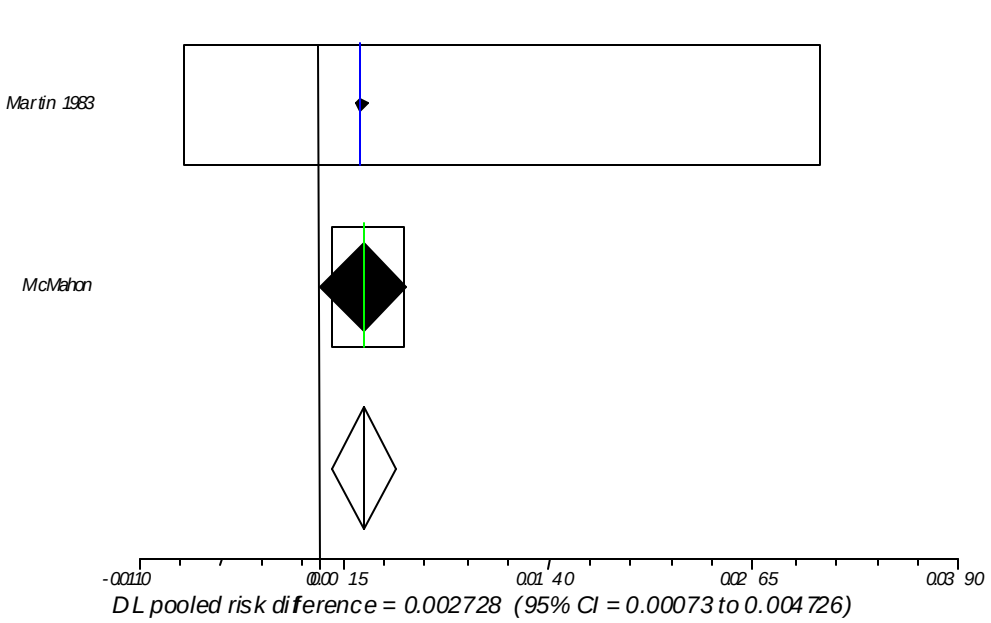
Asymptomatic uterine rupture of a cesarean scar, also referred to as uterine dehiscence, is an asymptomatic separation of the uterine scar that is an incidental finding at cesarean or from manual exploration of the uterus following a vaginal delivery. Asymptomatic uterine rupture might not necessitate operative intervention. Five of eight prospective cohort studies reported routinely performing uterine exploration after VBAC (Evidence Table 7).[21, 23, 24, 26, 27] In these five studies, rates of nonsignificant, asymptomatic uterine rupture ranged from 0/1,000[26] to 18.9/1,000,[23] with a mean weighted average rate of 12.6/1,000 in women undergoing TOL. Three studies compared TOL with ERCD in women with prior CD and asymptomatic uterine rupture of a cesarean scar (Evidence Table 7).[23, 24, 57] For these three studies, there was no statistically significant difference between the rates for asymptomatic uterine rupture in TOL and 16.4/1,000 (95 percent CI, 5.39 to 28.4) ERCD 12.9/1,000 (95 percent CI, 4.28 to 26.2) (Figure 6).

Figure 6. Asymptomatic Uterine Rupture: TOL versus ERCD
Risk difference, 95% CI



Three[4, 5, 58] of seven[4-6, 58-61] population-based retrospective cohort studies provide information about their method of classification for symptomatic uterine rupture. (Evidence Table 1). Two[4, 58] used ICD-9 codes which have been demonstrated to be unreliable (see Appendix G).[62] Nine fair to good observational studies provide the best evidence for the frequency of symptomatic uterine rupture of the cesarean scar.[5, 20-24, 26, 27, 57] The Nova Scotia database[5] had nurses and physicians extract data from charts based on an explicit definition of uterine rupture as a defect that involved the entire wall of the uterus, that was symptomatic, or that required operative intervention. They reported 10 symptomatic uterine ruptures in 3,249 TOLs (3/1,000) versus one in 2,889 cases of ERCD. Eight prospective cohort studies reported rates of symptomatic uterine rupture.[20-24, 26, 27, 57] Rates of symptomatic uterine rupture ranged from 0/1,000[57] in one of the smallest studies to 7.8/1,000 in the largest study.[20] The pooled rate for all prospective studies was 3.16/1,000 (95 percent CI, 1.29 to 5.78). Two studies[5, 57] provide comparative data for rates of symptomatic uterine rupture in TOL versus ERCD (Figure 7). When combined, these data suggest that there is an additional risk of 2.7/1000 for symptomatic uterine rupture for TOL over ERCD.

Figure 7. Symptomatic Uterine Rupture: TOL versus ERCD



Assessing the chances of significant neonatal or maternal morbidity is difficult, due to inconsistencies in classification and reporting. Frequently cited case series reported risks of neonatal death ranging from 1.6[63] to 45.8 percent,[64] and hysterectomy from 17[65] to 85.7 percent[66] (Evidence Table 7). Although none of the fair-to-good-quality population-based or prospective cohort studies specifically reported rates of clinically significant or catastrophic uterine rupture, rates were derived from details provided on cases. There were no cases of maternal death secondary to scar separation in any of the eight fair-to-good-quality prospective cohort studies,[20-24, 26, 27, 57] nor the one good-quality population-based retrospective cohort[5] reporting on uterine dehiscence or rupture (Evidence Table 6). Studies that explicitly recorded uterine rupture-related perinatal or maternal death, infant morbidity, or maternal hysterectomy[5, 20-22, 26, 55, 56] consistently reported results for symptomatic uterine ruptures; therefore, this will serve as denominator. The only population-based study with these data[5] reported no maternal deaths (0 percent), two perinatal deaths (18 percent), and two hysterectomies (18 percent) related to 11 symptomatic uterine ruptures of cesarean scars. Eight prospective cohort studies[20-24, 26, 27, 57] and two uterine rupture case series[55, 56] reported on uterine rupture-related perinatal death. Six studies[20, 21, 24, 26, 27, 57] of varying size, from 162 to 5,022 TOLs, reported no cases of uterine rupture-related perinatal deaths; the other two large cohort studies (3,957 TOLs[22] and 1,796 TOLs[23]) reported rates of 14-20 percent respectively, and the uterine rupture case series reported rates of 6 percent[55] and 4 percent.[56] Among twelve studies, 11 uterine-rupture related perinatal deaths were reported in 202 uterine rupture; suggesting that the risk of perinatal death given uterine rupture is 5 percent. Given a symptomatic uterine rupture rate of 3/1000 and 5 percent chance of perinatal death due to uterine rupture, the perinatal death rate due to TOL would be expected to be 1.5/10,000 rather than the 12.9 or 90/10,000 reported in Smith and Mc Mahon respectively. If the highest rate of uterine-rupture related perinatal death found by McMahon were true, the conditional probability for uterine-rupture related perinatal death would be 6/10,000 in TOL versus 0/10,000. Reflecting on the perinatal death rates associated with route of delivery (not just uterine rupture) reported in Smith and McMahon, 12.9-90/10,000 in TOL and 1.1-50/10,000 in

ERCD, these uterine rupture- related conditional perinatal death rates emphasize the need for caution in communicating the risk of perinatal death due to chosen route of delivery to a patient.

One population-based study[5], four prospective studies,[20-22, 26] and one uterine rupture case series[55] reported on uterine rupture-related hysterectomy with rates ranging from 0-33 percent. The total uterine rupture related hysterectomy rate among these studies was 26 in 159 cases of symptomatic uterine rupture (16 percent). Given a symptomatic uterine rupture rate of 3/1000, and 16 percent chance of hysterectomy given a symptomatic uterine rupture, our best estimate of the risk of uterine rupture-related hysterectomy for women choosing TOL is 4.8/10,000.

Increased Risk with Induction

Uterine rupture was reported in 29 of 48 studies of labor induction; however, 15 of these did not report the definition used. Twelve studies reported no cases of symptomatic uterine rupture. Of those studies providing a clear definition of symptomatic uterine rupture and finding any cases of uterine rupture, the lowest rate among the induction groups was 0.35 percent (1 of 289) in a prospective cohort study of oxytocin,[30] and the highest was 6.25 percent (1 of 16) in a randomized controlled trial of mifepristone.[35] The rates of rupture among women undergoing spontaneous onset of labor in these studies ranged from a low of 0.15 percent in a prospective study of PGE2 gel[36] to a high of 0.8 percent in a similar prospective cohort study of oxytocin.[28]

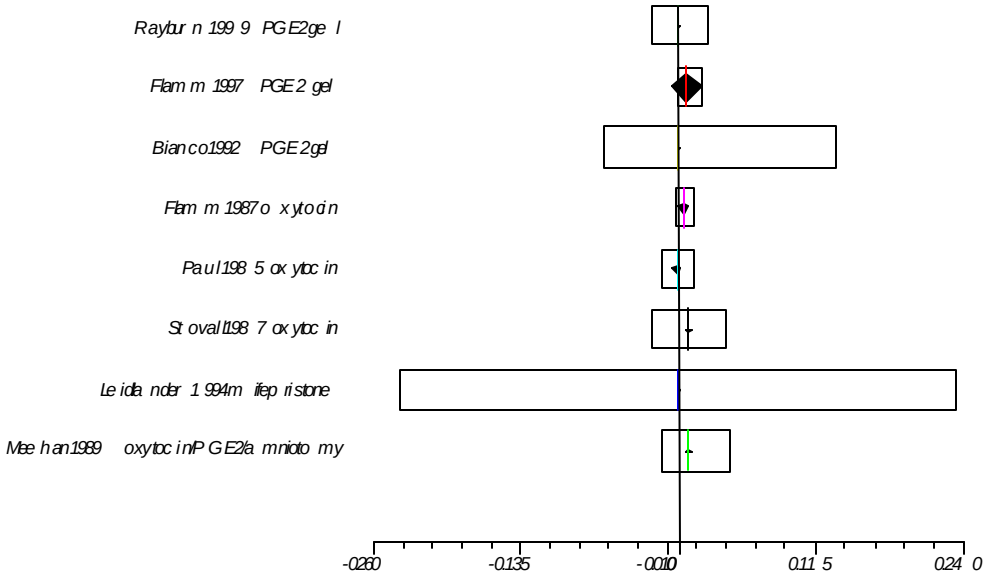
In studies comparing any method of labor induction with spontaneous labor (Figure 8), the rupture rate was slightly increased (pooled risk difference 0.3 percent, 95 percent CI, -.09 to 0.7 percent).

Comparing labors requiring oxytocin with spontaneous labor (Figure 9), a significant difference was not seen (pooled risk difference 0.3 percent, 95 percent CI, -0.01 to 0.6). All of these studies provided a clear definition of uterine rupture, but none stratified the outcome by oxytocin used for induction or augmentation. Three studies provided data on the maximum dose of oxytocin allowed by protocol.

All three studies[32-34] of a prostaglandin versus spontaneous labor that reported uterine rupture rates used PGE2 gel (Figure 10). Two studies[32, 34] found no difference in uterine rupture rates; however, neither study gave a definition of rupture. The third, much larger, study[33] found an insignificant increase in ruptures with PGE2. Although not statistically significant, the pooled risk difference was slightly elevated, 0.42 percent (95 percent CI, -0.53 to 1.36 percent).

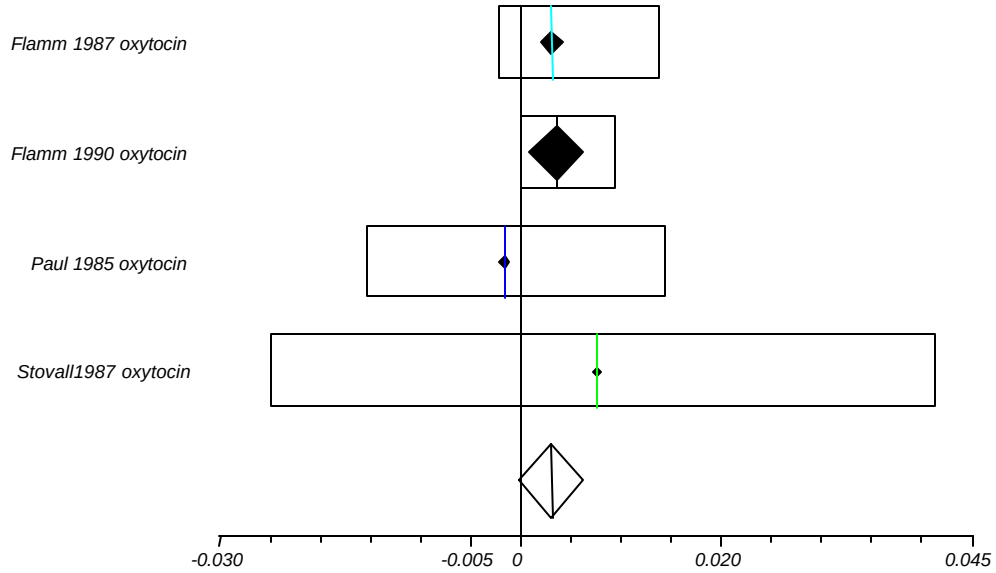
Only one study[67] compared one induction method versus another. It compared misoprostol to PGE2 (gel or pessary) in a prospective cohort study that did not provide a definition of uterine rupture.[67] This study found a higher rate of rupture with misoprostol, but the difference was not significant. The largest study of prostaglandin was excluded from analysis due to poor definition of uterine rupture.[4] Although the precision and accuracy of the results are reduced, the magnitude of the effect showing an increase in the rate of uterine rupture suggests that a real association between PG induction of labor and uterine rupture probably exists.

Figure 8: Uterine Rupture: All Induction Methods versus Spontaneous Labor
Risk difference, 95% CI



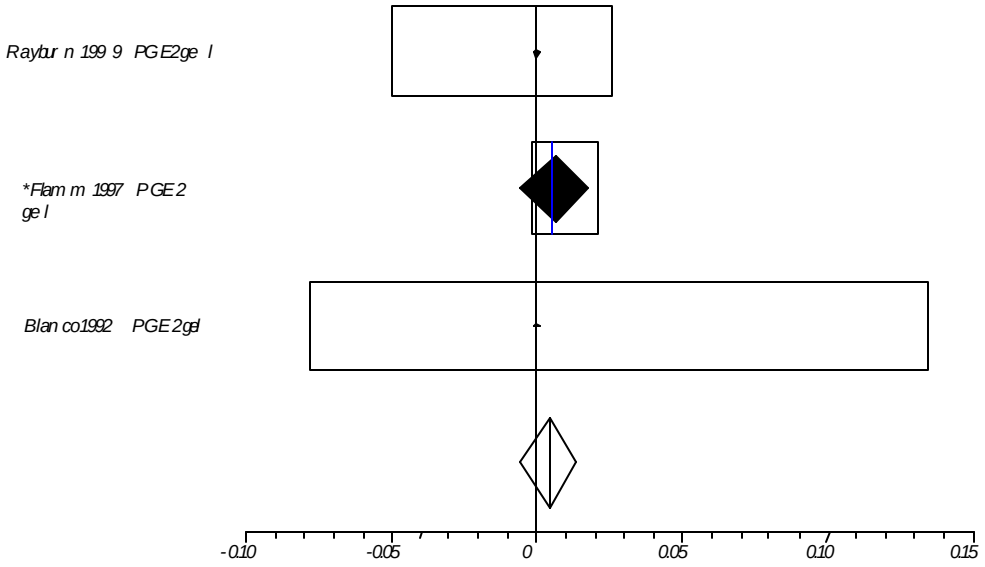
Study	# Induced	# CD	# SL	# CD
Rayburn 1999[32] PGE2 gel	143	0	151	0
Flamm 1997[33] PGE2 gel	453	6	4569	33
Blanco 1992[34] PGE2 gel	25	0	56	0
Flamm 1987[28] oxytocin	485	2	1005	1
Stovall 1987[27] oxytocin	133	1	116	0
Paul 1985[30] oxytocin	289	1	395	2
Lelaidier 1994[35] mifepristone	16	1	16	1
Meehan 1989[50] oxytocin/PGE2/amniotomy	127	1	162	0
DerSimonian-Laird pooled risk difference = 0.31% (95% CI = -0.09 to 0.72) Q statistic ("non-combinability" for risk difference) = 2.3; P = 0.94				

Figure 9: Uterine Rupture: Oxytocin versus Spontaneous Labor
Risk difference, 95% CI



Study	# Induced	CD	# SL	CD
Flamm 1987[28]	485	2	1005	1
Flamm 1990[22]	1201	6	2756	4
Stovall 1987[27]	133	1	116	0
Paul 1985[30]	289	1	395	2
DerSimonian-Laird pooled risk difference = 0.31% (95% CI = -0.012% to 0.63%) Q ("non-combinability" for risk difference) = 1.3; P = 0.73				

Figure 10 Uterine Rupture: Prostaglandins versus Spontaneous Labor
Risk difference, 95% CI



*Uterine r uptu redef ined wel l

Study	# Induced	CD	# SL	CD
Rayburn 1999[32] PGE2 gel	143	0	74	0
Flamm 1997[33] PGE2 gel	453	6	4569	33
Blanco 1992[34] PGE2 gel	25	0	46	0
DerSimonian-Laird pooled risk difference = 0.42% (95% CI = -0.53% to 1.36%) Q ("non-combinability" for risk difference) = 0.66; P = 0.72				

Predictors of Major Morbidity due to Uterine Rupture

Fetal tracing predictors. In those cases where uterine rupture cannot be prevented, the next best thing would be to identify the earliest sign that it has occurred or is in the process of occurring, and to intervene to prevent significant neonatal or maternal morbidity or mortality. Ten fair-to-good-quality studies reported on abnormalities in FHR tracing as a sign of rupture.[21-23, 25, 26, 30, 50, 53, 55, 56] (Evidence Table 7). Abnormalities in FHR tracings were the most common sign of uterine rupture in 33–100 percent of all studies and 55–87 percent of fair-quality studies. Given that the definition of rupture used in most studies was any defect that involved the entire uterine wall, was symptomatic, or required operative intervention, it is not surprising that the most common sign of uterine rupture in these studies was FHR disturbances. Nonreassuring FHR tracing is the fourth leading indication for cesarean (in order: prior cesarean, breech, dystocia, fetal distress). Most commonly studies of uterine rupture reported the occurrence of prolonged fetal bradycardia. The definition of prolonged fetal bradycardia is often not provided or is inconsistent, despite a consensus definition from the NICHD workshop on electronic fetal monitoring (decrease in baseline greater than 15 beats/minutes lasting between 2 and 10 minutes).[68] Other signs reported in uterine rupture studies in descending order are maternal vaginal bleeding, maternal pain, and uterine contraction disturbances.

Many have wondered whether there are any factors that can prevent poor neonatal outcome when there are signs of potential rupture. Two fair-quality case series[55, 56] have studied cases of

uterine rupture of the cesarean scar to determine whether any predictive premonitory signs exist. Leung et al. were the first to perform an exploratory analysis to study risk factors for poor neonatal and maternal outcome; particularly FHR and uterine contraction patterns.[55] They identified 106 cases of symptomatic uterine rupture from 11,179 TOLs in women with prior CD at LA County-USC Women's Hospital, from which they were able to review the records of 99. The scar type was unknown in 99 percent of their population. They categorized cases of uterine rupture based on complete, partial, or no extrusion of the fetus. Combining death, asphyxia, and respiratory distress, they concluded that perinatal morbidity and mortality was significantly greater in cases where the fetus was extruded. However, they report that the six neonates requiring intubation were extubated and discharged from the neonatal intensive care unit (NICU) within 24 hours (range 1-24 hours) and were discharged from the hospital without adverse sequelae. If these six temporary outcomes (e.g., without significant adverse sequelae) are removed, major perinatal morbidity (asphyxia or death) occurred in 7/41 (17 percent) cases of partial or complete extrusion and 4/58 (6.9 percent) cases of nonextruded fetuses ($p = 0.113$). Of note, four of the fetal deaths occurred in patients who presented with fetal distress and underwent immediate CD, leaving two cases occurring in women undergoing supervised labor (one in the extruded group and one in the nonextruded group). Looking for premonitory signs of uterine rupture, they found that abnormalities of FHR tracing (prolonged deceleration only [defined as FHR less than 90 beats/min that exceeded 1 minute and without return to baseline], prolonged decelerations preceded by late decelerations, prolonged decelerations preceded by severe variables, mild late decelerations only, or fetal distress on admission necessitating CD) occurred in 91/99 cases (91.9 percent) and that all cases of fetal extrusion had prolonged decelerations. Prolonged decelerations occurred in 17/41 (41.5 percent) patients with extrusion and 15/58 (25.9 percent) without. In studying patients with prolonged deceleration further, they found that no patient who had prolonged deceleration only as their sign had significant clinical morbidity when delivery occurred within 17 minutes of the onset of deceleration. If the three cases of temporary neonatal intubation were removed, one case of neonatal asphyxia and no deaths in the prolonged bradycardia group would remain. Although the small numbers make the data unstable, it is intriguing that the one case of asphyxia occurred when there was 32 minutes between the onset of bradycardia and delivery, compared with 22 minutes and less in the group with intubation or no complications. Thus it is unknown what neonatal outcomes would arise between 22 and 32 minutes from bradycardia.

Leung et al. have done a superb job of exploring the details of their cases of uterine rupture; however, they are limited by the constraints of case series data. Data from a control group are important for understanding details about the association between fetal bradycardia and poor infant outcome. Decelerations are not rare; in fact, only 1.4 percent of all deliveries do not have FHR decelerations.[69] Prolonged decelerations, especially given Leung's definition, are rare, occurring in 7.9–12.5 percent of patients receiving epidurals.[70] Causes of prolonged decelerations include cervical examination; rapid decent in the second stage of labor; maternal hypotension due to positioning, epidural, or other; maternal hypoglycemia; reactive hypothermia such as with a cold amnioinfusion; prolonged cord compression (oligohydramnios); tetanic uterine contractions; maternal seizures, and cord prolapse, in addition to uterine rupture. Because fetal bradycardia is not specific to uterine rupture, the presence of a control group would allow some insight into associations with uterine rupture versus these other causes. Additionally, it is important to know details about the context of decision-making, in order to know what portion of

time delays are preventable (e.g., substantial time between decision to go to cesarean and actual time for cesarean).

A second and more recent case series found no relation between time from FHR deceleration and infant outcome.[56] All medical records in a single-institution hospital were examined to identify cases of "complete cesarean scar disruption," defined as uterine scar separation that extended through visceral serosa. As above, the study was conducted in a tertiary care hospital with in-house anesthesia and obstetrics. The authors report on 23 cases of uterine rupture of a cesarean scar, six with partial or complete expulsion of the fetus. Fetal heart rate abnormalities—which included tachycardia and late, variable, or prolonged (not defined) decelerations—were the initial sign of uterine rupture in 87 percent of cases (four had pain, one vaginal bleeding, and one hematuria). Prolonged deceleration was the first sign of uterine rupture in 6/6 (100 percent) of the extruded patients versus 8/17 (47 percent) without extrusion. There was one perinatal death that occurred in the non-extruded group (late decelerations more than 25 minutes before delivery, failed vacuum extraction, then cesarean), and three cases of impaired motor development diagnosed as hypoxic-ischemic encephalopathy, occurring in the extruded group; delivery occurred 15,16, and 23 minutes from onset of prolonged deceleration. When they looked at metabolic acidosis (their primary outcome, defined as umbilical artery pH less than 7.0 with base deficit greater than 12mMol/L), they found a non-significant trend towards less time between first sign to delivery (18 versus 24 minutes) and decision to delivery (13 versus 17 minutes) in the group with metabolic acidosis compared with those without acidosis ($p = 0.11$). In this case, the greater time delays in the group without metabolic acidosis could reflect less concern by the physician and thus a slower overall movement, rather than programmatic delays.

In summary, the literature on uterine rupture suffers from inconsistent use of terms and ambiguous definitions. Additionally, because uterine rupture of the cesarean scar is often diagnosed at cesarean performed for fetal tracing abnormalities, there is diagnostic review bias. Studies conducted thus far to examine the relationship between duration of FHR disturbance particularly prolonged bradycardia and adverse perinatal outcome, have had conflicting results. It is important to further examine the relationship between fetal tracing disturbances (e.g., prolonged fetal bradycardia) and uterine rupture. This can only be done by comparing instances of a particular fetal tracing disturbance in women undergoing a TOL and noting how many times it is truly associated with uterine rupture (true positive) and how many times it is not (e.g., false positive).

Summary

- The use of terms among studies is inconsistent.
- Definitions of terms among studies are ambiguous.
- There is not a significant difference in asymptomatic uterine rupture rates in TOL versus ERCD.
- Symptomatic uterine rupture is significantly more common in TOL versus ERCD, with an increased risk of 2.7/1000
- Based on the frequency and severity of symptomatic uterine rupture, the risk of perinatal death due to a rupture of a uterine scar is 1.5/10,000 and the risk of hysterectomy is 4.8/10,000. These rates of serious complications such as perinatal death, are probably more precise than overall risks from studies measuring death directly.

- The definition of uterine rupture as an outcome is confounded by a definition that includes the potential predictor of FHR tracing abnormality.
- Measurement of frequency of occurrence, predictors for what population is at greatest risk, and predictors for poor outcomes are difficult, because of the lack of standard case definition.

Question 5. Health Status

What is the health status and health-related quality of life for VBAC and repeat cesarean patients?

In general, there is limited research on the health status or health-related quality of life of patients in the weeks after any type of delivery. In studies of the general postpartum population, health status or health-related quality of life refers to general health, physical functioning, mental health, vitality, pain, social functioning, self-care activities, working, household psychosocial outcomes, and/or daily activities (including care of the infant).[12, 71-74]

No studies evaluated health status or health-related quality of life for women with a prior CD after a TOL, repeat CD, VBAC, or ERCD. There were no studies in the general birthing population that contained a subgroup analysis of women with prior CDs. Studies of the general postpartum population did not present data on subgroups of women with prior CD.[72, 74] Similarly, it was not possible to extrapolate results from the RCT of breech presentation, which examined the effect of route of delivery on health status, because women with a baby in breech presentation might not be similar to women with cephalic presentation and prior CD.[12] One review[71] and one prospective cohort study[75] separated health status and psychosocial results by planned, unplanned CDs and vaginal deliveries but neglected to describe the process, e.g., whether a TOL led up to the unplanned CD. Because of these limitations, the usefulness of these general postpartum population results as they relate to women with prior CDs is questionable. More research is needed.

Summary

- There were no studies of health status or health-related quality of life for VBAC or repeat CD patients.

Question 6. Patient Satisfaction

Regarding VBAC and repeat cesarean, what factors influence patient satisfaction/ dissatisfaction with their childbirth experience?

In this review, the term satisfaction refers to a feeling or a response to a birthing experience.[76, 77] Women who were interviewed after birth described satisfaction as a happy feeling.[78] Dissatisfaction was described as a negative feeling. Satisfaction is often multidimensional (e.g., satisfaction with information given, care and treatment, patient's involvement in decisionmaking, and control in process).[79] In this study, women might be satisfied with one aspect of the birthing experience but dissatisfied with another. The context,

birth process, and outcome affect the woman's sense of satisfaction.[78] Understanding how women feel before, during, and after the birth experience has not been explored.[76]

Studies that have measured satisfaction in the general birthing population suffer from a potential bias. Clinicians often gather the satisfaction data directly from the patients .[80] Also, the timing of the measurement might introduce recall bias. In five of 10 studies of one review, the satisfaction results were collected within days or weeks of delivery.[80] Several investigators have hypothesized that a woman having an emergency CD might be less critical if she believed the CD was performed to protect her own health or that of her baby.[80-82] The literature that focused on satisfaction for women attempting TOL and those choosing an ERCD was evaluated with these potential biases in mind.

Two cross-sectional studies[83, 84] met the inclusion criteria for this report (Evidence Table 8a). Two prospective cohort studies were also evaluated for inclusion, but both received quality ratings of poor (Evidence Table 8b).[85, 86] In both prospective cohort studies, the patient's own clinician interviewed her during her postpartum hospital stay[85, 86] and again at her 6-week checkup.[86] This method potentially introduces bias in that the patients might be unwilling to be completely honest if their own provider asks the questions about satisfaction, particularly if the clinician is actively caring for the patient during the postpartum stay. For this reason, both of these studies were rated poor and their results are likely to be invalid (Evidence Table 8b).

The two cross-sectional studies were of fair quality (Evidence Table 8a).[83, 84] These studies contained an unbiased assessment of patient satisfaction. The studies were rated fair for the following reasons: inclusion criteria were unclear (and refusal rates were not reported),[84] or was fair (72 percent),[83] or patients completed questionnaires over varied time frames during which satisfaction might have changed (1-18 months after delivery).[83]

These two studies reported satisfaction (feelings) of patients with differing delivery outcomes.[83, 84] One study reported feelings for patients achieving VBAC[84] while the other reported feelings of mothers (and fathers) who chose TOL but had another CD or who chose ERCD.[83]

In one study[84] women who completed a VBAC compared their vaginal deliveries with their prior CD experiences. Seventy percent of these women would choose VBAC again. In this study, 32 VBAC patients completed the Birth Experience Questionnaire, which contains six open-ended questions related to physical and emotional reactions to the birth experience. The responses were analyzed using content analysis by two independent reviewers (inter-rater reliability=92 percent). When all 156 comments describing feelings after birth were classified as either "adaptive" (responses that met the mother's goals for survival, growth, reproduction, or mastery) or "ineffective" (responses that did not meet the goals), chi square analysis revealed a statistically significant association between delivery and type of response (Table 5). Women were more likely to describe their feelings about their VBAC as "adaptive" and were more likely to describe their feelings about their prior CD as "ineffective." When compared with their CD experience, women described their VBAC experience as "feeling relieved, excited, more confident, and in control."

Table 5. Responses to Vaginal versus Cesarean Delivery

	Vaginal delivery	Prior CD
Total ineffective responses	37	65
Total adaptive responses	42	12

Chi square [1, n = 156] = 22.70, p < .0005)

The second study captured the feelings of women who chose TOL but ended up having another CD or who initially chose ERCD.[83] In this study, 228 couples who had experienced a CD responded to a media campaign to answer a birth survey. Ninety-one of these couples had a prior CD. The feelings of the mothers and fathers in the general population experiencing CDs are compared by obstetric history and shown in Tables 6 and 7. Thirty-five percent of mothers experiencing a second CD wanted more advice on how to cope with their feelings.

Table 6. Mother's Feelings After Cesarean Delivery

Feelings of. . .	Percent of Patients with First CD (n = 105)	Percent of Patients with first CD and Prior VD (n = 32)	Percent of Patients with second (or more) CDs (n = 91)
Relief	86	78	90
Disappointment	68	56	34
Frustration	41	56	35
Joy and happiness	93	67	90
Failure	25	31	18
Difficulty relating to baby	14	13	7
Guilt	20	22	11
Anger	20	28	20
Concern about scar	30	25	15
Guilty about dissatisfaction with birth experience	20	19	10
Uncertain about what you could do when you got home	33	59	21

CD=cesarean delivery; VD= vaginal delivery

Table 7. Father's Feelings After Cesarean Delivery

Feelings of. . .	Percent of Patients with First[t] CD Birth (n = 105)	Percent of Patients with First CD and Prior VD (n = 32)	Perfect of Patients with Second (or more) CD (n = 91)
Relief	93	76	90
Fear for mother and baby	70	55	52
Being left out	46	38	32
Joy and happiness	91	59	94
Anger	16	10	11
Guilt	10	3	11
Difficulty relating to the baby	7	3	4
Uncertain about what you could do when you got home	35	21	15

CD=cesarean delivery; VD= vaginal delivery

For both fathers and mothers, the feelings expressed most often by patients were of relief (that labor was completed and mother and baby were healthy) and joy and happiness. The proportion expressing these feelings was reduced when it was a couple who had experienced a CD after a prior VD.

The couples that participated in this study were self-selected and probably not representative of the general obstetric population. For example, 59 percent of the couples responding to this survey had attended prenatal classes compared with 30 percent in the general population for that region. Also, the study would be more pertinent to this review if the results had identified the subgroup of repeat CD patients who initially tried TOL.

Summary

- Studies of patient satisfaction largely consisted of patient's own provider obtaining information about satisfaction, introducing the possibility for measurement bias.
- Only two cross-sectional studies used methods other than the patient's own provider to obtain satisfaction information.
- No study measured satisfaction for the three types of delivery outcomes that could be experienced by women with prior CDs (VBAC, TOL followed by CD, or ERCD), which leaves room for much needed research.

Question 7. Cost and Health Care Resources

How are economic outcomes related to VBAC, repeat CD, and their respective complications?

One component of the decision to attempt a TOL or perform an ERCD is the economic value of each approach. Comparisons among alternative approaches can be evaluated using a cost-effectiveness design or other economic evaluation. While economic considerations should not be the sole driver for such a decision (unless TOL and ERCD are deemed clinically equivalent), the relative value of each approach might influence the decision.

Twelve economic analyses with data relevant to this topic were reviewed. Two of these[87, 88] are listed in Evidence Table 9a. The remaining 10 papers[89-99] had quality ratings of poor and are listed in Evidence Table 9b. The paper by Chung et al.[87] was rated good and the paper by Grobman et al.[88] was rated fair.

Chung et al.[87] focused on the probability of vaginal delivery for TOL and the cost-effectiveness of TOL in women with prior CDs. The study followed the guidelines for such analyses, including use of quality-adjusted life years (QALYs).[100] A QALY compares a certain state of health (e.g., life after a hysterectomy) to a perfect state of health. This analysis included a societal perspective, performed a long-term analysis, and included most adverse events associated with the two modes of delivery. The paper focused on sensitivity analyses for the rate of successful TOL (that is, achieving VBAC). If the TOL success rate is less than 65 percent, ERCD cost less and provided more QALYs than TOL. This means that ERCD is more cost-effective or more efficient. For TOL success rates between 65 percent and 74 percent, ERCD provided more QALYs at a cost of less than $50,000 per QALY (the upper limit of cost-effectiveness used in this article). For TOL success rates between 74 percent and 76 percent, ERCD provided more QALYs but at a prohibitive cost (greater than $50,000 per QALY). When the probability of vaginal delivery for TOL exceeded 76 percent, TOL was more effective and less costly. The results were also sensitive to the probability of infant mortality, costs for "moderate" morbidity for the infant, the probability of urinary incontinence, the discount rate,

and the probability of cesarean rupture. The authors defined moderate morbidity for the infant, "...principal diagnoses of meconium aspiration, neonatal infection/sepsis screening, and respiratory distress/failure." The authors recommend that more precise tools be developed to estimate the probability of a successful TOL and, if the probability of success were 74 percent or greater, that TOL would be the efficient (cost-effective) choice; if the probability of success were less than 74 percent, ERCD would be the efficient choice. Clearly, the success probability for TOL was a key variable in these analyses. Chung's analysis did not consider future pregnancies.

The study by Grobman et al.[88] used a variety of literature sources and estimated a cost of $2.4 million (M) to prevent one major neonatal adverse outcome by performing ERCD instead of TOL. This means that 1,591 ERCDs would be performed resulting in 0.1 additional maternal deaths and 74 additional maternal morbid events to prevent one serious neonatal outcome. Extensive sensitivity analyses estimated that the cost to prevent one major neonatal outcome would exceed $1M for all scenarios considered. This estimate was based on a payer or health care system perspective and considered a range of adverse outcomes including maternal and neonatal deaths and other major adverse outcomes.

Among the remaining 10 studies, there is at least one fatal flaw in each that cast doubt on the conclusions drawn. Several shortcomings are consistent across the 10 reports: the lack of cost data (reliance on charge data), failure to consider all relevant outcomes (especially among adverse events), lack of a societal perspective, and failure to use a recommended effectiveness outcome as the QALY.

Summary

- Based on the economic evaluation with the best quality score, when the probability of vaginal delivery is 76 percent or greater, TOL is more cost-effective and provides higher quality of life.
- Based on the economic evaluation with the best quality score[87] and assuming costs per QALY of $50,000 as cost-effective, the more cost-effective of TOL and ERCD depends on the probability of successful VBAC after TOL.
- Further evaluation is needed of the sensitivity of the probability cut point of 76 percent to other potential predictor variables.

Health Care Resources

One component of the economics of TOL versus ERCD is units of health care resources. Various types of health care resources (including time in labor and delivery, time in surgery for CD, and time in neonatal intensive care) contribute to the costs of delivery; however, other than one study of operative time,[101] the literature dealt with maternal and/or neonatal length of stay (LOS). One would expect shorter LOSs for successful TOL than for repeat cesarean, either elective or after failed TOL. Among 19 studies (two of which[102, 103] discuss exactly the same data) of resources for mother and/or infant, all had quality ratings of poor (Evidence Table 10). In all cases, there was no adjustment for baseline risk to allow for comparisons of resource units adjusted for other risk factors. Flamm et al.[20] reported fitting a regression model of maternal LOS in which significant predictors were medical center of delivery, TOL (yes or no), unknown status of prior uterine scar, absence of postpartum fever, lack of transfusion, 5-minute Apgar score of 7 or greater, and no tubal ligation. However, these authors did not provide details of this

regression model, so adjusted difference in LOS due to delivery mode cannot be estimated. The LOS for TOL was at least one day shorter across all studies. However, without information on other resources (including labor and delivery time, time in surgery, and time in neonatal intensive care) and without comparable groups or risk adjustment, there are no good estimates for resource utilization comparisons of TOL and ERCD.

Decision Factors

Question 8. Individual Factors

What individual factors influence route of delivery?

Thirteen fair-to-good-quality studies[36-39, 42, 104-111] examined individual factors that influence route of delivery (Evidence Table 11). We classified individual factors that influence route of delivery into four general categories (Table 8): (1) demographic, (2) past obstetric, (3) current obstetric, and (4) nonclinical.

Table 8. Individual factors by general categories

Category	Factors (number of studies)	
Demographic	*Age (20)* Race (1)	SES (0)
Past Obstetric	***Gravidity (6)*** ***Parity (12)*** *Prior VD (26)* *Order of Prior VD (10)* Previous Cervical Dilation (7)	*Number of prior CD (22)* *prior CD Indications:* **Recurrent versus Nonrecurrent (61)** **Recurrent versus Breech (44)** **Recurrent versus Fetal Distress (41)**
Current Obstetric	*Gestational age (15)* *Birth weight (37)* Multiple gestations (3) *Breech/External Cephalic* **Version (3/3)** *Cervical dilation (8)* Cervical dilation rate (2) **Cervical effacement (5)** *Station (5)*	**Bishop score (2)** SL (26) Induced labor (26) **Augmented labor (21)** Oxytocin use (nonspecified) (25) *Epidural use (16)* Maternal height (5) Maternal weight (4) Maternal weight gain (3)
NonClinical	Insurance (1) Hospital (2)	Physician (0)

Bold factors are those that had adjusted ORs from fair-to-good-quality studies

Three fair-to-good-quality cohort studies[36, 42, 107] provide conflicting results on the association of maternal age and likelihood of vaginal delivery (Table 9). While two[36, 42] suggest a negative association between increasing age and vaginal delivery, one[107] suggested the likelihood of VBAC increased with each year of maternal age (adjusted OR, 1.18; 95 percent CI, 0.98 to 1.40). While one could speculate that this discrepancy could be explained by the fact that McNally adjusted for more extraneous factors, none of these factors appeared associated with both the exposure (age) and outcome (VBAC) of interest. The only exception to this finding is parity, which we would expect to create an apparent association between increasing age and an increased likelihood of VBAC, based on previous studies. Because McNally adjusted for parity

and still found a positive association, and because Flamm and Weinstein did not adjust for parity and still showed a negative association, confounding apparently was not the reason for the different findings. Another possible explanation for the discrepancy lies in the fact that unlike the other two studies, McNally's population included only those who were induced. Perhaps it was the case that those who were induced tended to be younger in age (e.g., all less than 35 years old), and since McNally's calculations were based on the continuous data (for age), this resulted in the observed positive association. Although this theory cannot be tested using the information provided by McNally, this finding introduces the issues of the use of continuous versus categoric data, the consideration of the age ranges when calculating such measures of association, and the possible interaction between age and labor induction.

Table 9. Demographic Factors

Factor	Author (year)	Adjusted OR for VBAC	95 percent CI, p-value
Maternal Age	Flamm 1997[36]	**2.58** (<40 yrs)	1.55-4.3
	McNally 1999[107]	1.18 (per yr of age)	0.98-1.40
	Weinstein 1996[42]	0.9 (>37yr)	0.5-1.7

Bold=significant; NR=not reported; NS=not significant

There were no fair-to-good quality studies for the individual factors of maternal race or socio-economic factors.

Past Obstetric Factors

While over 50 studies have investigated the influence of clinical history and past obstetric factors on the outcome of TOL after prior CD, only five were of fair-to-good quality. This relatively small percentage of quality studies did not provide any information for the individual factors of gravidity, parity, and previous cervical dilation.

Prior vaginal delivery (VD) is associated with an increased likelihood of vaginal delivery in TOL. This association is strongest when the prior VD occurred after cesarean. Of the 26 studies investigating the role of prior VD, only one was rated as fair. McNally[107] demonstrated that those with a prior VD had a significantly higher probability of a VBAC compared with those without a prior VD (adjusted OR 27.78; 95 percent CI 3.85 to 200). Four of 10 studies addressing the order of the prior VD,[36, 38, 42, 112] were rated as either being good or fair-quality and suggest that order of the Prior VD is important as well. While studies by Flamm[36] and Weinstein[42] showed that those with a vaginal delivery before prior CD had a significantly higher likelihood of VBAC compared with those without such a history (adjusted OR 1.53; 95 percent CI, 1.12 to 2.10 and adjusted OR 1.8; 95 percent CI, 1.1 to 3.1, respectively), Flamm[36] and Macones[38] demonstrated that this probability of VBAC was greatly increased if instead the prior VD came after the prior CD (adjusted OR 3.39; 95 percent CI 2.25 to 5.11 and adjusted OR 7.69; 95 percent CI 3.23 to 20, respectively). The significance of having a prior VD after prior CD was further illustrated by the only good-quality study.[112] Caughey found that those with a prior VD after prior CD were more than three times as likely to have a vaginal delivery compared with those with a prior VD before prior CD (adjusted OR 3.48; 95 percent CI, 1.9 to 6.1). Overall, the importance of having a prior VD was perhaps most strongly demonstrated by Flamm,[36] who showed that those with a vaginal delivery both before and after prior CD had a nine-fold increase in the likelihood of VBAC compared with those without a prior VD (adjusted OR 9.11; 95 percent CI, 2.18 to

38.04) (Table 10).

When considering the issue of prior CD, the two most investigated factors include the number of prior CDs and prior CD indication. Of the 22 studies looking at the number of prior CDs, only one was rated as being fair in quality.[39] Consistent with the overall literature, Pickhardt[39] demonstrated that the probability of VBAC significantly decreased as the number of prior CDs increased (adjusted OR 0.43; $p < 0.05$). By controlling for a great number of potential confounders in his analysis, Pickhardt established this factor as a true independent predictor of TOL outcome. Also consistent with the overall VBAC literature were the findings of the two[36, 42] of 61 studies given a fair rating regarding prior CD indication. While Flamm[36] demonstrated that those with a nonrecurrent indication compared with those with a recurrent prior CD indication (CPD or failure to progress), had a significantly higher VBAC rate (adjusted OR 1.93; 95 percent CI, 1.58 to 2.35), Weinstein[42] showed similar, yet nonsignificant findings. Weinstein also found that although nonsignificant, those with a prior CD indication of breech presentation or fetal distress had a greater chance of VBAC compared with those with a recurrent indication (adjusted OR 1.9; 95 percent CI, 1.0 to 3.6 and adjusted OR 1.05; 95 percent CI, 0.4 to 2.6, respectively). As reported by previous studies, those with a prior CD indication of breech presentation had the highest relative likelihood of VBAC.

Table 10. Past Indicators of VBAC Delivery

Factor	Author (year)	Adjusted OR for VBAC	95 percent CI p-value
Prior VD	McNally 1999[107]	**27.78**	3.85-200
Order of prior VD			
Before prior CD	Flamm 1997[36]	**1.53**	1.12-2.10
	Weinstein 1996[42]	**1.8**	1.1-3.1
After prior CD	Flamm 1997[36]	**3.39**	2.25-5.11
	Macones 2001[38]	**7.69**	3.23-20
After vs. Before prior CD	Caughey 1998[112]	**3.48**	1.9-6.1
Before & After prior CD	Flamm 1997[36]	**9.11**	2.18-38.04
Number of prior CD	Pickhardt 1992[39]	**0.43**	p<0.05
Prior CD Indication			
Nonrecurrent vs. Recurrent	Flamm 1997[36]	**1.93**	1.58-2.35
Recur vs. Nonrecurrent	Weinstein 1996[42]	0.8	0.3-2.0
Breech vs. Recurrent	Weinstein 1996[42]	1.9	1.0-3.6
Fetal Distress vs. Recurrent	Weinstein 1996[42]	1.05	0.4-2.6

Bold=significant; NR=not reported; NS=not significant

Current Obstetric Factors

We found no fair or good studies addressing the factors of multiple gestations, cervical dilation rate, SL, induced labor, oxytocin use, maternal height, maternal weight, and maternal weight gain.

The review of the current obstetric factors related to the fetus, including gestational age and birth weight, produced findings similar to those of previous reviews. Two[39, 110] of 15 studies (including the article focusing on gestational age greater than 40 weeks) providing information regarding gestational age were considered to be of fair quality (Evidence Table 11). Both of these studies concluded that there is a negative association between gestational age and the likelihood of VBAC. Although 37 studies provided information regarding birth weight, only

two[42, 111] (including the article focusing on birth weight) were rated as being of fair quality. In a separate study from the one mentioned above, Zelop[111] demonstrated that those with a birth weight greater than 4,000 g had nearly half the likelihood of VBAC compared with those with infants weighing less than 4,000 g (adjusted OR, 0.59; 95 percent CI, 0.45 to 0.77). While Weinstein[42] showed similar findings with regards to birth weight, his results were not significant, which again could be explained by his relatively small sample size and decreased power to detect a difference.

Three case series provide the only data regarding the association between external cephalic version (ECV) and VBAC.[104, 105, 108] Rates for VBAC after ECV attempts ranged from 65.8 to 100 percent. By comparing ECV attempts in those with prior CD to those without prior CD, Flamm[105] showed that those with prior CD were significantly more likely to be successfully verted (82 percent and 61 percent, respectively, $p = 0.02$). Although the overall VBAC rate in these three studies ranged from 50 to 54.5 percent, de Meeus[104] showed that of those who had a successful version, the VBAC rate was actually higher (76 percent). Another finding of interest came from the Schacter[108] study, which found that those delivering within a week of ECV had a significantly lower VBAC rate compared with those who delivered more than a week after ECV (0 percent [0/4] and 86 percent [6/7], respectively).

Four[36, 38, 39, 109] of the eight studies that examined the influence of cervical dilation at admission on VBAC were rated as being of fair quality. Three[36, 38, 39] found a positive association between cervical dilation and the likelihood of VBAC. For example, Flamm[36] found that those with a cervical dilation greater than 4 cm were significantly more likely to have VBAC, compared with those with a cervical dilation less than 4 cm (adjusted OR, 2.16; 95 percent CI, 1.66 to 2.82). Macones[38] and Pickhardt[39] showed similar findings in that those with a higher cervical dilation were significantly more likely to have VBAC (adjusted OR, 1.87; 95 percent CI, 1.14 to 3.23 and adjusted OR, 1.62; $p < 0.05$, respectively). The fourth study[109] found no significant association between cervical dilation and TOL outcome, which might be due to a lack of power and relatively small sample size. Two of the five studies[36, 107] identified by this review to include the factor of cervical effacement were determined to be of fair quality. Both of these studies found an association between higher cervical effacement and higher likelihood of VBAC. Flamm[36] showed the internal consistency of this association by demonstrating that compared with those with a cervical effacement at admission of less than 25 percent, both those with an effacement of 25 to 75 percent and those with an effacement of greater than 75 percent had significantly higher likelihoods of VBAC (adjusted OR, 1.79; 95 percent CI, 1.31 to 2.44 and adjusted OR, 2.72; 95 percent CI, 2.00 to 3.71, respectively). Similar to these findings, McNally[107] found that those with an effacement of 100 percent had a five-fold increase in the likelihood of VBAC compared with those with a cervical effacement less than 100 percent (adjusted OR, 5.0; 95 percent CI, 1.28 to 19.23). None of the five studies that presented information regarding fetal station were rated as being of fair-to-good quality. However, while the evidence in the fair-quality study by Stronge[109] regarding head engagement did not present itself in the form of fetal station, it appeared very similar in nature. Stronge defined head engagement as when less than three-fifths of the head was palpable on abdominal exam or when the cranium was palpated below the level of the ischial spines during vaginal examination. Those with head engagement had a 12-fold increase in the likelihood of VBAC compared with those without head engagement (adjusted OR, 12.3; 95 percent CI, 4.6 to 33.3). The collective consideration of the cervical factors in the form of a Bishop score was investigated by two studies, of which only one was of fair quality. This study by Weinstein[42] found that those with a

Bishop score greater than 4 were significantly more likely to have VBAC compared with those with a score less than 4 (adjusted OR, 6.0; 95 percent CI, 3.5 to 10.4) (Table 11).

The effects of various *medications* on TOL outcome have been one of the more heavily investigated areas of VBAC literature. No fair-to-good-quality studies provided information regarding labor induction or oxytocin use (in general); however, of 21 studies that provided information regarding the factor of labor augmentation, there were two fair-quality studies.[38, 109] Although Macones[38] demonstrated that those with labor augmentation were significantly less likely to have VBAC compared with those without augmentation (adjusted OR, 0.47; 95 percent CI, 0.25 to 0.88), Stronge[109] found no significant association between labor augmentation and TOL outcome. Once again, one could speculate that this difference in results could be due to a lack of power in Stronge's study to find an association or perhaps due to a differential level of confounding adjustment. Of the 16 studies to investigate the influence of epidural use on the outcome of TOL, only one was of fair quality. Although nonsignificant, McNally[107] demonstrated that those with the use of an epidural tended to have a lower likelihood of VBAC compared with those who did not use an epidural.

Table 11. Current Indicators of VBAC Delivery

Factor	Author (year)	Adjusted OR for VBAC	95% C p-value
Gestational Age	Pickhardt 1992[39]	**0.81**	p < 0.05
	Zelop 2001[110]	**0.67** (>40wks GA, spontaneous)	0.56-0.83
	Zelop 2001[110]	**0.67** (>40wks GA, induced)	0.45-0.91
Birth weight	Weinstein 1996[42]	0.95 (>4000g)	0.17-5
	Zelop 2001[111]	**0.59** (>4000g)	0.45-0.77
Cervical Dilation	Flamm 1997[36]	**2.16** (>4cm)	1.66-2.82
	Macones 2001[38]	**1.87**	1.14-3.23
	Pickhardt 1992[39]	**1.62**	p < 0.05
	Stronge 1996[109]	NR	NS
Effacement	Flamm 1997[36]	**2.72** (>75%) – referent <25 percent	2.00-3.71
	Flamm 1997[36]	**1.79** (25-75%) – referent <25 percent	1.31-2.44
	McNally 1999[107]	**5.0** (100%)	1.28-19.23
Station	Stronge 1996[109]	**12.3**	4.6-33.3
Bishop score	Weinstein 1996[42]	**6.0** (score ≥4)	3.5-10.4
Augmentation	Macones 2001[38]	**0.47**	0.25-0.88
	Stronge 1996[109]	NR	NS
Epidural use	McNally 1999[107]	0.26	0.06-1.12

Bold=significant; NR=not reported; NS=not significant

NonClinical Factors

Although medical decisions are often based on clinical factors alone, it is important to remember that nonclinical factors might also play an important role in VBAC. For example, McMahon[5] found that those who attended prenatal classes were significantly less likely to fail a TOL compared with those who did not attend (crude OR, 0.8; 95 percent CI, 0.6 to 0.9). In addition to this, Fraser[106] conducted a fair-quality RCT comparing the effect of either a verbal-based (individualized discussion program) or a document-based (pamphlet) prenatal program for those attempting a TOL after prior CD. Although statistically nonsignificant, the results showed

that those in the verbal treatment arm had a higher rate of VBAC compared with those in the document treatment arm (53 percent and 49 percent, respectively; RR, 1.1; 95 percent CI, 1.0 to 1.2). This review investigated the influence of three nonclinical factors (i.e., insurance, physician characteristics, and hospital characteristics) on the outcome of a TOL after prior CD.

While a number of studies in the VBAC literature provided information regarding the nonclinical factors of insurance status, physician characteristics, and hospital characteristics, none of them were of fair-to-good quality. The majority failed to adjust for confounding (e.g., Socol[113], McMahon[5]); those that did provide adjusted ORs (e.g., Goldman,[114] King,[115] Stafford[116]) did so using database information that limited them to the comparison between those with VBAC and those with CD, which included those with either an ERCD or a failed TOL.

Summary

- The vast majority of studies looking at individual factors that influence the route of delivery were of poor quality due to inadequate control for confounding factors.
- The factors that were significantly associated with an *increased likelihood of vaginal delivery* (i.e., successful TOL) were: maternal age less than 40 years,[36] PRIOR VD (particularly vaginal delivery after cesarean),[36, 38, 42, 107] a nonrecurrent indication for the prior CD,[36] and favorable cervical factors.[36, 38, 39, 42, 107, 109]
- The factors that were significantly associated with a *decreased likelihood of vaginal delivery* (i.e., failed TOL) were: an increasing number of prior CDs,[39] gestational age greater than 40 weeks[39, 111] birth weight greater than 4000 g,[111] and augmentation of labor.[38]

Question 9. Patient Preferences

What factors influence a patient's decision making regarding VBAC or ERCD?

Several factors might influence a patient's preference for TOL, including education about VBAC, the patient's ethnicity, and social motives. Preference refers to choice about delivery method (TOL or ERCD).

Two recent systematic reviews[80, 117] that addressed a women's choice for delivery reported that the included studies were descriptive and had many methodologic limitations: small sample sizes, selection bias, recall bias and preferences assessed by potentially biased observers. In particular, one review noted that in seven of 10 studies, the women's own providers recorded the patient's preferences for delivery.[80] This direct involvement by women's providers in recording results might have influenced women's responses. Also, only three of the 10 studies reported if the women received education on birthing options, so whether the women made informed decisions was unclear. There were also conceptual issues to consider. Only seven of 10 studies reported whether the women requesting ERCD had an obstetric contraindication for TOL. Some women might not really have had a choice to make.

The findings of these two reviews[80, 117] provided a backdrop for the current review. Before considering patient preference results, the studies were evaluated for the methodologic limitations identified in these reviews.

One RCT,[106] one nonrandomized trial,[118] four prospective cohort studies,[24, 57, 119, 120] one

retrospective cohort study,[121] and four cross-sectional studies[84, 122-124] met the inclusion criteria for this report (Evidence Table 12a).

Four additional prospective studies[85, 86, 125, 126] and one cross-sectional study[127] were excluded for poor quality (Evidence Table 12b). In four of the five studies the patient's own provider interviewed the patients directly, introducing bias to the preference measures.[85, 86, 125, 126] The patients might be unwilling to provide complete information if their own provider asks the questions, particularly if the provider is actively caring for the patient during the postpartum stay. Also, the providers might insert their own perspective on the reasons for delivery. The last study we rated as poor did not identify patients eligible for VBAC and lost 67 percent of patients in recruitment.[127] The results of these five studies excluded for poor quality are not discussed further in this section (Evidence Table 12b).[85, 86, 125-127]

The methods to collect patient preference data varied across the included studies. In four of the 11 studies, the women completed questionnaires.[57, 84, 106, 118] In two studies independent researchers interviewed the patients about their reasons for delivery.[120, 124] In one retrospective cohort study, certified abstractors reviewed the charts, followed by a second reviewer, an obstetric nurse.[121]

Only the RCT met all criteria and was rated good quality for all results.[106] We rated the remaining studies fair because they did not clearly state their inclusion or exclusion criteria,[122-124] they had fair followup (60 to 80 percent),[118] were unclear about followup,[57] or had unreported followup rates.[24, 84, 128] Other reasons for a fair rating included no description of how the measures were tested for validity or reliability,[24, 118, 120] or a lack of clarity about who interviewed patients.[119] When the inclusion/exclusion criteria were not reported or were vague, the number of women eligible for TOL was unknown. Attempted TOL rates and VBAC rates for three studies were unknown.[118, 123, 124]

Factors Relating to Patient's Birth Choice and Reasons for Choice

Before patient preferences were assessed, the proportion of women who actually had a choice was determined for each study. The proportion of eligible women (minimal requirement: low-transverse scar, singleton fetus, and no other contraindications) choosing to attempt a TOL ranged from 22.6 to 90 percent in the six fair-to-good-quality studies that were clear about the inclusion/exclusion criteria.[24, 57, 106, 119, 121, 128] As might be expected, the two studies conducted in the early 1980s[24, 57] had much lower attempt rates (22.6 to 31.5 percent) compared with the other four studies, which were conducted between 1989 and 2001 (attempt rates 42 to 90 percent).[106, 119, 121, 128]

In total, 1,083 of 2733 eligible women in six studies chose TOL (sample weighted average of 39.6 percent).[24, 57, 106, 119, 121, 128] The VBAC rate for eligible women choosing TOL ranged from 56.5 to 84.5 percent. In total, 778 of the 1,083 eligible women had a VBAC (sample weighted average of 71.8 percent).

The heterogeneity of the inclusion criteria (when they were assessed) might have contributed to variation in the proportion choosing a TOL. In three studies the women were pregnant and had a history of a prior CD when preference was assessed.[24, 119, 122] In three studies the women were assessed within days of delivery.[84, 106, 118] In one study the assessment was within 1 month of delivery,[124] and in one study the women were assessed several months after delivery.[57] Finally, in one study the women were interviewed both when they were pregnant and postpartum.[120]

Several factors (race, prior VD, social motives, safety, future childbearing plans) appeared to

influence choice of delivery. The proportion of nonwhite patients ranged from 2.4 to 47 percent in the four fair-quality studies that reported race.[118, 120-122] Only one prospective cohort study of good quality examined the effect of race on preference.[120] In this study 23/43 (53.5 percent) nonwhite patients attempted a TOL and 42/50 (84 percent) of white patients attempted a TOL. Forty-seven percent of the nonwhite patients were black, 28 percent were Latino, and 21 percent were Asian. All women in this study were middle-class and working class women. Although the white patients were more educated than the nonwhite patients, all other socioeconomic status indicators were similar. Several results in this study suggested that the minority patients had less opportunities to gain medical information about delivery options than white patients. Fewer minority patients attended childbirth courses (43 percent) during their first pregnancy when compared with white patients (81 percent) ($p < .0001$). Compared with white patients, minority patients were less likely to have been told by their former providers after their prior CD that VBAC was possible ($p < .003$). Even though minority patients received less medical information and encouragement for a TOL, more patients (39 percent) identified the provider as an important influence in their decision, compared with 19 percent of white patients ($p < .02$).

In addition to informational differences between the races, underlying cultural ideologies might account for the different approaches to delivery.[120] From structured interviews, these investigators reported that ethnic minority women viewed labor as a painful necessary evil that does not relate to one's intrinsic worth. Forty-six percent of minority patients did not want to experience labor again compared with 22 percent of white patients. If a woman could become a mother through a less painful, less risky manner, e.g., with an ERCD, no one look downed on them. By contrast, these same investigators described the view of labor by white patients as a challenge to be overcome to gain full status as mothers. White women viewed vaginal birth as a "once-in-a-lifetime experience not to be missed."

Two of 11 studies examined prior VD as a predictor for a TOL preference.[24, 123] In both studies, patients who had delivered at least one baby vaginally were more likely to choose TOL. A greater proportion of the women choosing TOL had a history of vaginal delivery either before or after their CD (18/53, 40.0 percent) when compared with women who chose ERCD (only 5/46, 10.9 percent had prior VDs) ($p = 0.007$).[123] Possibly, women who have already succeeded with a vaginal delivery have a stronger self-efficacy or belief that by doing a TOL they will indeed deliver the baby vaginally. One cross-sectional study that examined state anxiety reported that women choosing TOL had lower state anxiety and felt better prepared than women choosing ERCD.[122] Four of 11 studies cited fear of labor or fear of failure as a strong reasons for choosing ERCD.[57, 118, 123, 124] These patients felt that a TOL would lead to a difficult labor, failure to deliver vaginally, and, in the end, another CD.[57]

Social motives (ability to care for children at home, convenience) appeared more often in these studies as the primary reason for selecting TOL or ERCD than careful weighing of health risks for mother or baby. Six of the seven studies that reported patients' reasons for choosing TOL cited "easier recovery" as a strong reason.[84, 118, 120, 122-124] Women in these studies already had children at home who needed care, so a shorter delivery was very desirable. Five of the six studies reported that the women wanted to experience a vaginal birth.[84, 118, 120, 122, 124] Structured interviews with women before delivery and 2 months after delivery showed that the women also chose TOL so their husbands could be more involved.[128, 129] Finally, two of 10 studies cited convenience as a primary reason for ERCD.[57, 118] A scheduled delivery allows mother and provider to set a date that coordinates well with work and allows time to plan for childcare.

Safety for the mother and/or baby was cited as an important reason in only four of the 11

studies reporting reasons for deliveries.[84, 118, 122, 124] In a cross-sectional survey of women who had just delivered healthy babies either by ERCD or VBAC, 18/21 women who chose and delivered by VBAC felt that vaginal delivery was safest for the mother compared with 7/11 women who chose and delivered by ERCD.[124] In this same group of mothers who chose and delivered by VBAC, 10/21 felt vaginal delivery was safest for the infant also, compared with 2/11 who chose and delivered by ERCD. Since this study only recruited women with healthy babies, the results are potentially biased in that the patients tended to believe the method was safe because the outcome was good. Another study using structured interviews showed that the women did not know actual probabilities or complication rates when they made their decisions.[129] It was unclear if the provider had told them the probabilities and they did not recall them or place importance on them, or if the patients were never informed of the actual probabilities.

Only one good-quality RCT[106] and two fair-quality prospective cohort studies[24, 120] examined the effect of future childbearing plans on the birthing preference. In the RCT, 23 percent of women with a low motivation for a TOL desired to have a ligation sterilization compared with the 13 percent of women with a high motivation for TOL.[106] In one prospective cohort study,[128] 22/56 (39.3 percent) women having an ERCD had their tubes tied after delivery, compared with 4/44 (9.1 percent) of women delivering vaginally. Similarly, more women having an ERCD, 245/547 (44.8 percent) requested a ligation sterilization, compared with 18/101 (17.8 percent) of women experiencing VBAC, and 14/61 (23.0 percent) choosing TOL but having a CD.[24]

Education, Hospital, and Physician Influence on Patient Delivery Choices

The confidence a woman has to succeed at TOL might also be related to how knowledgeable she is about VBAC, particularly before she becomes pregnant or early in her pregnancy. Only three of the 11 studies with valid results described an education process for women with prior CD.[106, 120, 121] The best-quality study, a good-quality RCT,[106] reported that overall there was no difference in the proportion of eligible women attempting a TOL when given a pamphlet at 21 weeks' gestation versus an individualized VBAC education and support program started at 21 weeks' gestation. However, when the subgroup of patients with very low motivation for TOL was educated and given support, more patients, 28/86 (32.6 percent) chose TOL than the very low motivated patients who received pamphlets (18/93, 19.4 percent) (RR, 1.7; 95 percent CI, 1.0 to 2.8, $p = 0.043$). The investigators also commented that it was possible that the intervention was launched too late to influence the patient's choices. Indeed, 28 to 49 percent of patients in four other studies had decided to attempt a TOL before the pregnancy began.[84, 118, 123, 124] Another 34 to 40 percent of patients decided to attempt a TOL before the midpoint of their pregnancy.[118, 124] The results of these studies suggest that education should be started shortly after the first CD, perhaps at the first postnatal visit.[123] In contrast, only 0 to 15 percent of the women in two studies had decided to have a ERCD before their pregnancy began, but 25 to 42 percent had selected it by the middle of the pregnancy.[118, 124]

The likelihood of VBAC counseling also appears related to the overall CD rate of the hospital the patient chooses for delivery. One fair-quality retrospective cohort study of 51 California hospitals reported that hospitals with higher overall CD rates had higher rates of ERCDs without documented evidence of counseling regarding TOL.[121] In this study, 1,662 birth records were randomly selected from 11 "high CD" hospitals (average CD rate of 30 percent), from 32 "intermediate CD" hospitals (average CD rate of 21 percent), and from eight "low CD"

hospitals (average CD rate of 15 percent). Of women eligible for TOL who chose ERCD, 21 percent of women at the "high CD" hospitals had no documented proof of counseling, compared with 15 percent of "intermediate CD" hospitals and 0.3 percent of "low CD" hospitals ($p < 0.01$ for the three proportions). Another 36 percent of women at "high CD" hospitals were counseled but refused TOL, compared with 29 percent at "intermediate CD" hospitals and 10 percent of women from "low CD" hospitals ($p < 0.01$ for three proportions). The study further reported that once a patient had been counseled and consented to a TOL, she had a similar chance of a vaginal delivery regardless of the underlying hospital CD rate.

The patient's exposure to VBAC education appears related not only to the hospital she chooses for delivery but also to her own specific physician. The specific wording the provider uses in discussing TOL with patients is difficult to document and might reflect the provider's underlying preferences. In one retrospective cohort study of the general birthing population (not focused on patients with prior CD) for 11 physicians, the variances for CD rates were not explained by patient obstetric risk factors, socio-economic status, service status, or physician's experience, suggesting that the physician's own practice style might influence route of delivery.[130] In a cross-sectional study of 19 public hospitals in Italy, obstetricians would chose TOL if they worked at a large hospital (delivered more than 1,000 babies/year) ($p < 0.01$), and if they worked at a hospital with a CD rate of less than 25 percent ($p < 0.001$).[131]

The education and support for TOL a patient perceives from her physician might also be related to her ethnicity. In one fair prospective cohort study, 60 percent of nonwhite patients were aware of a VBAC option before the pregnancy, compared with 86 percent of white patients ($p < 0.003$).[120] Seventy-two percent of white patients felt they received "some to much" information and encouragement by their provider on attempting a TOL, compared with 50 percent for nonwhite patients ($p < 0.005$). Although white patients perceived that they received sufficient information, a lower proportion of white patients placed great value on their physician's information than nonwhite patients. Thirty-nine percent of nonwhite patients in one prospective cohort study felt the doctor was an important influence, compared with 19 percent of white patients ($p < 0.02$).[120]

Summary

- Patient preferences for birth choice are unclear because of the heterogeneity of the 11 included studies.
- Several factors appear related to choice for TOL (white race; prior VD; lower levels of anxiety during the pregnancy).
- Lack of medical information along with cultural ideologies might account for minority women being less likely to attempt a TOL when compared with white women.
- A woman's choice for delivery was often based on social motives (e.g., easier recovery, so she can care for baby and children at home).
- Only four of 11 studies cited safety for mother or baby as important reasons for delivery choice.
- It remains unclear if VBAC education increases the proportion of women who choose TOL. Future studies of education should include education before next pregnancy, perhaps at the postnatal visit of patients with first CD. Future work should also insure that all patients regardless of race receive the same information.

Question 10. Provider Characteristics

How do legislation, policy, guidelines, hospital characteristics, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?

Several aspects of the overall health care system might impact the rates of VBAC, TOL, and ERCD and safety of each route. These various aspects are grouped into legislation or other legal characteristics (Evidence Table 13), guidelines or policies (Evidence Table 14a, 14b), physician characteristics (Evidence Table 15), hospital characteristics (Evidence Table 116a, 16b), and insurance modalities (Evidence Table 17a, 17b). No study reported on how legislation, policy, guidelines, hospital characteristics, provider characteristics, insurance type or access to care affect the safety of TOL or ERCD. Studies that consider these factors focus exclusively on VBAC rates. Studies that address more than one of these categories are discussed under each characteristic addressed.

Legal or Legislative Characteristics

Two papers[115, 132] were identified that compared VBAC rates under different legal circumstances (both rated good). Studnicki et al.[132] compared the year before and the year after implementation of legislation of obstetrics guidelines in Florida (EvidenceTable 15). This law mandated that obstetricians receive guidelines on obstetric care (including TOL and VBAC for women with prior CD) and that hospitals use peer review to enforce the guidelines. Most hospitals implemented these rules either in the last quarter of 1992 or the first quarter of 1993. The VBAC rate in women with prior CD increased from 26.7 percent in 1992 to 30.9 percent in 1993. Rates in 1990 and 1991 were 21.8 percent and 25.6 percent, respectively. When stratified by potential confounder variables, in 12 of 54 strata there was a significant increase in VBAC rate from 1992 to 1993. The authors also did not look for an overall time trend to determine what would have been expected without legislative action. Sample sizes by strata were not provided. Thus, this legislation, which was intended to increase rates of TOL, appeared to do so, at least in the short term.

King and Lahiri[115] considered a variety of medical and socioeconomic predictors of rates of VBAC including two variables related to professional liability. These two variables were annual average paid loss (for years 1985-1989) of the hospital due to malpractice claims settlements divided by patient days and the mature-claims-made rate for OB/GYNs in the county of the hospital. A multiple logistic model to predict the probability of VBAC was developed. This model adjusted for a variety of patient demographic and socioeconomic characteristics and for hospital characteristics. The authors fit models with and without data from New York City to determine whether the influence of a characteristic on the results was due largely to New York City. Hospital-paid loss due to practice claims was statistically significant when New York City patients were excluded (OR, 0.96; 95 percent CI, 0.95 to 0.98) but not when New York City patients were included (OR, 1.01; 95 percent CI, 0.99 to 1.03). The physician's premium was statistically significant with the inclusion of hospitals in New York City (OR, 0.98; 95 percent CI, 0.97 to 0.99 for risk of a $5,000 increase in annual premiums) but not when New York City hospitals were excluded (OR, 1.01; 95 percent CI, 1.00 to 1.08). No summary statistics are provided to facilitate interpretation of these ORs and inclusion of interaction terms for New York City would have been more useful. Whether these ORs are statistically significant, the

magnitude of the OR is small, indicating relatively little impact on rates of VBAC. While the professional liability variables are statistically significant, since the odds ratios are close to 1.0 they may not be very meaningful.

These two studies provide little evidence of the impact of legal or legislative components on rates of VBAC. For the paper by King and Lahiri,[115] the effect of hospital paid loss due to malpractice claims settlements and physician's malpractice premiums were relatively small (OR very close to 1.0). Changes observed in VBAC rates in Studnicki et al.[132] occurred only in some risk strata. There are not studies regarding the impact of the current malpractice crisis on availability of obstetric providers and impact on a patient's options. Thus additional research needs to be conducted to determine the influence of legal and legislative factors on changing provider behavior relative to type of delivery.

Guidelines

Nine articles[133-141] were identified that addressed guidelines or policies to modify rates of outcomes (typically to increase rates of VBAC). One[133] was rated good and three[134-136] were rated fair (Evidence Table 14a). There were two randomized trials[133, 134] that assessed the effect of guidelines. Lomas et al.[133] reported on a Canadian trial in which hospitals were randomized to no intervention, opinion leader intervention, or audit and feedback intervention. The number of hospitals is small (8, 4, and 4, respectively) and there were no differences in the baseline characteristics reported. The analysis did account for the sampling model used. There were significant differences in the rates of women offered a TOL (opinion leader 74 percent, audit and feedback 56 percent, no intervention 51 percent, $p = 0.002$), rates of women undertaking a TOL (opinion leader 38 percent, audit and feedback 21 percent, no intervention 28 percent, $p = 0.007$), VBAC rates (opinion leader 25 percent, audit and feedback 12 percent, no intervention 14 percent, $p = 0.003$), and ERCD rates (opinion leader 54 percent, audit and feedback 70 percent, no intervention 67 percent, $p = 0.001$). There were no significant differences in rates of unscheduled CDs. While multiple comparisons were not made to determine exactly which groups differed from one another, opinion leaders appear to have a greater impact in modifying rates of delivery methods than does audit and feedback.

Bickell et al.[134] selected a random sample of 45 hospitals in New York to receive a program of peer review and audits of 100 cases of labor and delivery with feedback These hospitals were compared with the remaining 120 hospitals in the state to determine differences in VBAC and repeat CD rates. While there was a significant difference in the overall CD rate, there were no significant differences in rates of VBAC or repeat CD, when comparing the year before audits began (1988) with the year after the audits and feedback were completed (1993) There were no differences in baseline characteristics reported and no adjustment was made for potential confounders.

There was one retrospective cohort study rated fair. Santerre,[136] using data from a group of 55 hospitals in Massachusetts, performed a regression analysis on VBAC rates over 9 years (1985-1993) during which time the ACOG guidelines were published (in 1988). Using a model that adjusted for potential confounding variables including some baseline risk factors (e.g., low birth weight, race, and source of payment), the model predicted a "permanent" 5.6 percent increase in VBAC rate attributable to the guidelines.

Lomas et al. [135] also compared average monthly change in rates of repeat CD in Ontario for 6 years before and two years after publication of guidelines recommending reductions in the rates

of CD. The guidelines were a Canadian national consensus statement similar to the National Institutes of Health 1980 consensus conference in the US. The rates of repeat CD decreased at a higher rate after the guidelines than before. As these authors did not fully describe the other variables included in their regression model, this study was rated fair.

The study[133] that provides the best evidence suggests that use of opinion leaders provides a greater likelihood of changing practice compared with audit and feedback. A recent conference summary[142] echoed this view when it concluded that involvement of opinion leaders is an important step in achieving local buy-in for guidelines. Another study[134] of peer review and audit failed to demonstrate a significant change in the rates of either VBAC or RCD. The other two studies[135, 136] suggested that publications of national guidelines do impact practice although perhaps not to the degree expected.

Provider Characteristics

All 14 studies of clinician characteristics[114, 143-155] were rated poor (Evidence Table 15). In all cases, there was no adjustment of baseline risk and/or potential confounding variables (Evidence Table 13c). There is a strong likelihood of selection bias especially for type of clinician (e.g., midwife versus obstetrician) in these studies. That is, to the extent that a patient's choice of provider depends on the patient's underlying risk profile (e.g., choosing an obstetrician over a midwife due to care for a high-risk pregnancy) comparisons of rates across types of providers need to be adjusted by risk to be valid. The effect of patient self-selection in provider outcomes has been tested in an RCT of low risk pregnancies (non-VBAC), to resident physician versus midwifery management.[156] Prior to the study, primary cesarean rates were reported to be 9 percent for the physician service and 2 percent in the midwifery service. When 492 low-risk women were randomized to provider, there was no difference in primary cesarean rates between the two groups. Thus, without proper controlling for patient selection factors, these studies provide no useful information with respect to differences in VBAC rates among types of providers.

Hospital Characteristics

Of 22 studies that included hospital characteristics [5, 29, 61, 114-116, 136, 143, 147, 157-169], nine were rated good or fair (Evidence Table 16a). Of these, six were comparative studies[5, 115, 116, 136, 163, 164] (comparing TOL and ERCD) and three[29, 157, 162] were descriptive studies (only reporting results of TOL).

Gregory et al.[164] compared VBAC rates across hospital settings in California in a study that was rated good. Rates of VBAC (adjusted for baseline and medical characteristics of mother and fetus) were 14 percent in private nonteaching hospitals, 57 percent in public hospitals, 60 percent in private teaching hospitals, and 41 percent in health maintenance organizations (HMOs). When compared with private, nonteaching hospitals, the repeat CD rates in other types of hospitals was statistically significantly different ($p < 0.001$). The adjusted repeat CD rates were 85.7 percent in private, non-teaching hospitals (the reference group), 43.0 percent in public hospitals, 40.0 percent in private teaching hospitals and 59.0 percent in HMOs.

McMahon et al.[5] compared rates of TOL and VBAC with type of hospital in Nova Scotia. Compared with tertiary care centers, the ORs for TOL rate were 0.5 (95 percent CI: 0.5 to 0.6) for regional hospitals and 0.4 (0.3 to 0.5) for community hospitals. The ORs for successful TOL

were 0.7 (0.6 to 0.8 and 0.5 to 0.9, respectively) for both regional and community hospitals, compared with the tertiary care centers.

Stafford[116] reported on relationships between several hospital characteristics and rates of VBAC. The study was rated good and represented all relevant discharges in California in 1986. Across hospital ownership types (compared with proprietary hospitals), the adjusted ORs for VBAC were (1.4; 95 percent CI, 1.2 to 1.6) for private nonprofit hospitals, 3.9 (3.3 to 4.6) for Kaiser Permanente hospitals with Kaiser payment, 2.6 (1.4 to 4.6) for Kaiser Permanente hospitals without Kaiser payment, 2.5 (2.1 to 2.9) for county hospitals with indigent payment, 2.7 (2.1 to 3.5) for county hospitals without indigent payment, and 3.7 (3.0 to 4.6) for the University of California hospitals. Compared to nonteaching hospitals, the adjusted ORs for VBAC were 0.7 (0.6 to 0.8), 0.9 (0.8 to 1.0), and 1.7 (1.5 to 1.9) for nonmedical-school-affiliated teaching hospitals, medical-school-affiliated hospitals, and Council of Teaching Hospitals member hospitals, respectively. Compared with a hospital without an NICU), the adjusted OR for VBAC for a hospital with an NICU was 0.9 (0.8 to 1.0). Across four categories of annual numbers of births, rates of VBAC increased with increasing numbers of annual births.

King and Lahiri[115] assessed the impact of various hospital factors on the VBAC rates in New York hospitals in a study rated good. Compared with voluntary hospital ownership, church hospitals had a higher OR (1.13; 95 percent CI, 1.01 to 1.26) of VBAC compared with ERCD. The odds ratio was not significantly different from 1 (1.07; 95 percent CI, 0.95 to 1.21) if New York City hospitals were excluded. Government hospitals had a lower OR (0.77; 95 percent CI, 0.63 to 0.94) and this association did not change if New York City hospitals were excluded. Odds ratios increased with increasing levels of care from I (reference) to II (1.30, 95% CI: 1.18 to 1.44) to III (1.55; 95 percent CI, 1.34 to 1.81). The OR for teaching hospitals was 1.11 (0.99 to 1.24) compared with nonteaching hospitals although not significantly greater unless New York City hospitals were excluded (OR 1.36; 85 percent CI, 1.21 to 1.54).

Santerre[136] evaluated various predictors for rates of VBAC in a panel of 55 hospitals in Massachusetts in a study rated fair. The authors were specifically interested in ACOG guidelines but they also controlled for other factors, including hospital characteristics. Their model estimated lower VBAC rates at hospitals with a higher proportion of low birth weight babies, hospitals with a higher percentage of Hispanic babies, and nonteaching hospitals. Volume of births, presence of neonatal ICU, ownership status, and urban location did not predict VBAC rate in their model.

Shiono et al.[163] surveyed a random sample of US hospitals in a study rated fair. They reported rates of TOL adjusted for size of the delivery service (the stratification variable). Adjusted TOL rates were 12.5 percent and 6.5 percent in hospitals with and without NICUs, respectively. Rates for TOLs were 14.6 percent and 6.6 percent in hospitals with and without OB residency, respectively. Rates of TOLs and VBAC increased with increasing size of delivery service, but rates of successful TOLs were highest in hospitals with the smallest (less than 500) and largest (5,000 or more) number of annual deliveries.

The three descriptive studies[29, 157, 162] of hospital characteristics were all rated fair. These evaluated VBAC in small rural hospitals. Raynor[29] reported on the VBAC rate in a small rural hospital in North Carolina. The rate of TOL in 67 eligible patients was 76 percent and the rate of VBAC among these was 61 percent. Two uterine ruptures were reported in this study but neither was related to labor. Schimmel et al.[162] reported on a nurse-midwife service in a rural county in California. Among 37 patients, the VBAC rate was 87 percent and no uterine ruptures were reported. While these studies are small, they provide some evidence of the success of VBAC in

rural settings. The third descriptive study was conducted by Walton et al.[157] at an isolated US military hospital in Japan. Of 62 patients, 79 percent agreed to a TOL but 14 failed to meet guidelines for VBAC. Of the remaining 32, 88 percent achieved a VBAC. No uterine ruptures were reported. These reports, while limited, suggest that VBAC might be safely attempted in small rural hospitals. However, the effects of an adverse outcome of a TOL in a small rural setting have yet to be defined.

The comparative studies suggest there are some differences among types of hospital ownership with respect to rates of VBAC. However, categorization of hospital types varied across studies makes comparisons across studies difficult. Gregory et al.[61] reported higher rates of VBAC in public hospitals and private, non-teaching hospitals, and lower rates in private, non-teaching hospitals. Stafford[116] found statistically significantly higher rates of VBAC in Kaiser-affiliated hospitals, county hospitals, and University of California hospitals, compared with proprietary and private, nonprofit hospitals. King[115] found that, compared with voluntary ownership, rates of VBAC were statistically significantly higher in church-affiliated hospitals and lower in government-affiliated hospitals. McMahon et al.[5] found statistically significantly lower ORs for VBAC in regional and community hospitals, compared with tertiary medical centers. Santerre[136] found no statistically significant association of type of hospital ownership with VBAC rates. Thus, additional research is required to clarify this potential association.

With respect to hospitals with teaching programs, Gregory et al.[61] found private teaching hospitals had statistically significantly higher rates of VBAC than private non-teaching hospitals. King and Lahiri[115] estimated an statistically non-significant OR of 1.11 comparing VBAC and ERCD in teaching versus non-teaching hospitals. Stafford[116] found the highest OR for VBAC versus ERCD at hospitals that were members of the Council of Teaching Hospitals but ORs for other teaching hospitals (whether or not they were affiliated with medical schools) were lower than for non-teaching hospitals. Santerre[136] found a statistically significantly lower VBAC rate among non-teaching hospitals than teaching hospitals. Shiono et al.[163] estimated that hospitals with OB residency programs had statistically significantly different rates VBAC rates about twice as high as those that did not. Thus, as with ownership above, some studies suggest that teaching hospitals have higher rates of VBAC than non-teaching hospitals, but the association does not hold across all categorizations of teaching versus nonteaching.

With respect to the association of an NICU with rates of VBAC, Shiono et al.[163] estimated VBAC rates were about twice as high in hospitals with an NICU compared with hospitals without an NICU. Stafford[116] found an OR of 0.9 comparing hospitals with an NICU with those without (for VBAC versus ERCD). Santerre[136] found no significant association of the presence of an NICU with VBAC rate. Thus if there is an association of the presence of an NICU with VBAC rate, this association is not consistent across studies.

Across several hospital characteristics, there are no consistent associations with rate of VBAC. This might reflect lack of consistent definitions of categories across studies (e.g., types of hospital ownership), changes in these categorizations over time, a variation in the potential confounding variables that were controlled for in each study, or other factors.

As discussed in the patient preferences section, the decision between a TOL and ERCD is generally made prior to arrival at the hospital for delivery. Thus some hospital characteristics are likely to be confounded with other health care system characteristics (or patient or clinical status characteristics). In particular, providers affiliated with a particular type of hospital might exert much more influence on the decision for TOL or ERCD than the hospital itself. To the extent that a specific type of provider is associated with a particular type of hospital, there is a potential

for confounding of provider type with hospital type. It is important to know the extent to which hospital characteristics influence the decision on mode of delivery, compared with other health care system characteristics, so that future interventions can be effectively targeted.

Insurance

Among 12 papers[60, 115, 116, 136, 159, 164, 167, 169-173] evaluating the effect of insurance type on VBAC rates, five[115, 116, 136, 164, 170] were rated good or fair (Evidence Table 17a). The other seven were rated poor (Evidence Table 17b).

Stafford[170] reported on a cohort of women who delivered in 1986 in California in a study rated good. Unadjusted rates of VBAC were 8.1 percent (95 percent CI, 7.6 percent to 8.6 percent) for private insurers, 8.3 percent (7.3 percent to 9.4 percent) for non-Kaiser HMOs, 9.4 percent (8.6 percent to 10.1 percent) for Medi-Cal (California Medicaid), 18.1 percent (16.3 percent to 19.9 percent) for self-pay, 19.9 percent (18.3 percent to 21.5 percent) for Kaiser Permanente, 24.8 percent (20.4 percent to 29.3 percent) for indigent services, and 17.1 percent (10.5 percent to 19.7 percent) for other payers. Stafford reported that the unadjusted rates were similar to rates stratified on three potential confounders and rates adjusted by logistic regression model but only reported unadjusted rates. Stafford[116] reported adjusted ORs for the above cohort in another study rated good. The adjusted ORs for VBAC compared with ERCD (with private insurance as the reference) were 1.0 (95 percent CI, 0.8 to 1.1) for non-Kaiser HMO, 0.8 (0.8 to 0.9) for Medi-Cal, 1.7 (1.5 to 1.9) for self-pay, 3.9 (3.3 to 4.6) for Kaiser-Permanente with Kaiser payment, 2.6 (1.4 to 4.6) for Kaiser Permanente without Kaiser payment, 1.9 (1.0 to 3.6) for indigent services, and 1.3 (1.1 to 1.5) for other payers. All were significantly different from the reference except for nonKaiser HMO.

King and Lahiri[115] compared VBAC rates and adjusted ORs (adjusted for baseline risk and potential confounders) for VBAC across four insurance types. There was little variation among VBAC rates (21 percent for Medicaid to 25 percent for HMOs) and only the OR between HMOs and private insurance was different from 1 (1.15, 95% CI: 1.02, 1.30). The authors provided results for the state of New York that both included and excluded data from New York City. If data from New York City were omitted, the previous OR would not be different from 1 (OR 1.03; 95% CI, 0.90 to 1.17) but the OR comparing self-pay with private insurance (1.28; 95% CI, 1.01 to 1.81) would differ significantly from 1 (this OR was not different with data from New York City included). These ORs are all close to 1.0 whether or not they are statistically significant, suggesting a weak relationship of insurance type with VBAC rate.

A multivariable regression model by Santerre[136] showed no effect of payment source (private payer or public payer) on rates of VBAC. Thus, insurance type had no impact on VBAC rates after adjusting for other factors. Similarly, Gregory et al.[164] found no difference in VBAC rates for a dichotomous payment source variable (private insurance: yes or no) in a multivariable regression model.

The association between types of insurance (or payer) and VBAC rates are inconsistent across studies. While data from 1986 in California showed substantially higher rates of VBAC with Kaiser Permanente coverage and, to a lesser extent, indigent services and self-pay, similar associations have not been seen in other studies. Thus, this result may have been unique with respect to state, year, and payor.

In summary, because many factors including patient characteristics, access to obstetric providers, practice variation among providers, training of providers, ability to perform a cesarean

expeditiously, and hospital characteristics may all influence the likelihood of a patient to choose TOL and the safety of each choice, current studies have not been able to identify the conditions that increase risk of TOL or ERCD. While the various characteristics of health care systems have been discussed separately above, studies need to look across these characteristics to provide a complete picture and avoid potential confounding variables. For example, an analysis of type of provider might determine a lower rate of VBAC among midwives than among obstetricians. However, midwives might be more likely to provide obstetric care to women without insurance and women of lower education levels and socio-economic status, and might be more likely to work in clinical settings without around-the-clock availability of surgical and anesthetic services and might be subject to different legal restrictions. Given the large number of potential confounders, careful adjustment for these potential confounders needs to be performed. This will require large and detailed data sets with information on patients (both mother and newborn), hospital, and provider.

Summary

- Studies of legislation, policy, guidelines, hospital characteristics, provider characteristics, insurance type or access to care focus exclusively on VBAC rates rather than safety.
- There are no studies regarding the impact of the current malpractice crisis on availability of obstetric providers and impact on a patient's options.
- Studies of provider characteristics failed to control for important confounders such as patient selection bias.
- Studies of hospital characteristics consistently report higher VBAC rates for teaching hospitals, but they conflict on whether having a NICU affects rates.
- The association between insurance status and VBAC rates is inconsistent among studies
- Current studies have not controlled for confounding for factors such as patient selection bias, as such, they have not identified conditions or practice management styles that increase risk of TOL or ERCD.

Chapter 4. Conclusions

This report found that there were no high quality data providing definitive answers for decisionmaking about future childbirth following cesarean delivery, one of the most commonly performed surgical procedures in the U.S. (affecting up to 640,000 women each year).

The following summarizes the type of study design, the quality of the evidence from studies, and the suitability of the study design to answer the particular question for each key question.

Summary of Evidence for Key Questions

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 1 *What is the frequency of VD in those who undergo a TOL (SL, I, and A) after prior LTC or unknown scar?*	II-2	Fair-Good: Several large prospective and retrospective studies; mostly consistent findings.	Greatest
Question 2 *How do risk assessment tools identify who will have a VD after a TOL?*			
Predictive tools	II-2	Fair-Good: Large cohort studies suggest tools can provide additional data predicting likelihood of (VD).	Greatest
Imaging modalities	I	Good: RCT demonstrated that imaging was ineffective to predict VD.	Greatest
Question 3 *What are relative harms associated with TOL (SL,I and A) and repeat cesarean?*	II-2	Fair-Poor: Many large cohort studies inconsistently defined outcomes.	Moderate
Maternal Death		Fair: Studies consistently found no maternal death risk increase from TOL versus ERCD.	Least
Hysterectomy		Fair-Poor: Many studies failed to report indication for hysterectomy.	Moderate
Transfusion		Fair: Two studies consistently found slightly increased risk for transfusion in TOL although not significant in one.	Moderate
Infection		Poor: Definitions inconsistent.	Moderate
Incontinence/Pelvic Floor		No studies.	Moderate
Infant Death		Poor: Most studies found increased risk of perinatal death for TOL versus ERCD, yet magnitude varied greatly.	Least
Neurologic impairment		Poor: Few studies of poor quality.	Least
Respiratory impairment		No studies.	Moderate

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 4 *What is the incidence of uterine rupture of cesarean scar, and are there methods for preventing poor clinical outcomes?*			
Incidence	II-2	Fair-Poor: Several large cohort studies inconsistent in terminology; many with consistent findings of increased risk of symptomatic UR in TOL vs ERCD.	Moderate
Methods for preventing poor outcomes	II-3	Poor: Few studies, variation in case definition. Fetal bradycardia frequently associated with UR; inclusion of fetal tracing findings in definition of UR makes assessing true value difficult.	Least
Question 5 *What are the health status and health-related quality of life for VBAC and repeat cesarean patients?*	None	No studies of women with prior CD.	NA
Question 6 *Regarding VBAC and ERCD,what influences patient satisfaction/ dissatisfaction with the birth experience?*	III	Fair: Two cross-sectional studies with varied findings.	Least
Question 7 *How are economic outcomes related to VBAC, repeat CD, and their respective complications?*	Econ	Fair-Good: One good economic model suggests VBAC cost-effective, provides higher quality of life when chance of VD is 76 percent or greater.	Greatest
Question 8 *What individual factors influence route of delivery?*	II-2	Fair-Poor: Several retrospective cohort studies conducted; all vary in items considered, each with limited adjustment for confounders.	Moderate
Question 9 *What factors influence a patient's decision making regarding VBAC or ERCD?*	I, II, III	Fair: One good RCT and eight fair quality cohort or cross-sectional studies found women who preferred TOL more likely to be White, value process of labor, value social motives such as ease of recovery.	Moderate
Question 10 *How do legislation, policy, guidelines, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?*			
Legislation	II-3	Poor: Few studies only examined impact on VBAC rates, not safety. None examined malpractice rate crisis' impact on access or safety.	Moderate

Key Question	Study Type*	Quality of Evidence	Suitability of Study Design†
Question 10 (continued)			
Guidelines	I, II	Fair-Good: Several studies consistently found the provision of guidelines especially with recommendations of opinion leaders increased VBAC rates; no studies on safety.	Moderate
Provider Characteristics	II	Poor: Several studies, none of which adjusted for differences in baseline risk or potential confounders.	Moderate
Hospital	II	Fair: Consistently found teaching hospitals had higher VBAC rates; no comparisons for safety.	Moderate
Insurance	II	Fair: Several studies with conflicting findings.	Moderate

*Study design categories—I: randomized, controlled trials; II-1: controlled trials without randomization; II-2: cohort or case-control; II-3: multiple time series; III: opinions, descriptive epidemiology. U.S. Preventive Services Task Force (1996).

†Suitability of study design categories—Greatest: For comparison studies: Concurrent comparison groups and prospective measurement of exposure and outcome; For rates: population-based or multicenter prospective cohort studies. Moderate: All retrospective designs or multiple pre or post measurements but no concurrent comparison group; Least: Single pre and post measurements, no concurrent comparison group or exposure, outcome measured in a single group at the same point in time. Community Preventive Services Task Force (2000).

Likelihood of Vaginal Delivery

What is the frequency of vaginal delivery in women who undergo a TOL (spontaneous onset, induced or augmented) after prior low transverse cesarean or unknown scar?

Rates of vaginal delivery for women attempting TOL ranged from 60 to 82 percent. The largest population-based study reported a rate of 60.4 percent. These data may be the best reflection for vaginal delivery rates for the general population who attempt a TOL with low transverse scar across a diversity of settings of care and practice management. The combined vaginal delivery rate for all prospective cohort studies, largely conducted in university and tertiary care settings, was 75.9 percent. Further studies that investigate the true prevalence of vaginal delivery, accounting for practice variation, are needed.

There was a 10 percent reduction in the likelihood of vaginal delivery when oxytocin was used for ether induction or augmentation. There was a similar trend in reduced likelihood of vaginal delivery with prostaglandins. Most studies did not report rates for patients requiring medical augmentation or induction of labor separately from patients undergoing spontaneous labor. Furthermore, studies that did report separate rates, were not able to account for the contribution of reason for augmentation or induction, nor the impact of practice variation. Leaving insufficient data to determine the effect of medical induction and augmentation of labor.

Predictive Tools

How accurate are risk assessment tools for identifying patients who will have a vaginal delivery after trial of labor?

In considering whether to attempt a TOL or ERCD, patients, clinicians, payors, and policy-makers are confronted with the dilemma of weighing the likelihood of probabilities for vaginal delivery and health outcomes for each option.

Two validated scoring systems were identified.[36, 40] These two scoring systems shared the design of incorporating various predictive factors available at a patient's admission, similar study patient exclusion criteria (e.g., classical or low vertical incision, multiple gestations, and malpresentation), and a roughly similar range of predicted vaginal delivery probabilities of 45 to 95 percent. In addition to these similarities, the two scoring systems also shared several limitations. First, both scoring systems were based on preselected populations of patients who were willing to attempt a TOL. Because of this design, both studies are affected by verification or workup bias, where the results are relatively distorted by the fact that not everyone who is eligible for a TOL is included in the study (e.g., the patient who is eligible for a TOL, but decides to have a ERCD is not incorporated into the study and not used for the creation of the scoring system). Another common limitation is that these scoring systems were created and validated for use at the time of admission, thus invalidating the application of the scoring systems at any other point during the pregnancy. For example, Flamm stated that because cervical dilation and effacement often change dramatically between the last prenatal examination and the time of admission, the use of his scoring system before the onset of labor would yield an incorrect prediction. The last common limitation stems from the included predicting variables themselves such as accuracy of a patient's past obstetric history (e.g., indication of a prior CD) if the medical record is not available, and the variable and subjective in nature of cervical dilation and effacement. The lack of accurate past obstetric data or the variability of various clinical findings between providers could potentially affect the precision of the predicted results.

However, beyond these similarities lie several differences that make the Flamm scoring system a relatively better predictive tool. First of all, Flamm's scoring system was developed prospectively and with a considerably larger sample size, compared with the Troyer scoring system (2,502 and 264, respectively). Flamm's scoring system can also be said to be more precise and accurate, in that the point values assigned to each of the included variables were based on the Beta coefficients of the logistic regression model. This system, which was not employed by Troyer, takes into account the relative predictive weights for each variable, while controlling for any possible confounding distortion. The use of a 10-point scoring system by Flamm also increases the accuracy and precision of his system by allowing for a more exact prediction of the probability of success, relative to Troyer's four-point scoring system. The value of a scoring system depends on its ability to accurately stratify patients into high and low-risk groups with low false positive or negative rates. In the case of TOL, an ideal tool would stratify all women eligible for a trial of labor into those with high and low likelihoods of vaginal delivery, with minimal false positives. The tool should minimize the number of patients predicted to be at high chance for vaginal delivery that actually have to have a cesarean after a lengthy trial of labor (false positives), because it is this group that has the highest risk to sustain complications of TOL such as uterine rupture. Flamm's test was able to provide additional information to slightly under one-half of the population tested, with a relatively low false positive rate of 2.6 percent. In order to know whether this tool is effective, it needs to be tested in different populations with differing baseline VBAC rates, and ideally tested in all eligible women rather than just those who already chose TOL.

Of the seven imaging studies identified, only one received a good quality rating.[47] Although this RCT was similar to the other studies, in that it lacked any statistical adjustment for

confounding, its randomization of subjects presumably allowed for control of confounding through study design. The finding that 60 percent (33/55) of those considered to have an inadequate pelvis by postpartum XRP had a vaginal delivery, compared with the 30 percent (27/89) of those considered to have an adequate pelvis by postpartum XRP, provides support for the conclusion that XRP is a poor predictor of TOL outcome and might unnecessarily increase CD rates.

Maternal and Infant Health Outcomes

What are the relative harms associated with a TOL (spontaneous onset, induced, augmented) and repeat cesarean?

There is no direct evidence comparing the risks and benefits of TOL relative to ERCD in similar patients. Several fair and good quality cohort studies provide indirect evidence about the relative benefits and harms associated with each route. Their findings are itemized below:

- Maternal death rates did not differ between TOL and ERCD.
- The best evidence suggests that hysterectomy rates do not differ between TOL and ERCD.[5]
- Rates of infection were increased in ERCD versus TOL (8.6 to 9.73 percent versus 6.6 to 6.79 percent).[5, 24]
- Studies that performed subgroup analyses for TOL with and without vaginal delivery consistently reported that rates of infection were significantly higher in women who had a TOL but ultimately had a cesarean delivery.
- There is conflicting evidence regarding whether induction of labor had any effect on infection rates.
- There is insufficient evidence regarding the effect of TOL and ERCD on APGAR score and respiratory morbidity.
- No study measured infant death directly attributable to a mother's choice of TOL or repeat CD.
- Two large population-based studies report increased risk of perinatal death associated with TOL, but they differ in the magnitude of risk.(90/10,000 TOL versus 50/10,000 ERCD[5] compared with 12.9/10,000 TOL versus 1.1/10,000 ERCD.[6])

Methodologic deficiencies in the literature are striking. Comparisons across studies were hampered by lack of standards for reporting severity of disease or condition, and inconsistencies in definitions of outcomes. Studies often did not pay close attention to comparability of groups, specifically, the ERCD group was often not ensured to be otherwise eligible for TOL. Other factors such as parity, type and number of previous cesarean, were often not considered.

Studies did not pay close attention to and account for the importance of co-interventions such as use of oxytocin and other medical agents for augmentation or induction of labor.

Most importantly, variations in reporting of important clinical outcomes such as hysterectomy, infection, maternal mortality, and perinatal mortality made it difficult to determine true probability of outcomes, potential preventive measures, or outcomes that were directly attributable to route of delivery or labor management. Lack of precision made it difficult to

determine whether the rates truly represented risk of clinically significant outcomes or significant misclassification or confounding.

There were no studies of the long-term consequences of TOL versus ERCD such as incontinence, pelvic support disorders, or infant sequelae from neurologic or respiratory disorders.

Uterine Rupture

What is the incidence of uterine rupture, and are there methods for preventing major morbidity and mortality due to uterine rupture?

Studies varied in their use of terms to describe the spectrum (e.g., asymptomatic, symptomatic, clinically significant) of uterine rupture of the cesarean scar. Our best attempt to separate the groups in a meaningful way found that there was no difference in rates of asymptomatic uterine rupture (dehiscence) between TOL and ERCD. There was a significant increase in the occurrence of symptomatic uterine ruptures in TOL. Specifically, for every 10,000 women attempting TOL there would be 27 additional symptomatic uterine ruptures. Based on the frequency and severity of symptomatic rupture, for every 10,000 women undergoing a trial of labor, there would be 1.5 uterine rupture related perinatal deaths and 4.8 rupture related hysterectomies.

Lack of precise definitions also prevents the ability to determine the value of certain premonitory signs. Because the definition of uterine rupture frequently includes ruptures discovered when cesarean is performed for fetal heart tracing disturbances, it is not possible to determine the accuracy of fetal tracing as a premonitory sign.

Health Status

What are the health status and health-related quality of life for VBAC and repeat cesarean patients?

No studies provide information on health status or health-related quality of life, related to TOL versus ERCD.

Patient Satisfaction

Regarding VBAC and repeat cesarean, what factors influence patient satisfaction/ dissatisfaction with their childbirth experience?

It is important not only to consider the health outcomes for TOL and VBAC, but also whether patients are satisfied with their childbirth experience. Only two fair cross-sectional studies provided results on satisfaction for women attempting VBAC or ERCD. Other studies allowed the patient's provider to measure satisfaction, introducing the possibility of measurement bias.

Cost and Health Care Resources

Cost

Discussion of economic evaluations. The use of cost per QALY from a societal perspective as an economic outcome to compare health care delivery options is recommended by current guidelines.[100] While there is no single threshold value for cost per QALY in the US, the upper limit of cost effectiveness of $50,000 per QALY used by Chung et al. is a reasonable limit for the US health care system.[87] This limit can reflect one extra QALY at a cost of $50,000 or 50 extra QALYs at a cost of $1,000 per QALY. A value of $50,000 per QALY is slightly less than the cost per QALY for treatment guided by routine coronary angiography compared with initial medical therapy without angiography, or use of driver-side and passenger-side airbags compared with driver-side air bags alone.[174]

The use of QALYs as an economic outcome for methods of delivery means that both the mother and the newborn contribute QALYs to the analysis. It seems appropriate that both maternal and newborn QALYs should be counted, as both are outcomes influenced by the decision on mode of delivery. Economists typically do not differentiate QALYs on the basis of the age of the person receiving the QALY. That is, a QALY is counted the same for a senior age 80 as for a child age 5. Thus, a comparison between a childhood vaccination program and hip replacement surgery is facilitated by using cost per QALY.

Additional analyses using the model of Chung et al.[87] would be useful. The authors could have performed two-way sensitivity analyses with each of the other sensitive variables listed above and TOL success probability to determine how sensitive these results are to two variables at once. For example, if an increase of 0.5 percent in the probability of cesarean rupture were to shift the decision point from 74 to 80 percent, then both of these two factors would need to be predicted to determine which delivery option was more efficient. That is, the results might be sensitive to more than one variable at a time. One problem with the recommendations of this study based on TOL success rate is that the recommendations ignored the imprecision of the estimated TOL success rate. If the TOL probability of success were 72 percent or 76 percent with a prediction error of +/- 4 percent (e.g., a CI for the prediction of 68 percent to 76 percent for a TOL success rate of 72 percent), the prediction interval would include the decision cut point of 74 percent. This means that the prediction does not select an efficient option in this case. A Monte Carlo simulation analysis that would allow introduction of random variation into the model of Chung et al. could help to evaluate the effect of uncertainty in the prediction parameter. For example, instead of using a predicted probability on TOL success, one could use the expected probability and the standard error around the probability to generate a sample of individuals, determine the experience of these individuals, and estimate the resulting cost per QALY. Another concern is the inclusion of fecal and urinary incontinence during the first year after birth in the model of Chung et al. As summarized elsewhere in this report, the evidence for a higher rate of these adverse events in TOL than ERCD is inconclusive. The authors should have included no additional cases of incontinence in the sensitivity analyses.

The valuation of different costs in these economic evaluations needs review. There are a number of costs associated with TOL and ERCD that are very difficult to measure. These events include, but are not limited to, cerebral palsy, loss of fertility after a hysterectomy, or death of the mother or of the newborn. These events have substantial societal costs that might be problematic to measure. To the extent these events are not properly valued in the above analyses,

the analyses are potentially biased. The use of a broad range of sensitivity values might address this concern to some extent. With respect to major neonatal adverse events such as cerebral palsy, the costs include more than direct medical costs. The societal costs (e.g., long-term care, special education, lost productivity, and legal costs) of a major neonatal adverse event might be substantially higher than the direct medical costs. For example, the productivity lost for a newborn with a cognitive deficit could be substantial from a societal perspective. However, these societal costs were not included in the model of Grobman et al.[88] Cerebral palsy after uterine rupture had the highest cost in this model (base case about $180,000) but occurred with very low probability. Maternal and neonatal deaths were not explicitly valued except in sensitivity analyses and then with a relatively small value ($100,000), because of the payer or provider perspective. While it is likely that these probabilities change with each subsequent pregnancy (e.g., a successful TOL indicates a higher probability of success for future TOLs).[107] Another problem with costs is the true cost of the perinatal period (including times associated with labor and delivery for a TOL and with surgical processes for RCD). Chung et al. used charges for these costs; charges might not reflect actual time spent in labor and delivery or in surgery. More detailed studies that evaluate these times for series of patients would improve these models. These details are as important as LOS (see next section on health care resources below) for an accurate estimate of total costs.

The model of Chung et al.[87] also considers only one pregnancy. The model of Grobman et al.[88] did include more than one pregnancy after an initial CD. In this latter model, probabilities for each subsequent pregnancy appear to be the same as for the index pregnancy. Some women might be expected to have additional pregnancies and each pregnancy and the modes of delivery in the previous pregnancies are likely to modify the probabilities for subsequent pregnancies. For example, a repeat CD might increase the risk of other adverse events if a TOL is considered for the next pregnancy. Similarly, a successful VBAC means that a woman is more likely to have a TOL end in VBAC for subsequent pregnancies. While the data for subsequent pregnancies might be somewhat limited, the impact on future pregnancies is important.

In summary, the model of Chung et al.[87] provided the best evidence of the relative value of TOL and ERCD, and suggested that the cost-effectiveness of TOL versus ERCD depends strongly on the probability of successful VBAC after a TOL. If this probability is "high," VBAC is more cost-effective, while if this probability is "low," ERCD is more cost-effective. Additional research is needed before precise values of high and low in the above can be assigned. Also there is likely a range of probabilities between the high and low values in which the cost-effectiveness might be indeterminate. The discussion above describes some additional analyses using the model of Chung et al. that might address some of these issues raised. However, other concerns, especially achieving a prediction tool of the desired precision, might be problematic. A second model by Grobman et al.[88] provided only fair evidence, from a payer perspective, of the medical costs of TOL versus ERCD. Thus, Grobman et al. do not provide conclusive evidence of the value of VBAC over ERCD.

Health Care Resources

All studies were rated poor, mainly for lack of adjustment for potential confounding variables.

Individual Factors

What individual factors influence route of delivery?

This review identified 96 studies that met the requirements for inclusion. However, upon further review, 83 of these studies were considered of poor quality and were subsequently removed from the analysis. The most common reason that studies were rated poor was due to lack of adjustment for important confounders. While many studies commented on the extensive list of factors that influence the outcome of TOL, very few studies actually considered those factors when conducting their analyses. Instead of stratifying their analysis or running multivariate models (e.g., logistic regression), studies often provided only bivariate analyses (i.e., Chi-square, Fisher exact, or t-tests). By neglecting to control for confounding, the measures of association provided by these studies might be distortions of the true association and hence should be interpreted with caution.

Overall there was an *increased likelihood of vaginal delivery* for women who had a prior vaginal delivery (particularly VD after cesarean), maternal age less than 40 years, a nonrecurrent indication for one's prior CD, and favorable cervical assessment. There was a *decreased likelihood of vaginal delivery* for women with an increased number of prior CDs, gestational age greater than 40 weeks, birth weight greater than 4000 grams, and augmentation of labor. Although all of these significant findings come from good to fair quality studies, it is important to remember that some of these factors do in fact vary between individual health care providers. For example, the cervical examination performed by one provider may differ from the exam of another or in another instance; the decision to augment a labor and how aggressively this approach should be applied may also be dramatically different between providers. In any case, these inter-provider variations may have not only affected the obtained results and perceived associations, and also has possible implications in the use of such knowledge in the clinical realm.

Patient Preferences

What factors influence a patient's decisionmaking regarding VBAC or ERCD?

A woman's choice for delivery was often based on social motives (e.g., easier recovery so she can care for her baby and children at home). Only four of 11 studies cited safety of the mother or bay as important reasons for delivery choice. It remains unclear if VBAC education increases the proportion of women who choose TOL. Future studies should include education, ideally before next pregnancy.

Provider Characteristics, Legislation, Access to Care

How do legislation, policy, guidelines, provider characteristics, insurance type, and access to care affect health outcomes for VBAC candidates?

One of the things a decisionmaker would want to know in deciding between TOL and ERCD is what conditions of care including practice management, training of the provider, and hospital characteristics increase the risks of each choice. There were no high quality data for this issue, in

fact, studies of these factors exclusively examined VBAC rates rather than the safety of each choice.

Legal or Legislative Factors

No study provided direct evidence for the impact of rising malpractice rates on VBAC or ERCD. Two studies were identified that provided any data regarding legal and/or legislative effects. One study in Florida found a significant difference in VBAC rates before and after enactment of statewide legislation emphasizing dissemination and peer-review enforcement of guidelines. Analysis failed to consider underlying time trend in VBAC rates independent of legislation. Another study in New York found small changes (ORs between 0.95 and 1.0) in probability of VBAC for either hospital-paid loss due to malpractice claims or $5,000 increase in annual physician insurance premium increase. No other studies of the effects of increasing insurance premiums were identified.

Guidelines

- A randomized trial[133] demonstrated that opinion leaders are able to modify provider behavior to a greater extent than audit and peer review.
- A second randomized trial[134] failed to show a significant change in response to audit and peer review.
- Two retrospective cohort studies[135, 136] used data over time to show increases in VBAC rates in response to national VBAC guidelines.

Provider Characteristics

Provider characteristics such as training to perform a cesarean, clinical volume, and management characteristics may affect outcomes of TOL and ERCD. Though these may be important factors, no studies that examined these factors, controlled for important confounders such as patient selection bias. Thus, there is no evidence as which if any of these factors may increase risk.

Hospital Characteristics

- Most studies of the effect of teaching hospitals found that teaching hospitals had higher VBAC rates.
- Studies disagreed whether the presence of a NICU in the hospital affected VBAC rates
- In small rural hospitals, three studies of small case series found VBAC success rates of 67 to 88 percent with no serious adverse events. More extensive experience might modify this result.

Insurance Types

There were conflicting data regarding the impact of types of health insurance on VBAC rates.

Chapter 5. Future Research

It is clear from this report, that the literature about TOL and ERCD is significantly flawed.

- One of the highest priorities for future research should be the development of standardized reporting measures of disease severity and outcomes of delivery. For example, standardized reporting of disease/condition severity especially for conditions with devastating consequences such as uterine rupture, and precise definitions for important health outcomes, such as delineation between outcome and predictor such as fetal tracing findings and clinically significant uterine rupture, to enable identification of important for premonitory predictors.
- Studies also need to be consistent in the definition of their conceptual cohort. In comparing TOL to ERCD, it is important to ensure that the ERCD group would have been eligible for a TOL.
- Future studies of tools to predict likelihood of vaginal delivery need to be tested in populations with varying baseline risk and also add considerations for the consequences of prediction such as the likelihood of clinically significant uterine rupture from a false positive test.
- Patients make decisions by a complex process weighing social ramifications and values in parallel with probabilities of health risks. Therefore, future studies should focus on accurately measuring this important dimension of childbirth decisionmaking.
- Patients make decisions based on short and long-term consequences of their choices. Therefore, further research needs to focus on long-term health outcomes such as pelvic floor dysfunction, incontinence, or the long-term repercussions of neonatal conditions such as neurologic and respiratory conditions.
- In order to consider long-term consequences and quality of life, studies need to use appropriate long-term methods such as survival analysis and studies that use QALYs need to be able to delineate maternal and neonatal consequences separately and in present data in a meaningful way.
- Factor such as malpractice coverage, and insurance variation, limit patients' ability to choose. No data was available for this very real determinant. Future studies are needed to examine the impact of factors such as the malpractice crisis and malpractice reform on choices available and outcomes from TOL and ERCD.

Vaginal Delivery Rates

- Future studies of vaginal delivery rates in TOL, should evaluate the impact of labor management strategies such as induction of labor on likelihood of success.
- Studies examining the factors that may explain why vaginal delivery rates differ in some study populations are needed.

Predictive Tools

- Studies with the objective of creating a predictive tool should attempt to use a prospective study design, avoid workup or verification bias (i.e., try to incorporate all of those who are eligible for a TOL into the study, instead of only those who decide on that route of delivery), and specify the reproducibility and generalizability of the predictive tools by validating it in another distinct population.
- Although the avoidance of workup or verification bias might be difficult if not impossible to do, one can minimize this bias by maximizing the percentage of those eligible for a TOL that actually attempt a TOL.
- By weighting the contribution of each variable and adjusting for confounding distortion, the use of a point system based on Beta coefficients and logistic regression modeling might provide more accurate and precise estimates of the probability of vaginal delivery.
- To date, the two best scoring systems are by Flamm and Troyer. Each of these scoring systems could benefit from further validation studies (e.g., using a non-HMO study population with the Flamm scoring system, and using a prospectively designed validation study with the Troyer scoring system).

Maternal and Infant Health Outcomes

Future research should focus on conducting methodologically rigorous studies to provide direct evidence regarding the relative benefits and harms of trial of labor and ERCD. If randomized trials are not done, good-quality studies of TOL versus ERCD must pay attention to the following:

Population - Studies should be conducted in populations of women who are similar in every respect except choice of delivery route (comparability of groups).

Specificity of Intervention - Studies should pay close attention to and account for the importance of co-interventions such as use of oxytocin and other medical agents for augmentation or induction of labor.

Precise and Standard Outcome Measures Variations in reporting of important clinical outcomes were striking. Studies should consider the following factors in developing outcome measures:

- **Etiology** - Outcomes such as hysterectomy, infection, maternal mortality, perinatal mortality must pay specific attention to explicitly identifying the etiology. Lack of precision in this regard allows for both under and over- reporting of cases due to misclassification. Examples include whether hysterectomy was performed due to maternal hemorrhage secondary to clinically significant uterine rupture versus hemorrhage due to abruption, uterine rupture through the uterine fundus in a woman with a low transverse incision either due to trauma or other non-incisional causes, and perinatal death due to lethal anomaly versus intolerance or management of labor.

- **Standard Terminology** - In order to accurately measure outcomes, there must be a consistent terminology. Lack of this, prevents accurate and meaningful comparisons of risks for each delivery choice. Outcomes such as infection, hemorrhage, and uterine rupture were not consistently defined.

- **Separating prevention/prediction strategies from outcomes**- As long as potentially important predictors of events such as prolonged fetal bradycardia as a predictor for clinically significant uterine rupture are included in the definition of uterine rupture, their true value as a predictor rather than a confounder will remain unknown.

Uterine Rupture

- Future studies need to use standard terminology for uterine rupture. Motivated by this need, we convened a conference call of national experts including representatives from the American College of Obstetricians and Gynecologists, American Academy of Family Physicians, Centers for Disease Control and Prevention, National Institutes of Health, and investigators from major VBAC studies to begin terminology discussions. The group proposed terminology based on anatomic findings. The term complete uterine rupture of a cesarean scar would be used to indicate a separation of all layers of the uterine wall including serosa. Incomplete rupture of a cesarean scar would be used to indicate a defect that did not extend through the entire thickness of the uterine wall (e.g. serosa intact). This latter term would include what are often referred to as uterine windows. Details are provided in Appendix G.
- Studies should be explicit in reporting uterine rupture related health outcomes. Inconsistencies in reporting health outcomes such as perinatal death, maternal death, and hysterectomy attributable to uterine rupture, limits our ability to fully appreciate the significance of this condition.
- Every effort should be made in future research studies to separate important predictors from the definition of uterine rupture. Failure to do so limits the ability to determine the value of factors such as fetal bradycardia as a predictor of risk.
- Fetal bradycardia should be further explored as an important predictor of uterine rupture by use of a control group and reporting all instances of fetal bradycardia that occur in patients undergoing a TOL and the frequency of finding uterine rupture for this signal.

Health Status

- Attention to development of a tool focused on maternal health that includes a woman's ability to care for her infant.
- Measurement of maternal and infant health status that measures these outcomes longitudinally over time.
- Documentation of delivery process (e.g., TOL followed by repeat CD, VBAC, or ERCD) as it relates to health status.

Patient Satisfaction

- Measurement and comparison of satisfaction as it relates to all delivery processes (TOL followed by repeat CD, VBAC, repeat CD).
- Ascertainment of the level of information provided to the patient and the level of involvement in decisionmaking. A future trial could test the effect on patient satisfaction and/or other psychosocial outcomes of the use of various approaches to providing information and involving the women in decisions. Intervention patients in these trials might receive packets that include videos, pamphlets, access to a computerized decision aid, etc., covering the risks, benefits, and realities of recovery from either TOL or ERCD. Intervention patients would also be given many opportunities to become involved in the decisionmaking.

Cost and Health Care Resources

Ascertainment of true cost data. Data on costs (rather than charges) is sparse in the literature relating to these two alternatives. The costs of labor and delivery and of the surgical processes are poorly understood. Detailed time-in-motion studies would help to estimate these costs. The costs of specific health outcomes (as adverse events) are also poorly understood. This is especially true for outcomes that might have long-term societal costs such as special education and lost productivity for severe adverse neonatal outcomes, and lost productivity for maternal deaths. Economic evaluations need to estimate these costs in a better way and to include these long-term costs in models. Once costs are available, economic evaluations need to assume a societal perspective, use QALYs as a summary outcome measure, allow for two or more pregnancies after an initial CD, and include all adverse outcomes and associated long-term costs of these outcomes.

Individual Factors

- First of all, there is a need for studies to consider certain factors such as maternal race, spontaneous and induced labor, oxytocin use, and nonclinical factors (i.e., the nonitalicized factors in the above table). Previous studies of these factors have demonstrated their influence on the outcome of TOL; however, the lack of adjustment for potential confounders makes the interpretation of these associations less valid.
- Second, there is the question of which study design best addresses this issue. Although database studies easily allow for large sample sizes (and hence the power to detect differences), they are often limited by the lack of individual patient data and thus the ability to control for confounding. While retrospective cohorts usually allow for the adjustment of confounders using individual patient data, they are limited by the availability and validity of previously collected data. Overall, it appears that the prospective cohort design allows the best opportunity to address the issue of predictive factors. Although expensive and time-consuming, this design allows one to collect the information desired, in a manner that improves the validity of the results.

- Third and perhaps most important, there is an overwhelming lack of adjustment for confounding in the literature. Evaluation of the fair-to-good-quality studies showed that certain factors had a significant influence over the outcome of a TOL; these factors include but are not limited to: prior VD, order of prior VD (especially vaginal delivery after prior CD), cervical dilation, cervical effacement, and Bishop's score. This finding only strengthens the importance of considering these other factors when conducting research and making clinical decisions.

Patient Preferences

- Develop an instrument to measure a women's preferences for birth. The instrument should include preferences related to both risk and social motives.
- It remains unclear if VBAC education increases the proportion of women who choose TOL. Future studies of education should include education before next pregnancy, perhaps at the postnatal visit of patients with first CD.

Health Care Resources

- Future research on units of health care resources should address more than LOS. Other important units of resources include time spent in labor and delivery and time spent in steps in the surgical process. Resources associated with serious adverse events also need to be estimated (e.g., special education after severe neonatal outcomes).
- Research involving units of health care resources (e.g., LOS) should either compare TOL and ERCD at similar baseline risk or perform careful adjustment for baseline risk factors and other confounding variables. Otherwise comparisons of these resources suffer potential biases.
- If more detailed economic evaluations are conducted (i.e., that go beyond the total patient charge), the units of health care resources should be identified as part of that study. Further, the trade-offs between all the other economic outcomes (beyond LOS) will require full economic analyses to compare difference units of resources appropriately.

Implications for Legal, Health Care System, and Provider Characteristics

Across legal or legislative factors, guidelines, provider characteristics, hospital characteristics, and types of insurance or payments, there are several general future research needs. Research needs specific to one of these are presented after the general needs.

- Studies must either focus on a relatively homogeneous low-risk patient to compare across providers or to adjust analyses carefully for baseline risk and other potential confounding variables, to make sure comparisons among levels of characteristics are valid.
- Studies also need to include as many potential predictors and potential confounders as possible. While this review has separated these health care system characteristics for ease

of discussion, proper evaluation should include all of these. That is, a hospital characteristic might be a potential confounder for insurance type.

- Complete evaluation of all of these health care system characteristics in a single set of analyses will require consortium level research. That is, only if large, complete data sets are assembled from multiple sources (including hospitals, insurers, and physicians) will research to address all of these diverse characteristics be possible.
- For future research on the impact of legal and legislative characteristics on the choice of mode of delivery, studies need to be long term, collect adequate data on potential confounders, and estimate any underlying time trend independent of the intervention.
- Guidelines, especially as championed by an opinion leader, have been demonstrated to effectively modify provider behavior (e.g., to increase rates of VBAC). Other approaches (e.g., peer review and audit) have not demonstrated a clear impact on changing VABC rates. Further research into alternative systems of rewards (e.g., bonus payments for a successful VBAC in patients who meet guidelines) and or punishments (e.g., including VBAC rate as a quality index) might also warrant additional research.
- Studies looking at provider characteristics need to adjust for baseline differences in risk and other potential confounding variables.
- Also, for provider (and hospital) characteristics, the analysis must match the sampling design. Specifically, patients are attended by physicians and deliver at specific hospitals. The clustered nature of this relationship (patient nested and clinician nested within one or two hospitals) needs to be reflected in the statistical analyses employed.
- With respect to hospital characteristics, future studies need to make definitions of different characteristics as clear as possible. This is especially important, as some hospital characteristics are potentially confounded with one another. For example, hospitals that have high levels of care, have NICUs, are teaching hospitals, and have large numbers of deliveries might be the same small set of hospitals. That is, particular hospital characteristics might occur as groups and not as independent factors.
- A relationship between insurance type and rates of VBAC has not been demonstrated. However, to the extent that VBAC rate is becoming a quality measure, additional research on this particular association might not be warranted. If rate of VBAC becomes a widely used quality measure, there will likely be no association with type of insurance.
- Malpractice insurance premiums may also influence the decision on mode of delivery for women with prior CD. Increasing rates of malpractice insurance might lead some providers either to not provide any delivery services or to choose a mode of delivery perceived to be less risky for mother and/or child. Careful evaluations of rates of VBAC and ERCD across time (before and after changes in premiums) and across geographic regions (one or more in which changes in premiums were large and one or more in which changes in premiums were small) would allow appropriate comparisons to be made. That is, the changes in rates in the geographic region(s) in which the premiums were high could be compared with rates in the region(s) in which premiums were low. Inclusion of potential confounders including patient-level risk factors would need to be included in any such study.

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Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Randomized Controlled Trials			
Lelaidier 1994[35] FAIR	France	Unclear Study duration 6 months, manuscript received May 1993 To evaluate the tolerance and efficacy of mifepristone in women with prior CD with an unfavorable cervix.	Women with one prior delivery, by CD. Bishop's scores </= 3 I/A: 16 SL: 16 Age: Mean age 33(m), 32(pl) Parity: 1 Race: Not reported Insurance:NR
Rayburn 1999[32] FAIR	USA	To compare effectiveness of PGE2 vaginal to expectant management	1 prior low-transverse CD, gestational age >/=38 wks, accurate gestational dating by exam or ultrasound < 20 wks, no labor, no fetal growth abnormalities, reassuring FHR tracings, and unfavorable cervix (Bishop score </= 6) IA: 143 SL: 151 Age: Mean age 27 (both groups) Parity: NS Race: White: 15% (PGE), 18% (EM) Black: 34% (PGE), 32% (EM) Hispanic: 47% (PGE), 48% (EM) Asian: 2% (PGE), 2% (EM) Other: 1% (PGE), 0% (EM) Insurance: NS

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Lelaidier 1994[35] FAIR	• Unknown scar • Nonvertex presentation • Multiple pregnancies • Premature rupture of membranes • Previously delivered vaginally.	*Intervention:* Mifepristone 200mg on days one and two, monitored on days 3 and 4. *Control:* Placebo on days one and two, monitored on days 3 and 4. *Other Procedures, Interventions:* If no labor by day 4: induction with prostaglandins if Bishops score </=3, ARM+oxytocin if >/=4	66% Prolonged pregnancy 22% pre-eclampsia 0.1% IUGR
Rayburn 1999[32] FAIR	• Medical complications (insulin-dependent DM, pregnancy-induced HTN) • Grand multiparity • Hypertonic uterine patterns • Nonvertex presentation • Multifetal gestation • Ruptured membranes • Known hypersensitivity to prostaglandins • Placenta previa • Unexplained vaginal bleeding • Active genital herpes infection • Suspected cephalopelvic disproportion.	*Intervention:* Prostaglandin E2 gel (Prepidil(r)) 0.5mg into cervical canal; patients supine x 15 min after, FHM x 2 hrs, repeated at weekly visits. *Control:* Expectant management (EM). *Other Procedures, Interventions:* None, patients to return for exams in qwks 40, 41 if no labor.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Population-Based Database			
McMahon 1996[5] GOOD	Canada Nova Scotia	1986-1992 To determine the morbidity and mortality of TOL vs. elective repeat CS	Database Description: Nova Scotia Perinatal Database covering more than 80% of pregnant women in the province Singleton pregnancies with one prior low transverse CD SL/IA- 3249 ERCD- 2889 *Age:* <19 - >35 *Parity:* SL/IA- 1 = 2468 (76%) 2= 547 (16.8%) > = 234 (7.2%)
Smith 2002[6] FAIR	Scotland	1992-1997 To determine the risk of intrapartum still birth or neonatal death from TOL versus planned repeat CD in women with prior CD	Database Description: All patients discharged from maternity hospitals in Scotland Singleton pregnancies between 37-42 weeks, cephalic, without lethal congenital anomalies SL/IA- 15515 Repeat CD- 9014 Age: SL/IA- median 30 (interquartile range 26-33) ERCD- median 31 (interquartile range 27-34) Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
McMahon 1996[5] GOOD	• Non-vertex presentation (119) • Multiple gestation (118) • Vertical or T-incision (37) • Previa (36) • HSV (7) • Prior uterine surgery (2)	NA	NR
Smith 2002[6] FAIR	• Multiple gestation • Noncephalic outside 37-42 weeks GA • Perinatal deaths or stillbirths due to congenital anomalies	NA	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Prospective Cohort			
Blanchette 2001[52] FAIR	USA	1996-99 To report the results of a 4 year attempt to aggressively promote a TOL.	All patient with prior CD offered TOL, unless medically contraindicated IA- 16 SL- 9 Age: NR Parity: NR Race: NR Insurance: NR
Blanco 1992[34] FAIR	USA	1987-88 To determine the safety and efficacy of PGE2 gel for induction of labor or ripening the cervix in women with a prior low-transverse CD for a TOL.	Prior lower segment CD attempting TOL, with a medical indication for delivery, an unfavorable cervix and a singleton, vertex fetus with a reactive nonstress test IA- 25 (I) of these 5 (I+a) SL- 56 of these 9 (a) Age: mean 24.7 (PGE2), 22.4 (oxy) Parity: mean 1.4 (PGE2), 1.3 (oxy) Race: NR Insurance: NR
Cowan 1994[25] FAIR	USA	1990-91 To examine factors that may affect the success rate for TOL, as well as those for uterine rupture	Any woman with prior CD choosing TOL I- 67 A-167 SL-359 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Blanchette 2001[52] FAIR	Not defined	*Intervention:* Misoprostol and/or oxytocin. *Control:* SL *Other procedures, interventions:* None stated	NR
Blanco 1992[34] FAIR	• Asthma • OB indication for an immediate delivery • Active labor • Favorable cervix	*Intervention:* 1mg PGE2 gel (pharmacy compounded) intracervically with repeat after 4 hrs if active labor not established *Control:* SL *Other procedures, interventions:* FHR and uterine contractions monitored.	NR
Cowan 1994[25] FAIR	• Known vertical scar • Breech presentation • Multiple gestation	*Intervention:* NA *Control:* NA *Other procedures, interventions:* Continuous EFM, Oxytocin used for induction or augmentation of labor	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Duff 1988[26] GOOD	USA Madigan Army Medical Center	1984-1987 To evaluate the outcome of TOL in women with a history of a single low transverse CD.	All women with 1 prior low transverse cesarean SL/IA- 227 (281 eligible; 54 excluded for vertical incision (10), unknown incision (5), footling breech (3), medical complications of pregnancy and unfavorable cervix (18), EFW>4500g (18)) ERCD- NR Age: NR Parity: NR Race: NR Insurance: Armed services medical coverage
Flamm 1997[33] FAIR	USA Southern California, Kaiser	1990-92 To evaluate the use of intravaginal PGE2 in patients with prior CD.	All pregnant women with prior CD IA- 453 SL-4569 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Duff 1988[26] GOOD	• Indication for repeat cesarean • EFW >4500gm • Unknown scar.	*Intervention:* NA *Control:* NA *Other procedures, interventions:* Oxytocin used for induction or augmentation if indicated. Uterine exploration after VD for defect.	NR
Flamm 1997[33] FAIR	• Known classical or low vertical incision • Breech presentation • Twin gestation.	*Intervention:* PGE2 gel (pharmacy compounded) 2-4 mg intravaginally q 4hrs (max dose not stated). *Control:* SL *Other procedures, interventions:* Electronic FHM in all patients. Oxytocin induction or augmentation if indicated.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Flamm 1994[20] FAIR	USA Southern California, Kaiser	1990 To evaluate the outcomes of TOL and ERCD.	All women with prior CD delivery (unknown scar and more than 1 prior CD allowed) SL/IA- 5022 ERCD- 2207 Age: SL/IA: 294 + 5.1 CD: 30.5 + 5.2 Parity: NR Race (overall): White = 208,577 (38.9%) Hispanic = 226,526 (42.2%) Black = 36,522 (6.8%) Other+Unknown = 65,160 (12.1%) Insurance: Government 261,297 (48.7%) HMO 160,130 (28.9%) PPO 64,669 (12.1%) Private 19,071 (3.6%) Self-pay 19,069 (3.6%) BCBS 11,328 (2.1%) Misc 1221 (0.2%)
Flamm 1990[22] FAIR	Southern California, Kaiser	1986-1988 To evaluate the probability of rare events such as uterine rupture in women with prior CD attempting TOL.	Prior CD wanting to attempt TOL. IA- 1201 Repeat CD- 2756 Age: NR Parity: 156 >1 prior CD Race: not clear, reported by hospital system Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Flamm 1994[20] FAIR	• Known prior classical or low vertical uterine incision • Spontaneous abortion (491) • Therapeutic abortion (79) • Transfer out of Kaiser (56) • Incomplete medical records (26)	*Intervention:* NA *Control:* NA *Other procedures, interventions:* Oxytocin used for induction/augmentation as needed. Postpartum exam of uterus at discretion of provider.	NR
Flamm 1990[22] FAIR	• Know breech presentation • Classical or low vertical scar • Twin gestation	*Intervention:* NA *Control:* NA *Other procedures, interventions:* FHR monitored continuously in all patients, Oxytocin as per standard of care.	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Flamm 1987[28] USA GOOD	USA Southern California, Kaiser	1984-85 To evaluate the outcome of oxytocin administration inpatients with prior CD attempting TOL.	Prior CD IA- 485 SL- 1291 Age: mean age 27 (oxytocin), 28 (control) Parity: NR Race: NR Insurance:NR
Martin 1983[24] FAIR	USA Universities in Mississippi and Alabama	1981-1982 To evaluate the safety of VBAC.	One or more prior CD (includes low vertical (76)) SL/IA- 717 (789 eligible; 72 ineligible for study) 162 attempted TOL ERCD- 555 8 desired cesarean and delivered vaginally Age: SL/IA:Successful VBAC = 22.2 + 0.9 Failed VBAC = 21.8 + 0.9 ERCD:mean = 23.3 + 0.3 Parity: "Distributed approximately equally" Race: "Distributed approximately equally" Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Flamm 1987[28] USA GOOD	• Known breech presentation • Twin gestation	*Intervention:* Oxytocin as per standard, up to max dose of 20mU/min *Control:* Those who did not receive oxytocin *Other procedures, interventions:* None stated	NR
Martin 1983[24] FAIR	• Classical, suspected macrosomia (EFW >4000gm) • Fetal malpresentation • Multiple gestation	*Intervention:* NA *Control:* NA *Other procedures, interventions:* All uteri explored postpartum, if dehiscence noted not repaired unless >2cm diameter. Oxytocin used for augmentation.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Meehan 1989[50] FAIR	Ireland	1982-87 To evaluate the safety of TOL.	One prior CD without a recurring indication for CD IA- 127 (I) Oxy: 17 ARM: 16 PG: 8 ARM+oxy: 42 ARM+PG: 21 A+O+P:23 217 (a) oxy: 30 ARM: 137 ARM+oxy: 50 SL- 162 ERCD- 430 Age: NR Parity: NR Race: NR Insurance: NR
Meier 1982[57] FAIR	USA Kaiser SanDiego	1980 to assess the safety of having most patients with prior cesarean attempt TOL	All TOL, 1st 6 of each month with elective repeat and one prior CS SL/IA- 207 ERCD- 62 Age: NR Parity: NR Race: NR Insurance: Kaiser Permanente Health Plan

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Meehan 1989[50] FAIR	Not defined	*Intervention:* NA *Control:* NA *Other procedures, interventions:* Continuous cardiotocography, oxytocin, AROM, prostaglandins and combinations used for induction and augmentation, uterine exploration immediately post-delivery.	NR
Meier 1982[57] FAIR	• Recurrent indication for cesarean • No obvious CPD	*Intervention:* NA *Control:* NA *Other procedures, interventions:* All monitored with IUPC and FSE, oxytocin used for augmentation and induction when indicated, more than 1 cesarean not excluded.	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of Study Research Objective	Population
Phelan 1987[23] FAIR	USA USC	1982-1984 To evaluate the risks of TOL.	TOL 1982-3 1 prior CD 1983-4 1-2 prior CD (low vertical, unknown allowed) SL/IA- 1796 (SL,I+A) ERCD- 314 Age: NR Parity: NR Race: NR Insurance: NR
Stovall 1987[27] FAIR	USA	1985-86 To determine whether the indications for TOL, use of epidural anesthesia, and use of oxytocin can be safely liberalized.	All patient with prior CD offered TOL (low-transverse or low-vertical sections), unless medically contraindicated. IA- 133 SL-139 Age: NR Parity: NR Race: NR Insurance: NR
Retrospective Cohorts			
Lao 1987[31] FAIR	Hong Kong	1992-1993 Report experiences with induction of labor in women with previous CS	One previous lower segment CS SL- 529 IA-137 (102 (a/o), 35 (a) Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1a. Study descriptions for vaginal delivery, maternal and infant outcomes - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for induction
Phelan 1987[23] FAIR	• Classical • Multiple gestation • Malpresentation	*Intervention:* NA *Control:* NA *Other procedures, interventions:* oxytocin administered according to ACOG guidelines, epidurals allowed, uterine exploration routinely performed	NR
Stovall 1987[27] FAIR	• Prior classical incision • Prior low-vertical in preterm pregnancy (e.g. preterm breech) • Low-transverse and low-vertical scar (T incision) • Failed TOL after primary CD	*Intervention:* NA *Control:* NA *Other procedures, interventions:* Internal monitoring,Oxytocin for induction or augmentation mean dose 7mU/min (range 0.4 - 32) mean duration 276 min (range 45-960).	NR
Lao 1987[31] FAIR	• Recurring cause of previous CS • Non-cephalic presentation • X-ray pelvimetry showing obstetric conjugate of <10cm and transverse diameter of <11.5cm	[illegible] Bishop score 4-6: amniotomy + oxytocin Bishop score <4: 3mg PGE2 tablets + amniotomy + oxytocin Also, manual monitoring of contractions and fetal HR Reason for Induction: 43% post-maturity 6% PROM 13% hypertension 23% leaking at term7% antepartum hemorrhage	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Randomized Controlled Trials			
Xenakis 1995[175] POOR	USA	1993 To compare efficacy and safety of low-dose versus high-dose oxytocin augmentation	IA: 22 IC: 26 All nulliparous or multiparous women admitted >/= 37 wks gestation in active labor (including those with prior low transverse CD attempting TOL). Age: mean age 24 yrs Parity: NR Race: White: 10% (LD), 11% (HD) Black: 4.5% (LD), 2.6% (HD) Hispanic: 83% (LD), 86% (HD) Other: 2% (LD), 1% (HD) Insurance: NR
Wing 1998[176] POOR	USA	NR To compare the safety and efficacy of vaginally administered misoprostol with IV oxytocin for cervical ripening and labor induction in women with Prior CD	IA: 17 IC: 21 Requiring induction of labor for medical or OB indications with a history of one immediate prior CD without subsequent VD Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Randomized Controlled Trials			
Xenakis 1995[175] POOR	• Malpresentation • Placenta previa • Previous classic CD • Multiple gestation	*Intervention:* Low-dose: oxytocin 1mU/min increased by 1mU/min q30min up to max 4mU/min x 2 hrs. If no adequate contractions after 2hrs, dose increased by 1mU/min every 30 min until adequate contractions. *Control:* High dose: oxytocin 4mU/min and increased by 4mU/min every 15min until adequate contractions. *Other Procedures, Interventions:* Protocols for labor management, criteria for diagnosis of labor abnormalities, and indications for operative delivery were the same for both groups.	Augmentation started if: arrest of dilation or descent defined as no cervical change for 2hrs after latent phase with cervix >/=4cm, or no change in station of presenting part at full dilation for >1hr.
Wing 1998[176] POOR	NR	*Intervention:* Misprostol 25mcg intravaginally q6 hrs to max 4 doses. *Control:* Oxytocin by standard protocol (doses not stated). *Other Procedures, Interventions:* use of continuous FHR, uterine activity monitoring, and amniotomy in all patients.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Lyndon-Rochelle 2001[72] POOR	USA Washington state	1987-1996 To examine the risk of uterine rupture associated with VBAC (spont, induced) and repeat C/S Database Description: Retrospective. Washington state birth certificates,hospital discharge data (Comprehensive Hospital Discharge Reporting System).	Primiparous women who gave birth to singleton infants by CD and delivered a second child. Age: 14-48 SL: n=10,789 IA: n=1,960 induced with PGs; 366 without PGs ERCD: n=6,980 Parity: Overall- P2 Race: SL- White = 8949 (82.9%) Black = 318 (2.9%) Hispanic = 621 (5.8%) Other = 901 (8.4%) *ERCD:* White = 6056 (86.8%) Black = 164 (2.3%) Hispanic = 281 (4.0%) Other = 479 (6.9%) *Insurance:* SL: Commercial = 5659 (52.5%) Medicaid/uninsured = 2730 (25.3%) Managed care = 1992 (18.5%) Other = 408 (3.8%) *IA:* Without PG: Commercial = 1081 (55.2%) Medicaid/uninsured = 473 (24.7%) Managed care = 384 (19.6%) Other = 22 (1.1%) IA: White =1999 Black = 318 *With PG:* Commercial=206 (56.3%) Medicaid/uninsured = 90 (24.6%) Managed care = 64 (17.5%) Other = 6 (1.6%) *ERCD:* Commercial= 3936 (56.4%) Medicaid/uninsured = 1741 (24.9%) Managed care = 1119 (16.0%) Other = 184 (2.6%)

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Lyndon-Rochelle 2001[72] POOR	Women who delivered before 1989 b/c "repeat cesarean no labor" was not specified in birth cert until 1989	*Other Procedures, Interventions:* SL, induction of labor with or without prostaglandins on hospital discharge	Reasons not specified, health conditions such as diabetes, chronic hypertension, breech presentation, herpes, previa, preeclampsia reported

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Stone 2000[177] POOR	Australia	1995 To describe the population-based delivery outcomes for women giving birth in 1995 whose penultimate delivery was a cesarean Database Description: Perinatal Morbidity Statistics maintained by Victoria Perinatal Data Collection Unit, mandatory reporting of all births in Victoria represents 99.6% of all births	Women who gave birth in 1995 and whose penultimate delivery within a 5-year period was a cesarean SL/IA- 1482 Repeat CD-4663 Age: NR Parity: one - 3079 2 or more - 1584 Race: aboriginal - 32 non-aboriginal 3579 Insurance: NR
Gregory 1999[164] POOR	USA California	1995 To describe attempted and successful VBAC rates and rupture rates for women with and without prior cesareans and compare outcomes in hospitals with difference attempted VBAC rates Database Description: California Office of Statewide Health Planning and Development	All hospital deliveries in the state of CA (DRG 370-375) classified as prior cesarean if ICD9=654.2 No Prior CD- 469,929 SL/IA- 39,096 TOL 15,072 failed VBAC 24,024 VBAC ERCD- 27760 *Age:* >35 = 71,815 (13.4%) <35 = 464,970 Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Stone 2000[177] POOR	Multiple getation in current or previous delivery	NR	
Gregory 1999[164] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Rageth 1999[60] POOR	Switzerland	1983-1996 To examine risk of VBAC Database Description: containing 40% of Switzerland's deliveries	Prior cesarean NPCS- 226407 SL- 15154 IA- 2459 ERCD- 11433 Age: SL/IA- <30 = 8640 (49.05%) Parity: NR Race: NR Insurance: SL/IA- private = 6293 (35.73%) ERCD- private = 4862 (42.53%)
Holt 1997[59] POOR	USA Washington state	1987-1993 To examine relationships between prior obstetric complications and VBAC success	Primiparous women with prior cesarean SL- 6491 ERCD- 3619 Age: <20 - >35 Parity: Primiparous Race: White = 8784 (88.5%) Black = 253 (2.5%) Asian = 285 (2.9%) Hispanic = 452 (4.6%) Other = 153 (1.5%) Unknown = 183 Insurance: Private = 5281 (56.6%) HMO = 1338 (14.3%) Medicaid = 2013 (21.6%) Self = 501 (5.4%) Other = 202 (2.2%) Unknown = 775

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Rageth 1999[60] POOR	Twin pregnancies	Other Procedures, Interventions: Methods of Augmentation and Induction NR	NR
Holt 1997[59] POOR	• Second births prior to 1989 (when TOL added to birth certificate) • Unknown delivery method with second delivery	NA	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Stalnaker 1997[178] POOR	USA Florida	1989 - 95 To summarize demographic information and characteristics of antepartum care, intrapartum events and neonatal outcomes from the successful claims to the Florida Neurological Injury Compensation Fund	IA- 7 SL- 2 Age: NR (27 for whole group) Parity: NR (0.8 for whole group) Race: NR Insurance: NR Successful claim: Injury to the brain or spinal cord of a live infant weighing at least 2500gm at birth caused by oxygen deprivation or mechanical injury occurring in the course of labor deliver, or resuscitation in the immediate post-delivery period in a hospital which renders the infant permanently and substantially mentally and physically impaired.
Prospective Cohort			
Arulkumaran 1989[179] POOR	Singapore	Not clear To examine the characteristics, and success of TOL in patients requiring augmentation with oxytocin.	Prior lower segment CD attempting TOL, with fetus in cephalic presentation and abnormal progress of labor IA- 63 Age: 31 (FTOL), and 29 (VBAC) Parity: NR Race: NR Insurance: NR
Bais 2001[180] POOR	Netherlands	1990-1994 To determine clinical outcomes of VBAC in population with low overall cesarean rate	Prior CS • 20 breeches • 36 >1 prior CS • 30=forceps • 4=vacuum SL/IA- 184 142 VBAC 42 failed VBAC ERCD- 68/252 (27%) Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Stalnaker 1997[178] POOR	Delivering physician not participating in the fund, infant not meeting inclusion criteria and a determination by the board that the infant was not injured or that the injury was not birth-related.	NR	NR
Prospective Cohort			
Arulkumaran 1989[179] POOR	Required CD for reasons other than failure to progress (e.g. fetal distress or prolapse).	*Intervention:* Oxytocin 2mU/min increased q30 min (by 2 units up to 12, then by 4 units up to max 24mU/min) *Control:* None *Other procedures, interventions:* None stated	NR
Bais 2001[180] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Gherman 2001[181] POOR	USA	NR To evaluate the efficacy and safety of oral misoprostol for preinduction cervical ripening among patients with prior CD.	Gravidas with at least 36 weeks gestation, and one documented low transverse delivery. Bishop score <6 with medical or OB indication for labor induction IA- 10 Age: NR Parity: NR Race: NR Insurance:
Goldberger 1989[182] POOR	Israel	1987-1988 To compare effectiveness of PGE2 vaginal to expectant management.	One prior uncomplicated transverse lower uterine scar, with fully documented uneventful current term pregnancy IA: 19 SL: 155 ERCD:43 Age: NR Parity: NR Race: NR Insurance: NR
Goldman 1998[183] POOR	Israel	1991-1996 To report experience with oxytocin and PGE2 in TOL.	Prior CD IA- 208 oxytocin, 146 PGE2 SL- 166 Age: "Similar" Parity: "Similar" Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Gherman 2001[181] POOR	NR	*Intervention:* 50mcg dose. If cervical ripening or active labor did not ensue, repeat 50 mcg dose q 4 hr x max 6 doses. Oxytocin was subsequently administered. *Control:* None *Other procedures, interventions:* None stated	NR
Goldberger 1989[182] POOR	• Recurring cause of prior CD • Non-cephalic presentation • Estimated fetal weight > 4000g • Reactive NST • Pelvis deemed inadequate for vaginal delivery	*Intervention:* 1.5mg PGE2 pessary to posterior fornix, repeated after 6 hrs if no contractions. *Control:* Retrospective controls: 155 women with prior CD allowed spontaneous TOL (1985-6) and 43 women with no prior CD induced in similar way. *Other procedures, interventions:* Continuous recording of uterine activity and fetal HR, maternal BP, HR, UOP/color every 30min, epidural anesth. Encouraged, oxytocin augmentation if indicated	NR
Goldman 1998[183] POOR	•Prior classic or low vertical incision • Unknown scar • Prior hysterectomy or conservative myomectomy • Multiple gestation • Breech presentation • >1 prior CD.	*Intervention:* Oxytocin dosing not stated, PGE2 vaginal gel (Prostin E2(r)) *Control:* Spontaneous labor *Other procedures, interventions:* If vaginal delivery did not occur within 12 hours, CD performed.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Norman 1992[184] POOR	Sweden	NR To investigate if preinductive cervical ripening with PGE2 in women with 1 prior CD was safe.	Unripe cervix (cervical score </= 5) with one prior CD IA- 30 Age: Mean 30 (of those with prior VD) and 33 (those with no prior VD) Parity: NR Race: NR Insurance: NR
Silver 1987[185] POOR	USA	1983-85 To evaluate if oxytocin is effective for induction or augmentation in TOL.	Singleton pregnancy, one prior low-transverse CD requiring oxytocin for induction or augmentation. Induction criteria: an OB indication for delivery, absence of regular contractions, pretreatment dilation <3cm. Augmentation criteria: dilation >/= 4cm, regular uterine activity, no change in cervix x 1 hr I- 34 A-64 Age: NR Parity: Stated as not significantly different between success/failure groups Race: NR Insurance: NR
Sims 2001[186] POOR	USA	1997-99 To determine the impact of labor induction on success and safety of TOL.	Consecutive deliveries by women with prior CD IA- 57 SL- 179 ERCD- 269 Age, Parity: Reported as similar Race: Reported as a significantly higher proportion of African American women in SL group

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Norman 1992[184] POOR	Not defined	*Intervention:* 0.5mg PGE2 gel (Cerviprost (r)) intracervically, repeated at 24 hrs if cervix not changed. If cervix ripe, but no active labor at 5 and 24 hrs after gel, oxytocin started (dose not stated). *Control:* None *Other procedures, interventions:* External cardiotocography 30 min prior and 1 hr after gel application. After ROM, internal scalp electrodes placed on fetus.	NR
Silver 1987[185] POOR	Requiring oxytocin in 2nd stage only	*Intervention:* NR *Control:* NR *Other procedures, interventions:* NR	NR
Sims 2001[186] POOR	• Deliveries < 24 weeks • Intrauterine fetal death.	*Intervention:* NR *Control:* NR *Other procedures, interventions:* methods of induction; 1) oxytocin, 2) misoprostol 25-50 micrograms every 4 hours for 3 doses augmented with oxytocin, 3) dinoprostone 12 hours then oxytocin	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Videla 1995[187] POOR	USA	1988-91 To determine if cervical ripening with PGE2 gel is safe and effective in TOL compared to nulliparous women	One prior CD and requiring induction for OB or medical reason with an unfavorable cervix I- 94 IC- 866 A- 77/94 (82%)800/899 (89%) Age: reported as %< 20 yrs = 4(PGE2) Parity: NR Race: 45% white 20% Black, 30% Hispanic (PGE2) Insurance: NR
Prospective Cohort			
Sakala 1990[188] POOR	England	1984-86 To answer questions about oxytocin in TOL (adverse effects, success, and factors associated with failure).	>/= 1 prior low-transverse CD, and patient request for TOL I- 48 A- 25 SL- 164 Age: Mean 28 Parity: Mean 1.7 (oxy), 1.3 (SL) Race: NR Insurance: NR
Retrospective Cohorts			
Asaad 1994[189] POOR		NR Not stated	PROM >/= 37 wks, one prior CD with lower segment incision and non-recurrent cause, with doubt of healing of uterine scar I- 5 IC- 12 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Videla 1995[187] POOR	Classical incision, a nonreactive nonstress test, or regular uterine contractions	*Intervention:* PGE2 gel (pharmacy compounded); 2mg to external cervical os and posterior vaginal vault, repeated q4-6 hrs; max 4 doses *Control:* nulliparous women *Other procedures, interventions:* FHR and uterine activity monitored for all patients, amniotomy and internal monitoring used at OB discretion, oxytocin augmentation used if needed	NR
Prospective Cohort			
Sakala 1990[188] POOR	• Breech presentation • Multiple gestation • OB contraindications to TOL.	*Intervention:* NR *Control:* Spontaneous labor or elective CD. *Other procedures, interventions:* NR	NR
Retrospective Cohorts			
Asaad 1994[189] POOR	• Multiple pregnancies • Malpresentations	Intervention: oxytocin 2mU/min increased at 'intervals' up to 32mU/min until regular contractions. Control: SL Other procedures, interventions: maternal pulse, temp and fetal HR checked regularly	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Blanchette 1999[67] POOR	USA	Misoprostol: 1997-98 PGE2: 1996-97 To compare PGE1 (misoprostol) to PGE2 (dinoprostone) for cervical ripening and induction in a community hospital.	Singleton pregnancy at term, cephalic presentation, reassuring FHR, Bishop score <5 IA-16 IC-9 Age: Mean 29.8 (misoprostol) 29.5 (PGE2) Parity: NR Race: NR Insurance: NR
Choy-Hee 2001[195] POOR	USA	1996-98 To evaluate the safety and efficacy of cervical ripening with misoprostol in women with prior CD compared to those without prior CD.	Singleton pregnancy, Bishop score <6, cephalic presentation, and reassuring FHR I- 48 IC- 377 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Blanchette 1999[67] POOR	• Known hypersensitivity to prostaglandins • History of CD with vertical incision • Major uterine surgery • Placenta previa • Grand multiparity (>/= 6 prior deliveries) • History of asthma, glaucoma, or heart disease.	*Intervention:* Misoprostol 25mcg inserted into posterior vaginal fornix, with 25-50mcg q 4hrs to max 6 doses. If tachysystole (>/= 6 contractions/10 min) or contraction pattern of >/= 3/ 10 min, next dose withheld. Oxytocin was started 4 hrs after last dose of misoprostol, started at 1-2 mU/min and increased by </= 6mU/min q15-30 min until adequate pattern of contractions. *Control:* 1) PGE2 gel (Prepidil(r)) 0.5mg intracervically q 6hrs to max 3 doses. Oxytocin if needed 6 hrs after last dose of PGE2. OR 2) PGE2 slow-release pessary (Cervidil(r)) 10mg placed in vaginal posterior fornix for up to 12 hrs, removed when adequate uterine contraction pattern appeared.	NR
Choy-Hee 2001[195] POOR	None stated, but apparently vertical and classical incisions excluded (reported that 73% had low-transverse incision, 27% had unknown incision).	Intervention: 50mcg misoprostol placed in posterior vaginal fornix q 4hrs up to 24 hrs (6 doses) until cervix dilated 2 cm or regular contraction pattern seen or rupture of membranes and regular contractions. Oxytocin augmentation used when labor failed to progress or 4 hrs after the max 6 doses of misoprostol if active labor not achieved. Control: women without prior CD Other procedures, interventions: none specified	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Chua 1989[196] POOR	Singapore	1985-1988	Prior low segment CD SL/IA- 207 oxytocin used 97 (used for induction in 22, 75 augmented) ERCD- 98 indications incl, CPD,2 prior, malpresentation, IUGR, previa, porr fetal testing Age: NR Parity: NR Race: NR Insurance: NR
Chuck 1995[197] POOR	USA	1993 - 94 To compare misoprostol tablets to dinoprostone gel in induction of labor	35 to 42 weeks gestation admitted for labor induction I- 5 IC- 10 Age: mean 29.3 (miso), 28.7 (PGE2) Parity: mean 0.8 Race: NR Insurance: NR
Coltart 1990[198] POOR	UK	1980-1987	One prior CD, having second baby >26 weeks SL/IA- 195 117 not augmented 20 augmented 58 induced 2 AROM 6 AROM + oxytocin 32 = PG pessary 18 PG pessary + oxytocin ERCD- 158 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Chua 1989[196] POOR	NR		
Chuck 1995[197] POOR	nonvettex presentation, uterine scar other than prior low-transverse CD, ominous FHR tracing, multiple gestation, and complete vervical effacement	Intervention: misorprostol 50mcg intravaginally q 4hrs x max 5 doses Control: PGE2 gel (Prepidil (r)) 0.5mg intracervically q 4hrs x max 5 doses Other procedures, interventions: continuous FHR and tocodynomometery in all patients, cervical exam q 4hrs (more often if indicated)	NR
Coltart 1990[198] POOR	• Failed induction • Missing records	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Del Valle 1994[199] POOR	USA	1988-92 To evaluate the safety and efficacy of cervical ripening in women with prior low transverse CD undergoing induction of labor with an unfavorable cervix	>/=1 prior low-transverse CD I- 89 (PGE2 only: 36, Dilapan only: 41, Both: 12) IC- 61 (PGE2 only: 28, Dilapan only: 25, Both: 8) Age: Mean 27 Parity: Mean 1.6 Race: NR Insurance: NR
Lydon-Rochelle 2001[4] POOR	USA	1980-83 Report experiences with induction of labor in women with prior CS	One prior lower segment CS I- 137 (102 (a/o), 35 (a) SL- 529 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Del Valle 1994[199] POOR	None stated	Intervention: PGE2 gel (pharmacy compounded) intracervically 0.5mg q4-6 hrs or an osmotic dilator (Dilapan (r)) or both. Induction with oxytocin following ACOG guidelines (0.5-1 mU/min increased by 1-2 mU/min q30-60 min) Control: Women receiving dilation and induction agents, no prior CD Other procedures, interventions: NR	NR
Lydon-Rochelle 2001[4] POOR	Recurring cause of prior CS, non-cephalic presentation, X-ray pelvimetry showing obstetric conjugate of <10cm and transverse diameter of <11.5cm	Intervention: Bishop score > 6: amniotomy alone Bishop score 4-6: amniotomy + oxytocin Bishop score <4: 3mg PGE2 tablets + amniotomy + oxytocin Control: NR Other procedures, interventions: NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
MacKenzie 1984[200] POOR	England	1992 To identify predictors of unsuccessful TOL	All women with prior CD attempting TOL I- 170 IC- SL- 5 ERCD- A- 170 Age: mean 26.8 VBAC, 30.3 FTOL Parity: 2.0 VBAC, 1.5 FTOL Race: NR Insurance: NR
McNally 1999[107] FAIR	Ireland	199-1994 To review management of women with 1 prior CD to see predictors for success	One prior CD SL/IA- 244 (73.3%) 38 induced 50 oxytocin for augmentation ERCD- 89 Age: SL/IA- 28.7 + 4.9 successful 31.2 + 3.7 failed ERCD- 30.6 + 4.1 Parity: NR Race: NR Insurance: NR
Norman 1993[201] POOR	Canada Toronto	1980 To assess the safety of having most patients with prior cesarean attempt TOL	All TOL, 1st 6 of each month with elective repeat and one prior CS SL- 207 ERCD- 62 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
MacKenzie 1984[200] POOR	Vertical scar, placenta previa, breech or inappropriate size, head attitude or pelvimetry; active genital herpes infection; severe preeclampsia with rapid deterioration; signs of fetal distress with inability for fetal scalp pH, or fetal anomaly precluding safe vaginal delivery	Intervention: Aggressive use of PGE2 gel for cervical ripening, oxytocin and early amniotomy for induction or augmentation Control: SL Other procedures, interventions: none specified	NR
McNally 1999[107] FAIR	NR	38 induced with oxytocin	NR
Norman 1993 POOR	Recurrent indication for cesarean, no obvious CPD,	All monitored with IUPC and FSE, oxytocin used for augmentation and induction when indicated, more than 1 cesarean not excluded	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Plaut 1999[202] POOR	USA	1983-1992	Subject Eligibility: all women with prior CD eligible for VBAC SL/IA: 10,880 Age: NR Parity: NR Race: NR Insurance: NR
Plaut 1999[15] POOR	USA	1996-98 To report 4 cases of uterine rupture with misoprostol, to conduct a literature review, purpose of retrospective cohort study not clearly stated	Subject Eligibility: not clear, those attempting TOL I- misoprostol: 89 IC- 423 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Plaut 1999[202] POOR	Classical, prior UR, contraindication to labor, from 1983-1985 unknown excluded	Twins, breech allowed, manual exploration on all VD	NR
Plaut 1999[15] POOR	None stated	Intervention: misoprostol , doses not stated Control: unclear - combines those induced with oxytocin and SL Other procedures, interventions: none specified	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Ravasia 2000[214] POOR	Canada	1992-98 To determine and compare uterine rupture rates and VD rates among TOLs induced and SL	All patients with prior CD I- 575: 172 PGE2 (95 PGE2 alone, 77 PGE2/oxy) 129 Foley (11 Foley alone, 118 Foley/oxy) 274 cervical ripening (26 amniotomy, 214 oxy, 34 amnio/oxy) SL- 1544 Age: NR Parity: median 1 for PGE2 gel, Foley, and SL. 2 for Induction without cervical ripening Race: NR Insurance: NR
Segal 1995[51] POOR	Israel	1988-93 To assess rates of VBAC and complications in a rural community setting	Prior CD, known transverse or unknown scar, breech presentation I- 25 (I and/or a) SL- 26 ERCD- 16 Age: NR Parity: 57% = 1; 43% = >1 Race: 28% white 72% black Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Ravasia 2000[214] POOR	None stated	Intervention: 1) Cervical ripening with: PGE2 gel intravaginally ; 1-2mg q6-12 hrs to max 3 doses, OR 2) intracervical extra-amniotic placement of an 18-guage Foley catheter, inflated to 30-40ml with or without gentle traction and removed when the bulb was expelled through the cervical os; both followed by oxytocin if necessary 3) Induction without cervical ripening with oxytocin or amniotomy or a combination of both. Control: Spontaneous labor Other procedures, interventions: Oxytocin doses: 1-2 mU/min and increased by 1-2 mU q 30min. Oxytocin dose reduced or stopped when non-reassuring FHR occurred and restarted if appropriate. The use of oxytocin as augmentation was not	NR
Segal 1995[51] POOR	Other malpresentations, classical scar	Intervention: oxytocin for induction or augmentation Control: SL Other procedures, interventions: none specified	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Zelop 2000[193] POOR	USA Brigham	1988-93 To examine the effect of a disciplined approach to labor management in TOL	Rupture of membranes without contractions after 2 to 6 hrs, or slow progress of labor I- 142 (I), SL- 446, of these 198 (a) ERCD- 125 Age: NR Parity: NR Race: 71% white 15% Black2% Hispanic Insurance: NR
Zelop 1999[194] (3 pubs) POOR	USA	1984-96 To examine the effect of labor induction on the risk of uterine rupture	Term pregnancy with one prior lower segment (vertical, transverse or unknown) CD, no other deliveries I- 560 (I or a) (458 oxy alone, 35 PGE2 alone, 67 both) SL-2214 A- 1089 Age: NR Parity: NR Race: NR Insurance: NR
Case Control			
Leung 1993[54] POOR	USA	1994-1998 To identify risk factors for scar dehiscence	Cases: cases = dehiscence with 1 prior LSCD who underwent TOL Controls: Controls = one prior LSCD who underwent TOL without dehiscence Cases: 13 Controls: 13 Age: NR Parity: NR Race: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Zelop 2000[193] POOR	Prior classical incision, OB or medical contraindication to labor, or declined TOL	Intervention: oxytocin for induction or augmentation Control: SL, elective repeat CD Other procedures, interventions: FHR for all patients, internal uterine pressure sensors and internal fetal scalp electrodes when active labor started	NR
Zelop 1999[194] (3 pubs) POOR	None stated	Intervention: PGE2 gel (pharmacy compounded) 4mg intravaginally q 4hrs max 3 doses; or oxytocin induction or augmentation (1-2 mU/min increased by 1-2mU/min q15-20 min to max 20 mU/min Control: Spontaneous labor Other procedures, interventions: none specified	NR
Case Control			
Leung 1993[54] POOR	NA	NA	NA

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Miles 2000[203] POOR	UK	1983-90 To thoroughly investigate the risk factors of UR in patients undergoing TOL after CD	Prior CD attempting VBAC (including twin and breech) Cases: patients with prior CD and UR while undergoing subsequent TOL Controls: patients with prior CD and subsequent TOL and no UR during same time, randomly selected, grouped by year Cases: 70 Controls: 70 Age: NR Parity: NR Race: NR
Paterson 1991[165] POOR		1990-1997 Database	Database Description: hospital D/C data 36,727 singleton birth, >37 weeks, cephalic, history of at least one prior cesarean and no prior VD Age: TOL 29.0 (s.d. 4.8) ERCD 30.5 (s.d.5.0) Parity: primiparas 14,722 multiparas 16,5818 Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Miles 2000[203] POOR	• Prior classic incision • Placenta previa • Transverse lie • Conditions requiring immediate delivery and refusal of TOL	NR	NR
Paterson 1991[165] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Randomized Controlled Trials			
Xenakis 1995[175] POOR	USA	1993 To compare efficacy and safety of low-dose versus high-dose oxytocin augmentation	IA: 22 IC: 26 All nulliparous or multiparous women admitted >/= 37 wks gestation in active labor (including those with prior low transverse CD attempting TOL). Age: mean age 24 yrs Parity: NR Race: White: 10% (LD), 11% (HD) Black: 4.5% (LD), 2.6% (HD) Hispanic: 83% (LD), 86% (HD) Other: 2% (LD), 1% (HD) Insurance: NR
Wing 1998[176] POOR	USA	NR To compare the safety and efficacy of vaginally administered misoprostol with IV oxytocin for cervical ripening and labor induction in women with Prior CD	IA: 17 IC: 21 Requiring induction of labor for medical or OB indications with a history of one immediate prior CD without subsequent VD Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Randomized Controlled Trials			
Xenakis 1995[175] POOR	• Malpresentation • Placenta previa • Previous classic CD • Multiple gestation	*Intervention:* Low-dose: oxytocin 1mU/min increased by 1mU/min q30min up to max 4mU/min x 2 hrs. If no adequate contractions after 2hrs, dose increased by 1mU/min every 30 min until adequate contractions. *Control:* High dose: oxytocin 4mU/min and increased by 4mU/min every 15min until adequate contractions. *Other Procedures, Interventions:* Protocols for labor management, criteria for diagnosis of labor abnormalities, and indications for operative delivery were the same for both groups.	Augmentation started if: arrest of dilation or descent defined as no cervical change for 2hrs after latent phase with cervix >/=4cm, or no change in station of presenting part at full dilation for >1hr.
Wing 1998[176] POOR	NR	*Intervention:* Misprostol 25mcg intravaginally q6 hrs to max 4 doses. *Control:* Oxytocin by standard protocol (doses not stated). *Other Procedures, Interventions:* use of continuous FHR, uterine activity monitoring, and amniotomy in all patients.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Lyndon-Rochelle 2001[72] POOR	USA Washington state	1987-1996 To examine the risk of uterine rupture associated with VBAC (spont, induced) and repeat C/S Database Description: Retrospective. Washington state birth certificates,hospital discharge data (Comprehensive Hospital Discharge Reporting System).	Primiparous women who gave birth to singleton infants by CD and delivered a second child. Age: 14-48 SL: n=10,789 IA: n=1,960 induced with PGs; 366 without PGs ERCD: n=6,980 Parity: Overall- P2 Race: SL- White = 8949 (82.9%) Black = 318 (2.9%) Hispanic = 621 (5.8%) Other = 901 (8.4%) *ERCD:* White = 6056 (86.8%) Black = 164 (2.3%) Hispanic = 281 (4.0%) Other = 479 (6.9%) *Insurance:* SL: Commercial = 5659 (52.5%) Medicaid/uninsured = 2730 (25.3%) Managed care = 1992 (18.5%) Other = 408 (3.8%) *IA:* Without PG: Commercial = 1081 (55.2%) Medicaid/uninsured = 473 (24.7%) Managed care = 384 (19.6%) Other = 22 (1.1%) IA: White =1999 Black = 318 *With PG:* Commercial=206 (56.3%) Medicaid/uninsured = 90 (24.6%) Managed care = 64 (17.5%) Other = 6 (1.6%) *ERCD:* Commercial= 3936 (56.4%) Medicaid/uninsured = 1741 (24.9%) Managed care = 1119 (16.0%) Other = 184 (2.6%)

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Lyndon-Rochelle 2001[72] POOR	Women who delivered before 1989 b/c "repeat cesarean no labor" was not specified in birth cert until 1989	*Other Procedures, Interventions:* SL, induction of labor with or without prostaglandins on hospital discharge	Reasons not specified, health conditions such as diabetes, chronic hypertension, breech presentation, herpes, previa, preeclampsia reported

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Stone 2000[177] POOR	Australia	1995 To describe the population-based delivery outcomes for women giving birth in 1995 whose penultimate delivery was a cesarean Database Description: Perinatal Morbidity Statistics maintained by Victoria Perinatal Data Collection Unit, mandatory reporting of all births in Victoria represents 99.6% of all births	Women who gave birth in 1995 and whose penultimate delivery within a 5-year period was a cesarean SL/IA- 1482 Repeat CD-4663 Age: NR Parity: one - 3079 2 or more - 1584 Race: aboriginal - 32 non-aboriginal 3579 Insurance: NR
Gregory 1999[164] POOR	USA California	1995 To describe attempted and successful VBAC rates and rupture rates for women with and without prior cesareans and compare outcomes in hospitals with difference attempted VBAC rates Database Description: California Office of Statewide Health Planning and Development	All hospital deliveries in the state of CA (DRG 370-375) classified as prior cesarean if ICD9=654.2 No Prior CD- 469,929 SL/IA- 39,096 TOL 15,072 failed VBAC 24,024 VBAC ERCD- 27760 *Age:* >35 = 71,815 (13.4%) <35 = 464,970 Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Stone 2000[177] POOR	Multiple getation in current or previous delivery	NR	
Gregory 1999[164] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Rageth 1999[60] POOR	Switzerland	1983-1996 To examine risk of VBAC Database Description: containing 40% of Switzerland's deliveries	Prior cesarean NPCS- 226407 SL- 15154 IA- 2459 ERCD- 11433 Age: SL/IA- <30 = 8640 (49.05%) Parity: NR Race: NR Insurance: SL/IA- private = 6293 (35.73%) ERCD- private = 4862 (42.53%)
Holt 1997[59] POOR	USA Washington state	1987-1993 To examine relationships between prior obstetric complications and VBAC success	Primiparous women with prior cesarean SL- 6491 ERCD- 3619 Age: <20 - >35 Parity: Primiparous Race: White = 8784 (88.5%) Black = 253 (2.5%) Asian = 285 (2.9%) Hispanic = 452 (4.6%) Other = 153 (1.5%) Unknown = 183 Insurance: Private = 5281 (56.6%) HMO = 1338 (14.3%) Medicaid = 2013 (21.6%) Self = 501 (5.4%) Other = 202 (2.2%) Unknown = 775

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Rageth 1999[60] POOR	Twin pregnancies	Other Procedures, Interventions: Methods of Augmentation and Induction NR	NR
Holt 1997[59] POOR	• Second births prior to 1989 (when TOL added to birth certificate) • Unknown delivery method with second delivery	NA	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Stalnaker 1997[178] POOR	USA Florida	1989 - 95 To summarize demographic information and characteristics of antepartum care, intrapartum events and neonatal outcomes from the successful claims to the Florida Neurological Injury Compensation Fund	IA- 7 SL- 2 Age: NR (27 for whole group) Parity: NR (0.8 for whole group) Race: NR Insurance: NR Successful claim: Injury to the brain or spinal cord of a live infant weighing at least 2500gm at birth caused by oxygen deprivation or mechanical injury occurring in the course of labor deliver, or resuscitation in the immediate post-delivery period in a hospital which renders the infant permanently and substantially mentally and physically impaired.
Prospective Cohort			
Arulkumaran 1989[179] POOR	Singapore	Not clear To examine the characteristics, and success of TOL in patients requiring augmentation with oxytocin.	Prior lower segment CD attempting TOL, with fetus in cephalic presentation and abnormal progress of labor IA- 63 Age: 31 (FTOL), and 29 (VBAC) Parity: NR Race: NR Insurance: NR
Bais 2001[180] POOR	Netherlands	1990-1994 To determine clinical outcomes of VBAC in population with low overall cesarean rate	Prior CS • 20 breeches • 36 >1 prior CS • 30=forceps • 4=vacuum SL/IA- 184 142 VBAC 42 failed VBAC ERCD- 68/252 (27%) Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Stalnaker 1997[178] POOR	Delivering physician not participating in the fund, infant not meeting inclusion criteria and a determination by the board that the infant was not injured or that the injury was not birth-related.	NR	NR
Prospective Cohort			
Arulkumaran 1989[179] POOR	Required CD for reasons other than failure to progress (e.g. fetal distress or prolapse).	*Intervention:* Oxytocin 2mU/min increased q30 min (by 2 units up to 12, then by 4 units up to max 24mU/min) *Control:* None *Other procedures, interventions:* None stated	NR
Bais 2001[180] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Gherman 2001[181] POOR	USA	NR To evaluate the efficacy and safety of oral misoprostol for preinduction cervical ripening among patients with prior CD.	Gravidas with at least 36 weeks gestation, and one documented low transverse delivery. Bishop score <6 with medical or OB indication for labor induction IA- 10 Age: NR Parity: NR Race: NR Insurance:
Goldberger 1989[182] POOR	Israel	1987-1988 To compare effectiveness of PGE2 vaginal to expectant management.	One prior uncomplicated transverse lower uterine scar, with fully documented uneventful current term pregnancy IA: 19 SL: 155 ERCD:43 Age: NR Parity: NR Race: NR Insurance: NR
Goldman 1998[183] POOR	Israel	1991-1996 To report experience with oxytocin and PGE2 in TOL.	Prior CD IA- 208 oxytocin, 146 PGE2 SL- 166 Age: "Similar" Parity: "Similar" Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Gherman 2001[181] POOR	NR	*Intervention:* 50mcg dose. If cervical ripening or active labor did not ensue, repeat 50 mcg dose q 4 hr x max 6 doses. Oxytocin was subsequently administered. *Control:* None *Other procedures, interventions:* None stated	NR
Goldberger 1989[182] POOR	• Recurring cause of prior CD • Non-cephalic presentation • Estimated fetal weight > 4000g • Reactive NST • Pelvis deemed inadequate for vaginal delivery	*Intervention:* 1.5mg PGE2 pessary to posterior fornix, repeated after 6 hrs if no contractions. *Control:* Retrospective controls: 155 women with prior CD allowed spontaneous TOL (1985-6) and 43 women with no prior CD induced in similar way. *Other procedures, interventions:* Continuous recording of uterine activity and fetal HR, maternal BP, HR, UOP/color every 30min, epidural anesth. Encouraged, oxytocin augmentation if indicated	NR
Goldman 1998[183] POOR	•Prior classic or low vertical incision • Unknown scar • Prior hysterectomy or conservative myomectomy • Multiple gestation • Breech presentation • >1 prior CD.	*Intervention:* Oxytocin dosing not stated, PGE2 vaginal gel (Prostin E2(r)) *Control:* Spontaneous labor *Other procedures, interventions:* If vaginal delivery did not occur within 12 hours, CD performed.	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Norman 1992[184] POOR	Sweden	NR To investigate if preinductive cervical ripening with PGE2 in women with 1 prior CD was safe.	Unripe cervix (cervical score </= 5) with one prior CD IA- 30 Age: Mean 30 (of those with prior VD) and 33 (those with no prior VD) Parity: NR Race: NR Insurance: NR
Silver 1987[185] POOR	USA	1983-85 To evaluate if oxytocin is effective for induction or augmentation in TOL.	Singleton pregnancy, one prior low-transverse CD requiring oxytocin for induction or augmentation. Induction criteria: an OB indication for delivery, absence of regular contractions, pretreatment dilation <3cm. Augmentation criteria: dilation >/= 4cm, regular uterine activity, no change in cervix x 1 hr I- 34 A-64 Age: NR Parity: Stated as not significantly different between success/failure groups Race: NR Insurance: NR
Sims 2001[186] POOR	USA	1997-99 To determine the impact of labor induction on success and safety of TOL.	Consecutive deliveries by women with prior CD IA- 57 SL- 179 ERCD- 269 Age, Parity: Reported as similar Race: Reported as a significantly higher proportion of African American women in SL group

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Norman 1992[184] POOR	Not defined	*Intervention:* 0.5mg PGE2 gel (Cerviprost (r)) intracervically, repeated at 24 hrs if cervix not changed. If cervix ripe, but no active labor at 5 and 24 hrs after gel, oxytocin started (dose not stated). *Control:* None *Other procedures, interventions:* External cardiotocography 30 min prior and 1 hr after gel application. After ROM, internal scalp electrodes placed on fetus.	NR
Silver 1987[185] POOR	Requiring oxytocin in 2nd stage only	*Intervention:* NR *Control:* NR *Other procedures, interventions:* NR	NR
Sims 2001[186] POOR	• Deliveries < 24 weeks • Intrauterine fetal death.	*Intervention:* NR *Control:* NR *Other procedures, interventions:* methods of induction; 1) oxytocin, 2) misoprostol 25-50 micrograms every 4 hours for 3 doses augmented with oxytocin, 3) dinoprostone 12 hours then oxytocin	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Videla 1995[187] POOR	USA	1988-91 To determine if cervical ripening with PGE2 gel is safe and effective in TOL compared to nulliparous women	One prior CD and requiring induction for OB or medical reason with an unfavorable cervix I- 94 IC- 866 A- 77/94 (82%)800/899 (89%) Age: reported as %< 20 yrs = 4(PGE2) Parity: NR Race: 45% white 20% Black, 30% Hispanic (PGE2) Insurance: NR
Prospective Cohort			
Sakala 1990[188] POOR	England	1984-86 To answer questions about oxytocin in TOL (adverse effects, success, and factors associated with failure).	>/= 1 prior low-transverse CD, and patient request for TOL I- 48 A- 25 SL- 164 Age: Mean 28 Parity: Mean 1.7 (oxy), 1.3 (SL) Race: NR Insurance: NR
Retrospective Cohorts			
Asaad 1994[189] POOR		NR Not stated	PROM >/= 37 wks, one prior CD with lower segment incision and non-recurrent cause, with doubt of healing of uterine scar I- 5 IC- 12 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Videla 1995[187] POOR	Classical incision, a nonreactive nonstress test, or regular uterine contractions	*Intervention:* PGE2 gel (pharmacy compounded); 2mg to external cervical os and posterior vaginal vault, repeated q4-6 hrs; max 4 doses *Control:* nulliparous women *Other procedures, interventions:* FHR and uterine activity monitored for all patients, amniotomy and internal monitoring used at OB discretion, oxytocin augmentation used if needed	NR
Prospective Cohort			
Sakala 1990[188] POOR	• Breech presentation • Multiple gestation • OB contraindications to TOL.	*Intervention:* NR *Control:* Spontaneous labor or elective CD. *Other procedures, interventions:* NR	NR
Retrospective Cohorts			
Asaad 1994[189] POOR	• Multiple pregnancies • Malpresentations	Intervention: oxytocin 2mU/min increased at 'intervals' up to 32mU/min until regular contractions. Control: SL Other procedures, interventions: maternal pulse, temp and fetal HR checked regularly	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Blanchette 1999[67] POOR	USA	Misoprostol: 1997-98 PGE2: 1996-97 To compare PGE1 (misoprostol) to PGE2 (dinoprostone) for cervical ripening and induction in a community hospital.	Singleton pregnancy at term, cephalic presentation, reassuring FHR, Bishop score <5 IA-16 IC-9 Age: Mean 29.8 (misoprostol) 29.5 (PGE2) Parity: NR Race: NR Insurance: NR
Choy-Hee 2001[195] POOR	USA	1996-98 To evaluate the safety and efficacy of cervical ripening with misoprostol in women with prior CD compared to those without prior CD.	Singleton pregnancy, Bishop score <6, cephalic presentation, and reassuring FHR I- 48 IC- 377 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Blanchette 1999[67] POOR	• Known hypersensitivity to prostaglandins • History of CD with vertical incision • Major uterine surgery • Placenta previa • Grand multiparity (>/= 6 prior deliveries) • History of asthma, glaucoma, or heart disease.	*Intervention:* Misoprostol 25mcg inserted into posterior vaginal fornix, with 25-50mcg q 4hrs to max 6 doses. If tachysystole (>/= 6 contractions/10 min) or contraction pattern of >/= 3/ 10 min, next dose withheld. Oxytocin was started 4 hrs after last dose of misoprostol, started at 1-2 mU/min and increased by </= 6mU/min q15-30 min until adequate pattern of contractions. *Control:* 1) PGE2 gel (Prepidil(r)) 0.5mg intracervically q 6hrs to max 3 doses. Oxytocin if needed 6 hrs after last dose of PGE2. OR 2) PGE2 slow-release pessary (Cervidil(r)) 10mg placed in vaginal posterior fornix for up to 12 hrs, removed when adequate uterine contraction pattern appeared.	NR
Choy-Hee 2001[195] POOR	None stated, but apparently vertical and classical incisions excluded (reported that 73% had low-transverse incision, 27% had unknown incision).	Intervention: 50mcg misoprostol placed in posterior vaginal fornix q 4hrs up to 24 hrs (6 doses) until cervix dilated 2 cm or regular contraction pattern seen or rupture of membranes and regular contractions. Oxytocin augmentation used when labor failed to progress or 4 hrs after the max 6 doses of misoprostol if active labor not achieved. Control: women without prior CD Other procedures, interventions: none specified	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Chua 1989[196] POOR	Singapore	1985-1988	Prior low segment CD SL/IA- 207 oxytocin used 97 (used for induction in 22, 75 augmented) ERCD- 98 indications incl, CPD,2 prior, malpresentation, IUGR, previa, porr fetal testing Age: NR Parity: NR Race: NR Insurance: NR
Chuck 1995[197] POOR	USA	1993 - 94 To compare misoprostol tablets to dinoprostone gel in induction of labor	35 to 42 weeks gestation admitted for labor induction I- 5 IC- 10 Age: mean 29.3 (miso), 28.7 (PGE2) Parity: mean 0.8 Race: NR Insurance: NR
Coltart 1990[198] POOR	UK	1980-1987	One prior CD, having second baby >26 weeks SL/IA- 195 117 not augmented 20 augmented 58 induced 2 AROM 6 AROM + oxytocin 32 = PG pessary 18 PG pessary + oxytocin ERCD- 158 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Chua 1989[196] POOR	NR		
Chuck 1995[197] POOR	nonvettex presentation, uterine scar other than prior low-transverse CD, ominous FHR tracing, multiple gestation, and complete vervical effacement	Intervention: misorprostol 50mcg intravaginally q 4hrs x max 5 doses Control: PGE2 gel (Prepidil (r)) 0.5mg intracervically q 4hrs x max 5 doses Other procedures, interventions: continuous FHR and tocodynomometery in all patients, cervical exam q 4hrs (more often if indicated)	NR
Coltart 1990[198] POOR	• Failed induction • Missing records	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Del Valle 1994[199] POOR	USA	1988-92 To evaluate the safety and efficacy of cervical ripening in women with prior low transverse CD undergoing induction of labor with an unfavorable cervix	>/=1 prior low-transverse CD I- 89 (PGE2 only: 36, Dilapan only: 41, Both: 12) IC- 61 (PGE2 only: 28, Dilapan only: 25, Both: 8) Age: Mean 27 Parity: Mean 1.6 Race: NR Insurance: NR
Lydon-Rochelle 2001[4] POOR	USA	1980-83 Report experiences with induction of labor in women with prior CS	One prior lower segment CS I- 137 (102 (a/o), 35 (a) SL- 529 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Del Valle 1994[199] POOR	None stated	Intervention: PGE2 gel (pharmacy compounded) intracervically 0.5mg q4-6 hrs or an osmotic dilator (Dilapan (r)) or both. Induction with oxytocin following ACOG guidelines (0.5-1 mU/min increased by 1-2 mU/min q30-60 min) Control: Women receiving dilation and induction agents, no prior CD Other procedures, interventions: NR	NR
Lydon-Rochelle 2001[4] POOR	Recurring cause of prior CS, non-cephalic presentation, X-ray pelvimetry showing obstetric conjugate of <10cm and transverse diameter of <11.5cm	Intervention: Bishop score > 6: amniotomy alone Bishop score 4-6: amniotomy + oxytocin Bishop score <4: 3mg PGE2 tablets + amniotomy + oxytocin Control: NR Other procedures, interventions: NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
MacKenzie 1984[200] POOR	England	1992 To identify predictors of unsuccessful TOL	All women with prior CD attempting TOL I- 170 IC- SL- 5 ERCD- A- 170 Age: mean 26.8 VBAC, 30.3 FTOL Parity: 2.0 VBAC, 1.5 FTOL Race: NR Insurance: NR
McNally 1999[107] FAIR	Ireland	199-1994 To review management of women with 1 prior CD to see predictors for success	One prior CD SL/IA- 244 (73.3%) 38 induced 50 oxytocin for augmentation ERCD- 89 Age: SL/IA- 28.7 + 4.9 successful 31.2 + 3.7 failed ERCD- 30.6 + 4.1 Parity: NR Race: NR Insurance: NR
Norman 1993[201] POOR	Canada Toronto	1980 To assess the safety of having most patients with prior cesarean attempt TOL	All TOL, 1st 6 of each month with elective repeat and one prior CS SL- 207 ERCD- 62 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
MacKenzie 1984[200] POOR	Vertical scar, placenta previa, breech or inappropriate size, head attitude or pelvimetry; active genital herpes infection; severe preeclampsia with rapid deterioration; signs of fetal distress with inability for fetal scalp pH, or fetal anomaly precluding safe vaginal delivery	Intervention: Aggressive use of PGE2 gel for cervical ripening, oxytocin and early amniotomy for induction or augmentation Control: SL Other procedures, interventions: none specified	NR
McNally 1999[107] FAIR	NR	38 induced with oxytocin	NR
Norman 1993 POOR	Recurrent indication for cesarean, no obvious CPD,	All monitored with IUPC and FSE, oxytocin used for augmentation and induction when indicated, more than 1 cesarean not excluded	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Plaut 1999[202] POOR	USA	1983-1992	Subject Eligibility: all women with prior CD eligible for VBAC SL/IA: 10,880 Age: NR Parity: NR Race: NR Insurance: NR
Plaut 1999[15] POOR	USA	1996-98 To report 4 cases of uterine rupture with misoprostol, to conduct a literature review, purpose of retrospective cohort study not clearly stated	Subject Eligibility: not clear, those attempting TOL I- misoprostol: 89 IC- 423 Age: NR Parity: NR Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Plaut 1999[202] POOR	Classical, prior UR, contraindication to labor, from 1983-1985 unknown excluded	Twins, breech allowed, manual exploration on all VD	NR
Plaut 1999[15] POOR	None stated	Intervention: misoprostol , doses not stated Control: unclear - combines those induced with oxytocin and SL Other procedures, interventions: none specified	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Ravasia 2000[214] POOR	Canada	1992-98 To determine and compare uterine rupture rates and VD rates among TOLs induced and SL	All patients with prior CD I- 575: 172 PGE2 (95 PGE2 alone, 77 PGE2/oxy) 129 Foley (11 Foley alone, 118 Foley/oxy) 274 cervical ripening (26 amniotomy, 214 oxy, 34 amnio/oxy) SL- 1544 Age: NR Parity: median 1 for PGE2 gel, Foley, and SL. 2 for Induction without cervical ripening Race: NR Insurance: NR
Segal 1995[51] POOR	Israel	1988-93 To assess rates of VBAC and complications in a rural community setting	Prior CD, known transverse or unknown scar, breech presentation I- 25 (I and/or a) SL- 26 ERCD- 16 Age: NR Parity: 57% = 1; 43% = >1 Race: 28% white 72% black Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Ravasia 2000[214] POOR	None stated	Intervention: 1) Cervical ripening with: PGE2 gel intravaginally ; 1-2mg q6-12 hrs to max 3 doses, OR 2) intracervical extra-amniotic placement of an 18-guage Foley catheter, inflated to 30-40ml with or without gentle traction and removed when the bulb was expelled through the cervical os; both followed by oxytocin if necessary 3) Induction without cervical ripening with oxytocin or amniotomy or a combination of both. Control: Spontaneous labor Other procedures, interventions: Oxytocin doses: 1-2 mU/min and increased by 1-2 mU q 30min. Oxytocin dose reduced or stopped when non-reassuring FHR occurred and restarted if appropriate. The use of oxytocin as augmentation was not	NR
Segal 1995[51] POOR	Other malpresentations, classical scar	Intervention: oxytocin for induction or augmentation Control: SL Other procedures, interventions: none specified	

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Zelop 2000[193] POOR	USA Brigham	1988-93 To examine the effect of a disciplined approach to labor management in TOL	Rupture of membranes without contractions after 2 to 6 hrs, or slow progress of labor I- 142 (I), SL- 446, of these 198 (a) ERCD- 125 Age: NR Parity: NR Race: 71% white 15% Black2% Hispanic Insurance: NR
Zelop 1999[194] (3 pubs) POOR	USA	1984-96 To examine the effect of labor induction on the risk of uterine rupture	Term pregnancy with one prior lower segment (vertical, transverse or unknown) CD, no other deliveries I- 560 (I or a) (458 oxy alone, 35 PGE2 alone, 67 both) SL-2214 A- 1089 Age: NR Parity: NR Race: NR Insurance: NR
Case Control			
Leung 1993[54] POOR	USA	1994-1998 To identify risk factors for scar dehiscence	Cases: cases = dehiscence with 1 prior LSCD who underwent TOL Controls: Controls = one prior LSCD who underwent TOL without dehiscence Cases: 13 Controls: 13 Age: NR Parity: NR Race: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Zelop 2000[193] POOR	Prior classical incision, OB or medical contraindication to labor, or declined TOL	Intervention: oxytocin for induction or augmentation Control: SL, elective repeat CD Other procedures, interventions: FHR for all patients, internal uterine pressure sensors and internal fetal scalp electrodes when active labor started	NR
Zelop 1999[194] (3 pubs) POOR	None stated	Intervention: PGE2 gel (pharmacy compounded) 4mg intravaginally q 4hrs max 3 doses; or oxytocin induction or augmentation (1-2 mU/min increased by 1-2mU/min q15-20 min to max 20 mU/min Control: Spontaneous labor Other procedures, interventions: none specified	NR
Case Control			
Leung 1993[54] POOR	NA	NA	NA

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population
Miles 2000[203] POOR	UK	1983-90 To thoroughly investigate the risk factors of UR in patients undergoing TOL after CD	Prior CD attempting VBAC (including twin and breech) Cases: patients with prior CD and UR while undergoing subsequent TOL Controls: patients with prior CD and subsequent TOL and no UR during same time, randomly selected, grouped by year Cases: 70 Controls: 70 Age: NR Parity: NR Race: NR
Paterson 1991[165] POOR		1990-1997 Database	Database Description: hospital D/C data 36,727 singleton birth, >37 weeks, cephalic, history of at least one prior cesarean and no prior VD Age: TOL 29.0 (s.d. 4.8) ERCD 30.5 (s.d.5.0) Parity: primiparas 14,722 multiparas 16,5818 Race: NR Insurance: NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 1b. Study descriptions for vaginal delivery, maternal and infant outcomes - poor quality studies (continued)

Author Year Quality	Exclusion criteria	Intervention Control Other Procedures	Reasons for Induction
Miles 2000[203] POOR	• Prior classic incision • Placenta previa • Transverse lie • Conditions requiring immediate delivery and refusal of TOL	NR	NR
Paterson 1991[165] POOR	NR	NR	NR

IA=induced or augmented; TOL=trial of labor; CD=cesarean delivery; NR=not reported; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; HR=heart rate; CPD= cephalopelvic disproportion; PGE= prostaglandin E2; IUGR=intrauterine growth restriction; GA=gestational age; EM=electronic monitoring

Evidence Table 2. Vaginal delivery- good or fair quality studies

Author Year Quality	Population
Large population-based studies	
McMahon 1996[5] FAIR	One LTCD, not clear what was done with unknown
Prospective Cohort	
Duff 1988[26] GOOD	One prior LTCD, unknown not allowed
Flamm 1988[21] GOOD	LTCD and unknown and more than 1 prior
Blanco 1992[34] FAIR	One prior LTCD, PGE2 (up to 3x) Gel induction of labor vs spontaneous onset of labor (oxy as needed in either group)
Flamm 1997[33] FAIR	Prior LTCD, unknown allowed, more than 1 allowed
Flamm 1994[20] FAIR	All verticals excluded, unknown allowed, more than 1 allowed
Flamm 1990[22] FAIR	LTCD, unknown, more than 1 prior
Flamm 1987[28] FAIR	LTCD, unknown, more than 1 prior

LTCD=low transverse cesarean delivery; PGE2=prostaglandin E2; SL=spontaneou

Vaginal Delivery Rate

Overall: 1962/3249
(60.4%)

Overall: 167/227 (74% 95% CI 66-78%)

Overall- 1315/1776 (74%)
SL (non-Medicated)- 3151/4047 (78%)
Any Oxtocin- 1140/1686 (68%)

Induced- PG gel
18/25
(74%)

Induced- PG gel
233/453 (51%)

Overall- 3746/5022 (75%)

Overall: 2977/3957 (75%) 1986-1988
SL - 2146/2756 (78%)
Any Oxtocin- 831/1201 (69%)

Overall: 1314/1776 (74%)
SL (non-Medicated)-1005/1291 (78%)
Any Oxtocin- 309/485 (64%)

s labor

Evidence Table 2. Vaginal delivery- good or fair quality studies

Author Year Quality	Population
Stovall 1987[27] FAIR	LTCD or LTVS allowed more than 1 allowed not clear what was done with unknown
Phelan 1987[23] FAIR	Low vertical, unknown, LTCD allowed during 2nd year more than 1 allowed
Paul 1985[30] FAIR overlapping data with Phelan 87	Not more than 1, low vertical, unknown and LTCD allowed
Martin 1983[24] FAIR	One or more, includes low-vertical, no rupture occurred in the 76 with prior vertical
Cowan 1994[25] FAIR	More than 1 prior, LTCD and unknown included, known vertical excluded (2vertical entered)
Retrospective Cohorts	
Raynor 1993[29] FAIR	LTCD,unknown, more than 1 allowed, (2 verticals allowed)

LTCD=low transverse cesarean delivery; PGE2=prostaglandin E2; SL=spontaneou

(continued)

Vaginal Delivery Rate
Overall: 214/272 (79%) SL (non-Medicated)- 116/139 (83%) Any Oxtocin- 98/133 (74%)
Overall: 1465/1796 (82%)
Overall: 614/751 (82%) SL (non-Medicated)- 395/443 (89%) Augmented (Oxytocin)- 177/257 (69%) Induced- 23/ 32 (72%)
Overall: 101/162 (62%)
Overall: 478/593 (81%) SL- 315/359 (88%) Augmented (Oxytocin)- 117/167 (70%) Induced- 46/67 (69%)
Overall- 61% SL - 17/16 (65%) Any Oxtocin- 14/25 (56%)

s labor

Evidence Table 3a. Predictive tools- good or fair quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Scoring Tools				
Flamm 1997[33] GOOD	USA Southern California Kaiser Permanente	Prospective cohort 1990-1992 To develop a scoring system to predict the likelihood of vaginal birth in patients undergoing a TOL after previous cesarean delivery using factors known *at the time of hospital admission*.	All women with a previous cesarean delivery	Elective repeat cesarean, incomplete chart data.
Vinueza 2000[41] FAIR	USA Spartanburg Regional Medical Center, South Carolina	Retrospective cohort 1992-1997 To determine the applicability of a simple scoring system, by Troyer and Parisi, in predicting the success of a trial of labor among parturients with prior cesarean delivery.	Women with a documented previous LTCS	ERCD, suspected fetal distress within one hour of admission
Weinstein 1996[42] FAIR	Israel Hebrew University	Retrospective cohort 1981-1990 To evaluate the relative weight of the different variables that may influence the chances of vaginal birth after one cesarean delivery, with the aim of developing a predictive score for success of such a trial.	Women with one prior abdominal delivery	ERCD, incomplete records, classic or unknown scar, hx of rupture, absolute CPD, previa, fetal malpresentation incompatible with a safe VD

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery; ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3a. Predictive tools- good or fair quality studies

Author Year Quality	Methods	Number Eligible/ Attempting TOL
Scoring Tools		
Flamm 1997[33] GOOD	• Each patient attempting a TOL given a computer-generated random number; then sorted in ascending order; first 2502 assigned to score development group and last 2501 to score testing group. • Very few patients will achieve the highest score category (6%). • Even the lowest score group had nearly 50% vaginal delivery rate. • This scoring system is only valid for use at the time of the admission.	5022/5003
Vinueza 2000[41] FAIR	• Inter-group comparisons revealed significant differences in gestational age (p=0.004), cervical dilation on admission (p<0.0001), birth weight (p=0.034) • distribution of population according to score: 0 - 21%, 1 - 41%, 2 - 28%, 3 to 4 - 10%. • confirmed the inverse relationship between score and successful VD.	263/636
Weinstein 1996[42] FAIR	• Past indication categories *Grade A:* malpresentation, PIH, twins *Grade B:* placenta previa/abruptio, prematurity, PROM *Grade C:* fetal distress, CPD, FTP, cord accident *Grade D:* macrosomia, IUGR	572/471

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=va
progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=pr
ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelv

Score development	Author Year Quality
	Scoring Tool
Chi Square and Student t-test analysis for all predictors. Those significant at a p<0.05 were included in one of three logistic regression models: historic, intrapartum, and perinatal factors. Those predictors significant at a p<0.05 were entered into the final logistic regression model. Points were then assigned to each predictor according to their Beta Coefficient, where higher scores were given to those predictors associated with a successful TOL. Final range: 0-10.	Flamm 1997[33] GOOD
Applied the scoring system proposed by Troyer and Parisi (1992).	Vinueza 2000[41] FAIR
Multiple variables were examined and were entered into a logistic regression model to control for confounding and to evaluate the effect of these variables on labor outcome. The score was then developed on the basis of the relative weights (odds ratios).	Weinstein 1996[42] FAIR

aginal birth after cesarean; FTP=failure to TOL=trial of labo
ior cesarean delivery; progress; CD=ce
ic disproportion; XRP=x-ray pelvimetry; ERCD=elective

ble 3a. Predictive tools- good or fair quality studies (continued)

Predictors included	Performance
ls	
Age under 40: (2 points) *Vaginal birth history:* before and after (4) after CD (2) before CD (1) none (0) *Reason other than FTP for CD:* (1) *Cervical effacement at admission:* >75% (2) 25-75% (1) <25% (0) *Cervical dilation 4cm or more at admission:* (1)	Score % with VD 0 to 2: 49.1 3: 59.9 4: 66.7 5: 77.0 6: 88.6 7: 92.6 8 to 10: 94.9 *Overall VBAC rate: 74.9%*
• Previous dysfunctional labor • No prior VD • Nonreassuring fetal heart tracing on admission • Labor induction	Score % with VD 0 98% 1 69% 2 40% 3 to 4 33% *Overall VBAC rate*: 63% (167/263)
Bishop score ≥4 (if yes, 4 points); VD before CD (2) Past indication - Grade A (6), Grade B (5), Grade C (4), Grade D (3)	Score % with VD ≥4 ≥58% ≥6 ≥67% ≥8 ≥78% ≥10 ≥85% ≥12 ≥88% • Sensitivity: 85.6% (of predicting VD) • Specificity: 67.7% (of predicting CD) • Overall accuracy: 80.0% *Overall VBAC rate*: 78.1% (368/471)

or; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to
sarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery;
repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3a. Predictive tools- good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Jakobi 1993[37] FAIR	Israel Rambam Medical Center	Retrospective cohort Dates NR To examine 15 identified prognostic factors, in order to evaluate the predictive value or a better selection of patients for VBAC.	Women with one previous cesarean delivery, who attempted a TOL without using oxytocin	Unknown scar type or other than low transverse incision, nonvertex presentation, multiple gestation, ruptured membranes and no contractions for more than 16 hours or at >42 weeks gestation
Troyer 1992[40] FAIR	USA Hermann Hospital, University of Texas	Retrospective cohort 1990-1991 To characterize risk factors in patients undergoing trial of labor after previous cesarean section.	Women with a documented previous lower transverse CD, gestational age >36 weeks, singleton pregnancy, vertex presentation.	ERCD, undocumented incision, low vertical incision, classic incision, multiple gestation, malpresentation, <36 weeks gestation.
Macones 2001[38] FAIR	USA University of Pennsylvania	Case-control 1994-1998 To assess the effectiveness of a neural network for predicting the likelihood of success of a TOL	Women with a PCS. *Cases:* failed TOL *Controls:* VBAC	Unknown scar type, previous vertical cesarean delivery.

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery; ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3a. Predictive tools- good or fair quality studies

Author Year Quality	Methods	Number Eligible/ Attempting TOL
Jakobi 1993[37] FAIR	It was hospital policy that no elective cesareans were done at the patients' request; the model was tested retrospectively on the same population that it was derived from. Only 8 futile TOLs took place; 76 unjustified CDs were performed.	261/261
Troyer 1992[40] FAIR	• The lowest group still had a VD rate of 46.1% • Distribution of population according to score: 0 - 22%, 1 - 35%, 2 - 33%, 3 to 4 - 10%	567/264
Macones 2001[38] FAIR	Cases: n=100 Controls: n=300	400/400

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=va
progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=pr
ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelv

Score development	Author Year Quality
Chi Square tests were used to calculate success rates associated with different factors. To address the issue of confounding, a multivariate analysis with discriminant analysis was performed. The six most significant prognostic factors were used to create a predictive model.	Jakobi 1993[37] FAIR
Multiple variables were examined and four were found to be significantly associated with TOL outcome included: previous dysfunctional labor, no prior VD, nonreassuring fetal heart tracing on admission, labor induction. Each variable was assigned a point value of one. After summing the values, the higher scores were more likely to fail a TOL.	Troyer 1992[40] FAIR
Over 70 predictive factors were reviewed and analyzed using unpaired t-tests and the Mann-Whitney U test. Significant associations were entered into a model that would ensure a high sensitivity (in order to detect those women who would fail a TOL).	Macones 2001[38] FAIR

aginal birth after cesarean; FTP=failure to TOL=trial of labo
ior cesarean delivery; progress; CD=ce
ic disproportion; XRP=x-ray pelvimetry; ERCD=elective

ɔle 3a. Predictive tools- good or fair quality studies (continued)

Predictors included	Performance
Previous breech (0.516 - standardized function coefficient); Previous successful VBAC (0.353); Station at admission (0.302); Admission without rupture of membranes (0.296); Dilation at admission (0.281); Previous failure to progress (-0.265)	• Predictive value for successful VBAC: 94.5% (139/147) • Predictive value for failed VBAC: 33.3% (38/114). • Overall predictive value: 68%. *Overall VBAC rate: 82.3%*
Previous dysfunctional labor; No prior VD; Nonreassuring fetal heart tracing on admission; Labor induction	Score / % with VD 0 — 91.5% 1 — 73.9% 2 — 66.7% 3 to 4 — 46.1% *Overall VBAC rate: 72.7%* (192/264)
A history of substance abuse; Prior successful VBAC; Admission cervical dilation; Need for labor augmentation.	• Sensitivity: 77% (of predicting CD) • Specificity: 65% (of predicting VD) • Overall accuracy: 69% • Area under ROC curve: 0.77

or; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to
sarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery;
repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3a. Predictive tools- good or fair quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Pickhardt 1992[39] FAIR	USA Mississippi Medical Center - Jackson Mississippi	Case-control 1989 To determine if there are valid predictors before parturition, of vaginal birth after previous cesarean birth success that could be used to enhance the obstetric care of a patient	Women with a PCS. *Cases:* failed TOL *Controls:* VBAC	Incomplete data or unobtainable charts
Imaging Modalities				
Thubisi 1993[47] GOOD	South Africa King Edward VIII Hospital-Durbin	RCT 1990 To determine whether antepartum XRP reliably identified women suitable for a trial of labor or repeat elective cesarean section after one previous section.	Women with one previous LTCS. *Group 1*: antepartum XRP *Group 2*: postpartum XRP	ERCD, abnormal fetal lie or presentation, obstetric complications requiring planned delivery, maternal medical disorders contraindicating a TOL, multiple pregnancy, preterm labor, grossly contracted pelvis on examination, intrauterine death

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery; ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3a. Predictive tools- good or fair quality studies

Author Year Quality	Methods	Number Eligible/ Attempting TOL
Pickhardt 1992[39] FAIR	• R squared for Equation 2 (0.1552) was slightly larger than the R squared for Equation 1 (0.1018), indicating that Equation 2 is slightly better than Equation 1; however neither of these indicates a clear superiority. • Pickhardt recommended that it was appropriate to encourage a TOL in almost all patients with a prior LTCS.	336/312
Imaging Modalities		
Thubisi 1993[47] GOOD	• Patients randomly assigned (alternately) to one of two groups: 1) antepartum XRP group - XRP at 36 weeks before the mode of delivery was decided upon (n=144), 2) control group - no antepartum XRP, but they did receive a postpartum XRP (n=144). • 60 of the 144 in the antepartum XRP group were considered to have an inadequate pelvis, leaving 84 attempting a TOL in the intervention group.	306/228

TOL=trial of labor; RCT=randomized controlled trial; NR= not reported; VBAC=va
progress; CD=cesarean delivery; LTCD=low transverse cesarean delivery; PCD=pr
ERCD=elective repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelv

Score development	Author Year Quality
Nineteen specific obstetric variables were examined and analyzed using t-tests and chi-square tests for univariate analysis. The factors were then entered into a logistic stepwise regression (p to enter 0.05), which resulted in two different regression equations (based upon the number of subjects used to formulate the model).	Pickhardt 1992[39] FAIR
	Imaging Mod
Measurements of the pelvis saggittal inlet (<11cm), saggittal outlet (<10cm), transverse inlet (<11.5cm), transverse outlet (bispinous <9cm), were considered inadequate, as defined by Russel and Richards (1971).	Thubisi 1993[47] GOOD

aginal birth after cesarean; FTP=failure to TOL=trial of labo
ior cesarean delivery; progress; CD=ce
ic disproportion; XRP=x-ray pelvimetry; ERCD=elective

ɔle 3a. Predictive tools- good or fair quality studies (continued)

Predictors included	Performance
• Equation 1 (n=101): constant (-4.4183), estimated fetal weight (0.0010), number of previous CD (0.7719). • Equation 2 (n=306): constant (-8.6165), number of previous CD (0.8326), cervical dilation in cm (-0.4803), estimated gestational age (0.2160)	• Equation 1: Sensitivity: 60.4% (of predicting CD) Specificity: 66.0% (of predicting VD) Accuracy: 63.4% • Equation 2: Sensitivity: 38.4% Specificity: 87.9% Accuracy: 71.9% *Overall VBAC rate*: 63.1%
alities	
Pelvic dimensions: adequate or inadequate	• Sensitivity: 26.2% (of predicting CD) • Specificity: 45.0% (of predicting VD) • Positive Predictive Value: 40.0% • Negative Predictive Value: 30.3% • 27.7% (23/84) in the antepartum XRP group who were considered to have an adequate pelvis had a VD, which was significantly less than the 41.6% (60/144) in the control group (**p<0.05**). • Postpartum XRP of the control group revealed that a greater proportion of those considered to have an inadequate pelvis delivered vaginally (60% - 33/55), compared to those considered to have an adequate pelvis (30% - 27/89). • 30.3% (27/89) of those in the control group considered to have an adequate pelvis by postpartum XRP had a VD.

or; RCT=randomized controlled trial; NR= not reported; VBAC=vaginal birth after cesarean; FTP=failure to
sarean delivery; LTCD=low transverse cesarean delivery; PCD=prior cesarean delivery;
repeat cesarean delivery; VD=vaginal delivery; CPD=cephalopelvic disproportion; XRP=x-ray pelvimetry;

Evidence Table 3b. Predictive tools - poor quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Imaging Modalities				
Abitbol 1991[205] POOR	USA New York: Jamaica Hospital and State University at Stony Brook	Prospective cohort Dates NR To evaluate the efficacy of the cephalopelvic disproportion index (CPDI) in predicting the outcome of a TOL in those with and without a PCS.	VBAC candidates per ACOG recs: without diabetes, without hypertension, with estimated fetal weight <4000gm, and a known previous lower segment scar (subset of subjects in a larger study).	Patient consent, noncephalic presentation, complications during the course of labor.
Thurnau 1991[48] POOR	USA University of Oklahoma Oklahoma City, Oklahoma	Prospective cohort 1988-1990 To evaluate the efficacy of the fetal pelvic index (FPI) as a predictor of fetal-pelvic disproportion in gravid women attempting VBAC. Also to compare the FPI findings with those of x-ray pelvimetry and ultrasonographical derived estimated fetal weight > 4000gm.	Women between 35 and 43 weeks' gestation with a desire for VBAC.	No XRP performed, no ultrasonographic measurements performed, inadequate labor trial before CD (cervical dilation <5cm).

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Methods	Number eligible/ attempting TOL	Score development
Imaging Modalities			
Abitbol 1991[205] POOR	• The overall study included 100 patients, from which a subset of 34 were patients attempting a TOL following a previous CD. • Results provided are a combination of two groups: 1) those attempting VBAC 2) primigravids at full term, with an unengaged fetal head. • >12mm CPDI does not guarantee a VD; this may be due to variations in joint mobility, intensity of contractions, position of cephalic presentation, fetal abdomen, and other obstetric factors.	34/34	Considered three measurements: 1) biparietal diameter of the fetal head 2) anteroposterior diameter of the pelvic inlet 3) the bispinal diameter of the midpelvis. The BPD of the fetal head was then matched to the smaller of the two pelvic dimensions (SPD). The difference between the two was termed the CPDI (=SPD-BPD).
Thurnau 1991[48] POOR	• 64 patients with cephalic presentation, 1 with breech. • 58 patients with spontaneous labor, 7 requiring induction or augmentation. • Compared FPI with Ultrasonography based EFW and XRP. Both had low sensitivities of 0.11 and 0.17, respectively).	74/65	Measured the anteroposterior (APD) and transverse diameters (TD) to calculate the circumference (C=(TD+APD)x0.5pi) of the fetal cranium (HC), fetal abdomen (AC), maternal pelvic inlet (IC), and maternal midpelvis (MC). The differences between the four circumferences (HC-IC, HC-MC, AC-IC, AC-MC) were calculated and the two most positive values were summed to equal the fetal-pelvic index (FPI). A positive FPI identifies a fetus that is larger than the pelvis (fetal-pelvic disproportion); a negative FPI identifies a fetus that is smaller than the pelvis (no fetal-pelvic disproportion).

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Predictors included	Performance
Imaging Modalities		
Abitbol 1991[205] POOR	• Biparietal diameter of the fetal head • Anteroposterior diameter of the pelvic inlet • Bispinal diameter of the midpelvis	CPDI / % with VD <9mm 0 (0/13) 9-12mm 21.1 (4/19) >12mm 73.5 (50/68)
Thurnau 1991[48] POOR	Fetal-pelvic index: positive or negative	• *Sensitivity:* 72% (positive test in those with CD) • *Specificity:* 100% (negative test in those with VD) • *PPV:* 100% (13/13 with positive FPI, required CD) • *NPV:* 90% (47/52 with negative FPI, had VD) • *Overall accuracy:* 92.3% (60/65) • *Fischer's exact test:* **p<0.00001**

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Morgan 1988[206] POOR	USA University of Oklahoma Oklahoma City, Oklahoma	Prospective cohort To compare the efficacy of three methods used to identify fetal-pelvic disproportion (FPI, XRP, EFW>4000g) in patients delivering neonates weighing >4000gm after an adequate TOL.	Women with PCS, who required the use of oxytocin in labor, had suspected fetal-pelvic disproportion, and suspected fetal macrosomia.	<37 weeks gestation, neonates <4000gm.
Lao 1987[31] POOR	Hong Kong Princess Margaret Hospital Hong Kong	Retrospective cohort 1980 - 1983 To determine if X-ray pelvimetry (XRP) is useful in a TOL after PCS.	Women with one previous lower segment CD who attempted a TOL.	no XRP performed
Mahmood 1987[45] POOR	Scotland Bellshill Maternity Hospital Lanarkshire	Retrospective cohort 1982-1983 To assess the role of radiological pelvimetry in the management of patients who have had a PCS.	Women with a PCS.	More than one PCS, previous classical scar, no XRP

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Methods	Number eligible/ attempting TOL	Score development
Morgan 1988[206] POOR	• FPI has a relatively high predictive accuracy. • XRP and ultrasound, when used alone, do not predict fetal-pelvic disproportion accurately.	101/34	Measured the anteroposterior (APD) and transverse diameters (TD) to calculate the circumference (C=(TD+APD)x0.5pi) of the fetal cranium (HC), fetal abdomen (AC), maternal pelvic inlet (IC), and maternal midpelvis (MC). The differences between the four circumferences (HC-IC, HC-MC, AC-IC, AC-MC) were calculated and the two most positive values were summed to equal the fetal-pelvic index (FPI). A positive FPI identifies a fetus that is larger than the pelvis (fetal-pelvic disproportion); a negative FPI identifies a fetus that is smaller than the pelvis (no fetal-pelvic disproportion).
Lao 1987[31] POOR	No information was provided for a summary of adequate pelvises, but only for each measurement separately (OC, TC, APO).	666/445	Considered three measurements: 1) obstetric conjugate (OC) inlet, 2) transverse diameter (TD) inlet, and 3) antero-posterior outlet (APO) diameter. Adequate: OC >11cm, TD >12cm, and an APO >11cm. Inadequate: OC <11cm, TD<12cm, or APO <11cm.
Mahmood 1987[45] POOR	No uniformity among obstetricians about category of patients in whom an XRP should be performed or when it should be done; or what constituted a contracted pelvis - some considered a AP diameter of inlet <11.5cm, whereas others used a figure of <11.0cm; at other times pelvic shape determined the category of pelvis.	239/89	No consistent criteria for classification of contracted. Some used an AP diameter of inlet <11.5cm, while others used a cutoff of <11.0cm. Others ignored diameters and based their decision on pelvis shape.

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value;
NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Predictors included	Performance
Morgan 1988[206] POOR	Fetal-pelvic index: positive or negative	• Sensitivity: 92% (positive test in those with CD) • Specificity: 71% (negative test in those with VD) • Positive Predictive Value: 67% (12/18 with a positive FPI, required a CD) • Negative Predictive Value: 94% (15/16 with a negative FPI, had a VD) • Overall accuracy: 79.4% (27/34) • Fischer's exact test: **p<0.001**
Lao 1987[31] POOR	Pelvic dimensions: adequate or inadequate	• OC>11cm: VBAC: 84.5% (321/380) • TD>12cm: VBAC: 84.5% (324/383) • APO>11cm: VBAC: 84.1% (286/340) Similar proportions of adequate measurements in the FTOL group (NS difference).
Mahmood 1987[45] POOR	Pelvic dimensions - measurements	No statistically significant difference in pelvic dimensions between those who failed a TOL and those with VBAC. AP Inlet: *VBAC:* 12.3±1.0cm *FTOL:* 12.1±0.8cm AP Outlet: *VBAC:* 12.2±1.0cm *FTOL:* 11.8±1.0cm

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion criteria
Wright 1985[49] POOR	S. Africa Peninsula Maternity Hospital	Retrospective cohort Dates NR To assess the value of XRP in those undergoing a TOL following a previous CD.	Women with one prior LTCS, with no other viable pregnancy	Inadequate antenatal assessment (specifics NR)

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Methods	Number eligible/ attempting TOL	Score development
Wright 1985[49] POOR	• Due to the lack of a concise definition regarding the decision of who should be given a ERCD, the interpretation of this data must be done cautiously. • A pelvic brim inlet >11cm demonstrated a high success of VD, while one <11cm still demonstrated a 50% chance of VD. • Sacrum dimensions/shape appeared to be of little value. • Head engagement demonstrated a high PPV, while the lack of head engagement showed a fairly high specificity for CD.	100/59	At the 36th and 38th week of pregnancy patients had an erect lateral pelvimetry performed, where the following dimensions were considered: 1) anteroposterior diameter of pelvic brim 2) curvature of the sacrum 3) engagement of the fetal head

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 3b. Predictive tools - poor quality studies (continued)

Author Year Quality	Predictors included	Performance
Wright 1985[49] POOR	Pelvic dimensions: adequate or inadequate	Pelvic AP brim inlet: • *Sensitivity:* 84% of those with a VD had >11cm inlet. • *Specificity:* 50% of those with CD had <11cm inlet. • *PPV:* 84% (38/45) with >11cm had a VD. • *NPV:* 50% (7/14) with <11cm had a failed TOL. Sacrum: • *Sensitivity:* 71% with a VD had a curved sacrum. • *Specificity:* 40% with a CD had a flat sacrum. • *PPV:* 80% with a curved sacrum had a VD. • *NPV:* 24% with a flat sacrum had a CD. Head engagement: • *Sensitivity:* 66% with a VD had head engagement. • *Specificity:* 79% with a CD had no head engagement. • *PPV:* 91% with head engagement had a VD. • *NPV:* 42% without head engagement had a CD.

VBAC=vaginal birth after cesarean; ACOG=American College of Obstetricians and Gynecologists; TOL=trial of labor; CD=cesarean delivery; CPDI= cephalopelvic disproportion index; PCD=prior cesarean delivery; VD=vaginal delivery; BPD=biparietal diameter; SPD= smallest pelvic diameter; PPV= positive predictive value; NPV= negative predictive value; FTOL=failed trial of labor; APD= anteroposterior diameter; TD= transverse diameter; EFW=estimated fetal weight; XRP=x-ray pelvimetry; FPI=fetal-pelvic index; AP=anterior-posterior;

Evidence Table 4a. Maternal outcomes - good or fair quality studies

Author Year Quality	Number in study	Uterine Rupture
Randomized Controlled Trials		
Lelaidier 1994[35] FAIR	32	Measured: Yes Definition: Not defined Results: *I*- 1 case of scar separation reported (found during C-section). *Control*- 1 case of scar separation reported (found during C-section)
Rayburn 1999[32] FAIR	294	Measured: Yes Definition: Not defined Results: *I*- 0 *SL*- 0
Population Based Studies		
McMahon 1996[5] GOOD	6,138	Measured: Yes Definition: A defect that involved the entire wall of the uterus, that was symptomatic or required operative intervention. Results: *SL/IA*- 10 (0.3%) *ERCD*- 1 (0.0%)
Prospective Cohort		
Blanchette 2001[52] FAIR	25	Measured: Yes Definition: Uterine separation requiring an emergency laparotomy for a nonreassuring fetal heart rate tracing or maternal hemorrhage. Results: *IA*- 11; 7 inductions (1-miso, 4-oxytocin, 2-miso/oxy) and 4 augmentations (oxy). *SL*- 1
Blanco 1992[34] FAIR	81	Measured: Yes Definition: NR Results: *IA*- 0 *SL*- 0

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Major Bleeding (req hyst, tx)	Maternal Infection (metritis, wound infection)	Maternal Death
Randomized Controlled Trials			
Lelaidier 1994[35] FAIR	Measured: Definition: Not defined Results:	Measured: Yes Definition: Not defined Results: *I*- 1 infected wound *IC*- 1 infected wound	Measured: Yes Results: *I*- 0 *IC*- 0
Rayburn 1999[32] FAIR	Measured: Definition: Not defined Results: *I*- 0 *SL*- 0	Measured: Definition: Not defined Results: *I*- 8 (5.6%) *SL*- 7 (4.6%)	Measured: Yes Results: *I*- 0 *SL*- 0
Population Based Studies			
McMahon 1996[5] GOOD	Measured: Yes Definition: Hysterectomy, transfusion Results: SL/IA- hyst = 5 (0.2%) - 2 due to UR TX= 36 (1.1%) ERCD- hyst = 6 (0.2%) TX = 39 (1.3%)	Measured: Yes Definition: temperature >38.0 included uterine, urinary, pulmonary, wound infection or sepsis Results: SL/IA- fever= 171 (5.3%) abd-wound inf= 43 (1.3%) ERCD- fever = 185 (6.4%) abd wound inf = 63 (2.2%)	Measured: Yes Results: SL/IA- 0 ERCD- 0
Prospective Cohort			
Blanchette 2001[52] FAIR	NR	NR	Measured: Yes Results: 0
Blanco 1992[34] FAIR	NR	Measured: Yes Definition: Endometritis Results: *SL*- 3	Measured: Yes Results: *I*- 0 *SL*- 0

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Uterine Rupture
Cowan 1994[25] FAIR	593	Measured: Yes Definition: Scott's definition - "a complete separation of the wall of the pregnant uterus, with or without expulsion of the fetus, endangering the life of the mother or fetus" bloodless uterine scar dehiscence = any defect in the preexisting scar with no fetal or maternal compromise. Results: *SL*-3 *IA*- 2
Duff 1988[26] GOOD	227	Measured: Yes Definition: Dehiscence = disruption of any portion of the lower segment incision. Results: *SL/IA*-1 received oxytocin in labor VB, decreased uterine tone, fetal bradycardia, 60% of scar disrupted, repaired).
Flamm 1997[33] FAIR	5,022	Measured: Yes Definition: NR. Exam of uterus postpartum at discretion of birth attendant. Results: *IA*- 6/453 (1.3%) (all also received oxytocin) *SL*- 33/4569 (0.7%)
Flamm 1990[22] FAIR	3,957	Measured: Y Definition: any defect that involved the entire uterine wall or was symptomatic or required operative intervention Results: *IA*- 6/1201 (0.5%) *IC*- 4/2756 (0.15%)

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery; EBL=estimated blood loss

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Major Bleeding (req hyst, tx)	Maternal Infection (metritis, wound infection)	Maternal Death
Cowan 1994[25] FAIR	Measured: Yes Definition: Amount Results: *SL/IA*-successful VBAC: 453 (95%) EBL<500 14 EBL 501-700 10 EBL 701-1000 1 EBL >1000 UR ave EBL >1500cc 3/5 UR symptomatic blood loss	NR	NR
Duff 1988[26] GOOD	Measured: Yes Definition: PP Hemorrhage classified as atony cervical or vag lacerations. Results: *SL/IA*-"no differences between succesful and not".	Measured: Yes Definition: Chorioamnionitis or endomyometritis=intrapartum fever in association with uterine tenderness, fetal tachycardia and no other localizing signs of infection, endo=pp maternal temp >38, uterine and adnexal tenderness. Results: *SL/IA*-12/167 with successful VBAC 11/60 with failed VBAC	NR
Flamm 1997[33] FAIR	NR	NR	NR
Flamm 1990[22] FAIR	NR	NR	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Uterine Rupture
Flamm 1987[28] GOOD	1,776	Measured: Yes Definition: Results: *IA*- 2 *IC*- 1
Flamm 1988[21] GOOD	1,776	Measured: Yes Definition: Asymptomatic uterine windows - small defects visualized at CS or palpated at VD. True uterine rupture - defect involving entire uterine wall that was symptomatic or requiring operative intervention. Results: SL/IA-0 - successful VD, 3 failed TOL (1 required hysterectomy) 2 oxytocin augmented (1 total expulsion of infant at 1cm dilation Apgars 1,2,8 hysterectomy), 2nd pushing oxytocin and epidural pain btwn ctx thin layer of peritoneum over infant head Apgars 1,8,9 no uterine ruptures in patients with multiple cesareans or unknown scar 11 noted to have asymtpomatic uterine windows
Flamm 1994[20] FAIR	7,229	Measured: Yes Definition: Uterine rupture was defined as any defect that involved the entire uterine wall or was symptomatic or required operative intervention. Results: *SL/IA*- 39/5022
Flamm 1990[22] FAIR	3,957	Measured: Yes Definition: Uterine rupture was defined as any defect that involved the entire uterine wall, was symptomatic or required operative intervention. Results: *SL/IA*- 3 cases in 1984-5 see 1988 flamm 7/3957 1986-8 (1.8/1000)

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Major Bleeding (req hyst, tx)	Maternal Infection (metritis, wound infection)	Maternal Death
Flamm 1987[28] GOOD	Measured: Yes Definition: Not defined (hysterectomies reported). Results: *IA*- 1 *IC*- 1	Measured: Yes Definition: Febrile morbidity Results: *IA*- 18/485 (3.7%) *IC*- 35/1291 (2.7%)	Measured: Yes Results: *I*- 0 *IC*- 0
Flamm 1988[21] GOOD	Measured:Yes Definition: hysterectomy Results: 1 successful VBAC, 1 failed TOL	NR	Measured: Yes Results: *SL/IA*-0 (none)
Flamm 1994[20] FAIR	Measured: Yes hyst due to UR measured unsure if all hyst measured transfusion. Definition: Results: *SL/IA*- hyst due to UR = 3/5022 (0.12%) Transfusion = 0.72% *ERCD*- hyst 0.27% (p=.2053) transfusion = 1.72% (p=.0001)	Measured: Yes Definition: NR Results: *SL/IA*- 12.7% *ERCD*-16.4%	Measured: Y Results: *SL/IA*-1 (aspiration pnemonitis - TOL pt emergent CS for fetal distress)
Flamm 1990[22] FAIR	NR	NR	Measured: Yes Results: *SL*- None *ERCD*- 2

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Uterine Rupture
Meier 1982[57] FAIR	269	Measured: Yes Definition: uterine scar separation Results: *SL/IA*- successful VBAC 0/175 failed VBAC = 1/32 *ERCD*- 1 (1.6%)
Meehan 1989[50] FAIR	344	Measured: Yes Definition: Rupture of scar accompanied by intra-abdominal or vaginal bleeding or bloodless dehiscence. Results: *IA*- A+O+P : 1/23 (4.3%) *SL*- 0 *ERCD*- 0
Paul 1985[30] (see also Phelan 1987) FAIR	889	Measured: Yes Definition: Dehiscence "scar separation" rupture = scar separation requiring operative intervention. Results: *SL/IA*- 11/614 successful VBAC 5/137 failed VBAC *ERCD*- 4/157
Phelan 1987[23] (see Paul 1985) FAIR	2,110	Measured: Yes Definition: Dehischence = scar separation not requiring operative intervention. rupture = separation requiring operative intervention. Results: *SL/IA*- dehiscence = 34/1796 (1.9%) rupture = 5/1796 (0.3%) rupture rate oxytocin 3% vs no oxytocin 2% *ERCD*- 7/314 dehischence or rupture
Stovall 1987[27] FAIR	272	Measured: Yes Definition: Dehiscence= palpable or visualized defect in previous uterine scar. uterine window= dehiscence not requiring surgical intervention. rupture= dehiscence requiring surgical intervention. Results: *SL/IA*- 1, oxytocin augmentation, epidural

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Major Bleeding (req hyst, tx)	Maternal Infection (metritis, wound infection)	Maternal Death
Meier 1982[57] FAIR	Measured: Yes Definition: Blood transfusion Results: *SL/IA*- NR *ERCD*- 1 (1.6%)	Measured: Yes Definition: febrile morbidity, not defined Results: 2/32 (6.3%) failed TOL, 11/62 ERCD (17.7%)	Measured: Yes Results: *SL/IA*- None *ERCD*- None
Meehan 1989[50] FAIR	NR	NR	Measured: Yes Results: *I*- 0 *SL*- 0 *ERCD*- 0
Paul 1985[30] (see also Phelan 1987) FAIR	Measured: Yes Definition: Hysterectomy Results: *SL/IA*- 0 in successful VBAC 2 failed VBAC intact scar, pphem, atony *ERCD*- 5 (1 complete scar separation and percreta, 1 laceration extension into vagina, 1 accreta, 2 hem and atony	Measured: Yes Definition: "febrile morbidity" Results: *SL/IA*-14/614 (2.3%) successful VBAC 37/137 (27%) failed VBAC *ERCD*- 23/157 (25%)	Measured: Yes Results: 0
Phelan 1987[23] (see Paul 1985) FAIR	Measured: Yes Definition: hysterectomy Results: *SL/IA*- 5/1796 (all for atony) *ERCD*- NR	Measured: Yes Definition: NR Results: *SL/IA*- 159/1796 53/1465 (3.6%)successful VBAC 106/331 (32%) failed VBAC *ERCD*- 56/314 (18%)	Measured: Yes Results: 1 postpartum pulmonary embolus failed TOL for fetal distress
Stovall 1987[27] FAIR	NR	NR	Measured: Yes Results: SL/IA-0

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Uterine Rupture
Retrospective cohorts		
Lao 1987[31] FAIR	666	

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4a. Maternal outcomes - good or fair quality studies (continued)

Author Year Quality	Major Bleeding (req hyst, tx)	Maternal Infection (metritis, wound infection)	Maternal Death
Retrospective cohorts			
Lao 1987[31] FAIR	Measured: Yes Definition: not defined Results: IA=6/102 (6%)	NR	Measured: Yes Results: IA=0, SL=NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies

Author Year Quality	Number in study	Uterine rupture
Randomized Controlled Trials		
Taylor 1993[190] POOR	NR	Measured: Definition: Not defined Results: *IA* - 1 (I + a) *SL*- 0
Xenakis 1995[175] POOR	48	Measured: Definition: Not defined. Results: *IA :* 1 dehiscence; *Control:* 1 dehiscence
Wing 1998[176] POOR	38	Measured: Definition: Separation of the prior uterine incision that required emergency laparotomy usually diagnosed at the time of acute fetal distress requiring immediate operative intervention or acute maternal hemorrhage with hypotension and shock. Results: *IA:* 1 (plus 1 dehiscence) *Control:* 0
Population Based Studies		
Bais 2001[180] POOR	252	Measured: Yes Definition: NR Results: *SL/IA*- 1/184 (in failed VBAC) *ERCD*- 0/68
Beall, M 1984[191] POOR	857	Measured: Yes Definition: Not defined "scar rupture," scar dehiscence" used interchangeably no "complete scar rupture". Results: SL/IA- 1% of 97 unknown scar (figure 2 says 8%) 2% of 204 LTCD (figure 2 says 7.5%) ERCD- 1% of 354 unknown 4% of 170 LTCD

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Major Bleeding (required hysterectomy, treatment)	Maternal Infection (metritis, wound infection)	Maternal Death
Taylor 1993[190] POOR	Measured: Definition: NR Results:	Measured: NR Definition: Results:	Measured: Y Results: *I*- 0 *IC*- 0
Xenakis 1995[175] POOR	Measured: Definition: NR Results:	Measured: NR Definition: Results:	Measured: Y Results: *I*- 0 *IC*- 0
Wing 1998[176] POOR	Measured: Definition: NR Results: *I*- 1 patient required 4 units PRBCs *IC*- NR	Measured: NR Definition: Results:	Measured: Y Results: *I*- NR *IC*- NR
Population Based Studies			
Bais 2001[180] POOR	Measured: Yes Definition: hemorrhage= >500cc, hemorrhage >1000cc blood transfusion hysterectomy Results: SL/IA- >500cc=31 (17%) [14 failed VBAC] >1000cc = 9 (5%) [3 failed VBAC] transfusion= 8 (4%) [4 failed VBAC] hysterectomy=none ERCD- >500cc=20 (29%) >1000cc = 6 (9%) transfusion= 4 (6%) hysterectomy=none	Measured: Yes Definition: NR pp fever Results: SL/IA- 16/184 (9%) ERCD- 7/68 (10%)	Measured: Y Results: Overall- None
Beall, M 1984[191] POOR	Measured: Yes Definition: Hysterectomy Results: Overall- none in any group	Measured: Yes Definition: maternal fever Results: SL/IA- 56% unknown scar 34% LTCD ERCD- NR	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Number in study	Uterine rupture
Gregory 1999[61] POOR	469,929	Measured: Yes Definition: NR Results: *NPCD*- 104/469,929 13/17,209 elective primary cesarean 64/51,333 failed labor (CD) 27/401,387 VD labor *SL/IA*- 288/66,856 (0.43%) 174/15,072 failed VBAC 35/24,024 VBAC *ERCD*- 79/27,760
Holt 1997[59] POOR	10,110	NR
Lyndon-Rochelle 2001[4] POOR	36,966	Measured: Yes Definition: ICD-9-CM code 665.0 or 665.1 recorded on hospital d/c form Results: *SL*- 56 *I*- 24 (9 induced with PG, 15 without PG)
Stone 2000[177] POOR	NR	Measured: Yes Definition: ICD-9 coding 665.0 and 665.1 Results:
Prospective Cohort		
Arulkumaran 1989[179] POOR	63	NR
Asaad 1994[189] POOR	NR	NR
Gherman 2001[181] POOR	10	Measured: Yes Definition: NR Results: *IA*- 1/10 (10%)

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Major Bleeding (required hysterectomy, treatment)	Maternal Infection (metritis, wound infection)	Maternal Death
Gregory 1999[61] POOR	Measured: NR Definition: Results:	Measured: NR Definition: Results:	NR
Holt 1997[59] POOR	Measured: NR Definition: Results:	NR	NR
Lyndon-Rochelle 2001[4] POOR	Measured: Y Definition: hysterectomy Results: 12/20,004 without UR 4/91 with UR	Measured: Y Definition: puerperal infection Results: 243/20,004 without rupture 8/91 with rupture	NR
Stone 2000[177] POOR	Measured: NR Definition: Results:	NR	NR
Prospective Cohort			
Arulkumaran 1989[179] POOR	Measured: NR Definition: Results:	NR	NR
Asaad 1994[189] POOR	NR		
Gherman 2001[181] POOR	Measured: NR Definition: Results:	NR	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Number in study	Uterine rupture
Goldberger 1989[182] POOR	217	Measured: Yes Definition: Not defined; post-delivery check of uterine cavity. Results: *IA*- 0 *SL*- 0
Goldman 1998[183] POOR	520	Measured: Yes Definition: Not defined, but dehiscence reported separately. Results: *IA*- 0 (1 dehis) *IA*- 0 (1 dehis) *SL*- 0 (0 dehis)
Miller 1992[173] POOR	318	Measured: Yes Definition: NR Results: *SL/IA*- 1/125 (0.8%) 1 previous CD fetal distress, oxytocin augmentation + epidural delivered by emergent CS for "fetal distress".
Norman 1992[184] POOR	313	Measured:NR Definition: Results: *IA*- 0
Sakala 1990[188] POOR	237	Measured: Yes Definition: Symptomatic separation of prior scar, associated with perinatal morbidity. Results: *IA*- 0 *SL*- 0
Silver 1987[185] POOR	98	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Major Bleeding (required hysterectomy, treatment)	Maternal Infection (metritis, wound infection)	Maternal Death
Goldberger 1989[182] POOR	Measured: Yes Definition: Not Defined Results: *IA*- 0 *IC*- 0 *SL*- 0	Measured: Yes Definition: Not defined Results: *IA*- 0 *IC*- 0 *SL*- 0	Measured: Yes Results: *I*- 0 *IC*- 0 *SL*- 0
Goldman 1998[183] POOR	Measured: Yes Definition: Not defined Results: *IA*- 0 hyst/3 hemorrhage oxytocin 0 hyst/5 hemorrhage PGE2 *SL* - 0 hyst/6 hemorrhage	NR	Measured: Yes Results: *I*- 0 *SL*- 0
Miller 1992[173] POOR	Measured: Yes Definition: Blood transfusion Results: *Overall*- No difference	Measured: Yes Definition: Temp 38^{o} C or more on 2 occasions more than 24 hours apart. Results: *SL/IA*- 15/44 (34.9%) failed VBAC required postpartum antibiotics *ERCD*- 26/193 (13.5%) NS	NR
Norman 1992[184] POOR	Measured: NR Definition: Results:	NR	Measured: Yes Results: *I*- 0
Sakala 1990[188] POOR	Measured: Yes Definition: Blood transfusion Results: *IA*- 1 *SL*- 4	Measured: Yes Definition: Endometritis Results: *IA*- 6 *SL*- 7	NR
Silver 1987[185] POOR	Measured: Yes Definition: Not defined Results: *IA*- 2 CD patients required blood transfusion - group not described.	Measured: Yes Definition: Described as endometritis Results: *IA*- 11 cases - 9 in CD patients - group not described.	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Number in study	Uterine rupture
Sims 2001[186] POOR	505	Measured: Yes Definition: Asymptomatic rupture symptomatic rupture. Results: *SL*- NR "states intermediate rate" *IA*- 7.00% *ERCD*- 1.50%
Videla 1995[187] POOR	1131	Measured: Yes Definition: "Overt rupture" Results: *SL*- 3 [1 following VD, 2 failed VBAC] only 1 received oxytocin *IA*- 1
Zelop 1999[194] POOR	3303	Measured: Yes Definition: complete rupture of prior uterine scar in association with >= 1 of: laparotomy for hemorrhage or hemoperitoneum, excessive injury to the bladder or extrusion into the peritoneal cavity of any portion of the fetal-placental unit, CD for nonreassuring FHR or suspected rupture as evidenced by the acute onset of incisional pain Results: Induction: Oxy alone: 9/459 (2%), PGE2 alone: 1/35 (2.9%), oxy plus PGE2: 3/67 (4.5%)

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 4b. Maternal outcomes - poor quality studies (continued)

Author Year Quality	Major Bleeding (required hysterectomy, treatment)	Maternal Infection (metritis, wound infection)	Maternal Death
Sims 2001[186] POOR	Measured:NR Definition: Results:	NR	NR
Videla 1995[187] POOR	Measured: NR Definition: Results:	Measured: Yes Definition: "Chorioamnionitis" Results: 23 successful VBAC 14 failed VBAC	NR
Zelop 1999[194] POOR	Measured: Definition: hysterectomy I=2 (0.4%) SL=2 4 (0.2%)	NR	I=0 SL=0

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 5a. Infant outcomes - good or fair quality studies

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Randomized Controlled Trials				
Lelaidier 1994[35] FAIR	32	NR	Measured: Yes Results: I- 0 IC- 0	NR
Rayburn 1999[32] FAIR	294	NR	Measured: Yes Results: I- 0 SL- 1	NR
Population-Based Database				
McMahon 1996[5] GOOD	6,138	NR	Measured: Yes Results: SL/IA- 9/1000 ERCD- 5/1000	NR
Smith 2002[6] FAIR	24,529	NR	Measured: Yes Results:SL/IA- 20/15515 (12 emergent CD, 8 vaginal delivery) RCD- 1/9014	NR
Prospective Cohorts				
Blanco 1992[34] FAIR	81	NR	Measured:Yes Results: I- 0 SL- 0	NR
Cowan 1994[25] FAIR	660	NR	Measured: NR None reported 1 serious neurologic sequelae. Results:	Measured: Y- Apgar Definition: Results: SL/IA- 5-min Apgar >7 = 463 (97%) <7=14
Duff 1988[26] GOOD	281	Measured: Yes Definition: Positive culture blood, urine, CSF, CXR c/w pneumonia. Results: SL/IA- "no differences between successful and not"	NR	NR

NR=not reported; I=induced; SL=spontaneous labor; ERCD=elective repeat cesarean delivery;

CSF=cerebral spinal fluid; CXR=chest x-ray; IA=induced or augmented;

Evidence Table 5a. Infant outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Flamm 1997[33] FAIR	5,022	NR	Measured: Yes Results: IA- 0 SL- 0	NR
Flamm 1987[28] GOOD	1,776	NR	Measured: Yes Results: IA- 0/485 SL- 1/1291	NR
Flamm 1988[21] GOOD	1,776	NR	Measured: Yes Results: SL/IA- 5 antepartum fetal deaths <36 weeks, no evidence of UR, "one would have been prevented by elective repeat at term", one intrapartum death involving silastic vacuum for fetal distress no evidence of rupture on uterine exam, one died due to prematurity total 6 fetal and 1 neonatal death for rate 4/1000 (vs 11/1000 in 9 participating hospitals).	NR
Flamm 1994[20] FAIR	7,229	NR	Measured: Yes Results: rate of 7/1000 live births	Measured: Yes- Apgar Definition: Results: SL/IA- 5-min Apgar <7 = 1.48% ERCD- 5-min Apgar <7 = 0.68% (p=.004)
Flamm 1990[22] FAIR	3,957	NR	Measured: Yes Results: SL/IA-1 related to uterine rupture 2 previous cesareans unknown scar labored at home.	Measured: Y- Apgar Definition: Results: SL/IA- 5 min Apgar <7=9/1000 (when 20 cases of IUFD due to anencephaly, lethal malformations excluded).

NR=not reported; I=induced; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; CSF=cerebral spinal fluid; CXR=chest x-ray; IA=induced or augmented;

Evidence Table 5a. Infant outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Martin 1983[24] FAIR	717	NR	Measured: Yes Results: SL/IA- 3 fetal & 0 neonatal in successful VBAC • 1 fetal and & neonatal in failed VBAC • NO FETAL DEATHS OCCURRED IN UR OR DEHISC GROUP • all fetal deaths occurred prior to labor with macerated fetuses. ERCD- 3 fetal & 5 neonatal 4/5 neonatal deaths due to RDS prior to term 1/5 congenital malformation incompatible with life.	NR
Meehan 1989[50] FAIR	344	NR	Measured: Yes Results**:** I- 0 SL- 0 ERCD- 0	NR
Meier 1982[57] FAIR	269	NR	Measured: Yes Results: SL/IA- 1/207 fetal death prior to labor 2 previous CS ERCD- None	NR
Paul 1985[30] FAIR	889	NR	Measured: Yes Results: NPCD?/SL/IA- 7 fetal - 6/7 antepartum, 1 intrapartum = (540 gm breech), 4/6 no uterine dehiscence 35-42 weeks, 2UR preterm TOL 7 neonatal - 2 TOL with anomalies, 5 <700gm ERCD- 2 neonatal with anomalies.	NR

NR=not reported; I=induced; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; CSF=cerebral spinal fluid; CXR=chest x-ray; IA=induced or augmented;

Evidence Table 5a. Infant outcomes - good or fair quality studies (continued)

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Phelan 1987[23] (see Paul 1985) FAIR	2,110	NR	Measured: Yes Results:17 fetal, 23 neonatal deaths; 11 <750gm, 14 congenital anomalies, 6 preterm	NR
Stovall 1987[27] FAIR	272	NR	Measured: Yes Results: SL/IA- None	Measured: Y- Apgar Definition: Results: SL/IA- 1 rupture LTCD, 5-min Apgar = 7 oxytocin 5 (3.8%) had 5-min Apgar <7, vs no oxytocin 4 (2.9%).
Retrospective Cohorts				
Lao 1987[31] FAIR	666	NR	Measured: Yes Results: I- 0 IC- 1	NR
Raynor 1993[29] FAIR	NR	NR	Measured: Yes Results: SL- 1 28wks SROM polycystic kidneys	NR

NR=not reported; I=induced; SL=spontaneous labor; ERCD=elective repeat cesarean delivery; CSF=cerebral spinal fluid; CXR=chest x-ray; IA=induced or augmented;

Evidence Table 5b. Infant outcomes - poor quality studies

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Population Based				
Bais 2001[180] POOR	252	NR	Measured: Y Definition: SL/IA- 3/184 (1.2%) [1-rh dz,1 abruption,1-cord proplapse]	Measured: Y Definition: Apgar Results: SL/IA- 5-min Apgar <7 = 3/`84 (2%) - all in failed TOL ERCD- 5-min Apgar <7 = 0/68
Beall 1984[191] POOR	857	NR	Measured: Yes Results: SL/IA- total of 6 perinatal deaths: 1. Term still birth may have been avoided by CD 2. 920-gm premature may have been avoided by CD 3. 2 other premature infants 4. 1 premature delivered out of hospital lethal anomaly 5/1,000 LTCD 11/1,000 unknown	NR
Holt 1997[59] POOR	10,110	NR	Measured: Yes Results: SL/IA- 74/6491 ERCD- 52	NR
Rageth 1999[60] POOR	226,407	NR	Measured: Yes Results: I/IC/SL- 86/17613 (0.5%) ERCD- 32/11433 (0.3%)	NR
Stone 2000[177] POOR	6145	NR	Measured: Y Results:29 preterm, 3 term1 home deliver, 1 fetal hypoxia prior to cesarean. 1 UR	NR
Prospective Cohorts				
Arulkumaran 1989[179] POOR	63	NR	NR	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 5b. Infant outcomes - poor quality studies (continued)

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Blanchette 2001[52] POOR	NR	NR	Measured: Yes Results: I- 2 (1-miso, 1-oxy) SL- 0	
Miller 1992[173] POOR	318	NR	Measured: Yes Results: No prior CD?/SL/IA- neonatal = 1/80 successful VBAC perinatal = 1/80 successful VBAC neonatal = 1/45 failed VBAC prinatal = 0/45 failed VBAC ERCD- neonatal = 1/193 perinatal = 0/193	Measured: Y-Apgar Results: SL/IA- 5-min Apgar <7 = 6/80 (7.5%) successful VBAC 0/45 failed VBAC ERCD- 5-min Apgar <7 = 4/193 (2.1%)
Norman 1992[184] POOR	313	NR	Measured: Yes Results: I- 0	NR
Silver 1987[185] POOR	98	NR	Measured: I- all Apgars >/=7 Results:	NR
Retrospective Cohorts				
Choy-Hee 2001[195] POOR	425	NR	Measured: Yes Results: I- 0 IC- 0	NR
Chua 1989[196] POOR	207	NR	Measured: Results:	Measured: Yes Definition: Apgar Results: SL- 5-min Apgar <7 = 2 (1.8%) I- 5-min Apgar <7 = 2 1= induced, 1 augmented ERCD- 5-min Apgar <7 = 3/98 (3.1%)

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 5b. Infant outcomes - poor quality studies (continued)

Author Year Quality	Number in study	Infant Sepsis	Infant Death	Other Infant Outcomes
Chuck 1995[197] POOR	15	*Measured:* *Definition:* *Results:*	*Measured:* Yes *Results:* I- 0 IC- 0	NR
Del Valle 1994[199] POOR	150	NR	*Measured:* Yes *Results:* I- 0 IC- 0	NR
MacKenzie 1984[200] POOR	170	NR	*Measured:* Yes *Results:* I- 0	NR
Segal 1995[51] Israel Poor	67	NR	*Measured:* Yes *Results:* I- 0	NR
Stone 1994[204] POOR	NR	NR	*Measured:* Yes *Results:* I- 0	NR
Videla 1995[187] Poor	1,131	NR	*Measured:* Yes *Results:* SL-	NR
Zelop 1999[194] (3 pubs) POOR	3,303	NR	*Measured:* Yes *Results:* I- 0 SL- 0	NR

NR=not reported; IA= induces or augmented; SL=spontaneous labor; PRBC=packed red blood cells; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery; PGE2=prostaglandin E2 LTCD=low transverse cesarean delivery

Evidence Table 6. Uterine rup

Author Year Quality	Country Setting
Population-based	
McMahon 1996[5] GOOD	Canada Nova Scotia
Smith 2002[6] FAIR	Scotland
Prospective Cohort	
Duff 1988[26] GOOD	USA Madigan Army Medical Center
Flamm 1988[21] GOOD	USA Southern California Kaiser
Cowan 1994[25] FAIR	USA
Flamm 1994[20] FAIR	

NR=not reported; CD=cesarean delive

ture: terms, definitions, and predictors **Evidence Tal**

Terms & definitions	Author Year Quality
Term: uterine rupture *Definition:* a defect that involved the entire wall of the uterus, was symptomatic, and required operative intervention	McMahon 1996[5] GOOD
Term: uterine rupture *Definition:* NR	Smith 2002[6] FAIR
Term: uterine scar dehiscence *Definition:* disruption of any portion of the lower segment incision *Use:* description of case reported patient with vaginal bleeding, fetal bradycardia, delivered by repeat CD apgars 4,8, 60% of scar disrupted	Duff 1988[26] GOOD
Term: asymptomatic uterine window *Definition:* small defects visualized at CD or palpated at VD *Term:* true uterine rupture *Definition:* defect involving entire uterine wall - symptomatic or requiring operative intervention *Use:* one CD performed for maternal pain classified as rupture had thin layer of peritoneum over scar; one with partial extrusion of fetus reported no sign of rupture, CD performed for failure to progress, both cases mother and infant did well.	Flamm 1988[21] GOOD
Term: bloodless uterine scar dehiscence *Definition:* any defect in the preexisting cesarean scar with no maternal or fetal compromise *Term:* true uterine rupture *Definition:* Scott's definition - "a complete separation of the wall of the pregnant uterus, with or without expulsion of the fetus, endangering the life of the mother or fetus" *Use:* one rupture occurred at fundus with an intact uterine scar	Cowan 1994[25] FAIR
Term: uterine rupture *Definition:* any defect that involved the entire uterine wall or was symptomatic or required operative intervention	Flamm 1994[20] FAIR

ry; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor NR=not reported

ble 6. Uterine rupture: terms, definitions, and predictors (continued)

Signs Symptoms	Labor factors	Patient factors
NR	NR	NR
NA	NA	NA
1/1 vaginal bleeding and fetal bradycardia	NR	NR
No sign: 1/3 CD for failure to progress *Fetal distress:* 1/3 *Abdominal pain:* 1/3	NR	NR
Abnormal fetal tracing (immediate and prolonged fetal bradycardia): 5/5	*Oxytocin:* 3/5 UR (1 vertical, 1 2 prior CD) *Epidural:* 1/5 UR	NR
NR	NR	NR

l; CD=cesarean delivery; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor

Evidence Table 6. Uterine rup

Author Year Quality	Country Setting
Flamm 1990[22] FAIR	USA Southern California, Kaiser
Martin 1983[24] FAIR	USA Universities in Mississippi and Alabama
Meehan 1989[50] FAIR	Ireland
Meier 1982[57] FAIR	USA Kaiser SanDiego
Paul 1985[30] FAIR	USA USC

ture: terms, definitions, and predictors (continued) **Evidence Tal**

Terms & definitions	Author Year Quality
Term: uterine rupture *Definition:* any defect that involved the entire uterine wall or was symptomatic or required operative intervention *Use:* 2/10 UR occurred following VD	Flamm 1990[22] FAIR
Term: dehiscence *Definition:* nontraumatic separation of the uterine scar without bleeding or extrusion of fetus into wound *Term:* uterine rupture *Definition:* scar separation with bleeding, hematoma formation, or extrusion of the fetus	Martin 1983[24] FAIR
Term: bloodless dehiscence *Definition:* dehiscence of uterine scar not associated with bleeding. It includes small 'window' defects and larger defects in which bleeding was not a feature *Term:* True Rupture *Definition:* rupture of the uterine scar accompanied by intra-abdominal or vaginal bleeding	Meehan 1989[50] FAIR
Term: scar dehiscence *Definition:* uterine scar separation *Use:* incidentally noted at CD	Meier 1982[57] FAIR
Term: uterine dehiscence *Definition:* any palpable and/or visualized uterine defect. *Use:* Further sub grouped into dehiscences that required no intervention and those that did require intervention, which were termed uterine rupture	Paul 1985[30] FAIR

ble 6. Uterine rupture: terms, definitions, and predictors (continued)

Signs Symptoms	Labor factors	Patient factors
"Variable or prolonged bradycardia most common warning sign" 7/10 had abnormal EFM	*Oxytocin:* 6/10 UR NS different from non-rupture	NR
NR	NR	NR
Fetal distress: 1/1 UR	*Oxytocin:* NS *Epidural:* NS	NR
No sign reported: 2/2 dehiscences found at CD	NR	NR
5 UR: • Abdominal Pain: 2/5 • Postpartum bleeding: 1/5 • No sign reported: arrest of dilation found • Partial extrusion of fetus 1/5 • Abnormal fetal tracing: 1/5 Comment: 25 CD for "fetal distress" - 18/751 TOL vs. 7/458 repeat CD (7/18 TOL emergent CD, 2/7 ERCD emergent CD)	NR	NR

Phelan 1987[23] FAIR	USA USC

NR=not reported; CD=cesarean delive

Term: uterine dehiscence *Definition:* scar separation not requiring operative intervention *Term:* Rupture *Definition:* separation requiring operative intervention	Phelan 1987[23] FAIR

ry; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor NR=not reported

Fetal distress such as severe variable decelerations or prolonged fetal bradycardia most frequent sign No cases of UR with maternal pain and changes in uterine tone	NR	NR

l; CD=cesarean delivery; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor

Evidence Table 6. Uterine rup

Author Year Quality	Country Setting
Stovall 1987[27] FAIR	USA U of Tennessee
Case-control	
Connolly 2001[53] FAIR	
Leung 1993[54] FAIR	

ture: terms, definitions, and predictors (continued) **Evidence Tal**

Terms & definitions	Author Year Quality
Term: dehiscence *Definition:* palpable or visualized defect in previous uterine scar *Term:* Uterine window *Definition:* dehiscence not requiring surgical intervention or blood component replacement *Term:* Uterine rupture *Definition:* dehiscence requiring intervention	Stovall 1987[27] FAIR
Term: scar dehiscence (further classified as partial and complete) *Definition:* NR *Use:* life threatening complication, "common symptoms include fetal distress, abdominal pain, scar tenderness, vaginal bleeding. Rarely massive hemorrhage and hypovolemic shock may be presenting symptom"	Connolly 2001[53] FAIR
Term: uterine rupture *Definition:* uterine scar separation and emergent laparotomy, acute fetal distress necessitating operative intervention, or acute maternal bleeding manifested by hypotension or shock	Leung 1993[54] FAIR

ble 6. Uterine rupture: terms, definitions, and predictors (continued)

Signs Symptoms	Labor factors	Patient factors
Pain, vaginal bleeding, loss of uterine tone in the one case of UR	NR difference between UR and Non-UR	NR
Fetal distress: 9/13 cases vs. 2/13 controls (OR 12.3 95% CI: 1.9-81) *Scar tenderness:* 8/13 cases vs. 0/13 controls *Vaginal bleeding:* 6/13 cases vs. 0/13 controls	*Oxytocin* Induction: 0/13 cases vs. 2/13 controls Augmentation: 10/13 cases vs. 3/13 controls (OR 4.5; 95% CI 0.9313-42.8) *Epidural* 5/13 cases vs. 8/13 controls (OR 2.5; 95% CI 0.41-26.2)	*Maternal Age (mean):* 31.5 cases vs. 27.5 controls (OR per 1 yr in age 1.35; 95% CI 1.03-2.19) *Parity (Mean):* 3.15 cases vs. 2.85 controls (OR per 1-unit 1.59; 95% CI 0.17-18.9) *Prior VD (before or after CD):* 7/13 cases vs. 5/13 controls (OR 1.29; 95% CI 0.2175-11.86) *GA (Mean):* 39.3 cases vs. 40.3 controls NS
NR but included in case series data	*Any Oxytocin:* 54/70 cases vs. 39/70 controls (OR 2.7; 95% CI 1.2-6.0) Induction = 11/70 cases vs. 10/70 controls Augmentation = 43/70 cases vs. 29/70 controls Epidural 29/70 cases vs. 19/70 controls (OR 1.9; 95% CI 0.9-4.1)	*Age,Parity:* NR *Prior VBAC:* 11/70 cases vs. 16/70 controls (OR 0.5; 95% CI 0.1-1.6) *CD for CPD:* 22/70 cases vs. 21/70 controls (OR 0.9; 95%CI 0.4-2.0) *Unknown scar:* 61/70 cases vs. 59/70 (OR 1.3; 95% CI 0.4-3.1) *>1CD:* 23/70 cases vs. 11/70 controls (OR 2.6; 95%CI 1.1 - 6.4)

NR=not reported; CD=cesarean delive

ry; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor NR=not reported

l; CD=cesarean delivery; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor

Evidence Table 6. Uterine rup

Author Year Quality	Country Setting
Case series	
Bujold 2002[56] FAIR	
Leung 1993[55] FAIR	

NR=not reported; CD=cesarean delive

ture: terms, definitions, and predictors (continued) **Evidence Tal**

Terms & definitions	Author Year Quality
Term: complete uterine rupture *Definition:* "uterine scar separation with the overlying visceral peritoneum (uterine serosa) opened. All uterine ruptures had been confirmed at the time of emergency laparotomy. Records with uterine dehiscences (not defined) were excluded"	Bujold 2002[56] FAIR
Term: Uterine rupture *Definition:* uterine scar separation and emergent laparotomy, acute fetal distress necessitating operative intervention, or acute maternal bleeding manifested by hypotension or shock	Leung 1993[55] FAIR

ry; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor NR=not reported

ble 6. Uterine rupture: terms, definitions, and predictors (continued)

Signs Symptoms	Labor factors	Patient factors
Fetal tracing abnormality: 20/23 patients *Abdominal Pain:* 1/23 first symptom (3 of abnormal tracings also reported pain) *Vaginal Bleeding:* (1 of the patients with fetal tracing abnormality) *Hematuria:* 2/23 first sign	*Oxytocin:* 5/9 metabolic acidosis vs. 9/14 without acidosis NS *Induction of labor:* 3/9 with acidosis vs. 5/14 without NS *Epidural:* 8/9 with acidosis vs. 12/14 without acidosis NS	*Maternal Age:* NS difference between those with and without metabolic acidosis nor extrusion
Fetal tracing abnormality: 91/99 *Pain:* 13/99 *Vaginal Bleeding:* 11/99	*Oxytocin:* NS difference in extrusion *Epidural:* NS difference in extrusion	*Maternal Age:* NS difference for extrusion *Parity:* NS difference for extrusion *Prior VBAC:* 16 patients with prior VBAC had rupture *CD for CPD:* NS difference

l; CD=cesarean delivery; VD=vaginal delivery; UR=uterine rupture; EFM=electro fetal monitor

Evidence Table 7. Uterine rupture details

Author Year Quality	Population	Uterine exploration	Asymptomatic Uterine Rupture TOL	Symptomatic Uterine Rupture TOL
Cowan 1994[25] FAIR	All verticals excluded, unknown and more than 1 prior allowed	NR	NR	5/593 (.008%)
Flamm 1994[20] GOOD	All verticals excluded, unknown allowed	Discretion	NR	39/5022 (.007%)
Duff 1988[26] GOOD	One prior LTCD, unknown not allowed	Yes	NR	1/227 (.0044%) called dehiscence but symptomatic
Flamm 1988[21] GOOD	LTCD and unknown and more than 1 prior	Yes (discretion?)	11/1776 (0.6%)	3/1776 (0.2%) (1/3 still had thin layer of peritoneum over scar)
Flamm 1990[22] FAIR	LTCD, unknown, more than 1 prior	Majority no longer did	NR	7/3957 (.0018%)

NR=not reported; LTCD=low transverse cesarean delivery; TOL=trial of labor; ERCD=elective repeat cesarean delivery; LVCD=low vertical cesarean delivery; CPD=cephalo pelvic disproportion;

Evidence Table 7. Uterine rupture details (continued)

Author Year Quality	Major Morbidity associated with Symptomatic uterine rupture TOL	Extrusion TOL	Asymptomatic Uterine Rupture ERCD	Symptomatic Uterine Rupture ERCD
Cowan 1994[25] FAIR	1 fetus with severe neurologic sequelae	NR	NR	NR
Flamm 1994[20] GOOD	0 maternal death 3/39 hysterectomy 0 neonatal deaths	NR	NR	NR
Duff 1988[26] GOOD	0 maternal or perinatal deaths	NR	NR	NR
Flamm 1988[21] GOOD	0 maternal death 0 neonatal death 1 hysterectomy *ERCD:* NR	2 partial extrusions, both babies did well, 5-min Apgar >7, one mom required hysterectomy, 3rd peritoneum intact no maternal or neonatal sequelae	NR	NR
Flamm 1990[22] FAIR	0 maternal death 1 hysterectomy infant born vaginally Apgar 9 3 Apgar <7(one cerebral palsy at 15months) 1 perinatal death related to rupture	NR	NR	NR

NR=not reported; LTCD=low transverse cesarean delivery; TOL=trial of labor; ERCD=elective repeat cesarean delivery; LVCD=low vertical cesarean delivery; CPD=cephalo pelvic disproportion;

Major Morbidity associated with symptomatic uterine rupture
ERCD
NR
NR
NR
NR
NR

IUPC=intrauterine pressure catheter

IUPC=intrauterine pressure catheter

Evidence Table 7. Uterine rupture details (continued)

Author Year Quality	Population	Uterine exploration	Asymptomatic Uterine Rupture TOL	Symptomatic Uterine Rupture TOL
Phelan 1987[23] FAIR	Low vertical, unknown, LTCD allowed during 2nd year more than 1 allowed	Yes	34/1796 (1.9%)	5/1796 (0.3%)
Stoval 1987[27] FAIR	LTCD or LVCD allowed more than 1 allowed not clear what was done with unknown	Yes	6/272 (.022%)	1/272 (.0037%)
Paul 1985[30] FAIR	Not more than 1, low vertical, unknown and LTCD allowed	Yes	11 (included in Phelan, 1987)	5 (included in Phelan, 1987)
Martin 1983[24] FAIR	One or more, includes low-vertical, no rupture occurred in the 76 with prior vertical	Yes	1/101 successful 3/61 failed (4/162=.024%)	1/61 failed (1/162=.006%)
Meier 1982[57] FAIR	LTCD, no unknown, no "obvious CPD"more than 1allowed	NR	1/207 (.004%)	NR
McMahon 1996[5] GOOD	1 LTCD, not clear what was done with unknown	NR	NR	10/3249 (0.3%)

Evidence Table 7. Uterine rupture details (continued)

Author Year Quality	Major Morbidity associated with Symptomatic uterine rupture	Extrusion TOL	Asymptomatic Uterine Rupture ERCD	Symptomatic Uterine Rupture ERCD
Phelan 1987[23] FAIR	1 neonatal death, post rupture, scar intact, fetal Bradycardia = sign 4600g Apgar 0,0,3, none in transverse scar	NR	7/314 (.022%)	NR
Stoval 1987[27] FAIR	0 maternal or fetal deaths	1 expulsion mentioned, signs = tearing, pain, IUPC changes delay in diagnosis 20 min, total expulsion, Apgars 4,7, mom and baby did well, no intubation	NR	NR
Paul 1985[30] FAIR	2 fetal deaths (classical incision 3 prior CD, fundal incision) 0 maternal deaths 0 hysterectomy	2 complete expulsions (one classical incision, one fundal incision)	see Phelan 1987	NR
Martin 1983 FAIR	0 fetal death 0 maternal death no comment on hysterectomy	NR	4/555 (.007%)	2/555 (.0036%)
Meier 1982[57] FAIR	0 maternal or fetal deaths	NR	1/62 (.016%)	NR
McMahon 1996[5] GOOD	2 perinatal deaths 2 hysterectomy 0 maternal deaths	NR	NR	1/2889 (0.0%)

Major Morbidity associated with symptomatic uterine rupture
ERCD
NR
NR
NR
0 maternal deaths 0 perinatal deaths in UR group 0 hysterectomy for UR
NR
0 maternal deaths 0 perinatal deaths 0 hysterectomy for UR

NR=not reported; LTCD=low transverse cesarean delivery; TOL=trial of labor; ERCD=elective repeat cesarean delivery; LVCD=low vertical cesarean delivery; CPD=cephalo pelvic disproportion; IUPC=intrauterine pressure catheter

NR=not reported; LTCD=low transverse cesarean delivery; TOL=trial of labor; ERCD=elective repeat cesarean delivery; LVCD=low vertical cesarean delivery; CPD=cephalo pelvic disproportion; IUPC=intrauterine pressure catheter

Evidence Table 8a. Patient satisfaction - good or fair quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Parity and previous history
Cross-Sectional				
Fawcett 1994[84] FAIR	USA General hospital in Pennsylvania small town	Cross-sectional BEQ 12-48 hours after delivery Inferred 1991-1992 Compare women' s reactions to their VBAC reactions to their previous CD experience	Women who completed a VBAC. Not clear if all eligible patients were recruited and number who refused. *TOL:* Mean age 28.8 yrs (SD 5.5 yrs) *ERCD:* Age, race NA	*TOL:* 29/32 (90.6%) had 1 prior delivery 3/32 (9.4%) 2 or more deliveries *ECRD:* NA
Erb 1983[83] FAIR	Canada Communities throughout Manitoba	Cross-sectional Responders to media campaign. 1979-1982 Assess women's feelings after first and repeat CD, 1-18 months after delivery	Parents who had first or repeat CD who responded to a media campaign. *TOL:* Age, race NA *ECRD:* Parents mean age 29 yrs	*TOL:* NR *ECRD:* NR

TOL=trial of labor; CD=cesarean delivery; ERCD=elective repeat cesarean delivery; BEQ=Birth Experience Questionnaire; VBAC=vaginal birth after cesarean;

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Parity and previous history

Evidence Table 8a. Patient satisfaction - good or fair quality studies (

Author Year Quality	TOL resulting in vaginal delivery	TOL emergency CD
Cross-Sectional		
Fawcett 1994[84] FAIR	70% would choose VBAC again 30% undecided Greater proportion felt relieved/excited & in control during the vaginal delivery. Patients perceived they worried more about their infant with their prior CD.	NA
Erb 1983[83] FAIR	NA	*For mothers with repeat CD:* 35% wanted help coping with feelings 90% felt relieved 90% joyous 35% frustrated 34% disappointed 20% angry 18% failure as women *For fathers:* 94% felt joyous 90% relieved 52% felt fearful for baby and mother 32% left out

TOL=trial of labor; CD=cesarean delivery; ERCD=elective repeat cesarean delivery; BEQ= Questionnaire; VBAC=vaginal birth after cesarean;

Author Year Quality	TOL resulting in vaginal delivery	TOL emergency CD

(continued)

ERCD

NA

For repeat CD in general:
35% wanted help coping with feelings
90% felt relieved
90% joyous
35% frustrated
34% disappointed
20% angry
18% failure as women

ERCD

Evidence Table 8b. Patient satisfaction- poor quality studies

Author Year Quality	Country Setting	Study design Years of study Research objective	Population	Exclusion Criteria
Cohort				
Mould 1996[86] POOR	University college hospital. CD rate of 18%.	Prospective cohort Clinicians interviewed women 2-3 days after delivery and at their six week checks 1994 Assess the extent to which women contribute to the decision for a CD and their satisfaction.	Recruited 102 of 104 women who had an emergency CD. 26 of the 102 had prior CD.	NR
Abitbol 1993[85] POOR	USA VBAC program in NY hospital 62% service patients 38% private	Prospective cohort Clinician and social worker interviewed women before and 2-3 days after delivery 18 month collection, no dates Investigate reasons for TOL or ERCD	Recruited all pregnant patients with prior CD who met ACOG guidelines. Refused not reported. Total group: 45% white 34% black 15% Latin American 6% other	Patients who didn't meet ACOG standards. 38/364 (10.4%)

TOL=trial of labor; CD=cesarean delivery; ERCD=elective repeat cesarean delivery; ACOG=American College of Obstetricians and Gynecologists; VBAC=vaginal birth after cesarean

Evidence Table 8b. Patient satisfaction- poor quality studies

Author Year Quality	Patients attempt TOL	TOL resulting in vaginal delivery	TOL Emergency CD	ERCD
Cohort				
Mould 1996[86] POOR	NA	NA	INVALID: Emergency CD not just VBAC: 37/73 (51%) reported having medium or above say in decision 22/73 (30%) reported no say	INVALID: ERCD not just VBAC: 20/29 (69%) reported having medium or above say in decision 2/29 (7%) reported no say
Abitbol 1993[85] POOR	INVALID: 99/187 (53%)	INVALID: all VBACs: 88/122 (68%) satisfied 64/80 (80%) no complications 19/42 (45%) with complications	INVALID: 16/65 (25%) satisfied	INVALID: 116/125 (93%) satisfied

TOL=trial of labor; CD=cesarean delivery; ERCD=elective repeat cesarean delivery; ACOG=American College of Obstetricians and Gynecologists; VBAC=vaginal birth after cesarean

Evidence Table 9a. Economic evaluations- good or fair quality studies

Author Year Quality	Country Setting	Study type	Perspective	Comparisons	Primary outcomes
Chung 2001[87] GOOD	USA	Cost-utility study	Society	TOL and ERCD	Cost per QALY
Grobman 2000[88] FAIR	USA Illinois	Cost effectiveness	Payer or health care system	TOL and ERCD	Neonatal neurologic injury or death averted, maternal deaths, CD, costs

TOL=trial of labor; ERCD=elective repeat cesarean delivery; QALY=quality adjusted life year; VBAC= vaginal birth after cesarean; CD=cesarean delivery

Evidence Table 9a. Economic evaluations- good or fair quality studies (continiued)

Author Year Quality	Cost data sources Cost unit Discount rate (base)	Results	Sensitivity analyses
Chung 2001[87] GOOD	Resources used at medical center, national costs, adverse event treatment costs US dollar 3%	*If VBAC rate is* • *<65%:* ERCD costs less with more QALYs • *65%-74%:* ECRD more cost effective(<$50,000/QALY) • *74%-76%:* ECRD more QALYs but >$50,000/QALY • *>76%:* TOL costs less with more QALYs	Extensive one-way sensitivity analyses. *Sensitive parameters:* • infant mortality probability • VBAC success probability • moderate neonate morbidity costs • urinary incontinence probability
Grobman 2000[88] FAIR	Literature, expert opinion and hospital charges US dollar 3%	To prevent 1 major adverse neonatal outcome (cerebral palsy or neonatal death) costs $2.4M, 0.1 maternal deaths, 74 maternal morbid events, and 1591 CD.	Costs to prevent 1 major neonatal adverse event > $1M for all parameter values.

TOL=trial of l TOL=trial of labor; ERCD=elective repeat cesarean delivery; QALY=quality adjusted life year; VBAC= vaginal birth a vaginal birth after cesarean; CD=cesarean delivery

Evidence Table 9a. Economic evaluations- good or fair quality studies (continiued)

Author Year Quality	Generalizability	Missing from analysis	Comments
Chung 2001[87] GOOD	High: most data based on national not local sources.	Cost for medical staff on standby for TOL, zero rates for fecal and urinary incontinence.	Extensive and carefully planned economic evaluation addressing societal perspective allowing comparisons to other resource demands. Including costs of standby staff for TOL would likely require higher VBAC rate for cost-effectiveness of TOL. Before cost-effectiveness recommendations are based solely on VBAC success probabilities, two-way sensitivity analyses should be performed.
Grobman 2000[88] FAIR	High	Many neonatal adverse events (low frequency or less severe), ICU time seems underestimated also.	No societal perspective. No pooled effectiveness (e.g. QALY). Broad range of included complications. 1999 US dollars. Included potential for multiple pregnancies. Assumptions about subsequent pregnancies not clear (appear to use same assumptions as for index pregnancy). Probabilities for subsequent pregnancies likely change although data for probabilities of subsequent pregnancies may be problematic. Other reasonable simplifications made to develop model.

TOL=trial of l TOL=trial of labor; ERCD=elective repeat cesarean delivery; QALY=quality adjusted life year; VBAC= vaginal birth a vaginal birth after cesarean; CD=cesarean delivery

Evidence Table 9b.Economic evaluations- poor quality studies

Author Year Quality	Country Setting	Study type	Perspective	Comparisons	Primary outcomes
DiMaio 2002[99] POOR	USA Florida	Cost analysis	Hospital (?)	TOL and ERCD	Total costs
Clark 2000[94] POOR	USA	Cost benefit analysis	Payer (?)	TOL and ERCD	Total provider costs
Chuang 1999[93] POOR	USA	Cost and expected utility model	NR	TOL and ERCD	Expected utility and costs
Shorten 1998[96] POOR	Australia	Cost analysis	Health care system	TOL and ERCD	Total average costs
Traynor 1998[95] POOR	USA Illinois	Cost accounting	Hospital	50 consecutive women each with TOL, ERCD, women with prior vaginal birth only	Total hospital charges

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture

Evidence Table 9b. Economic evaluations- poor quality studies (continued)

Author Year Quality	Cost data sources Cost unit Discount rate (base)	Results	Sensitivity analyses
DiMaio 2002[99] POOR	Hospital cost accounting data US dollar NA	Lower costs for TOL than for ERCD for mother, neonate, and combined	None
Clark 2000[94] POOR	Cost (charges) from health plan US dollar ?	Small savings for TOL (<$500). If include cerebral palsy as outcome, TOL costs more (<$220)	Only rate of long-term neonatal costs
Chuang 1999[93] POOR	Costs (charges?) from one hospital in Boston MA US dollar NA	ECRD had higher expected utility and lower expected cost for TOL rates < 70%	Model sensitive to utilities for ERCD, successful and failed TOL
Shorten 1998[96] POOR	Average DRG level costs Australian dollar NA	TOL reduced costs by ~30% compared to ERCD	Breakeven point (equal cost for TOL and ERCD) at 68% emergency RCD
Traynor 1998[95] POOR	Hospital charge data US dollar NA	Mean (SD) gross patient charges: TOL $5820 ($1609), ERCD $6785 ($771), $4685 ($966)	None

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture

Evidence Table 9b. Economic evaluations- poor quality studies (continued)

Author Year Quality	Generalizability	Missing from analysis	Comments
DiMaio 2002[99] POOR	Limited data based on 1 hospital for 1 year	Details on costs, rehospitalizations, MD costs.	No comparison of baseline risk. Number of emergency RCDs not stated. Study does not evaluate cost-effectiveness (no effectiveness measure as life year). Does use costs rather than charges.
Clark 2000[94] POOR	Limited by cost data from one health care system.	Complications from ERCD, MD costs.	Omitted complications from ERCD. Limited focus of analysis. Included only one long-term outcome.
Chuang 1999[93] POOR	Limited by cost data from one hospital.	Perinatal costs / outcomes, maternal death	Broad categories of complications only. No incremental analysis of cost and consequences.
Shorten 1998[96] POOR	Limited sample size; Australian costs may differ from USA	Societal costs, utilities, effectiveness measure	Results based on experience of 170 women with prior CD. Validated comparison to 2 other data sets (1 lacked infant outcome data). Reduction of routine admission to Special Care Neonatal Nursery would increase TOL advantage. Data set relatively small; few rare complications occurred (unclear for UR).
Traynor 1998[95] POOR	Limited		Private insurance. Excluded women if newborn treated in special care nursery. VBAC rate 84%. Excluded perinatal costs. No complications observed. No MD fees.

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture

Evidence Table 9b. Economic evaluations- poor quality studies (continued)

Author Year Quality	Country Setting	Study type	Perspective	Comparisons	Primary outcomes
Finkler 1997[89] POOR	USA California	Correlation analysis	Hospital	Delivery mode with resource costs, case mix, maternal LOS, neonatal morbidity	Correlation coefficients
Keeler 1996[90] POOR	USA California	Retrospective Cohort	Insurer	Rate of CD before and after equalization of MD fees for Csx and VD	CD rates
Spellacy 1991[91] POOR	USA California	Economic model	Society (?)	Cost savings from reward / penalty system for VBAC	Net costs
Hadley 1986[97] POOR	USA Pennsylvania	Retrospective Cohort	Payer (?)	TOL and ERCD	Total charges
Flamm 1985[98] POOR	USA California	Cost analysis	Payer (?)	TOL and ERCD	Total costs
Shy 1981[92] POOR	USA	Cost model	Payer (?)	TOL and ERCD	Mortality and direct medical costs

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture; ?=inferred, not stated

Evidence Table 9b. Economic evaluations- poor quality studies (continued)

Author Year Quality	Cost data sources Cost unit Discount rate (base)	Results	Sensitivity analyses
Finkler 1997[89] POOR	Direct payroll and non-payroll expenses for obstetrics US dollar NA	As physicians lack incentive to choose mode of delivery, there were no significant correlations of Csx rates with cost per delivery	None
Keeler 1996[90] POOR	MD fees paid by insurer US dollar NA	No change in overall CD rate, 7% increase in rates of breech presentation	None
Spellacy 1991[91] POOR	Rough estimates US dollar	Paying physicians 10% more for VBAC than repeat CD will save billions	None
Hadley 1986[97] POOR	Patient billing data US dollar NA	TOL lower average charges by $1960	None
Flamm 1985[98] POOR	Approximation for national data US dollar NA	Assuming TOL saves $300 per patient, could save up to $600M / year	None
Shy 1981[92] POOR	Blue Shield charge estimates US dollar NA	Fewer deaths (25%) with planned TOL. Higher costs (26%) with ERCD	None for cost model.

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture

Evidence Table 9b. Economic evaluations- poor quality studies (continued)

Author Year Quality	Generalizability	Missing from analysis	Comments
Finkler 1997[89] POOR	May be unique to setting like Kaiser-Permanente (no incentive related to mode of delivery	None	Costs directly to levels and mix of staffing, case mix and operation scale. Risk adjustment included. Cost estimates excluded perinatal costs (e.g. nursery). Results may not apply in a fee-for service environment. Included midwives on staff and scheduled coverage of physicians and midwives.
Keeler 1996[90] POOR	Fee for service insurers	None	CD rates post fee equalization all within confidence limits of pre equalization period. No overall effect. A few MD's left plan following equalization.
Spellacy 1991[91] POOR	High	None	"Back-of-the-envelope" estimate of reward to MD for VBAC. Very simplistic. May need to increase by >10% as costs of VBAC to MD may exceed 10%
Hadley 1986[97] POOR	Limited data based on 1 hospital	Charge details, costs, insurance type, long term effects	Small cohort (40 TOL and 35 ERCD). No long-term effects included. Conservative TOL criteria.
Flamm 1985[98] POOR	Only crude approximation	Most details, adverse outcomes	Back of the envelope estimate of cost savings in US. Assumes TOL is appropriate for all prior CD patients. Ignores any complications.
Shy 1981[92] POOR	Limited by year of model.	All morbidity (including AE's)	No comparison of mortality and costs. Cost data very limited (only hospital, MD, anesthesiologist and neonatal ICU). Results dated. No sensitivity analyses on costs.

TOL=trial of labor; ERCD=elective repeat cesarean delivery; NA=not applicable; MD=medical doctor; RCD=repeat cesarean delivery; CD=cesarean delivery; UR=uterine rupture

Evidence Table 10. Health care resources- poor quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Systematic Reviews				
Roberts 1997[117] POOR	USA	1980-1996 Comparison of TOL and ERCD	(I) Article in Medline or in references/(E) Developing country	TOL ERCD
Prospective Cohort Study Designs				
Flamm 1994[20] POOR	USA CA	1990 Evaluate outcomes in a cohort of women with prior CD	(I) Delivery at participating hospital, woman with prior CD/(E) Spontaneous or therapeutic abortion, left provider, incomplete records.	TOL ERCD
Miller 1992[173] POOR	Australia	1989-1990 Assess outcomes in women with prior CD	(I) Women with at least 1 prior CD who delivered in hospital	ECD Emergency CD VBAC
Phelan 1987[23] POOR	USA CA	1982-1984 Evaluation of risks associated with TOL	(I) 1 or 2 prior CD, unknown scar type/(E) Known classical scar, multiple gestation, malpresentation	Successful TOL Failed TOL (RCD) No TOL: VD No TOL: ERCD No TOL: indicated RCD

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Systematic Reviews				
Roberts 1997[117] POOR	Maternal/neonatal: 10,428/379	Maternal/ Neonatal LOS (days)	2.94/2.99	No risk adjustment, no standard errors
	3,597/599		4.11/4.96	
Prospective Cohort Study Designs				
Flamm 1994[20] POOR	5,022	Mean (SD) maternal LOS (hours)	57.2 (31.1)	P-value<0.0001. Risk adjustment performed but no details provided.
	2,207		84.9 (26.3)	Predictors of LOS included medical center, TOL, prior scar type unknown, no post-partum fever, no transfusion, 5-miunte Apgar>6 and no tubal ligation
Miller 1992[173] POOR	193	Maternal (SD) LOS (days)	7 (2.0)	No adjustment for baseline risk or other potential confounders
	45		7.0 (1.6)	
	66		4.9 (2.0)	
Phelan 1987[23] POOR	1,465	Mean maternal LOS (days)	2.2	No risk adjustment. No test of significance.
	331		4.2	
	69		2.3	
	314		4.2	
	464		4.2	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Stovall 1987[27] POOR	USA TN	1985-1986 Year-long prospective study of "liberalized" VBAC criteria	(I) Patients with prior CD (lower uterine segment transverse or vertical)/(E) Classical, previous low vertical in pre-term pregnancy, lower uterine transverse or vertical scar, or failed TOL after CD.	Vaginal delivery
				CD
Retrospective Cohort Study Designs				
Anonymous 1998[103] POOR	USA	1996 Estimate LOS for insurance claims	(I) Metropolitan Life Insurance Co. Group Health enrollee	CD
Anonymous 1998[103] POOR				Uncomplicated VD
				VBAC
				CD/Indemnity
				CD/Preferred Provider
				CD/Point of Service
				CD/HMO
				Uncomplicated VD/Indemnity
				Uncomplicated VD/Preferred Provider
				Uncomplicated VD/Point of
				Uncomplicated VD/HMO
				VBAC/Indemnity
				VBAC/Preferred Provider
				VBAC/Point of Service
				VBAC/HMO

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Stovall 1987[27] POOR	216	Maternal LOS (days)	2.1	No summary stats beyond mean LOS. No baseline statistics
	56		5.3	
Retrospective Cohort Study Designs				
Anonymous 1998[103] POOR	10,305	Maternal LOS (days)	3.01	Based on insurance claims data
Anonymous 1998[103] POOR	40,697		1.71	LOS may be impacted by insurance coverage
	887		1.76	Based on insurance claims data
			3.12	LOS may be impacted by insurance coverage
			3.07	Sample size by insurance type and mode of delivery not provided
			2.94	
			2.87	
			1.83	
			1.72	
			1.62	
			1.60	
			1.89	
			1.85	
			1.66	
			1.74	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Curtin 1997[167] POOR	USA	1995 Summarize data from 1995 National Hospital Discharge Survey	(I) Pregnancy in non-federal short-stay hospital	1988 1995
Hook 1997[207] POOR	USA OH	1992-1993 Compare neonatal outcomes for ERCD and TOL	(I) Women with prior CD, singleton delivery, >36 weeks gestation/(E) 18 neonates with congenital malformations	ERCD TOL VBAC after TOL RCD after failed TOL
Hanley 1996[208] POOR	USA NJ	1984 Describe contribu-tions of various factors to overall RCD rate	(I) Women with prior CD and either RCD or VBAC/(E) Missing record	ERCD Failed VBAC Indicated RCD
Taffel 1991[209] POOR	USA	1989 Monitor annual trends in pregnancy outcomes	(I) Birth in non-federal general and special short-stay hospitals	RCD Primary CD VD (all)

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Curtin 1997[167] POOR		Maternal LOS for RCD/% 4 days or more	4.3/71.7%	Exact number of women with prior CD not reported.
			3.3/21.0%	No adjustment for baseline risk or other potential confounders
Hook 1997[207] POOR	497	Mean (SD) LOS (days): maternal/ neonatal	4.5(1)/4.5(2)	No adjustment for baseline risk or other potential confounders
	492		3.6(1)/3.7(2)	
	336	Mean (SD) neonatal LOS (days)	3.1 (2)	P-value<0.01 for comparison of LOS between VBAC and failed TOL
	156		4.8 (2)	
Hanley 1996[208] POOR	107	Maternal median (min., max.) LOS (days)	3 (2-6)	No risk adjustment
	72		4 (3-8)	Significant differences between elective and other 2 (p-value<0.05)
	53		4 (2-14)	
Taffel 1991[209] POOR		Maternal LOS (days)	4.2	No risk adjustment, no standard errors
			4.8 2.4	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Eriksen 1989[210] POOR	USA (military)	1985-87 Evaluate outcomes in a cohort of women with prior CD	(II) Patients with prior CD (and age and parity-matched VD)/(E) Not eligible for TOL	VBAC RCD VD no prior CD
				VBAC RCD VD no prior CD
Flamm 1988[21] POOR	USA CA	1984-85 Evaluate outcomes in a cohort of women with prior CD	(I) Women with prior CD who volunteered for TOL	Success-ful TOL Failed TOL ERCD
Placek 1988[169] POOR	USA	1980-85 Summarize national survey data on delivery methods	(I) Patients in non-federal general and special short-stay hospitals	Primary CD RCD VD (not VBAC) VBAC
Placek 1988[211] POOR	USA	1986 Summarize national survey data on delivery methods	(I) Patients in non-federal general and special short-stay hospitals	Primary CD RCD VD (not VBAC) VBAC

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Eriksen 1989[210] POOR	69	Mean (SD) maternal LOS (days)	3.1 (1.6)	VBAC differs form RCD (p<0.0001) and from VD (p=0.0004)
	68		5.4 (2.0)	
	69		2.4 (0.84)	
		Mean (SD) neonatal LOS (days)	2.73 (1.3)	VBAC differs form RCD (p<0.0001)
			4.58 (2.23) 2.16 (0.66)	No risk adjustment
Flamm 1988[21] POOR	1,314	Mean (SD) maternal LOS (days)	2.2 (0.81)	No risk adjustment
	462		4.6 (1.29) 4.3 (NR)	
Placek 1988[169] POOR		Maternal LOS (days)	6.0	National data. No risk adjustment, no standard errors. VBAC significantly short LOS than either CD category (not other VD)
			5.6	RCD equals all repeat CD including indicated, elective, or failed TOL
			3 3.2	
Placek 1988[211] POOR		Maternal LOS (days)	5.2	National data. No risk adjustment, no standard errors. VBAC significantly short LOS than either CD category (not other VD)
			4.7 2.6 2.7	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Hadley 1986[212] POOR	USA PA	1982-83 Compare TOL to ERCD	(I) Prior CD, eligible for TOL/(E) >1 Prior CD, Non-low transverse scar, twins, prior uterine surgery, no consent, fetal macrosomia	ERCD
				Attempted TOL
				Successful TOL
				Failed TOL
Boucher 1984[213] POOR	USA CA	1980 Evaluate outcomes in a cohort of women with prior CD	(I) Delivery at study hospital/(E) Chart lost	Overall TOL
				Successful TOL
				Failed TOL (RCD)
				non-TOL Elective CD
				Labor&ROM
				Labor&ROM: RCD no TOL
				Labor&ROM: VD

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Hadley 1986[212] POOR	35	LOS (days) mother/infant	5.9/6.1	Maternal readmissions 2 TOL and 1 ERCD, ER visits TOL 2
	40		3.6/3.7	
	32		3.1/3.4	
	8		5.6/6.0	
Boucher 1984[213] POOR	308	Operative time (min)/maternal LOS (days)	NA/NR	No risk adjustment
	240		NA/NR	All groups not compared,only RCD LOS data only reported
	68		68.8 (23.9)/5.0 (1.4)	
	544		NR/NR	
	140		78.2 (26.1)/5.0 (1.5)	
	404		NA/NR	
	371		76.9 (46.5)/4.9 (1.6)	
	33		NA/NR	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Studies of Case Series				
Iglesias 1991[161] POOR	Canada (Alberta)	1985-89 Success of TOL in rural hospital	(I) Pregnant mother with prior CD eligible for TOL	1985 1986 1987 1988 1989
Surveys				
Mor-Yosef 1990[160] POOR	Israel	3 months in 1983-84 National survey to assess VBAC	(I) Singleton live delivery with previous CD/(E) Delivery before 26 weeks gestation, fetal malformations, home deliveries, multiple deliveries, >1 prior CD, incomplete data	VBAC RCD

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 10. Health care resources- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Studies of Case Series				
Iglesias 1991[161] POOR	27	Maternal LOS (days) successful TOL/failed TOL	5.0/none	No risk adjustment or standard deviations. Small n's
	28		4.7/6.0	
	24		5.6/5.0	
	25		4.1/5.5	
	33		3.3/6.2	
Surveys				
Mor-Yosef 1990[160] POOR	596	Mean (SD) maternal LOS (days)	3.8 (1.8)	No risk adjustment. Difference not significant
	484		7.2 (1.8)	

TOL=trial of labor; ERCD=elective repeat cesarean delivery; CD=cesarean delivery;LOS=length of stay; VBAC= vaginal birth after cesarean; RCD=repeat cesarean delivery; SD=standard deviation; HMO=health maintenance organization; ROM=rupture of membranes

Evidence Table 11. Individual factors - good or fair quality studies

Author Year Quality	Country Setting	Study category Years of study Research objective	Population
Randomized Controlled Trials			
Fraser 1997[106] FAIR	Canada/USA 11 Canadian hospitals 1 US hospital	Nonclinical 1992-1994 To assess whether, for women with PCD, a prenatal education and support program promoting VBAC delivery increases the probability of VD.	Women with one PCD. Stratified by motivational level (low or high), and then randomly assigned Group 1: verbal Group 2: document
Prospective Cohort			
Flamm 1997[36] GOOD	USA 10 Southern California Kaiser Permanente hospitals	Predictive tool 1990-1992 To develop a scoring system to predict the likelihood of vaginal birth in patients undergoing a TOL after PCD using factors known at the time of hospital admission.	Women with a PCD.
Stronge 1996[109] FAIR	Ireland National Maternity Hospital Dublin	Characteristics 1992-1994 To determine if routine measured clinical factors were associated with mode of delivery.	Women with one PCD
Retrospective Cohort			
Caughey 1998[112] GOOD	USA Brigham and Women's Hospital Boston, MA	Characteristics 1984-1996 To examine the effects of order of previous modes of delivery on the rate of CD and duration of a TOL among women with a history of one PCD and one previous VD.	Women with exactly one PCD and one previous VD. Compared: Group 1: PCD followed by VD (VD last) Group 2: VD followed by PCD (CD last)

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Eligible/ attempting TOL VB	Factors adjusted for through Multivariate Analysis
Randomized Controlled Trials			
Fraser 1997[106] FAIR	Previous VBAC, a classic CD or myomectomy scar, multiple gestation.	1284/905 649	RCT - assumed equal distribution of confounding factors
Prospective Cohort			
Flamm 1997[36] GOOD	ERCD, incomplete data	7229/5003 3746	Age, VD history, PCD indication, cervical effacement/dilation at admission
Stronge 1996[109] FAIR	ERCD, NR	239/195 150	Head engagement, dilation of cervix of more than 2cm, the use of oxytocin for augmentation
Retrospective Cohort			
Caughey 1998[112] GOOD	Unavailable chart information, no previous VD, more than one previous VD or CD.	NR/800 700	Maternal age, epidural use, induction, birth weight, gestational age, and previous indication for CD

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study category Years of study Research objective	Population
Jakobi 1993[37] FAIR	Israel Rambam Medical Center Hafia	Predictive tool Years NR To examine 15 previously identified prognostic factors, in order to evaluate the predictive value and relative importance of these factors and whether they could be used for a better selection of patients for VBAC.	Women with one PCD.
McNally 1999[107] FAIR	Ireland Coombe Women's Hospital Dublin	Medications/ characteristics 1993-1994 The aim of this study was, after induction of labor in women with a PCD, to compare the outcome in women with a history of VD with women who had never had a VD.	Women with one previous lower segment CD who had been induced with oxytocin and amniotomy. Compared: Group 1: **previous VD** Group 2: no previous VD
Weinstein 1996[42] FAIR	Israel Hebrew University Jerusalem	Predictive tool 1981-1990 To evaluate the relative weight of the different variables that may influence the chances of vaginal birth after one PCD, with the aim of developing a predictive score for success of such a trial.	Women with one PCD.

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Eligible/ attempting TOL VB	Factors adjusted for through Multivariate Analysis
Jakobi 1993[37] FAIR	Unknown scar, scar other than LTCS, nonvertex presentation, multiple gestation, ruptured membranes >16hrs and without contractions or >42wks.	NR/261 215	Parity, VD history, PCD indication, cervical dilation/effacement/station at previous CD, cervical dilation/effacement/station at admission, rupture of membranes, birth weight
McNally 1999[107] FAIR	Fetal distress upon induction	NR/103 82	Age, parity, VD history, gestational age, cervical effacement/dilation, prostaglandin administration, epidural analgesia, certainty of dates, presence or absence of meconium at amniotomy, birth weight
Weinstein 1996[42] FAIR	ERCD, incomplete records, classic or unknown scar, hx of rupture, absolute CPD, previa, fetal malpresentation incompatible with a safe VD	572/471 368	Maternal age, VD history, bishop score, fetal weight at CD, fetal weight, PCD indication

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study category Years of study Research objective	Population
Zelop (a)2001[110] FAIR	USA Brigham and Women's Hospital Boston, MA	(a) characteristics 1984-1996 To compare the outcomes in women with PCD at or before 40 weeks' gestation with those delivering after weeks.	Women with one PCD Compared: Group 1: 37 to 40 weeks gestation. Group 2: after 40 weeks gestation.
Zelop (b)2001[111] FAIR	USA Brigham and Women's Hospital Boston, MA	(b) characteristics 1984-1996 To compare the outcomes at term of a TOL in women with PCD who delivered neonates weight >4000g versus women with those weighing <4000g.	Women with one PCD undergoing a TOL after 24 weeks. Compared: Group 1: >4000g Group 2: <4000g
Case Control			
Macones 2001[38] FAIR	USA University of Pennsylvania Philadelphia, PA	Predictive tools 1994-1998 To assess the utility and effectiveness of a neural network for predicting the likelihood of success of a TOL, relative to standard multivariate predictive models.	Women with PCD. Compared: Group 1: VBAC Group 2: Failed TOL
Pickhardt 1992[39] FAIR	USA Mississippi Medical Center Jackson, MS	predictive tools 1989 To determine if there useful and valid predictors before parturition, of successful or unsuccessful vaginal birth after previous cesarean birth that could be used to enhance the obstetric care of a patient and her pregnancy.	Women with a PCD. Compared: Group 1: VBAC Group 2: Failed TOL

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Eligible/ attempting TOL VB	Factors adjusted for through Multivariate Analysis
Zelop (a)2001[110] FAIR	ERCD, preterm, multiple gestation, more than one PCD.	NR/2775 1923	PCD indication, birth weight
Zelop (b)2001[111] FAIR	ERCD, preterm	NR/2749 1912	Epidurals, maternal age, race, receiving public assistance, year of delivery, PCD indication, type of uterine hysterotomy
Case Control			
Macones 2001[38] FAIR	Unknown scar, vertical scar	NR/400 300	Substance abuse, parity, prior VBAC, weight gain during pregnancy, prepreganancy BMI, years since last delivery, cervical dilation at admission, need for augmentation
Pickhardt 1992[39] FAIR	Incomplete data or unobtainable charts	NR/312 212	Race, age, height, weight, gravidity, parity, estimated fetal weight, number of PCD, cervical dilation/effacement/station at admission, modified bishop score, estimated gestational age, number of previous VD, PCD indication, spontaneous rupture of membranes, placental grade, fluid status, spontaneous uterine activity

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Country Setting	Study category Years of study Research objective	Population
Case series			
de Meeus 1998[104] FAIR	France Poitiers University Hospital	characteristics 1988-1995 To determine if external cephalic version (ECV) is a reasonable alternative to repeat CD in case of breech presentation.	43 women with one PCD and current singleton pregnancy in breech presentation, attempting ecv.
Flamm 1991[105] FAIR	USA Kaiser Permanente Centers (Los Angeles, Anaheim, Riverside)	characteristics 1985-1990 To examine external cephalic version in those with breech presentation following one or more PCD.	Women undergoing external cephalic version for breech presentation. Compared: Group 1: with one or more PCD Group 2: no PCD
Schacter 1994[108] GOOD	Israel Kaplan Hospital Jerusalem	characteristics 24 month period - Years NR To describe our limited experience with external cephalic version (ECV) from breech to vertex presentation at term, with the use of ritodrine tocolysis, in women who had undergone a PCD.	Women with a PCD who at 36-37weeks gestation have malpresentation (breech or transverse lie), for which they undergo ECV.

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 11. Individual factors - good or fair quality studies (continued)

Author Year Quality	Exclusion criteria	Eligible/ attempting TOL VB	Factors adjusted for through Multivariate Analysis
Case series			
de Meeus 1998[104] FAIR	ERCD, <36weeks, rupture membranes, suspected IUGR, third-trimester bleeding, vertical uterine scar, obvious macrosomia, abnormal placental insertion, uterine malformation, or abnormal FHT on admission.	43/38 19	
Flamm 1991[105] FAIR	ERCD, ruptured membranes, labor, suspected IUGR, third-trimester bleeding, oligohydramnios, previous classical or vertical incision, or suspicious fetal monitoring pattern on admission.	NR/56 30	
Schacter 1994[108] GOOD	Previous metroplasty, low lying placenta, oligohydramnion, ruptured membranes	20/11 6	

TOL=trial of labor; VBAC=vaginal birth after cesarean; CD=cesarean delivery; PCD=previous cesarean delivery; ERCD=elective repeat cesarean delivery; NR=not reported; RCT=randomized controlled trial

Evidence Table 12a. Patient preferences - good or fair quality studie

Author Year Quality	Country Setting	Study design Intervention Years of study Research objective
Randomized Controlled Trial		
Fraser 1997[106] GOOD	CANADA & USA 11 Canadian hospitals 1 US hospital VBAC rate 39.3%.	RCT Randomized to receive pamphlet on VBAC benefits or prenatal education & support program. Questionnaire 1-3 days after delivery 1992-1994 Assess the effect of a prenatal education program on proportion of women attempting TOL
Cohort		
Kirk 1990[118] FAIR	USA 1 teaching hospital (a) (primary CD rate 14.8%, repeat 3%) 1 metropolitan hospital (b) (primary CD rate 13.6%, repeat 5.4%)	Nonrandomized trial Questionnaire during postpartum stay. Mailed follow-up to nonresponders. 1988-1989 Determine who makes decisions for CD and why those decisions are made.
Kline 1993[119] FAIR	USA Private nonteaching hospital in MO CD rate 28.5% (18.3% primary, 10.2% repeat)	Prospective cohort Patients interviewed before delivery and delivery data collected afterward from records 1988-1990 Determine the reasons for the birth choice.

BEQ=birth experience questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of la
elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12a. Patient preferences - good or fa

Eligibility Population	Author Year Quality	Education about VBAC?
	Randomized	***Controlled Trial***
All women with CD, single low transverse scar, gestational age >28 weeks. Read, write English or French. Recruited 1275/1301 *TOL:* Average age 31 (SD 5 yrs) *ERCD:* Average age 31 (SD 5 yrs)	Fraser 1997[106] GOOD	Document group: VBAC pamphlet at 21 weeks. Verbal group: Research nurse assessed the patient's motivation for VBAC and the attitudes of her physician and of her social network (husband, friends etc.) at 21 weeks. Addressed questions about pain and sterilization. 4-8 wks later, resource person provided support, etc.
	Cohort	
NR *TOL:* Mean age 27.6 yrs Hospital a: 20% nonwhite Hospital b: 2.4% nonwhite *ERCD:* Mean age 30.6 years Hospital a: 20% nonwhite Hospital b: 2.4% nonwhite	Kirk 1990[118] FAIR	NR but 55% of TOL patients knew about VBAC before current pregnancy; 49% of ERCD also knew.
Women with 1+ prior CD. Consecutive patients (when PI was chief resident on call) first then recruited elective repeat patients. Refused not reported. *TOL:* Mean 30.2 yrs (SD 5.0) (n=121 successful TOL) *ECRD:* Mean 30.1 years (SD 4.6) (n=120)	Kline 1993[119] FAIR	NR

abor; NR=not reported; ERCD=

BEQ=birth experience questionnaire; VBAC=vaginal birth after cesa
elective repeat cesarean delivery; DD=delivery decision; CD=cesarea

air quality studies (continued) **Evidence Table 1**

Delivery Decisions/ Attempt TOL/Eligible	VBAC/TOL	ERCD	Author Year Quality
			Randomized Co
Document Group: 440/634 (69.4%) Verbal Group: 465/641 (72.5%)	Document Group: 310/440 (70.5%) Verbal Group: 339/465 (72.8%)	Document Group (150/634 (23.7%) Verbal Group: 137/641 (21.4%)	Fraser 1997[106] GOOD
			Cohort
NR	NR	NR	Kirk 1990[118] FAIR
205/584 (35.1%)	153/205 (74.6%)	873/1078 (80.9%)	Kline 1993[119] FAIR

arean; TOL=trial of labor; NR=not reported; ERCD= BEQ=birth experience
an delivery elective repeat cesarea

.2a. Patient preferences - good or fair quality studies (continued)

Reasons or factors for elective repeat CD	Information sources for elective repeat CD
ntrolled Trial	
No differences between treatment groups. Women with low motivation for VBAC at baseline (21 weeks) were 3 times more likely to have an ERCD than those with high motivation. Women with low motivation were more likely to have already experienced labor, were less likely to be planning future pregnancies, were more likely to be seeking a tubal ligation.	Collected but not reported.
Reasons: 12/48 (25%) danger of TOL to mother; 14/48 (29.2%) danger of TOL to baby; 19/48 (39.6%) avoid labor pain; 13/48 (27.1%) convenience; 25/48 (52.1%) low chance of vaginal delivery; 18/48 (37.5%) knew what to expect. 15% of patients selected ERCD in before pregnancy. Another 25% decided in first half of pregnancy. 20% of patients thought they had at least a 75% chance of a vaginal delivery with a TOL.	52% of women made decision although most women (79%) rated the physician as a strong influence. Another 31% of women and physicians together made decision. 72% of women rated their husbands as a strong influence.
For 120 patients: 31.6% patient desire; 13.3% MD advice; 9.1% Patient & MD; 45.8% medical reason.	NR

e questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=
n delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12a. Patient preferences - good or fair quality studie

Author Year Quality	Country Setting	Study design Intervention Years of study Research objective
McClain 1985;1987; 1990[120] FAIR	USA 3 hospitals in San Francisco Bay area	Prospective cohort. Tape recorded semi-structured interview with women at home during last month of pregnancy & about two months postpartum 1983-1986 Examine in depth the women's choice of ERCD or TOL.
Martin, 1983[24] FAIR	USA Two teaching hospitals in Mississippi and Alabama.	Prospective cohort Interviewed women during pregnancy, reviewed medical charts after delivery 1981-1982 Examine choices, reasons, outcomes for women choosing TOL or ERCD.
Meier 1982[57] FAIR	USA Kaiser Hospital in CA Before study primary CD rate 9.8%. Repeat CD 7.1%.	Prospective cohort Patients and physicians completed questionnaires. 1980-1981 Report proportion of patients attempting and completing VBAC 1
Melnikow 2001[121] FAIR	USA 3 groups of nonfederal acute-care hospitals with high (30%), intermediate (21%), low (15%) CD rates.	Retrospective cohort Chart review 1992-1993 Estimate rates at which women were offered and attempted TOL.

BEQ=birth experience questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of la
elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12a. Patient preferences - good or fa

Eligibility Population	Author Year Quality	Education about VBAC?
Women with prior CD at one of three hospitals. Recruited 102 of 125 (80%) 23/43 nonwhite patients 42/50 white patients *ERCD:* 20/43 nonwhite patients 8/50 white patients.	McClain 1985;1987; 1990[120] FAIR	Education on TOL.
All women with one or more prior CD. Recruited 717/789 *TOL:* 22.0 yrs (SD .9 yrs) *ERCD:* 23.3 years (SD .3 years)	Martin, 1983[24] FAIR	NR
Women with single prior CD, low-transverse scar. Considered some patients with more than one prior CD *TOL:* NR *ERCD:* NR	Meier 1982[57] FAIR	NR
Randomly selected 1662 charts of deliveries. 369 charts of women with prior CD at 51 hospitals *TOL & ERCD:* Mean age 30.6 yrs. 47.4% nonwhite	Melnikow 2001[121] FAIR	Abstracted any counseling notes from charts. No cases of VBAC without documentation of counseling.

abor; NR=not reported; ERCD=

BEQ=birth experience questionnaire; VBAC=vaginal birth after cesa
elective repeat cesarean delivery; DD=delivery decision; CD=cesarea

air quality studies (continued) **Evidence Table 1**

Delivery Decisions/ Attempt TOL/Eligible	VBAC/TOL	ERCD	Author Year Quality
65/100 (65%). Also, 4/100 (4%) undecided but who had TOL.	39/69 (56.5%)	28/100 (28%). Also 3/100 (3%) who were undecided but had elective repeat CD.	McClain 1985;1987; 1990[120] FAIR
162/717 (22.6%)	101/162 (62.4%)	555/717 (77.4%)	Martin, 1983[24] FAIR
Inferred 207/658 (31.5%)	175/207 (84.5%)	inferred 451/658 (68.5%)	Meier 1982[57] FAIR
Hospitals with high CD rate (42%); intermediate (56%); low (90%)	Hospital with high CD rate (73.8%); intermediate (69.6%); low (78.9%)	Hospitals with high CD rate (58%); intermediate (44%); low (10%)	Melnikow 2001[121] FAIR

arean; TOL=trial of labor; NR=not reported; ERCD= BEQ=birth experience
an delivery elective repeat cesarea

.2a. Patient preferences - good or fair quality studies (continued)

Reasons or factors for elective repeat CD	Information sources for elective repeat CD
19/41 (46.3%) of nonwhite women didn't want to experience labor again. 10/45 (22.2%) of white women didn't want to experience labor again. 29/40 (72.5%) of nonwhite women had positive feelings about prior CD. 21/41 (51.2%) of white women had positive feelings. 22/56 (39%) of all women having CD had decided to have no more children and had their tubes tied at delivery time. Some women chose repeat CD to spare husband the long labor process.	For all patients: 36/100 (36%) patients influenced by friends. 15/92 (16.3%) patients influenced by relatives. Only 28/100 (28%) of women knew someone else who attempted a TOL after prior CD.
245/547 (44.8%) wanted tubal sterilization (p<.001).	NR
9/13 patients cited fear of difficult labor, fail to deliver and require a repeat CD. Convenience was second reason.	NR
Hospitals with high risk adjusted CD rates were more likely than hospitals with low CD rates to schedule ERCD without documentation of counseling for TOL (21% vs .3%, p<.01). Hospitals with high CD rates had higher proportion of women who were counseled and refused than hospitals with low CD rates (36% vs. 10%, p<.01).	NR

e questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=
n delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12a. Patient preferences - good or fair quality studie

Author Year Quality	Country Setting	Study design Intervention Years of study Research objective
Cross-Sectional		
Lau 1996[123] GOOD	CHINA Tertiary teaching hospital in Hong Kong CD 21.4%. 30% of women with prior CD attempt TOL. 80% succeed	Cross-sectional Structured interview during pregnancy or after first CD 1994 Investigate how much chance of vaginal delivery influences patient's acceptance or resistance to TOL.
Murphy 1989[124] GOOD	USA Two hospitals in Pacific Northwest	Cross-sectional 20 minute phone interview within 1 month of delivery 6 month period in the late 1980s. Assess women's contribution to CD or TOL decision, determine reasons.
Gamble 2001[122] FAIR	USA Major metropolitan teaching hospital	Cross-sectional Completed questionnaire during last month of pregnancy 1998-1999 Determine incidence of birth choice and reasons.
Fawcett 1994[84] FAIR	USA General hospital in small town in PA.	Cross-sectional BEQ 12-48 hrs after delivery Inferred 1991-1992 Compare women' s VBAC reactions to their previous CD experience.

Evidence Table 12a. Patient preferences - good or fa

Eligibility Population	Author Year Quality	Education about VBAC?
	Cross-Sectional	
Group 1: 50 patients who just had first CD interviewed during postnatal hospital stay 29.7 yrs (SD 3.6 yrs). *Group 2:* 50 pregnant patients with history of CD 32.8 yrs (SD 4.1 yrs). Recruited 100/101 *TOL & ERCD:* NR	Lau 1996[123] GOOD	NR. But implied that some education occurs since all patients were asked what the lowest success rate of VBAC they would consider and still have a VBAC.
Recruited all women with a prior CD who had delivered a infant of at least 30 weeks gestation; had no psychiatric condition; could read and speak fluent English. Recruited 50/53 TOL: Mean age 28 yrs. ERCD: Mean age 29 yrs.	Murphy 1989[124] GOOD	NR
Women between 36-40 weeks gestation, at least 18 years old. Read and write in English. Recruited 301/310 *TOL & ERCD:* NR for women with prior CD. Whole group: 79.7% under age 3; 11.7% nonwhite.	Gamble 2001[122] FAIR	NR
Women who completed a VBAC. Not clear if all eligible patients were recruited and number who refused *TOL:* Mean age 28.8 yrs (SD 5.5 yrs) *ERCD:* NA	Fawcett 1994[84] FAIR	NR but 71% knew abut VBAC before current pregnancy; 48% had decided for a TOL before current pregnancy. Another 39% decided by 2nd trimester.

air quality studies (continued) **Evidence Table 1**

Delivery Decisions/ Attempt TOL/Eligible	VBAC/TOL	ERCD	Author Year Quality
			Cross-Sectional
INVALID: Assuming a 50-70% success rate. 24/50 (48%) of Group 1 would choose TOL for next. 29/50 (58%) Group 2. Overall: 53/100 (53%).	NA	INVALID: Assuming a 50-70% success rate. 26/50 (52%) of Group 1 would choose ERCD for next. 21/50 (42%) Group 2. Overall 47/100 (47%).	Lau 1996[123] GOOD
INVALID: 33/50 (66.0%)	INVALID: 21/33 (63.4%)	12/50 (34%)	Murphy 1989[124] GOOD
17/40 (67.5%)	NR	13/40 (32.5%)	Gamble 2001[122] FAIR
NA. Only recruited VBAC patients.	100%. Study only recruited VBAC patients. NA	NA	Fawcett 1994[84] FAIR

2a. Patient preferences - good or fair quality studies (continued)

Reasons or factors for elective repeat CD	Information sources for elective repeat CD
More patients who chose ERCD 20/46 (43.5%) had a fear of vaginal delivery compared with 2/53 (3.8%) (p=.000).	
None of the patients had chosen an ERCD before pregnancy began. 5/12 (41.7%) chose ERCD before 4 months. 6/12 (50%) women wanted to avoid an unsuccessful labor and another 4/12 felt that a repeat CD was a safer method. 6/12 (50%) wanted to avoid the effect of the prolonged, painful labor.	None of the patients had chosen an ERCD before pregnancy began. 5/12 (41.7%) chose ERCD before 4 months. 9/12 (75%) felt the health care provider was the most influential source. 3/12 (25%) felt the health care provider was the major source of support.
Predominant reasons: safety of baby. Women who were very disappointed with last delivery were more like to chose CD.	NR
NA	NA

BEQ=birth experience questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of la
elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

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e questionnaire; VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=
n delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12b. Patient preferences - poor quality studies

Author Year Quality	Country Setting	Study Design Intervention Years of Study Research Objective	Population	Exclusion criteria
Cohort				
Quinlivan 1996[125] POOR	Austria Teaching hospital in Western Austria CD rate was 17.8%	Prospective cohort Physician who performed the surgery completed a computerized audit sheet 1995-1997 To determine reasons for emergency & ERCD, examine role of anesthesia in these	All public patients who delivered by CD Age and race NR	Private patients
Mould 1996[86] POOR	USA University college hospital CD rate of 18%.	Prospective cohort Clinicians interviewed women 2-3 days after delivery and at 6 week checks 1994 To assess extent to which women contribute to CD decision and their satisfaction	102/104 women who had an emergency CD 26/102 had prior CD Age and race NR	NR
Abitbol 1993[85] POOR	USA VBAC program in NY hospital 62% service patients 38% private	Prospective cohort Clinician and social worker interviewed women before and 2-3 days after delivery 18 month collection, no dates To investigate reasons for TOL or ERCD	Prior CD who met ACOG guidelines Refused NR Age and race NR	Didn't meet ACOG standards 38/364 (10.4%)

VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12b. Patient preferences - poor quality studies (continued)

Author Year Quality	Delivery decisions Reasons or factors for TOL Attempt TOL/Eligible VBAC/TOL	Delivery decisions Reasons or factors for ERCD
Cohort		
Quinlivan 1996[125] POOR	NR	DD:INVALID: 103 & another 47 deliveries partially attributed to mother's request 147 with more than 1 prior CD Reasons: INVALID: Women with more than 1 prior CD advised to have elective repeat.
Mould 1996[86] POOR	DD: INVALID: For next delivery, 44/87 (51%) of women would choose TOL Reasons, numbers NR	DD: INVALID: For next delivery, 43/87 (49%) of women would choose ERCD. Reasons: INVALID: Reasons for current CD: • 9/34 had fetal distress • 4/12 with mal presentation • 11/14 with prior CD/myomectomy • 7/19 failed to progress • 1/5 failed induction • 2/6 pregnancy induced hypertension • 1/1 patient desire.
Abitbol 1993[85] POOR	DD: NR Reasons:INVALID: For all TOL patients: • Main reason, wanted "natural birth" • 49% health of baby • 38% negative feeling toward CD (can't bond, felt failure) • 13% feared major surgery Attempt/Eligible: 187/312 (60%) VBAC/TOL: 122/187 (65%)	DD: 125/312 (40%) Reasons:INVALID: • 71.2% avoidance • 36.8% baby's health • 60.0% mom's work schedule • 20.8% med lay literature • 8.8% mom's health concerns.

VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12b. Patient preferences - poor quality studies (continued)

Author Year Quality	Country Setting	Study Design Intervention Years of Study Research Objective	Population	Exclusion criteria
Joseph 1991[126] POOR	USA Private Hospital in LA	Prospective cohort The patient's and MD's birth choice (and reasons) recorded and updated throughout pregnancy 1989 To determine if resistance from patient or MD prevents greater utilization of a VBAC program	One prior CD All women with one prior CD Age and race NR	• More than one prior CD • Classic scar • Abnormal presentation at term • Multiple gestation • Abnormal antepartum testing • Lumbar disc disease precluding epidural use • Medical complications • Fetal heart rate concerns.
Cross-Sectional				
Dilks 1997[126] POOR	USA Northeast Clinician's offices, childbirth classes, hospital-based clinics that served a tertiary care center	Cross-sectional Convenience sample. Childbirth Self-efficiency Inventory during pregnancy Inferred early to mid 1990s To compare self-efficacy of primigravidas and multigravidas with prior CD	At least 28 weeks gestation 74/225 (32.9%) Mean age: 32.3 yrs (SD 4.4 yrs) Nonwhite: 12/74 (16.2%)	Read and write English

VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 12b. Patient preferences - poor quality studies (continued)

Author Year Quality	Delivery decisions Reasons or factors for TOL Attempt TOL/Eligible VBAC/TOL	Delivery decisions Reasons or factors for ERCD
Joseph 1991[126] POOR	DD, reasons: NR Attempt/Eligible: 85/143 (59.4%) VBAC/TOL: 30/85 (35.2%)	DD: 92/143 (64.3%) Reasons:INVALID: • 28/92 (30.4%) MD advised diminished chance of vaginal delivery • 24/92 (26.1%) patients had fear of labor • 22/92 (23.9%) patients chose for convenience • 12/92 (13.0%) patients eligible but considered "poor candidates" • 6/92 (6.5%) had a fear of recurrent outcome
Cross-Sectional		
Dilks 1997[126] POOR	DD: NR Reasons:INVALID: The group electing for a TOL had similar expectation of the outcomes and similar self-efficacy as the primigravida group Numbers NR	DD: NA Reasons:INVALID: Group electing for a ERCD had lower expectation of the outcomes (p=.011) than the primigravida group.

VBAC=vaginal birth after cesarean; TOL=trial of labor; NR=not reported; ERCD=elective repeat cesarean delivery; DD=delivery decision; CD=cesarean delivery

Evidence Table 13. Legal and legislative factors - good quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I) / Excluded (E)	Study Group
Retrospective Cohort				
Studnicki 1997[132] GOOD	USA FL	1992-1993 Florida law mandates Obstetricianss receive guidelines and hospitals use peer review to enforce. This study is to evaluate outcomes.	(I) Birth at non-federal, acute-care hospital / (E) <30 deliveries paid for by state or state-administered funds	1992 (pre-rule) 1993 (post-rule)
King 1994[115] GOOD	USA NY	1989 Determine effects of hospital characteristics on VBAC rate	(I) Birth in NY hospital to NY resident with prior CD	Hospital paid loss Physician premiums for a $5000 annual increase

VBAC=vaginal birth after cesarean; CD=cesarean delivery; RCD=repeat cesarean delivery; CI=confidence interval

Evidence Table 13. Legal and legislative factors - good quality studies (continued)

Author Year Quality	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Retrospective Cohort				
Studnicki 1997[132] GOOD	22,938	VBAC rate: 1992	26.70%	Stratified by maternal age, insurance payor, race, timing of adoption of law, RCD vs. primary CD
	23,127	1993	30.90%	Of 54 categories with RCD, 12 found significant decreases in RCD (without adjusting for multiple comparisons).
King 1994[115] GOOD		Adjusted odds ratio (CI) with / without NYC	1.01 (0.99, 1.03)/ 0.96 (0.95, 0.98)	Results adjusted for risk and confounders
			0.98 (0.97, 0.99)/ 1.01 (1.00, 1.08)	

VBAC=vaginal birth after cesarean; CD=cesarean delivery; RCD=repeat cesarean delivery; CI=confidence interval

Evidence Table 14a. Guidelines - good or fair quality studies

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject Eligibility: Included (I)/Excluded (E)
Randomized Trial Designs				
Lomas 1991[133] GOOD	Canada	1988-89 Randomized trial of audit/ feedback, opinion leaders, and no intervention to improve clinical outcomes	Society of Obstetricians and Gynecologists of Canada and Ontario Hospital Association (1986)	(I) Women with prior CD (including not more than one and with no vertical uterine scar) in one of participating hospitals/(E) Not eligible for TOL

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14a. Guidelines - good or fair quality studies (continued)

Author Year Quality	Study Group	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Randomized Trial Designs					
Lomas 1991[133] GOOD	Control	8 hospitals (1233 women)	Offered TOL/underwent TOL	51.3%/28.3%	P-values+N3=0.002/0.007
	Audit/ feedback	4 hospitals (524 women)		56.3%/21.4%	Small number of hospitals. No adjustment for potential confounders but no differences in baseline variables reported
	Opinion leader	4 hospitals (739 women)		74.2%/38.2%	
	Control		VBAC rate/ ERCD rate	14.5%/66.8%	P-value=0.003/0.001
	Audit/ feedback			11.8%/69.7%	
	Opinion leader			25.3%/53.7%	
	Control		Dehiscence/ rupture of uterus	" 2/1	
	Audit/ feedback			0/0	
	Opinion leader			" 4/1	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 14a. Guidelines - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject Eligibility: Included (I)/Excluded (E)
Bickell 1996[134] FAIR	US NY	1988 1993 Test effectiveness of joint statewide peer review by specialty society and health department	Unclear: NY State Health Department and State ACOG Chapter collaborated	(I) Hospital with active delivery services/(E) If hospital refused, replacement hospital randomly selected
Retrospective Cohort Design				
Santerre 1996[136] FAIR	US (MA)	1985-93 Assess impact of ACOG guidelines (published 10/88) on VBAC rate	ACOG (1988)	(I) Data in panel of 55 hospitals

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 14a. Guidelines - good or fair quality studies (continued)

Author Year Quality	Study Group	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Bickell 1996[134] FAIR	Reviewed hospitals	45	VBAC rates (SD): 1988/1993	10.1% (1.4%)/24.8% (2.0%)	1988 value, 1993 value. No difference if models adjusted for other factors. Overall CD rate differ in 1988; all other differences not significant.
	Control hospitals	120		12.1% (0.9%)/24.8% (1.1%)	Limited impact on rates. This strategy may not be effective. Small number of hospitals in intervention group but may not matter.
	Reviewed hospitals	45	RCD rate (SD): 1988/1993	10.9% (0.5%)/10.2% (0.5%)	No adjustment of VBAC rates for potential confounding variables evident.
	Control hospitals	120		9.8% (0.3%)/9.2% (0.2%)	
Retrospective Cohort Design					
Santerre 1996[136] FAIR	1985		Unadjusted VBAC rate	6.60%	Regression model predicts about 5.6% "permanent" increase in VBAC rate.
	1986			8.50%	Minimum chi-square regression model used. Adjusted for some risk predictors (low birth weight, race, and payment source).
	1987			9.80%	Nature of panel of hospitals not defined.
	1988			12.60%	Denominator of VBAC rates unclear.
	1989			18.50%	
	1990			20.40%	
	1991			24.20%	
	1992			25.10%	
	1993			25.40%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 14a. Guidelines - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject eligibility: included (I)/excluded (E)
Lomas 1989[135] FAIR	Canada (Ontario)	1982-88 Assess effect of publication of guidelines	Society of Obstetricians and Gynecologists of Canada and Ontario Hospital Association (1986)	(I) All deliveries in hospitals

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 14a. Guidelines - good or fair quality studies (continued)

Author Year Quality	Study group	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Lomas 1989[135] FAIR	6 years before guidelines published		Mean (SD) monthly rate of change of rate of RCD per 100 patients from linear regression model	-0.041 (0.008)	Other variables in regression models not specified so unclear if controlled for confounders. Survey response rate 76% to 98% across samples.
	2 years after guidelines published			-0.113 (0.023)	Survey results not cited as contained self-reported attitudes not quantitative data.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject eligibility: included (I)/excluded (E)
Prospective Cohort Study Designs				
Myers 1988[139] POOR	USA IL	1985-87 Assess impact of program to reduce rates of CD at inner city hospital (established in 1986)	Local: 2nd opinion; dystocia, fetal distress, breech delivery criteria defined; comprehensive peer review	(I) Birth at hospital; no other criteria stated
Porreco 1985[140] POOR	USA CO	1982-83 Assess impact of CD manage-ment phil-osophy	Local: 8 "principles" to guide decision of TOL versus ERCD	(I) Birth at hospital; no other criteria stated

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies (continued)

Author Year Quality	Study group	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Prospective Cohort Study Designs					
Myers 1988[139] POOR	1985	122 prior CDs	ERCD rate/TOL rate (after VBAC)	55%/53%	No adjusting for potential confounders. Single hospital for short time period.
	1986	193		32%/80%	Unclear if true prospective cohort.
	1987	271		14%/70%	
Porreco 1985[140] POOR	OB management (clinic service)	1058 total deliveries	ERCD rate/Total RCD rate/VBAC rate	0.7%/1.4%/84.3%	No adjusting for potential confounders or description of baseline risk factors. Single hospital for short time period.
	Usual care (private service)	2459		5.7%/6.6%/77.6%	Denominators of rates: all births for ERCD rate and total RCD rate; TOL patients for VBAC rate. Unclear if true prospective cohort.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject eligibility: included (I)/excluded (E)
Retrospective Cohort Study Designs				
Myers 1993[137] POOR	USA IL	1985-91 Assess long-term impact of CD guidelines including RCD	Local hospital guidelines (implemented 1986)	(I) All deliveries in data base
Sanchez-Ramos 1990[138] POOR	USA FL	1986-89 Assess impact of new RCD guidelines (implemented in 7/87)	Local hospital guidelines (1987)	(I) All deliveries with prior low transverse or low vertical CD./(E) Patients with other indications for RCD.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies (continued)

Author Year Quality	Study group	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Retrospective Cohort Study Designs					
Myers 1993[137] POOR	1985		ERCD rate/VBAC after TOL rate	55%/53%	No risk adjustment or other potential confounders
Sanchez-Ramos 1990[138] POOR	1986		VBAC rate (among TOL)/RCD rate (among all births)	64.7%/8.0%	Difference 1989 rate - 1986 rate: VBAC rate p-value<0.0001, RCD rate p-value<0.0001
	1987			73.6%/7.4%	No adjustment for baseline risk or other potential confounders
	1988			85%/3.9%	
	1989			82.7%/3.3%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Guideline used	Subject eligibility: included (I)/excluded (E)
Coulter 1995[141] POOR	USA IL	Date NR Survey of TOL guidelines and VBAC rates among physician executives	Various	(I) Member of American College of Physician Executives/(E) Incomplete forms

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 14b. Guidelines - poor quality studies (continued)

Author Year Quality	Study group	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Coulter 1995[141] POOR	159 surveys	64 (41%) returned surveys	VBAC rates: HMO with/without VBAC policy	39%/40%	63% [47%] of HMO's [hospitals] have VBAC policy. 74% [87%] monitor performance. 28% [36%] hold provider accountable.
			VBAC rates: hospital with/without VBAC policy	37%/47%	Among high VBAC organizations (50%+): 66% [60%] VBAC rate
			VBAC rates: HMO with/without confor-mance monitoring	42%/36%	33 HMOs and 21 hospitals
			VBAC rates: hospital with/without conformance monitoring	48%/2%	No adjustment for risk or potential confounders.
			VBAC rates: HMO with/without provider account-ability	46%/39%	Self-reported data with very poor response rate for survey.
			VBAC rates: hospital with/without provider account-ability	59%/30%	
			VBAC rates: HMO with/without removal of incentives for surgery	46%/33%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Prospective Cohort Study Design				
Sinusas 2000[144] POOR	US (CT)	1996 Describe deliveries by family physicians	(I) Family practice MD with OB privileges	
Davis 1994[149] POOR	US (IL)	1987-90 Comparison of obstetrician and nurse-midwife rates of ERCD	(I) Women with low risk pregnancy not at risk of CD/(E) ERCD and indications of high-risk pregnancy	Obstetricians Nurse-midwives
Retrospective Cohort Study Design				
Coco 2000[148] POOR	US (PA)	1986-95 Does change in specialty change rates of CD?	(I) Delivery with Family Health Service (family physician residency)	1986-1989 (attendings all obstetricians) 1992-1995 (attendings all family physicians)
Harrington 1997[152] POOR	US (CA)	1988-92 Evaluate safety and efficacy of nurse-midwife delivery in low-risk patients	(I) Gestational age 36-43 weeks, in active labor, singleton cephalic presentation, estimated fetal weight 2500-4000 grams/(E) Medical complications other than diet-controlled gestational diabetes, records unavailable.	Matched cases (prior CD) and controls (no prior CD).

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Prospective Cohort Study Design				
Sinusas 2000[144] POOR	32 MDs (of 32 eligible), 478 deliveries		VBAC rate	1.7% of all deliveries (8 cases)
Davis 1994 POOR	455		Rate of CD after unsuccessful TOL	23.90%
	20			5%
Retrospective Cohort Study Design				
Coco 2000[148] POOR			RCD rate	8.00%
				2.90%
Harrington 1997 POOR	Harrington 1997[152] POOR	Prior CD	VD rate: uncomplic-ated (spontan-eous VD?)/total (includes operative VD)	91.3%/98.3%
	298	no prior CD		89.6%/99.0%

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
9% of family physicians in CT. No multivariable adjustment.
P-value<0.05
Multivariable model predicted rate of CD not RCD; no risk adjustment.
Odds ratio 0.362 (.250, .524)
P-value<0.001. No risk adjustment across time periods.
One asymptomatic cesarean rupture (0.3%). 84% of prior CD women had successful vaginal delivery.
Oxytocin use 1.2% [12.2%] in women with [without] prior vaginal delivery

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Stone 1996[151]	US (NY)	Describe outcomes for a nurse-midwife service (physicians comanage high risk cases) in a rural setting	(I) Women with prior CD using this service	Prior CD
Deutchman 1995[145] POOR	US (TN)	Compare low-risk pregnancies managed by family practice and OB at teaching hospital	(I) Non-high-risk pregnancy/(E) No prenatal care, twins, various maternal high-risk comorbidities.	Family physicians OB
Hueston 1995[150] POOR	US	Compare obstetrics residence program to family practice residence program pregnancy manage-ment across 5 states	(I) Monthly random sample of hospital deliveries/(E) Women who transferred in labor or who received care from a non-staff provider	Obstetrics supervised Family physician supervised

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Stone 1996[151]			VBAC Rate (1989 and 1994)	68% and 94%
Deutchman 1995[145]	578		Number of VBAC/RCD (rate)	9(1.6%)/14 (2.4%)
POOR	1364			10 (0.7%)/122 (8.9%)
Hueston 1995[150]	2804	Prior CD 14%	Number of RCD	438
POOR	1754	Prior CD 4%		63

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
No risk adjustment. Denominator for VBAC rate was TOL attempted. No adverse events reported.
Very small numbers of women with prior CD. No evidence of adjustment for VBAC rate Outcome assigned to FP or OB who provided prenatal care and labor management not necessarily delivery. Denominator all pregnancies. P-values (for comparisons of rates by provider) <0.001.
No risk adjustment for RCD rate included. No denominator for RCD rate.
14% of OB patients had prior CD but 15.6% had RCD. Practices are very heterogeneous.

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Hueston 1994[154] POOR	US	1990-91 Assess predictors of referral patterns for obstetrics.	(I) Random sample of up to 80 deliveries per month at 1 of 5 hospitals	Women who started care or began delivery with family practice physicians
Berkowitz 1989[153] POOR	US (NY)	1983-85 Evaluate effect of physician character-istics on CD rates	(I) Physicians who delivered at hospital (private patients only)/(E) 2 physicians with same surname and 4 who managed only high risk patients	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Hueston 1994[154] POOR	2568 began care/2648 began delivery	Referred to ObGyn early in care	Proportion with uterine scar	32%
		Not referred to ObGyn early in care		3%
		Referred to ObGyn in labor		10%
		Not referred to ObGyn in labor		2%
Berkowitz 1989[153] POOR	48 physicians		Correlation of age with repeat CD rate	0.18 (p>0.05)
			Repeat CD rate: male physician/ female physician	22.6/15.9 (p=0.46)
			Repeat CD rate: solo practice/group practice	18.1/23.8 (p=0.27)

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
Differences between those referred and those not referred significant (P<0.001) in both early labor and delivery. Independent predictor in multivariable model predicting probability of referral.
No risk adjustment
Small sample size. 37 physicians male and 23 in solo practice.
No risk adjustment (males were both older and more experienced).
Data from logbook (reliability?)

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Case-Control Study Design				
Goldman 1993[143] POOR	Canada (Quebec)	1985-88 Determine factors associated with VBAC	(I) Births in Quebec with prior CD/(E) Medical diagnosis, missing data on attending MD	VBAC RCD

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Case-Control Study Design				
Goldman 1993[143]	635 of 635	MD CD rate: 20-40%	Adjusted odds ratio (95% CI)	OR = 0.48 (0.38, 0.61)
POOR				
	Random sample 2593/12,473	MD CD rate: >40%		OR = 0.25 (0.17, 0.38)
		MD age 35 - 54		OR = 0.86 (0.64, 1.17)
		MD age >54		OR = 0.66 (0.44, 0.97)
		MD at risk patients: 5-10%		OR = 0.67 (0.52, 0.87)
		MD at risk patients: >10%		OR = 0.92 (0.67, 1.24)
		MD gender: male (female reference)		OR = 0.93 (0.67, 1.30)
		MD Specialty: OB (general practice reference)		OR = 0.99 (0.65, 1.48)
		Degree of hospital's neonatal & OB specialization: intermediate		OR = 2.46 (1.81, 3.34)
		Degree of hospital's neonatal & OB specialization: high		OR = 3.32 (2.17, 5.23)

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
Non-significant variables:
MD referral rate, gender, specialty OB, number annual deliveries
Patient's age, location (urban, intermediate, rural)
Hospital OB resource capacity and CD rate
Adjustment included only age and provincial region not baseline risk.
Possible confounder: patient self-selection for CD

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Goldman 1993[143] (continued)				
Goldman 1990[114] POOR	Canada (Quebec)	1985-87 Identify provider characteristics and other predictors of probability of VBAC following prior CD.	(I) Birth recorded in provincial data base/(E) Medical diagnosis (e.g. dystocia or fetal distress) for CD or incomplete data.	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Goldman 1993[143] (continued)		Referral rate: 10%-30%		OR=0.81 (0.64,1.03)
		Referral rate: >30%		OR=0.80 (0.61, 1.06)
		Annual deliveries: 50-150		OR=1.18 (0.79, 1.77)
		Annual deliveries: >150		OR=1.28 (0.83, 1.99)
Goldman 1990 POOR	400 cases and 1600 unmatched controls		Odds ratio (95% CI) for VBAC versus RCD: physician gender (female reference)	1.08 (0.71, 1.64)
			Age 35-54 (<35 reference)	0.83 (0.58, 1.20)
			Age >54 (<35 reference)	0.60 (0.37, 0.97)

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes

No risk adjustment (other than age). Odds ratios from multivariable predictive model.

Number of variables in predictive model suggests multicollinearity may be a problem.

Odds ratio >1 denotes higher probability of VBAC than reference group

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Goldman 1990[114] (continued)				

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Goldman 1990[114] (continued)			Ob/Gyn specialty (general practice reference)	1.32 (0.79, 2.19)
			Annual number of deliveries 50-150 (<50 reference)	0.51 (0.30, 0.89)
			Annual number of deliveries >150 (<50 reference)	0.76 (0.44, 1.31)
			High-risk pregnancies 5-10% (<5% reference)	0.76 (0.55, 1.05)
			High-risk pregnancies >10% (<5% reference)	1.19 (0.84, 1.68)
			Referral rate 10-30% (<10% reference)	0.48 (0.36, 0.64)
			Referral rate >30% (<10% reference)	0.50 (0.36, 0.70)
			CD rate 20-40% (<20% reference)	0.49 (0.36, 0.66)
			CD rate >40% (<20% reference)	0.17 (0.10, 0.27)

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
Control group includes some potentially not eligible for VBAC

Evidence Table 15. Provider characteristics - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Case Series				
Miller 1995[146] POOR	US (PA)	1988-92 Estimate VBAC rate in FP residency program in community hospital	(I) Women with 2 or fewer prior CD/(E) Women with prior classical or low vertical CD, breech, twins with A non-vertex, active genital Herpes	
Hangsleben 1989[155] POOR	US (MN)	1982-1987 5.5 years) Describe VBAC experience over 5 years in midwife service	(I) Women requesting VBAC in nurse-midwife service. (E) 15 women who requested ERCD.	
Surveys				
Barnsley 1990[147] POOR	Canada	NR	(I) Physician a member of Ontario Medical Association Section on Obstetrics and Gynecology	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 15. Provider characteristics - poor quality studies (continue

Author Year Quality	Sample size (enrolled/ complete)	Group	Measure	Estimate
Case Series				
Miller 1995[146] POOR	98 (11 of these excluded)		Repeat CD, Attempt VBAC, VBAC delivery	56%, 57% 77%
Hangsleben 1989[155] POOR	53		VBAC rate	83%
Surveys				
Barnsley 1990[147] POOR	192 returned surveys			

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

ed)

Notes
85% of those who failed TOL had cephalopelvic disproportion. No comparison group
Data on ERCD would have been interesting. Population may be highly selected but details not provided.
30% reported ERCD in <50% of patients but 77% noted TOL in hypothetical case

Evidence Table 16a. Hospital characteristics - good or fair quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: included (I)/excluded (E)	Study group
Retrospective Cohort Study Designs				
Gregory 1999[164] GOOD	USA CA	1991 Compare CD rates in Medicaid patients	(I) Medicaid patients delivering in Los Angeles County/(E) Inconsistent ICD-9 codes (N=2)	Number of hospitals (patients): Private non-teaching hospitals Public hospitals Private teaching hospital HMOs
McMahon 1996[5] GOOD	Canada Nova Scotia	1986-92 Compare outcomes of TOL versus ERCD	(I) Women who gave birth in Nova Scotia hospitals with at least 1 prior CD/(E) Nonvertex presentation, multiple gestation, prior CD with vertical to T-shaped incision, placenta previa, maternal Herpes simplex infection, previous uterine surgery.	Tertiary care Regional Community Tertiary care Regional Community

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Retrospective Cohort Study Designs				
Gregory 1999[164] GOOD	65 (5016)	Unadjusted RCD rate/adjusted RCD rate	85.7%/85.7% (reference group)	Adjusted RCD rates similar to unadjusted rates. All differences with reference group are significant (P<0.001)
	4 (2625)		44.2%/43.0%	Adjustment for maternal and fetal clinical conditions
	4 (883)		43.3%/40.0%	
	5 (84)		60.7%/59.0%	
McMahon 1996[5] GOOD	3,725	TOL rate/adjusted odds ratio (CI)	60.1%/1.0 (reference)	Adjusted for both baseline risk and other confounders. Cohort is population-based.
	1,956		43.1%/0.5 (0.5, 0.6)	
	457		36.3%/0.4 (0.3, 0.5)	
	2,239	Successful TOL rate/adjusted odds ratio (CI)	63.6%/1.0 (reference)	
	844		53.4%/0.7 (0.6, 0.8)	
	166		53.0%/0.7 (0.5, 0.9)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: included (I)/excluded (E)	Study group
King 1994[115] GOOD	USA NY	1989 Determine effects of hospital characteristics on VBAC rate	(I) Birth in NY hospital to NY resident with prior CD	Hospital ownership: voluntary Church Government Level I care Level II care Level III care Teaching hospital
Santerre 1996[136] FAIR	USA MA	1987-91 Assess impact of ACOG guidelines (published 10/88) on VBAC rate	(I) Data in panel of 55 hospitals	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/complete)	Measure	Estimate	Notes
King 1994[115] GOOD	10,636	Unadjusted VBAC rate/adjusted odds ratio (CI)	21.8%/1.0 (reference)	Odds ratio is for VBAC compared to ERCD. The following list results without New York City if CI changes with respect to no association (odds ratio=1.0)
	2,526		23.6%/1.13 (1.01, 1.26)	1.07 (.95, 1.21)
	782		19.7%/0.77 (0.63, 0.94)	
	7,030		18.7%/1.0 (reference)	
	3,754		24.2%/1.30 (1.18, 1.44)	
	3,160		26.6%/1.55 (1.34, 1.81)	
	1,065		25.8%/1.11 (0.99, 1.24)	1.36 (1.21, 1.54) if New York City hospitals excluded
Santerre 1996[136] FAIR				Regression model predicted lower VBAC rate at hospitals with higher proportion of low-birth-weight and Hispanic babies and non-teaching hospitals (VBAC rate average about 24% higher at teaching hospital than non-teaching hospital. Minimum chi-square regression model used. Results from model with supply-side and demand-side factors although models that exclude one of these in favor of the others explain more variability. Volume of births, presence of neonatal ICU, ownership status, and urban location did not predict VBAC rate in model.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: included (I)/excluded (E)	Study group
Case Series				
Raynor 1993[29] FAIR	USA NC	1988-91 Evaluate outcomes of VBAC in small rural practice	(I) 1 or more prior CDs, low transverse or unknown scar cephalic or breech presenta-tion/(E) Other malpresentations, vertical uterine scars	
Walton 1993[157] FAIR	USA (military hospital in Japan)	1988-89 Summarize VBAC experience in rural military hospital	(I) Pregnant women with prior CD/(E) Failure to meet ACOG criteria	Trial of labor
Schimmel 1992[162] FAIR	USA CA	1990 Summarize outcomes for midwife service for low income (Medicaid) women	(I) Women with at least 1 prior CD	
Surveys				
Stafford 1991[170] GOOD	USA CA	1986 Estimate rates of VBAC with adjustment for potential confounders	(I) Delivery by woman with prior CD in non-military hospital	Proprietary Private non-profit Kaiser Permanente with Kaiser payment Kaiser Permanente without Kaiser payment University of California

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/complete)	Measure	Estimate	Notes
Case Series				
Raynor 1993[29] FAIR		TOL rate/VBAC rate	51 of 67 (76%)/31 of 51 (61%)	Rates unadjusted. Small series. 2 uterine scar dehiscences in 67 patients. Level I nursery.
Walton 1993[157] FAIR	62 Women with prior CD	VBAC rate	28 of 32 (88%)	79% of 62 patients agreed to a TOL initially but 14 failed to meet guidelines for TOL. 3 decided to undergo ERCD in late pregnancy. Change of criteria after 10/98 (women with >2 prior CD offered TOL).
Schimmel 1992[162] FAIR	37	VBAC rate	32 of 37 (87%)	Rates unadjusted. Small series. Many Medicaid women refused care by obstetricians.
Surveys				
Stafford 1991[170] GOOD	7,511 Births	VBAC rate/Adjusted odds ratio (CI)	4.9%/1.0 (reference)	
	27,846		8.2%/1.4 (1.2, 1.6)	
	4,506 (includes next row)		/3.9 (3.3, 4.6)	VBAC rate 19.8% across Kaiser
			/2.6 (1.4, 4.6)	
	1,166		29.2%/3.7 (3.0, 4.6)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: included (I)/excluded (E)	Study group
Stafford 1991[170] (continued)				County with indigent payment
				County without indigent payment
				Non-teaching
				Non-medical school-affiliated teaching
				Medical school-affiliated teaching
				Council of Teaching Hospitals member
				Neonatal ICU in hospital
				No neonatal ICU
				Number of annual births < 1000
				1000-1999
				2000-3499
				3500 or more
				Median family income by zip code in $1000: 24.5 or more
				20.8-24.5
				17.5-20.7
				13.0-17.4
				<13.0

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/complete)	Measure	Estimate	Notes
	4396 (includes next row)		/2.5 (2.1, 2.9)	VBAC rate 23.6% across county
			/2.7 (2.1, 3.5)	
	25,935 births		7.1%/1.0 (reference)	
	4,046		9.8%/0.7 (0.6, 0.8)	
	7,807		12.1%/0.9 (0.8, 1.0)	
	7,367		23.3%/1.7 (1.5, 1.9)	
	25,039		14.2%/0.9 (0.8, 1.0)	
	20,386		6.8%/1.0 (reference)	
	7,995		5.4%/1.0 (reference)	
	11,900		7.8%/1.4 (1.4, 1.5)	
	13,833		11.8%/1.8 (1.7, 1.9)	
	11,687		16.6%/2.7 (2.4, 3.0)	
	9,064		10.1%/1.0 (reference)	
	8,620		10.4%/0.8 (0.7, 0.9)	
	9,648		10.4%/0.9 (0.8, 1.0)	
	8,860		10.3%/0.9 (0.8, 1.0)	
	9,233		13.0%/0.9 (0.8, 1.0)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: included (I)/excluded (E)	Study group
Shiono 1987[163] FAIR	USA	1984 Appraisal of obstetrical services at US hospitals	(I) 550 randomly selected hospitals (87% response rate)/(E) 12 hospitals outside of 50 states and DC.	Neonatal ICU in hospital No neonatal ICU OB residency No OB residency <500 annual deliveries 500-999 1000-1999 2000-4999 5000 or more

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16a. Hospital characteristics - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/complete)	Measure	Estimate	Notes
Shiono 1987[163] FAIR	174 hospitals	TOL rate (adjusted for size of delivery service)	12.50%	Results weighted to all US acute care hospitals. Not adjusted for patient level characteristics. Denominators for rates not clearly defined.
	248		6.50%	P-value<0.001 comparing neonatal ICU to none.
	119		14.60%	
	303		6.60%	P-value<0.001 comparing OB residency to none.
	145	TOL rate/TOL Success rate/VBAC rate	1.8%/57.8%/2.4%	VBAC rate is rate of TOL times success rate of TOL. These rates may be adjusted as the definition does not hold with simple multiplication.
	93		8.1%/44%/4.1%	
	84		12.5%/49.1%/9.0%	
	135		22.0%/49.9%/13.1%	
	36		25.4%/62.8%/16.4%	Test for trend significant at p-value<0.0.5.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Retrospective Cohort Study Designs				
Whitsel 2000[158] POOR	USA VT	1997-98 (6 months of 1999 for university hospital) Compare university and community hospitals RCD rate	(I) Pregnancies of 20+ week duration with prior CD	University hospital (level III NICU) 2 community hospitals
Gregory 1999[164] POOR	USA CA	1995 Assess rates of rupture in women with prior CD	(I) History of prior CD	Hospital with low VBAC rate Hospital with high VBAC rate (60%+)
Curtin 1997[167] POOR	USA	1995 Summarize data from 1995 National Hospital Discharge Survey	(I) Pregnancy in non-federal short-stay hospital	Hospital ownership: non-profit State or local government Proprietary Hospital number of beds: <100 100-499 >499

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Retrospective Cohort Study Designs				
Whitsel 2000[158] POOR	4358 deliveries (total deliveries)	Repeat CD rate	5.8% (estimated from graph)	P-value=0.02 across 3 hospitals for RCD overall. University CD rates stratified by 6 risk categories. RCD rate 43.2% in delivery>=36 weeks without medical risks, 54.2% with risks, 56.4% if delivery<36 weeks, 66.7% if multiple gestation, 100% if malpresentation, and 92.6% if not TOL permitted.
	1167deliveries		3.8% (estimated from graph)	Risk-adjusted results for RCD for community hospitals not reported for community hospitals.
Gregory 1999[164] POOR		VBAC rate/rupture rate/relative risk (CI)	55.6%/0.056 %/reference	Unadjusted rates of rupture. Artificial classes of low and high rates of VBAC (derived after exclusions of hospitals with <200 deliveries per year or no women with prior CD)
			65.0%/ 0.088%/1.56 (1.27, 1.92)	
Curtin 1997[167] POOR	29,000 pregnancy discharges in survey	VBAC rate (SE)	38.1 (1.6)	Exact number of women with prior CD not reported.
			30 (5.5)	Total CD not just RCD.
			25.7 (8.2) [based on <60 cases in sample]	
			28.5 (5.2)	
			36.9 (1.9)	
			38.7 (2.8)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Sieck 1997[168] POOR	USA OK	1993-96 Compare VBAC rates in rural and urban hospitals	(I) All deliveries	Rural Urban
Paterson 1991[165] POOR	UK England	1988 Audit of obstetric management of women with prior CD	(I) Prior CD with no other deliveries, singleton cephalic presentation, >36 weeks gestation	
Placek 1988[169] POOR	USA	1980-85 National survey estimates (National Hospital Discharge Survey)	(I) Patients in non-federal general and special short-stay hospitals	Hospital size: <100 beds 100-499 beds >499 beds Hospital ownership: proprietary Government Voluntary

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Sieck 1997[168]	3170 deliveries	TOL rate/VBAC rate/RCD rate	30.1%/60.2% /13.3%	No risk adjustment. No statistical analyses. Not population-based (ignores deliveries at other hospitals.
POOR	13,954 deliveries		46.6%/77.3% /6.5%	Denominators are eligible for VBAC for TOL rate, attempted TOL for VBAC rate, and total deliveries for RCD rate. Eligible for VBAC is estimate based on constant (85%) of successful VBAC and RCD. Method of selection of 4 hospitals not stated (possible selection bias).
Paterson 1991[165]	1059 women, 664 with TOL	Correlation: rate of TOL with rate of VBAC	r = -0.09 (p>0.05)	Descriptive (no comparison) study of correlations at level of hospital unit unadjusted for potential confounders.
POOR		Correlation: rate of VBAC with longer labor allowed	r = 0.51 (p<0.05)	Retrospective cohort study of a regional data base. Maternity unit is sample unit.
		Correlation: rate of VBAC with rate of oxytocin use	r = 0.31 (p>0.05)	
Placek 1988[169]		VBAC rate	4.4% (may lack precision)	No risk adjustment. National data base.
POOR			4.70%	Potential lack of precision is due to small sample size for numerators.
			5.70%	
			4.4% (may lack precision)	
			5.80%	
			4.70%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Case-Control Study Designs				
Goldman 1993[143] POOR	Canada (Quebec)	1985-88 Determine factors associated with VBAC	(I) Births in Quebec with prior CSx/(E) Medical Dx justifying RCD, missing data on MD	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Case-Control Study Designs				
Goldman 1993[143] POOR	635 cases and 2593 controls	Adjusted odds ratio (95% CI): Degree of education of served population: intermediate	0.44 (0.32, 0.59)	Adjusted for patient characteristics (age and provincial region) and provider and hospital characteristics. Does not adjust for clinical variables.
		Degree of education of served population: high	0.92 (0.64, 1.32)	Odds ratio is odds of VBAC compared to RCD.
		OB resource capacity: inter-mediate	0.90 (0.66, 1.22)	
		OB resource capacity: high	1.12 (0.78, 1.61)	
		Hospital CD rate: 15%-20%	1.01 (0.72, 1.40)	
		Hospital CD rate: >20%	0.90 (0.62, 1.31)	
		Degree of hospital's neonatal & obstetrical specialization: intermediate	2.46 (1.81, 3.34)	
		Degree of hospital's neonatal & obstetrical specialization: high	3.32 (2.17, 5.23)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Goldman 1990[114] POOR	Canada (Quebec)	1985-87 Identify hospital characteristics and other predictors of probability of VBAC following prior CD.	(I) Birth recorded in provincial data base/(E) Medical diagnosis (e.g. dystocia or fetal distress) for CD or incomplete data.	
Cross-Sectional Study Designs				
Skelton 1997[159] POOR	USA MO	1992 Explore relationships among quality, cost, and compet-ition	(I) 89 acute care hospitals in MO.	
Case-Series				
Kumar 1996[166] POOR	Australia	1994-96 Evaluate VBAC with early induction in remote-area hospital over almost 2 years	(I) 1 or 2 prior CD, delivery at hospital, willing to attempt TOL/(E) TOL contraindicated (no details)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Goldman 1990[114] POOR	400 cases and 1600 unmatched controls	Odds ratio (95% CI) for VBAC versus RCD: hospital CD rate 16-20% (<16% reference)	1.11 (0.74, 1.66)	No risk adjustment (other than age). Odds ratios from multivariable predictive model.
		Hospital CD rate >20% (<16% reference)	1.08 (0.98, 1.74)	Number of variables in predictive model suggests multicollinearity may be a problem.
		Degree of specialization intermediate (general care reference)	2.65 (1.46, 4.81)	Odds ratio >1 denotes higher probability of VBAC than reference group
		Degree of specialization specialized (general care reference)	3.18 (1.60, 6.28)	Specialization of care is a summary of 7 hospital characteristics
Cross-Sectional Study Designs				
Skelton 1997[159] POOR				Significant correlations of VBAC rate with average distance to 5 closest hospitals (-), total births (+), average charge per CD (+), CD LOS (+), CD rate (-), total normal newborns (+), normal newborn LOS (-), total VD (+), average charge per VD (+), average charge all procedures (+), patient satisfaction (+), expected and observed numbers of neonatal deaths (+), bed size (+), total discharges (+) and total inpatient days (+).
Case-Series				
Kumar 1996[166] POOR	33 women attempted TOL	Induction rate/overall and induced VBAC rates	87.9%/87.9% /89.7%	Very small series. No adverse events. Various reasons induction preferred in this setting (including patient travel time and provider convenience).

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/Excluded (E)	Study Group
Iglesias 1991[161] POOR	Canada (Alberta)	1985-89 Assess VBAC in small rural hospital	(I) Pregnant mother with prior CD eligible for VBAC	1985 1986 1987 1988 1989
Surveys				
Barnsley 1990[147] POOR	Canada	NR	(I) Ontario Medical Association section on obstetrics and gynecology	
Mor-Yosef 1990[160] POOR	Israel	3 months in 1983-84 National survey to assess VBAC	(I) Singleton live delivery with previous CD/(E) Delivery before 26 weeks gestation, fetal malformations, home deliveries, multiple deliveries, >1 prior CD, incomplete data	Medical center General hospital Peripheral hospital

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 16b. Hospital characteristics- poor quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Iglesias 1991[161]	TOL: 2	VBAC rate	100%	Small rural hospital. No risk-adjustment. Very small n.
POOR				
	12		75%	VBAC rate denominator is number attempting TOL
	17		76%	
	15		87%	
	26		81%	
Surveys				
Barnsley 1990[147]	192 returned surveys			Used hypothetical cases. Obstetricians in community hospital more likely to perform ERCD than those in teaching hospital. Obstetricians more likely to perform ERCD if anesthesia availability >15 minutes.
POOR				
Mor-Yosef 1990[160]	354	VBAC rate	58.1%	Collected patient-level data in survey. No risk adjustment. Difference not significant
POOR				
	542		50.9%	
	184		61.9%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 17a. Insurance Factors - good or fair quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Retrospective Cohort Design				
King 1994[115] GOOD	USA NY	1989 Determine effects of hospital characteristics on VBAC rate	(I) Birth in NY hospital to NY resident with prior CD	Private insurance
				HMO
				Self-pay
				Medicaid
Stafford 1991[116] GOOD	USA CA	1986 Estimate rates of VBAC with adjustment for potential confounders	(I) Delivery by woman with prior CD in non-military hospital	Private insurance
				Non-Kaiser HMO
				Medi-Cal (Medicaid) Self-pay
				Kaiser Permanente
				Indigent services in non-county hospital
				Other payers
Stafford 1990[170] GOOD	USA CA	1986 Estimate rates of CD in CA	(I) Non-military hospital delivery in 1986 with prior CD	Private insurance
				Other HMO's
				Medi-Cal
				Kaiser Permanente

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 17a. Insurance Factors - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Retrospective Cohort Design				
King 1994[115]	8,855	VBAC rate/Adjusted odds ratio (CI)	21.6%/1.0 (reference)	Results adjusted for risk and confounders. VBAC denominator is number of births with prior CD
GOOD				
	1,823		25.2/1.15 (1.02, 1.30)	1.03 (0.90, 1.17) without NYC
	616		23.4%/1.19 (0.96, 1.47)	1.28 (1.01, 1.81) without NYC
	2,650		20.7%/1.01 (0.89, 1.15)	No major difference from with NYC
Stafford 1991[116]	18,911	VBAC rate/Adjusted odds ratio (CI)	8.1%/1.0 (reference)	Adjusted for a range of potential confounders
GOOD				
	5,094		8.4%/1.0 (0.8, 1.1)	VBAC rate denominator is women with prior CD
	11,513		9.4%/0.8 (0.8, 0.9)	
	3,370		18.0%/1.7 (1.5, 1.9)	
	4,413		19.9%/NR	With Kaiser payment OR 3.9 (3.3, 4.6); without OR 2.6 (1.4, 4.6)
	666		25.2%/1.9 (1.0, 3.6)	
	1,458		17.0%/1.3 (1.1, 1.5)	
Stafford 1990[170]	18,837	VBAC rate (CI)	8.1% (7.6% 8.6%)	Blue Cross, Blue Shield, others
GOOD				
	5,064		8.3% (7.3%, 9.4%)	Non-Kaiser HMO's
	11,444		9.4% (8.6%, 10.1%)	California Medicaid
	4,385		19.9% (18.3%, 21.5%)	Stratified on three potential confounders and adjusted using logistic regression: similar results but only unadjusted reported.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 17a. Insurance Factors - good or fair quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject eligibility: Included (I)/Excluded (E)	Study Group
Stafford 1990[170] (continued)				Self-pay Indigent Services Other payers
Gregory 1999[164] FAIR	USA CA	1995 Compare outcomes of TOL	(I) Pregnancy of woman with prior CD	Private insurance (excluding all government, HMO, PPO, Blue Cross/ Blue Shield non-HMO non-PPO) versus all other payment sources.
Santerre 1996[136] FAIR	USA MA	1987-91 Assess impact of ACOG guidelines (published 10/88) on VBAC rate	(I) Data in panel of 55 hospitals	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

EvidenceTable 17a. Insurance Factors - good or fair quality studies (continued)

Author Year Quality	Sample size (enrolled/ complete)	Measure	Estimate	Notes
Stafford 1990[170] (continued)	3,353		18.1% (16.3%, 19.9%)	
	660		24.8% (20.4%, 29.3%)	
	1,445		17.1% (10.5%, 19.7%)	
Gregory 1999[164] FAIR		Adjusted odds ratio (CI) for risk of uterine rupture. Model adjusted for age, ethnicity and payment sources	1.09 (0.84, 1.29)	No significant association with binary classification of payer.
Santerre 1996[136] FAIR				Regression model showed no effect of payment methods on VBAC rates. Minimum chi-square regression model used.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/ Excluded (E)	Study Group
Prospective Cohort Designs				
Rageth 1999[60] POOR	Switzerland	1983-96 Evaluate risks of CD following prior CD	(I) Women with prior CD	TOL ERCD
Miller 1992[173] POOR	Australia	1989-90 Assess outcomes in women with prior CD	(I) Women with at least 1 prior CD who delivered in hospital	Private health insurance Public health insurance
Retrospective Cohort Designs				
Wagner 1999[171] POOR	USA	Measure association of insurance type and delivery method	(I) Prior CD, pregnancy >36 weeks, non-emergent/(E) Insurance status unclear	Medicaid/ Indigent Care Other private insurance

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies (continued)

Author Year Quality	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Prospective Cohort Designs				
Rageth 1999[60]	Of 17,613 who had a TOL, 6293 had private insurance	Unadjusted relative risk (95% CI)	0.84 (0.82, 0.87)	P-value< 0.001. No adjustment for baseline risk or other confounders.
POOR				
	Of 11,433 who had a ERCD, 4,862 had private insurance		Reference	
Miller 1992[173]	248	ERCD rate	62.50%	No adjustment for risk or other confounders.
POOR				
	70		54.30%	
Retrospective Cohort Designs				
Wagner 1999[171]	321	TOL rate/VBAC rate (as % of total sample)	64%/62%	Adjusted for other potential confounders. More frequent CD for fetal distress and abruption and less for failure to progress. Higher clinical risk status. Higher rates of unmarried, history of substance abuse, infection, chronic hypertension, smoking and less prenatal care. Lower mean birth rate. 20% more VBAC than TOL in report. Single institution study.
POOR				
	655		50% (P-value<0.0001)/60% (P>0.05)	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/ Excluded (E)	Study Group
Oleske 1998[172] POOR	USA CA,FL	1993 Describe variation in CD rates across 3 insurance types	(I) Singleton births, weight > 500g, in non-federal hospitals with 1 of 3 insurance types	Medicaid managed care (MMC) Medicaid fee-for-service (MFFS) Private managed care (PMC)
Curtin 1997[167] POOR	USA	1995 Summarize data from 1995 National Hospital Discharge Survey	(I) Pregnancy in non-federal short-stay hospital	Expected payment source: Blue Cross/Blue Shield Other private insurance Medicaid Other government sources Self Other
Placek 1988[169] POOR	US	1980-85 Summarize national survey estimates	(I) Pregnancy in non-federal short-stay hospital	Blue Cross Other private insurance Medicaid/other government Self-pay, no charge, other

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies (continued)

Author Year Quality	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Oleske 1998[172]		VBAC rates: CA/FL	27.42/42.29	No adjustment for risk or other confounders
POOR				
			22.67/34.49	Significantly higher than for MFFS in CA and than MFFS and PMC in FL (all p<0.01)
			27.77/28.44	Denominator for VBAC rate unclear.
Curtin 1997[167]				Exact number of women with prior CD not reported.
POOR				
Placek 1988[169]		VBAC rates	4.30%	No risk adjustment.
POOR				
			4.50%	
			5.80%	
			6.90%	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies (continued)

Author Year Quality	Country Setting	Years of study Research objective	Subject Eligibility: Included (I)/ Excluded (E)	Study Group
Cross-Sectional Designs				
Skelton 1997[159] POOR	US (MO)	1992 Explore relationships among quality, cost, and competition	(I) Pregnancy in acute care hospitals in MO.	

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Evidence Table 17b. Insurance factors - poor quality studies (continued)

Author Year Quality	Sample Size (enrolled/ complete)	Measure	Estimate	Notes
Cross-Sectional Designs				
Skelton 1997[159] POOR				Significant positive correlations of VBAC rate with total Medicaid discharges and total with no government assistance.

TOL=trial of labor; VBAC=vaginal birth after cesarean; ERCD=elective repeat cesarean delivery
SD=standard deviation

Acronyms and Abbreviations

A	Augmentation
AHRQ	Agency for Healthcare Research and Quality
AI	Augmentation/Induction
BW	Birthweight
CD	Cesarean Delivery
CI	Confidence Interval
CPD	Cephalopelvic Disporportion
CPDI	Cephalopelvic Disproportion Index
ECV	External Cephalic Version
EFW	Estimated Fetal Weight
EPC	Evidence-based Practice Center
ERCD	Elective Repeat Cesarean Delivery
FHT	Fetal Heart Tracing
FP	Family Medicine
FPI	Fetal Pelvic Index
FTOL	Failed Trial of Labor
FTP	Failure to Process
g	Grams
GA	Gestational Age
hrs	Hours
I	Induction
IUGR	Intrauterine Growth Restriction
LOS	Length of Stay
LTCS	Lower segment Transverse Cesarean Section
MD	Medical Doctor
mos	Months
NA	Not Applicable
NPV	Negative Predictive Value
NS-NR	Non-Significant/ actual p-value not reported
OR	Odds Ratio
OR(a)	Adjusted Odds Ratio
PCD	Previous Cesarean Delivery

PIH	Pregnancy Induced Hypertension
PLTCS	Previous Low Traverse Cesarean Section
PPV	Positive Predictive Value
PROM	Premature Rupture of Membranes
RCT	Randomized Clinical Trial
RR	Relative Risk
SD	Standard Deviation
SL	Spontaneous Labor
TOL	Trial of Labor
UR	Uterine Rupture
VBAC	Vaginal Birth After Cesarean Delivery
VD	Vaginal Delivery
wks	Weeks
XRP	X-ray Pelvimetry
yrs	Years

Appendix A. Project Personnel, Technical Panel, and Peer Reviewers

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Appendix B. Procedures for Suspect or Missing Data

If there was a discrepancy between data in text and tables of the studies we reviewed, we followed the following protocol:

- If the correct data could be derived from other data within the study, we used these data.

- If the data could not be determined from within the study, a search of an 'erratum' in the literature was done to see if updated data were published. If this was determined, the investigator used the updated information and included the study. The investigator noted this in the evidence table of the specific topic.

- If the study data could not be determined using other study data or no 'erratum' information was available, the study was excluded. In summary of subtopics, investigators noted how many and which studies were excluded for this reason.

(In some cases, where no data was available for an entire subtopic, investigators contacted authors to determine correct study data. See individual subtopic methods for details on this procedure.)

Appendix C. Identifying Developed Countries

Our research team decided to include only studies that were conducted in developed countries. We used the definition of "developed country" taken from the CIA World Factbook 2001, Appendix B (Washington, DC: Central Intelligence Agency). According to this source, 35 countries are considered developed countries:

- Andorra
- Australia
- Austria
- Belgium
- Bermuda
- Canada
- Denmark
- Faroe Islands
- Finland
- France
- Germany
- Greece
- Holy See
- Iceland
- Ireland
- Israel
- Italy
- Japan
- Liechtenstein
- Luxembourg
- Malta
- Mexico
- Monaco
- Netherlands
- New Zealand
- Norway
- Portugal
- San Marino
- South Africa
- Spain
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

Appendix D. Search Strategies: All Topics

VBAC Success/Maternal and Infant Outcomes

Spontaneous Labor

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 (trial of labor or trial of labour or trial of scar$).mp.
3 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
4 (vaginal birth or vaginal delivery or uterine rupture).mp.[mp=title, abstract, registry number word, mesh subject heading]
5 exp Labor/
6 2 or 3 or 4 or 5
7 exp cesarean section/ or "cesarean".mp.
8 6 and 7
9 1 or 8
10 limit 9 to human
11 limit 10 to english
12 10 not 11
13 limit 12 to abstracts
14 11 or 13

Elective Repeat Cesarean Section

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 (trial of labor or trial of labour or trial of scar$).mp.
3 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
4 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
5 exp Labor/
6 2 or 3 or 4 or 5
7 exp cesarean section/ or "cesarean".mp.
8 6 and 7
9 1 or 8
10 limit 9 to human
11 limit 10 to english language
12 10 not 11
13 limit 12 to abstracts

14 11 or 13
15 Risk factors/ or "risk factors".mp.
16 exp ethnic groups/ or "ethnic groups".mp.
17 exp demography/ or "demographics".mp.
18 Midwifery/ or "midwife".mp.
19 "NATUROPATH".mp.
20 Family practice/ or "family practice".mp.
21 Health maintenance organizations/ or "hmo".mp.
22 exp prepaid health plans/ or "prepaid health plans".mp.
23 Pregnancy outcome/
24 exp "Outcome assessment (health care)"/
25 Physicians, family/ or "family physician".mp.
26 exp insurance/ or exp insurance, health/
27 Hospitals, rural/ or Rural health/ or Rural health services/ or Rural population/ or "rural".mp.
28 Medical indigency/ or "medical indigency ".mp.
29 Urban health/ or Urban population/ or "metropolitan".mp.
30 exp hospitals, teaching/ or "teaching hospital".mp.
31 Hospitals, community/ or "community hospital".mp.
32 exp hospitals, public/ or "public hospital".mp.
33 exp hospitals, private/ or "private hospital".mp.
34 obstetric factor$.ti.
35 exp infant, low birth weight/ or "low birth weight".mp.
36 Fetal weight/ or "fetal weight".mp.
37 exp pregnancy, multiple/ or "multiple gestation".mp.
38 exp labor presentation/ or "labor presentation".mp.
39 Parity/ or "parity".mp
40 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
41 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39
42 40 or 41
43 14 and 42

Induction and Augmentation

Databases: MEDLINE (1980-April 2002), EMBASE (1980-April 2002), HealthSTAR (1980-April 2002)

1 exp labor, induced/ or "labor induction".mp.
2 (labor and augment$).tw
3 1 or 2
4 limit 3 to human
5 limit 4 to english language
6 4 not 5
7 limit 6 to abstracts
8 5 or 7

Predictors

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 (trial of labor or trial of labour or trial of scar$).mp.
3 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
4 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
5 exp Labor/
6 2 or 3 or 4 or 5
7 exp cesarean section/ or "cesarean".mp.
8 6 and 7
9 1 or 8
10 limit 9 to human
11 limit 10 to english language
12 10 not 11
13 limit 12 to abstracts
14 11 or 13
15 exp risk assessment/ or "risk assessment".mp.
16 exp probability/ or "probability".mp.
17 Predictive value of tests/
18 previous vaginal delivery.mp.
19 Gestational age/ or "gestational age".mp.
20 "SPONTANEOUS LABOR".mp.
21 Birth weight/ or "birth weight".mp.
22 Fetal weight/ or "fetal weight".mp.
23 exp labor presentation/ or Oxytocin/ or "cervical dilation".mp.
24 exp treatment outcome/ or Pregnancy outcome/ or "outcome".mp.
25 Cesarean section, repeat/ or "repeat cesarean".mp.
26 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27 14 and 26

Patient Satisfaction, Health Status, and Patient Preference

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 (trial of labor or trial of labour or trial of scar$).mp.
3 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
4 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
5 exp Labor/
6 exp cesarean section/ or "cesarean".mp.
7 1 or 2 or 3 or 4 or 5 or 6
8 exp health status/ or "health status".mp.
9 exp health status indicators/ or "health status indicators".mp.
10 exp quality of life/ or "quality of life".mp.
11 Patient satisfaction/ or "patient satisfaction".mp.
12 8 or 9 or 10 or 11
13 7 and 12
14 limit 13 to human
15 limit 14 to english language
16 14 not 15
17 limit 16 to abstracts
18 15 or 17
19 exp MALPRACTICE/ or malpractice.mp.
20 exp Jurisprudence/ or litigation.mp.
21 lj.fs.
22 19 or 20 or 21
23 7 and 22
24 limit 23 to (human and english language)
25 18 or 24
26 exp Depression, Postpartum/ or postpartum depression.mp.
27 7 and 26
28 27 not 25
29 limit 28 to (human and english language)
30 25 or 29

Economics/Cost

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 VBAC.mp.
3 1 or 2
4 ec.fs.
5 exp "costs and cost analysis"/
6 exp economics/
7 exp Insurance/
8 4 or 5 or 6 or 7
9 3 and 8
10 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
11 (trial of labor or trial of labour or trial of scar$).mp.
12 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
13 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
14 exp Labor/
15 11 or 12 or 13 or 14
16 exp cesarean section/ or "cesarean".mp.
17 15 and 16
18 10 or 17
19 limit 18 to human
20 limit 19 to english language
21 19 not 20
22 limit 21 to abstracts
23 20 or 22
24 8 and 23

Access

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 VBAC.mp.
3 (trial of labor or trial of labour or trial of scar$).mp.
4 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
5 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, cas registry/ec number word, mesh subject heading]
6 exp Labor/
7 3 or 4 or 5 or 6
8 exp cesarean section/ or "cesarean".mp.
9 7 and 8
10 1 or 2 or 9
11 exp Health Services Accessibility/
12 (access to healthcare or access to health care).mp.
13 exp HOSPITALS, RURAL/ or exp RURAL HEALTH SERVICES/
14 exp HOSPITALS, URBAN/ or exp URBAN HEALTH SERVICES/
15 Physicians, Family/ or family physicians.mp.
16 general practitioners.mp.
17 Midwifery/ or midwives.mp.
18 Length of Stay/
19 exp Clinical Competence/ or clinical competence.mp.
20 exp Utilization Review/
21 19 and 20
22 exp *clinical competence/
23 21 or 22
24 exp Physician's Practice Patterns/ or physician's practice patterns.mp.
25 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
26 11 or 12 or 25
27 10 and 26
28 limit 27 to (human and english language)

Medicaid

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 VBAC.mp.
3 (trial of labor or trial of labour or trial of scar$).mp.
4 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
5 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
6 exp Labor/
7 3 or 4 or 5 or 6
8 exp cesarean section/ or "cesarean".mp.
9 7 and 8
10 1 or 2 or 9
11 exp MEDICAID/ or medicaid.mp.
12 10 and 11
13 limit 12 to (human and english language)

Laws

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 VBAC.mp.
3 (trial of labor or trial of labour or trial of scar$).mp.
4 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
5 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
6 exp Labor/
7 3 or 4 or 5 or 6
8 exp cesarean section/ or "cesarean".mp.
9 7 and 8
10 1 or 2 or 9
11 exp LEGISLATION/ or legislation.mp.
12 lj.fs. or law$1.mp.
13 11 or 12
14 10 and 13

Guidelines

Databases: MEDLINE (1980-April 2002), HealthSTAR (1980-April 2002)

1 Vaginal birth after cesarean/ or "vaginal birth after cesarean".mp.
2 VBAC.mp.
3 (trial of labor or trial of labour or trial of scar$).mp.
4 Delivery/ or Episiotomy/ or Extraction, obstetrical/ or Home childbirth/ or Labor, induced/ or Natural childbirth/ or Version, fetal/
5 (vaginal birth or vaginal delivery or uterine rupture).mp. [mp=title, abstract, registry number word, mesh subject heading]
6 exp Labor/
7 3 or 4 or 5 or 6
8 exp cesarean section/ or "cesarean".mp.
9 7 and 8
10 1 or 2 or 9
11 exp Practice Guidelines/ or practice guidelines.mp.
12 10 and 11
13 limit 12 to english language

Appendix E. Studies Excluded at the Data Abstraction Phase by Topic and Reason

Studies that were initially included and at the data abstraction level were excluded (see Bibliography for full reference.)

Author, Year	Study Design	Reason
VBAC Success/ Maternal & Infant Outcomes		
Abitbol, 1993	Prospective Cohort	All women with history of cesarean / study follow-up or time period ambiguous
Aydemir, 1993		Unable to separate scarred uterus group and CD data by group
Hamilton, 2001	Case-Control	Comparison and control groups not comparable on CD rates
Holland, 1992	Retrospective Cohort	Insufficient description of population/data
Lynch, 1996	Case-Series	Data not presented in an understandable/usable way
Miller, 1994	Retrospective Cohort	Duplicate Data to Leung, 1993
Poma, 2000	Before-After Policy change	Data difficult to understand/abstract due to study design
Rozenberg, 1996	Prospective Cohort	Sensitivity/ specificity data not able to be analyzed
Schneider, 1988	Prospective Cohort	Noncomparable groups, vertical incisions
Predictive Tools and Individual Factors		
Del Valle, 1994	TBA	Incorrect comparison/no TOL group information
Goldman, 1990	Case-control	Incorrect comparison/no TOL group information
King, 1994	Database	Incorrect comparison/no TOL group information
Stafford, 1991	Database	Incorrect comparison/no TOL group information
Wagner, 1999	Retrospective Cohort	Error in data
Induction of Labor		
Grubb, 1996	RCT	Data on risk/benefit of induction in TOL not discernable
Kaplan, 1993	Retrospective Cohort	Data on risk/benefit of induction in TOL not discernable
Learman 1996	Retrospective Cohort	Data on risk/benefit of induction in TOL not discernable
Maslow, 2000	Retrospective Cohort	Data on risk/benefit of induction in TOL not discernable
Peleg, 1999	RCT	Data on risk/benefit of induction in TOL not discernable
Troyer, 1992	Retrospective Cohort	Data on risk/benefit of induction in TOL not discernable
Turner, 1997	Retrospective Cohort	Data on risk/benefit of induction in TOL not discernable

Cost, Healthcare Resources, and Provider Characteristics	
Author, Year	**Reason**
Abitol (1993)	No relevant data
ACOG (1996)	review
ACOG (1997)	No relevant data
Adams (2000)	General population
Afriat (1990)	Review
Ales (1990)	Wrong population
American Health Consultants (1996)	Review
Amini (1994)	General population
Anderson (1985) CMAJ	General population
Anderson (1999)	Wrong population
Anonymous (DS&B, 1998)	National data from insurer; limited cost and number of cases
Balaban (1994)	General population
Barclay (1989)	General population
Barros (1991)	Developing country
Bennetts (1982)	General population
Benson (2001)	No relevant data
Bertollini (1992)	General population
Bique (1999)	Wrong population
Blakemore (1990)	General population
Blegen (1995)	General population; no relevant data
Bonham (1983)	General population
Braveman (1996)	No data
Britton (1998)	General population
Brooten (1994)	General population
Bryan (1990)	Wrong population
Buist (1999)	General population
Burns (1993)	No relevant data
Burns (1994)	No relevant data
Butler (1993)	General population
Carey (1991)	General population
Carpenter (1987)	General population
Caughey (1998)	No relevant data
Cavero (1991)	General population
Chambliss (1992)	No relevant data
Chaska (1988)	General population
Chervenak (1996)	Editorial; no relevant data
Chez (2001)	No relevant data
Chua (1991)	Developing country (Sinagapore) or General population
Clark (1991)	General population
Clarke (1995)	No relevant data
Clarke (1996)	No relevant data
Clemenson (1993)	Review
Coco (1998)	Review
Combs (1992)	Wrong population
Committtee on Obstetric Practice (1996)	No relevant data

Comreid (1996)	Wrong population
Coody (1993)	Wrong population
Coonrod (2000)	General population
Cowan (1994)	No relevant data
Creedy (2000)	General population
Crump (1988)	General population
Curtin (1999)	No relevant data
Daniels (1989)	Review
Davies (1996)	No relevant data
Dawson (1997)	Editorial
de Meeus (1998)	No relevant data
de Regt (1986)	Wrong time
DeJoy (1999)	Letter
Demott (1990)	General population
DeMott (1999)	Letter
Dhall (1987)	Developing country
Dublin (2001)	No relevant data
Duff (1988)	No relevant data
Eakes (1990)	Wrong population
Eakins (1989)	No relevant data
Eddy (1990)	Review
Eidelman (1998)	General population
Eisenberg (1979)	Wrong time
Elliott (1997)	No relevant data
Emerson (2001)	Wrong population
Enthoven (1989)	General population
Evans (1984)	Data pre-1980
Fadda (2001)	Wrong population
Farmer (1996)	Wrong population; no relevant data
Feldman (1985)	Wrong population
Finkler (1982)	Review
Finkler (1991)	General population
Finkler (1993)	General population
Firth (1988)	No relevant data
Flamm (1985) Clin Obst & G, 28, 735	No relevant data
Flamm (1990)	No relevant data
Flamm (1997)	Review; no relevant data
Flanagan (1987)	Wrong population
Fraser (1987)	General population
Frigoletto	Wrong population
Gafni (1997)	Wrong population
Garite (1986)	Wrong population
Gates (1995)	No relevant data
Gifford (1995)	Wrong population
Gillette (1996)	Letter; no relevant data
Glasser (1988)	General
Gleicher (1984) JAMA 3273	General population
Gleicher (1986)	Editorial; no relevant data

Goeree (1995)	Wrong population; no relevant data
Goetzl (2001)	No relevant data
Gold (1987)	General population
Goldfarb (1987)	General population
Goldfarb (1991)	General population
Gonzalves (1993)	Wrong population
Gordon (1999)	Wrong population, no relevant data
Gould (1989)	Wrong population
Grazier (1987)	General population
Green (1995)	Editorial
Gregory (1994)	No relevant data
Gregory (1999)	Wrong population; no relevant data
Greis (1981)	General population
Greulich (1994)	General population
Grullon (1997)	Wrong popultion
Grzybowski (1991)	General population; no relevant data
Guirguis (1991)	Developing country
Hage (1992)	Wrong population
Haire (1991)	General population
Halpern (1999)	Letter
Haney (1999)	General population
Hanley (1996)	No relevant data; VBAC outcomes (N=376)
Haq (1988)	Review
Hart (1996)	Wrong population
Harwood (2001)	Wrong population
Heddleston (1991)	No relevant data
Hemminki (1991)	General population
Henry (1995)	No relevant data
Hibbard (1989)	General population
Hickson (1987)	No relevant data
Hillman (1990)	General population
Hornbrook (1981)	Wrong time
Hourvitz (1996)	Wrong population
Hsiao (1988)	No relevant data
Hueston (1993)	Wrong population
Hueston (1994)	General population
Hueston (1995) J Fam Pract, 40, 345	General population
Hueston (1995A)	General population
Hurst (1984)	General population
Institute of Clinical Systems Investigation (1996)	No relevant data
Janowitz (1982)	Developing country
Janowitz (1984)	Developing country
Jones (1991)	No relevant data
Joseph (1991)	No relevant data
Kaplan (1996)	Wrong population
Kazandian (1996)	No relevant data
Keeler (1993)	Review
Kennedy (1997)	Review

Kennell (1991)	General population
Kilpatrick (1995)	Wrong population
Kirk (1990)	No relevant data
Kizer (1988)	Letter
Kline (1993)	No relevant data
Koska (1989)	General population
Kotagal (1999)	Wrong population
Kozak (1989)	General population
Kramer (1997)	General population; no relevant data
Krieger (1993)	Editorial
Krikke (1989)	Wrong population
Lagrew (1998)	General population
Lavin (1982)	Data pre-1980
Leung (1993)	No relevant data
Leung (1998)	General population
Leyland (1993)	Letter
Lieberman (1998)	No relevant data
Lopez-Zeno (1992)	Wrong population
Lydon-Rochelle (2000)	Wrong population
Magann (1991)	Wrong population
Mansfield (1995)	General population
Mardon (1997)	General population
Marieskind (1989)	Review
Marta (1994)	Review
Martin (1997)	Wrong population (low-segment vertical) or review
Mauldin (1996)	General population
McClain (1990)	No relevant data
McCloskey (1992)	Wrong population
McCord (2001)	Developing country
McIntosh (1984)	General population
McIntosh (1991)	Review
Meehan (1989)	No relevant data ?
Menacker (2001)	No relevant data
Merrill (1999)	General population; no relevant data
Metropolitan Life Insurance Co, (1994)	No relevant data
Miller (1980)	No relevant data
Miller (1989)	Review
Miller (1994) Ob Gyn 255	No relevant data
MMWR 4/23/1993	General population
MMWR 8/16/96	General population
Moore (1986)	Wrong population
Mousa (2000)	Wrong population
Mozurkewich (2000)	No relevant data
Mundle (1996)	General population; no relevant data
Myers (1986)	Wrong population
Myers (1990) SA, NEJM	Letter
Myers (1993)	General population
Naef (1995)	No relevant data

Nesbitt (1991)	Wrong population
Newton (1989)	Wrong time
Norman (1995)	Editorial
Notzon (1990)	No relelvant data
November (2001)	Review
Oberman (1989)	General population
Obst (2001)	General population
Oleske (1991)	General population
Oleske (2000)	No relevant data
Panlilio (1992)	General population
Parrish (1993)	General population
Parrish (1994) JAMA 443	Wrong population
Paul (2000)	Developing country
Pauly (2001)	No relevant data
Petitti (1985)	Review
Petrou (2001)	General population
Phillips (1982)	Wrong time
Placek (1983)	Wrong time
Placek (1988)	General population
Poma (1999)	No relevant data
Porreco (1989)	Editorial
Porreco et al (1989)	Editorial
Pridjian (1991)	General population
Rabinerson (2001)	Letter; no relevant data
Radin (1993)	Wrong population
Regan Report on Nursing Law (1993) v34 No.2	Wrong population
Reid (1989)	General population
Resnick (1987)	General population
Reynolds (1997)	General population
Rhodes (1994)	Wrong population
Roberts (1994)	No relevant data
Roberts (1997)	Meta-analysis; no citations for included articles
Robertson (1990)	General population
Rochat (1988)	General population
Rock (1988)	Wrong population
Rogers (2000)	Wrong population
Rooks (1989)	General population
Rose (1999A and B)	Editorial
Rose (1999A) AFP 474	Editorial
Rosen (1990)	Review
Rosen (1991)	Review
Rubin (1981)	Wrong time
Ruderman (1993)	General population
Rudick (1984)	No relevant data
Sachs (1999)	Editorial; no relevant data
Sachs (1999)	Editorial
Sachs (1999A)	Editorial
Sachs (1999B)	Letter
Sack (1980)	Wrong population

Sakala (1993)	General population
Sanchez-Ramos (1992)	Wrong population
Sanchez-Ramos (1995)	General population
Sandmire (1994)	No relevant data
Sandmire (1996)	No relevant data
Satcher (1999)	Letter
Satin (1991)	General population
Satin (1994)	General population
Schipp (2000)	No relevant data
Schipp (2001)	No relevant data
Schnitker (1999)	Review
Scott (1991)	No relevant data
Scott (1997)	Review
Seminar in Nursing Law	Wrong population
Sennett (1983)	Wrong population
Shy (1980)	Wrong time
Siddiqui (1999)	General population
Sims (1984)	General population
Sirio (1999)	Letter
Skupinski (1996)	Wrong population
Spelliscy (1995)	Wrong population
Stafford (1990) JAMA 683	Review
Stafford (1993)	No relevant data
Stainaker (1997)	No relevant data
Statistical Bulletin (1988)	General population
Statistical Bulletin (1989)	Wrong time
Statistical Bulletin (1992)	General population
Stuart (2001)	General population
Taffel (1983)	General population
Taffel (1987)	No relevant data
Taffel (1991)	General population
Taylor (1997)	Wrong population
Torres (1989)	Wrong population
Tussing (1992)	Wrong population
Udom (1998)	General population; no relevant data
van Amerongen (1989)	No relevant data
Vimercati (2000)	No relevant data
Wall (1995)	Editorial
Wen (1998)	General population
Wennberg (1982)	No relevant data
Whitsel (2000)	No relevant data
Williams (1983) RL, AJPH	Wrong time
Wilner (1981)	Wrong time
Wright (1984)	Wrong time
Yanover	pre 1980
Young (1997)	Editorial
Zahniser (1992)	No relevant data
Zelop (2001)	No relevant data
Zhou (1991)	Developing country (China)

Appendix F. Criteria for Grading in the Internal Validity of Individual Studies

Our team used the criteria listed below to rate studies.* Details on use of these criteria follow. See individual topic method and/or results sections for discussion on those components considered fatal flaws for particular topics.

Randomized Controlled Trials

- Random assignment
- Allocation concealed
- Groups similar at baseline
- Eligibility criteria specified
- Outcome assessors blinded
- Care provider blinded
- Patient unaware of treatment
- Intention-to-treat analysis
- Maintenance of comparable groups
- Reporting of attrition, crossovers, adherence, and contamination
- Differential loss to followup or overall high loss to followup

Cohort Studies

- Comparable groups assembled/ Database representative for study (e.g., comparing women who all would qualify for TOL rather than TOL versus medically indicated repeat cesarean)
- Maintenance of comparable groups
- Clear definition of comparison groups/sufficient description of distribution of prognostic factors
- Measures equal, reliable, valid/ explicit definition of outcomes (objective, consistently applied e.g., uterine rupture)
- Outcome assessment blind to exposure status
- Loss/dropout rate
- Follow-up long enough for outcomes to occur
- Consider/adjust for potential important confounders (obstetric/medical conditions)

*Harris, R.P.Helfand, M.Woolf, S.H.Lohr, K.N.Mulrow, C.D.Teutsch, S.M.Atkins, D. (2001). Current methods of the U.S. Preventive Services Task Force. Am J Prev Med, V20; 21-35.

Undertaking Systematic Reviews of Research Effectiveness: CRD's Guidance for those Carrying Out or Commissioning Reviews. CRD Report Number 4 (2nd ed). NHS Centre for Reviews and Dissemination; York, England. March 2001.

Case-control Studies

- Case definition explicit
- State of the cases reliably assessed and validated
- Accurate ascertainment of cases
- Nonbiased selection of cases/controls *(controls randomly selected)*
- Cases and controls comparable with respect to potential confounding factors
- Procedures applied equally
- Appropriate attention to confounders
- Appropriate statistical analysis used (matched, unmatched, overmatching)

Case Series Studies

- Representative sample selected from a relevant population
- Inclusion criteria explicit
- Individuals entered the survey at a similar point in their disease progression
- Followup long enough for important events to occur
- Outcomes assessed using objective criteria/ blinding used
- If comparison of sub-series, sufficient description of the series and distribution of prognostic factors

The Methods Work Group for the US Preventive Services Task Force (USPSTF) developed a set of criteria by which the quality of individual studies could be evaluated in terms of both internal validity and external validity. The USPSTF accepted the criteria, and the associated definitions of quality categories, that relate to internal validity at its September 1999 quarterly meeting. Details on this criteria and grading study quality has also been documented.*

This document describes the criteria relating to internal validity and the procedures followed to make these judgments.

All topic teams will use initial "filters" to select studies for review that deal most directly with the question at issue and that are applicable to the population at issue. Thus, studies of any design that use outdated technology or that use technology that is not feasible for primary care practice may be filtered out before the abstraction stage, depending on the topic and the decisions of the topic team. The teams will justify such exclusion decisions if there could be reasonable disagreement about this step. The criteria below are meant for those studies that pass this initial filter.

Design-Specific Criteria and Quality Category Definitions

Presented below are a set of minimal criteria for each study design and then a general definition of three categories—good, fair, and poor—based on those criteria. These specifications are not meant to be rigid rules but rather are intended to be general guidelines, and

individual exceptions, when explicitly explained and justified, can be made. In general, a good study is one that meets all criteria well. A fair study is one that does not meet (or it is not clear that it meets) at least one criterion but has no known "fatal flaw." Poor studies have at least one fatal flaw.

Randomized Controlled Trials and Cohort Studies

Criteria:

- Initial assembly of comparable groups
  -for RCTs: adequate randomization, including first concealment and whether potential confounders were distributed equally among groups
  -for cohort studies: consideration of potential confounders with either restriction or measurement for adjustment in the analysis; consideration of inception cohorts
- Maintenance of comparable groups (includes attrition, cross-overs, adherence, contamination)
- Important differential loss to follow-up or overall high loss to follow-up
- Measurements: equal, reliable, and valid (includes masking of outcome assessment)
- Clear definition of interventions
- Important outcomes considered
- Analysis: adjustment for potential confounders for cohort studies, or intention to treat analysis for RCTs.

Definition of ratings based on above criteria:

Good: Meets all criteria: Comparable groups are assembled initially and maintained throughout the study (follow-up at least 80 percent); reliable and valid measurement instruments are used and applied equally to the groups; interventions are spelled out clearly; important outcomes are considered; and appropriate attention to confounders in analysis. In addition, for RCTs, intention to treat analysis is used.

Fair: Studies will be graded fair if any or all of the following problems occur, without the fatal flaws noted in the "poor" category below: Generally comparable groups are assembled initially but some question remains whether some (although not major) differences occurred in follow-up; measurement instruments are acceptable (although not the best) and generally applied equally; some but not all important outcomes are considered; and some but not all potential confounders are accounted for. Intention to treat analysis is done for RCTS.

Poor: Studies will be graded poor if any of the following fatal flaws exists: Groups assembled initially are not close to being comparable or maintained throughout the study; unreliable or invalid measurement instruments are used or not applied at all equally among groups (including not masking outcome assessment); and key confounders are given little or no attention. For RCTs, intention to treat analysis is lacking.

Case-control Studies

Criteria:

- Accurate ascertainment of cases
- Nonbiased selection of cases/controls with exclusion criteria applied equally to both
- Response rate
- Diagnostic testing procedures applied equally to each group
- Measurement of exposure accurate and applied equally to each group
- Appropriate attention to potential confounding variable

Definition of ratings based on criteria above:

Good: Appropriate ascertainment of cases and nonbiased selection of case and control participants; exclusion criteria applied equally to cases and controls; response rate equal to or greater than 80 percent; diagnostic procedures and measurements accurate and applied equally to cases and controls; and appropriate attention to confounding variables.

Fair: Recent, relevant, without major apparent selection or diagnostic work-up bias but with response rate less than 80 percent or attention to some but not all important confounding variables.

Poor: Major selection or diagnostic work-up biases, response rates less than 50 percent, or inattention to confounding variables.

Systematic Reviews

Criteria:

- Comprehensiveness of sources considered/search strategy used
- Standard appraisal of included studies
- Validity of conclusions
- Regency and relevance are especially important for systematic reviews

Definition of ratings from above criteria:

Good: Recent, relevant review with comprehensive sources and search strategies; explicit and relevant selection criteria; standard appraisal of included studies; and valid conclusions.

Fair: Recent, relevant review that is not clearly biased but lacks comprehensive and search strategies.

Poor: Outdates, irrelevant, or biased review without systematic search for studies, explicit selection criteria, or standard appraisal of studies.

Quality Analysis Details: Uterine Rupture

Three studies (Lydon-Rochelle, 2001; Rageth, 1999; Stone, 2000), used ICD-9 codes to measure uterine rupture rates, a method that has been shown to be inaccurate (Anonymous, 2000). Hospital discharge data has important limitations. For example, one state-wide study of ICD-9 codes from hospital discharge data compared the codes for uterine rupture to detailed medical records including surgical reports and discharge summaries in Massachusetts (Anonymous, 2000). In a seven-year period 1,244 suspected uterine ruptures were identified from ICD-9 codes. After detailed record review 480 (39.8 percent) of these were confirmed as true uterine ruptures rather than incidental extension of uterine incision at surgery or uterine windows without disruption. The positive predictive value was 50.7percent for the ICD-9 codes 665.0 (rupture of uterus before the onset of labor) and 665.1 (rupture of uterus during labor or not otherwise specified) and 28.6 percent for code 674.1 (disruption of cesarean wound including dehiscence or disruption of uterine wound). If they had restricted cases of uterine rupture to those identified by codes 665.0 and 665.1, as was done in the two retrospective studies above (Lydon-Rochelle, 2001; Stone, 2000), they would have missed one third of cases classified as having uterine rupture by chart review. Thus, ICD-9 codes are not an accurate means to identify cesarean disruption. Seven of 15 prospective cohort studies were rated poor.

References

Anonymous. Use of hospital discharge data to monitor uterine rupture--Massachusetts, 1990-1997; US Department of Health & Human Services. MMWR - Morbidity & Mortality Weekly Report 2000;49(12):245-8.

Lydon-Rochelle M, Holt VL, Easterling TR, et al. Risk of uterine rupture during labor among women with a prior cesarean delivery. New England Journal of Medicine 2001;345(1):3-8.

Rageth JC, Juzi C, Grossenbacher H. Delivery after previous cesarean: a risk evaluation. Swiss Working Group of Obstetric and Gynecologic Institutions. Obstetrics & Gynecology 1999;93(3):332-7.

Stone C, Halliday J, Lumley J, et al. Vaginal births after Caesarean (VBAC): a population study. Paediatric & Perinatal Epidemiology 2000;14(4):340-8.

Quality Ratings - Vaginal Delivery, Maternal and Infant Outcomes (see Bibliography for full citations)

Author/ Year/ Quality	Random assignment	Allocation concealed	Groups similar at baseline / Maintenance of comparable groups	Eligibility criteria specified	Blinded: Outcome Assessors/ Care Provider/ Patient	Cointerventions/Intention-to-treat analysis	Report of attrition, crossovers, adherence, & contamination	Differential loss to followup or overall high loss to followup	Quality Score
Random Control Trials									
Lelaidier 1994	Yes - randomized in pharmacy, "balanced rand list"	Yes - tablets all the same disp out of pharm	Yes, although diff in rates of postdates, IUGR between Mef and pl unsure if SS	Yes	Yes/Yes/Yes	Yes, f/u with oxytocin, specific details not available although authors looked at dose requirements /	?	NR	FAIR
Rayburn 1999	Yes pharmaceutical company computer generated	Yes	Yes except never looked at parity/NR	Yes	?/No/No	Yes oxytocin - similar between groups/No - non-compliance excluded prior to analysis	Yes oxytocin - similar between groups	No	FAIR
Xenakis 1995	inadequate (days of the week)	no	yes/NR	yes	No/No/No	None/NR	NR	none	POOR
Wing 1998	NR	NR	NR/NR	*yes*	No/No/No	None/NR	NR	none	POOR

Quality Ratings - Vaginal Delivery, Maternal and Infant Outcomes (see Bibliography for full citations)

Population-Based Database									
Author, Year	**Comparable groups assembled/ Database represent-ative for study**	**Main-tenance of com-parable groups**	**Clear definition of comparison groups/ sufficient description of distribution of prognostic factors**	**Measures equal, reliable, valid/ explicit definition of outcomes**	**Outcome assessment blind to exposure status**	**Loss / Drop - out rate**	**Follow-up long enough for outcomes to occur**	**Consider/Adjust for potential important confounders**	**Quality Score**
McMahon 1996	Yes	NA	Yes	Yes	No	NA	Yes	Yes	GOOD
Smith 2002	Uncertain	NA	Uncertain	Yes	No	NA	Yes	Yes	FAIR
Bais 2001	Uncertain	NA	No	Most	No	NA	Yes	No	POOR
Lyndon-Rochelle 2001	Yes	NA	Yes	No	No	NA	Yes	Yes	POOR
Stone 2000	Uncertain	NA	No	No for uterine rupture	No	NA	Yes	No	POOR
Gregory 1999	Uncertain	NA	No	Yes	No	NA	Yes	No	POOR
Rageth 1999	No	NA	No	No	No	NA	Yes	No	POOR
Holt 1997	Uncertain	NA	No	Yes	No	NA	Yes	No	POOR
Beall 1984	Yes	NA	Yes	No	No	NA	Yes	Not adjusted for age, parity, obsteric or medical complications	POOR

Quality Ratings - Vaginal Delivery, Maternal and Infant Outcomes (see Bibliography for full citations)

Prospective Cohort									
Author, Year	**Comparable groups assembled/ Database represent-ative for study**	**Main-tenance of comparable groups**	**Clear definition of comparison groups/ sufficient description of distribution of prognostic factors**	**Measures equal, reliable, valid/ explicit definition of outcomes**	**Outcome assessment blind to exposure status**	**Loss / Drop - out rate**	**Follow-up long enough for outcomes to occur**	**Consider/Adjust for potential important confounders**	**Quality Score**
Duff 1988	Yes	NA	Yes	Yes	No	NA	Yes	Y/N	GOOD
Flamm 1994	Yes	NA	Yes, age, prior #CD, birth weight	Yes	No	NA	Yes	Yes	GOOD
Flamm 1988	Yes	NA	NA	Yes	No	NA	Yes	looked at group specific rates for parity, prior CD reason	GOOD
Flamm 1987	yes	NA	partial, reasons for induction not given	yes	No	NA	Yes	Yes	FAIR
Blanchette 2001	nr	NA	No	yes	No	NA	yes	yes	FAIR
Cowan 1994	NA, no comparison	NA	NA, no comparison	Yes	No	NA	Yes	Y/N	FAIR
Flamm 1990	Yes/No	NA	NA	Yes, defined rupture	No	NA	Yes	uncertain	FAIR
Phelan 1987	Yes	NA	No info for parity, age	Yes	No	NA	Yes	Yes/No	FAIR

Quality Ratings - Vaginal Delivery, Maternal and Infant Outcomes (see Bibliography for full citations)

Paul 1985	Yes	NA	No	Yes	No	NA	Yes	No, scar type, age, parity	FAIR
Martin 1983	Yes	NA	No	Yes except fever	No	NA	Yes	No	FAIR

Quality Ratings: Predictive Tools and Individual Factors

RCT	**Quality Components**								
Study, Year	**Random assignment**	**Allocation concealed**	**Groups similar at baseline / Maintenance of comparable**	**Eligibility criteria specified**	**Blinded: Outcome Assessors/ Care Provider/ Patient**	**Intention-to-treat analysis**	**Report of attrition, crossovers, adherence, & contaminatio**	**Differential loss to followup or overall high loss to followup**	**Quality Score**
Thubisi, 1993	Y	NA	Y/N	Y	N/N/N	Y	NA	NA	GOOD
Fraser, 1997	Y	NA	Y/ Y & N	Y	N/N/N	N	Y	Y/N	FAIR
COHORT	**Quality Components**								
Study, Year	Comparable Groups. Clear inclusion criteria.	Maint. of comparable groups	Clear definition of comparison groups	Measures reliable, valid	Unbiased assessment of data and analysis of results	Loss / Drop - out rate	Follow-up long enough for outcomes to occur	Adjust for potential confounders (obstetric conditions)	Quality Score
Flamm, 97	Y	Y	Y/N	Y	N	NA	Y	Y	GOOD
Jakobi, 93	Y	Y	N	Y	N	NA	Y	Y	FAIR
McNally, 99	Y	Y	N	Y/N	N	NA	Y	Y	FAIR
Stronge, 1996	Y	Y	N	Y/N	N	NA	Y	Y/N	FAIR
Troyer, 92	Y	Y	N	Y/N	N	NA	Y	N	FAIR
Vinueza, 2000	Y	Y	Y	Y/N	N	NA	Y	N	FAIR
Weinstein, 96	Y	Y	N	Y/N	N	NA	Y	Y	FAIR
Zclop, 2001 (A)	Y	Y	Y/N	Y	N	NA	Y	Y	FAIR
Zclop, 2001 (B)	Y	Y	Y/N	Y	N	NA	Y	Y	FAIR
Abitbol, 91	N	NA	N	Y	N	NA	Y	N	POOR
Lao, 87	Y	Y	N	Y/N	N	NA	Y	N	POOR
Morgan, 88	Y	Y	N	Y	N	NA	Y	N	POOR
Thurnau, 91	Y	Y	N	Y	N	NA	Y	N	POOR
Wright, 85	Y	Y	N	Y/N	N	NA	Y	N	POOR

Quality Ratings: Predictive Tools and Individual Factors

Case-Control	Quality Components								
Author, Year	**Case definition explicit**	**State of the cases reliably assessed and validated**	**Accurate ascertainment of cases**	**Cases/ controls: Nonbiased selection & comparable confoundin**	**Procedures applied equally**	**Measurement of exposure accurate and applied equally**	**Appropriate attention to confounders**	**Appropriate statistical analysis used (matched, unmatched, overmatching)**	**Quality Score-Review 1**
Macones, 2001	Y	Y/N	Y	N/N	Y	Y/N	Y	Y	FAIR
Pickhardt, 92	Y	Y/N	Y/N	N/N	Y	Y/N	Y	Y	FAIR
Case-Series	**Quality Components**								
Author, Year	**Representative sample selected from a relevant population**	**Inclusion criteria explicit**	**Individuals entered the survey at a similar point in their disease progression**	**Follow-up long enough for important events to occur**	**Outcomes assessed using objective criteria/ blinding used**	**If sub-series, sufficient description & distribution of prognostic factors**			**Quality Score**
Flamm, 91	Y	Y	Y/N	Y	Y	N			FAIR
de Meeus, 98	Y	Y	Y/N	Y	Y	N			FAIR
Schatcher, 94	Y	Y/N	Y/N	Y	Y	Y			GOOD

Quality Ratings: Decision Making/Patient Preference

RCT	**Quality Components**								
Study, Year	**Random assignment**	**Allocation concealed**	**Groups similar at baseline / Maintenance of comparable groups**	**Eligibility criteria specified**	**Blinded: Outcome Assessors / Care Provider/**	**Intention-to-treat analysis**	**Report of attrition, crossovers, adherence, & con-**	**Differential loss to followup or overall high loss**	**Quality Score**
Fraser, 1997	Yes	Yes	No differences in baseline demographic. Similar proportions of women had previous labors and were requesting tubal	Used validated Birth Experience Rating Scale.	Blocked by hospital and by the women's motivation (either low or high)	Yes, used intent-to-treat	Yes	Lost 140/1275 (11.0%).	Good
COHOR	**Quality Components**								
Study, Year/ Quality/ Design	**Comparable Groups. Clear inclusion criteria.**	**Main-tenance of comparable**	**Clear definition of comparison groups**	**Measures reliable, valid**	**Unbiased assessment of data and analysis**	**Loss / Drop - out rate**	**Follow-up long enough for outcome**	**Adjust for potential confounders (obstetric**	**Quality Score**
Kirk, 1990	Incl/excl criteria NR. At Hospital B: 73% of patients who planned a TOL			NR	Yes	Lost 97/257 (38%)	Yes	NA	Fair: Fair follow-up, validity of measur

Quality Ratings: Decision Making/Patient Preference

Kline, 1993	Clear exclusion criteria. No differences in demographic	Yes	Women requesting elective CD. Women attempting TOL.	Validation unlikely but not reported.	Unclear who asked patients about delivery reasons but biased if patient's	NR	Yes	No confounders or adjustments are presented.	Fair. Unclear who interviewed patients. Potentially

Quality Ratings: Decision Making/Patient Preference

COHOR	Quality Components								
Study, Year/ Quality/ Design	**Comparable Groups. Clear inclusion criteria.**	**Main-tenance of comparable**	**Clear definition of comparison groups**	**Measures reliable, valid**	**Unbiased assessment of data and analysis**	**Loss / Drop - out rate**	**Follow-up long enough for outcome**	**Adjust for potential confounders (obstetric**	**Quality Score**
McClain, 1985; McClain, 1987; McClain, 1990	Yes	Yes	Women who chose TOL and those who chose elective repeat CD.	Unclear if reasons validated.	Yes	NR	Follow-up not reported.	Yes. Adjusted for education when examining ethnicity	Fair. Measures validation not reported
Martin, 1983	Yes			NR	Unclear who interview the women regarding	Accounted for all patients.	Follow-up NR	Accounted conditions (# of prior CDs, epidural	Fair. Measures validation NR.
Meier, 1982	Clear inclusion criteria.	Reported no demographics for groups.		NR	Yes	Lost 14/53 (26.4%) of TOL.	Yes	NA	Fair. Follow-up rate is for subgroup.
Melnikow, 2001	Yes, groups determined by underlying CD			Yes, used ICD-9CM coding.	Yes. Independent chart abstractio	Lost 73/1662 (4.3%)	NA	NR	Fair. No mention of adjustm
Quinlivan, 1996	Not clear of some patients eligible for TOL.	No baseline demographics or risks presented	Women with emergency and elective CD.	Probably clinically valid.	No, the clinician who performed the CD provided the data	NR	NA	NA	Poor.

Quality Ratings: Decision Making/Patient Preference

Cross-section	Quality Components								
Study, Year/ Quality/ Design	**Comparable Groups. Clear inclusion**	**Main-tenance of compara**	**Clear definition of comparison groups**	**Measures reliable, valid**	**Unbiased assessment of data and**	**Loss / Drop - out rate**	**Follow-up long enough for**	**Adjust for potential confounders**	**Quality Score**
Lau, 1996	Clear inclusion criteria			Not clear	Yes	NA	Yes	NA	Good
Murphy, 1989	Yes			Content validity. Pretesting.	Yes	Lost 3/53 (5.7%)	Y	NA. Discussed possible confounde	Good
Joseph, 1991	Clear exclusion criteria.	Unclear.	Presented may groups of patients with crossovers	Yes/No	No.	Accounted for all patients	Yes	Presented only descriptive	Fair.
Gamble, 2001	NR by group. Inclusion/exclusion			Yes. Content validity.	Yes	Lost 3% at recruitment	NA	NA	Fair. No demographics
Fawcett, 1994	NA. Only one group.	Unclear	Unclear	Interrater reliability was 92%.	Yes.	NR	12-48 hours after	NA	Fair. Follow-up rate
Mould, 1996	Clear inclusion criteria. No baseline demographic or risks presented	Cross-sectional study	Women having an ERCD. Women having an emergency CD.	Validation unlikely but not reported. Yes/No	No, patient's clinician interviewed for preference	Lost 15/102 (14.7%)	Yes	No	Poor
Abitbol, 1993	Clear inclusion criteria. No baseline demographics	Unclear.	Women requesting elective CD. Women attempting TOL.	Validation unlikely but not reported.	No	0%?	Yes	No	Poor. Potentially biased results.

Quality Ratings: Decision Making/Patient Preference

Dilks, 1997	Yes			Yes	Unclear	Recruited 74/225. Lost	Yes	NA	Poor. Recruit-ment rate

Quality Ratings- Economic Studies

Author/ year	Perspective Stated	Prog Benef. Described	Intervention Cost incl	Morbidity/SE Costs include	Averted Costs include	Induced Costs include	Costs/Ben counted	Sensitivity Analyses	C/E Ratio Stated	Quality Score
Chung (2001)	Good	Good	Good	Good	Good	Good	Good	Good	Good	GOOD
Grobman (2000)	Good	Good	Good	Good	Good	Good	Good	Good	Fair	**FAIR**
Finkler (1997)	Good	Poor	Good	Good	Good	Fair	NA	Poor	NA	**POOR**
Keeler (1996)	Good	Poor	Fair	Poor	Poor	Poor	NA	Poor	NA	**POOR**
Spellacy (1991)	Poor	Fair	Fair	Poor	Fair	Poor	NA	Poor	NA	**POOR**
Shy (1981)	Poor	Poor	Fair	Poor	Poor	Poor	NA	Poor	NA	**POOR**
Chuang (1999)	None	Fair	Fair	Fair	Poor	Poor	NA	Good	Poor	**POOR**
Clark (2000)	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Poor	NA	**POOR**
Traynor (1998)	Good	Fair	Good	Fair	Poor	Fair	NA	None	NA	**POOR**
Shorten (1998)	Good	Fair	Good	Fair	Fair	Fair	NA	Good	NA	**POOR**
Hadley (1986)	Fair	Good	Fair	Fair	Poor	Fair	NA	Poor	Poor	**POOR**
Flamm (1985)	Poor	Fair	Fair	Poor	Poor	Poor	NA	Poor	Poor	**POOR**
DiMaio (2002)	Poor	Fair	Fair	Fair	Fair	Fair	NA	Poor	Poor	**POOR**

Quality Ratings - Provider Characteristics

RCT									
Study, Year	**Random assign-ment**	**Allocation concealed**	**Groups similar at baseline / Main-tenance of com-parable groups**	**Eligibility criteria specified**	**Blinded: Outcome Assessors/ Care Provider/ Patient**	**Intention-to-treat analysis**	**Report of attrition, cross-overs, etc**	**Loss to follow-up**	**Quality Score**
Guidelines									
Bickell (1996)	Good	NA	Good/NA	Good	NA	Fair	NA	**NA**	FAIR
Lomas (1991)	Good	NA	Good/NA	Good	NA	Good	NA	**NA**	GOOD
CASE CONTROL									
Author, Year	**Case definition explicit**	**State of the cases reliably assessed and validated**	**Accurate as-certainment of cases**	**Non-biased selection of cases/ controls**	**Cases and controls comparable with respect to potential con-founding factors**	**Measure-ment of exposure accurate and applied equally/ Procedures applied equally**	**App attention to con-founders**	**App. Stat Analy**	**Quality Score**
Physician Characteristics									
Goldman (1993)	Good	Fair	Fair	Good	Poor	Fair/NA	Good	Poor	POOR
Goldman (1990)	Good	Good	NA	NA	Good	Fair	Poor	Good	POOR
Hospital Characteristics									
Goldman (1993)	Good	Fair	Fair	Good	Poor	Fair/NA	Good	Poor	Poor
Goldman (1990)	Good	Good	NA	NA	Good	Fair	Poor	Good	POOR

Quality Ratings - Provider Characteristics

Case-Series									
Author, Year	**Re-present-ative sample selected from a relevant pop-ulation**	**Inclusion criteria explicit**	**In-dividuals entered the survey at a similar point in their disease pro-gression**	**Follow-up long enough for important events to occur**	**Outcomes assessed using objective criteria/ blinding used**	**Sufficient description of the series (subseries) and distribution of prognostic factors**	**Other important issues**		**Quality Score**
Health Care Resources									
Iglesias (1991)	Good	Good	NA	NA	Good	NA	Poor (small n)		POOR
Hospital Characteristics									
Iglesias (1991)	Good	Good	NA	NA	Good	NA	Poor (small n)		POOR
Kumar (1996)	Good	Good	NA	NA	Good	NA	Poor (small n)		POOR
Raynor (1993)	Good	Good	NA	NA	Good	NA	Fair (smaller		FAIR
Schlimmel (1992)	Good	Good	NA	NA	Good	NA	Fair (smaller n)		FAIR
Walton (1993)	Good	Good	NA	NA	Good	Good	Fair (smaller		FAIR
Hangs-leben (1989)	Fair	Fair	NA	NA	Good	Fair	Poor (did not report ERCD in sample)		POOR
Cross-Sectional Studies									
Guidelines									
Coulter (1995)	NA	Good	NA	NA	Fair (self report)	Poor	Poor (small n)	Poor	POOR

Author, Year	Com-parable Groups/ Clear inclusion criteria	Main-tenance of com-parable groups	Clear definition of com-parison groups	Measures reliable, valid	Un-biased assess-ment of data	Loss / Drop - out rate	Follow-up long enough for outcomes to occur	Adjust for con-founders	Quality Score
Resources									
Flamm (1994)	Good	NA	Fair	Fair	NA	NA	NA	Poor	POOR
Mor-Yosef (1990)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Phelan (1987)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Placek (1988A)	Poor	NA	Good	Fair	NA	NA	NA	Poor	POOR
Placek (1988B)	Poor	NA	Good	Fair	NA	NA	NA	Poor	POOR
Roberts (1997)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Stovall (1987)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Taffel (1991)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Boucher (1984)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Cowan (1994)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Data Strat & Bench Marks	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Eriksen (1989)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Flamm (1988)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Hadley (1986)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Hanley (1996)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Curtin (1997)	Poor	NA	Fair	Fair	Good	NA	NA	Poor	POOR
Hook (1997)	Fair	NA	Fair	Good	Good	NA	NA	Poor	POOR
anonymous (1998) Data	Poor	NA	Poor	Good	Good	NA	NA	Poor	POOR

Author, Year	Comparable Groups/ Clear inclusion criteria	Main-tenance of com-parable groups	Clear definition of com-parison groups	Measures reliable, valid	Unbiased assess-ment of data	Loss / Drop - out rate	Follow-up long enough for outcomes to occur	Adjust for potential confounders (obstetric conditions)	Quality Score
Insurance Type									
Stafford (1990)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Stafford (1991)	Good	NA	NA	Good	NA	NA	NA	Good	GOOD
King (1994)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Gregory (1999)	Good	NA	Good	Good	NA	NA	NA	Fair	FAIR
Santerre (1996)	Fair	NA	Good	Good	NA	NA	NA	Good	FAIR
Oleske (1998)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Rageth (1999)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Wagner (1999)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Placek (1988A)	Poor	NA	Good	Fair	NA	NA	NA	Poor	POOR
Skelton (1997)	Good	NA	Good	Good	NA	NA	NA	Poor	POOR
Curtin (1997)	Poor	NA	Fair	Fair	Good	NA	NA	Poor	POOR
Miller (1992)	Fair	NA	Fair	Good	Good	NA	NA	Poor	POOR
Physician Charactreristics									
Davis (1994)	Poor	NA	Fair	Good	NA	NA	NA	Poor	POOR
Barnsley (1990)	Poor	NA	Poor	Fair	NA	NA	NA	Poor	POOR
Coco (2000)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Deutchman (1995)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Hueston (1995)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR

Author, Year	Comparable Groups/ Clear inclusion criteria	Main-tenance of com-parable groups	Clear definition of com-parison groups	Measures reliable, valid	Unbiased assess-ment of data	Loss / Drop - out rate	Follow-up long enough for outcomes to occur	Adjust for potential confounders (obstetric conditions)	Quality Score
Miller (1995)	NA	NA	NA	Good	NA	NA	NA	Poor	POOR
Sinusas (2000)	Poor	NA	NA	Good	NA	NA	NA	Poor	POOR
Stone (1996)	NA	NA	NA	Fair	NA	NA	NA	Poor	POOR
Berkowitz (1989)	Poor	NA	Adequate	Good	NA	NA	NA	Poor	POOR
Harrington (1997)	Fair	NA	Good	Good	NA	NA	NA	Poor	POOR
Hueston (1994)	NA	NA	NA	Fair	Good	NA	NA	Poor	POOR
Hospital Characteristics									
Gregory (1999)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Santerre (1996)	Fair	NA	Good	Good	NA	NA	NA	Good	FAIR
McMahon (1996)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
King (1994)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Stafford (1991)	Good	NA	NA	Good	NA	NA	NA	Good	GOOD
Barnsley (1990)	Poor	NA	Poor	Fair	NA	NA	NA	Poor	POOR
Shiono (1987)	Fair	NA	NA	Good	NA	NA	NA	Fair	FAIR
Whitsel (2000)	Good	NA	NA	Good	NA	NA	NA	Poor	POOR
Gregory (1999)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Mor-Yosef (1990)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Skelton (1997)	Good	NA	Good	Good	NA	NA	NA	Poor	POOR
Paterson (1991)	Good	NA	Good	Good	Good	NA	NA	Poor	POOR

Author, Year	Comparable Groups/ Clear inclusion criteria	Main-tenance of com-parable groups	Clear definition of com-parison groups	Measures reliable, valid	Unbiased assess-ment of data	Loss / Drop - out rate	Follow-up long enough for outcomes to occur	Adjust for potential con-founders (obstetric conditions)	Quality Score
Curtin (1997)	Poor	NA	Fair	Fair	Good	NA	NA	Poor	POOR
Sieck (1997)	Poor	NA	Good	Fair	Good	Poor	NA	Poor	POOR
Placek (1988A)	Poor	NA	Good	Fair	NA	NA	NA	Poor	POOR
Legal Factors									
King (1994)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Studnicki (1997)	Good	NA	Good	Good	NA	NA	NA	Good	GOOD
Guidelines									
Santerre (1996)	Fair	NA	Good	Good	NA	NA	NA	Good	FAIR
Lomas (1989)	Fair	NA	Good	Good	NA	NA	NA	Fair	FAIR
Myers (1993)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Sanchez-Ramos (1990)	Poor	NA	Good	Good	NA	NA	NA	Poor	POOR
Myers (1988)	Poor	NA	Adequate	Good	NA	NA	Adequate	Poor	Poor
Porreco (1985)	Poor	NA	Adequate	Good	NA	NA	Adequate	Poor	POOR

Appendix G. Uterine Rupture Terminology Conference: September 5, 2002

Call Participants:

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Purpose of the Uterine Rupture Terminology Conference Call

A conference call was held on September 5, 2002 to discuss terminology for uterine rupture. Specifically, some peer reviewers of the VBAC evidence report were concerned with terminology used in the draft report. If the members of the call could reach consensus on appropriate terminology, the final evidence report would be revised to reflect this consensus, as possible.

Defining Uterine Rupture

The draft evidence report found inconsistencies and ambiguities in terminology used for uterine rupture. Call participants were directed to a table of terminologies used for uterine rupture among several studies in the evidence report. We discussed the challenges in studying the epidemiology of the condition due to these inconsistencies. We also discussed the inability to identify predictors for morbidity due to uterine rupture when they were embedded in the definition of uterine rupture. Motivated by these issues, we presented the terminology used in the draft report to start discussion about more precise terminology.

One alternative terminology proposed was complete rupture, incomplete rupture, or window. Members of the call were pleased with the fact that incomplete and complete would provide a clear anatomic description. The majority felt that there was not a need to distinguish between incomplete rupture and window. There was some concern that these terms did not provide a description for the severity of the condition. Although the severity of the condition is important, indicating the origin or cause of uterine rupture is needed to establish contributing factors. One suggestion was to use the following terms:

Symptomatic Uterine Rupture Not Related to a Cesarean Scar
Symptomatic Uterine Rupture Related to a Cesarean Scar

Asymptomatic Uterine Rupture Not Related to a Cesarean Scar

Through discussion it was suggested that the descriptors, clinically significant or consequential, would be more appropriate than a/symptomatic since they are easier to define. However, questions as to what "clinically significant" meant were raised. Some members of the call considered any uterine rupture as "clinically significant" since the patient would need an unexpected surgical procedure and may have delivered her baby via an unintended route. Also, some mentioned that any uterine rupture could also lead to significant morbidity if left untreated.

It was then suggested that outcomes should not be used to diagnosis/describe a uterine rupture. In order to accurately determine and record the frequency of uterine rupture, it must be kept in simple terms. Several members of the call agreed with this suggestion. There was some agreement on using the following terms:

Incomplete uterine rupture of a cesarean scar - separation that was not completely through all layers of the uterine wall (e.g., serosa intact)

Complete uterine rupture of a cesarean scar - entire thickness of the uterine wall including visceral serosa (with or without expulsion of part or complete extrusion of fetal-placental unit)

Next Steps

The evidence report is constrained by the data provided within the studies. The text was revised to replace cesarean disruption with uterine rupture of a cesarean scar. Because few studies presented data exclusively for complete or incomplete rupture, the authors were not able to present these data specifically in the report. The text has included the table of terminology used among studies (referred to in the call) and a discussion of the difficulties raised by inconsistent terminology to pave the way for future research with explicit outcomes.

Although full consensus was not reached on terminology, the call was the first step in bringing together experts in the field to discuss this issue. Future work can be done to arrive at a consensus and potentially shape the field by uniformity in reporting terminology.