Comparative Effectiveness Review
Number 226

Labor Dystocia

Evidence Summary

Background

Condition and Treatment Strategies

Approximately 80 percent of American women will eventually have at least one child,[1] and the majority of these women will undergo labor. "Labor dystocia"— difficult or obstructed labor[2]—encompasses a variety of concepts, ranging from "abnormally" slow dilation of the cervix or descent of the fetus during active labor[3] to entrapment of the fetal shoulders after delivery of the head ("shoulder dystocia," an obstetric emergency). For the purposes of this systematic review, we assume that "labor dystocia" refers to "abnormal" labor progression during the latent (up to 4-6 cm dilation) or active phases (from 4-6 cm until full dilation) of the first stage of labor, or during the second stage (from complete cervical dilation until delivery of the baby, although, as discussed below, there have been substantial changes in practice since these "traditional" definitions were developed which raise questions about their generalizability to modern populations. We also limit our review to women in spontaneous labor, with definitions varying somewhat between studies but generally including the onset of spontaneous uterine contractions, and explicitly exclude studies of women undergoing induction, or women with premature rupture of membranes at term in the absence of contractions.

Purpose of Review

To review the evidence on the definition of "normal" labor progression and the comparative effectiveness of different strategies for treating labor dystocia in women with otherwise uncomplicated pregnancies. Strategies assessed include amniotomy, supportive care measures, epidural analgesia, frequency of cervical examination, intrauterine pressure catheters, high- versus low-dose oxytocin protocols, electronic fetal monitoring or intermittent auscultation during augmentation with oxytocin, and delayed or Valsalva pushing.

Key Messages

- Use of partograms did not impact important maternal or neonatal outcomes.
- Amniotomy plus oxytocin decreases duration of labor without increasing cesarean delivery rates.
- Emotional support interventions may reduce cesarean deliveries and instrumental deliveries.
- Much of the evidence on different interventions came from studies performed outside the United States. Differences in patient, provider, health system, and other characteristics may affect the applicability of these results to a U.S. setting.

Agency for Healthcare Research and Quality

Prolonged labor may increase the risk for maternal and neonatal infection, fetal distress, neonatal hypoxia, uterine rupture, and postpartum hemorrhage; it may also be a marker for increased risk of maternal pelvic floor and genital trauma during delivery (with a subsequent increased risk for future incontinence and pelvic organ prolapse).[4] Reducing the likelihood of these adverse maternal and neonatal outcomes is the underlying rationale for performing a cesarean delivery for the primary indication of labor dystocia.[3]

However, there is a tradeoff, since cesarean delivery itself increases the risk of maternal hemorrhage, venous thromboembolism, and injury to the bladder and other internal organs, and can affect post-delivery mother–baby interactions.[3,5] Further, having one cesarean delivery increases the likelihood of having subsequent cesarean deliveries.[3] A woman's risk for abnormal placentation (placenta previa or accreta, each of which is associated with significant maternal and neonatal morbidity and mortality) is directly related to the number of prior cesarean deliveries she has had.[6]

Although there is no consensus on the "optimal" cesarean delivery rate (conceptually, the rate that strikes a balance between benefits and harms for both mother and baby that is considered acceptable to most patients), there is general consensus that current rates in the United States are too high,[3,7] although whether the factors driving this rate are amenable to evidence-based solutions has been questioned.[8] There is also growing concern about increases in rates internationally, as reflected by a World Health Organization consensus statement.[9] Strategies to prevent a woman's first, or primary, caesarean delivery may therefore lead to significant improvements in maternal and neonatal outcomes by reducing both the number of primary and repeat cesareans.[3] For this reason, the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine (SMFM) have issued a joint consensus statement aimed at "preventing the first cesarean delivery."[3] with similar efforts instituted by the American College of Nurse Midwives.[10] Since abnormalities of labor progression are the single most common cause of primary cesarean delivery in the United States,[3,11] strategies aimed at reducing cesarean delivery for dystocia may have the largest potential impact on overall cesarean rates.

The effective management of labor dystocia is first dependent on the tool used to diagnose the disorder. In the 1950s, Friedman published his observations on the rate of cervical change among a cohort of women in spontaneous labor[12] and from this constructed labor curves representing the expected rate of cervical change in a population. Deviations from these curves, particularly rates of cervical change slower than expected from the Friedman curve are referred to as protracted or arrest disorders and represent labor dystocia. The Friedman curve has been the primary tool used to diagnose abnormal labor since then, though more recent data from the Consortium on Safe Labor have demonstrated that rates and characteristics of cervical change seen in modern obstetrics are quite different from that represented by the Friedman curve.[13] Identifying what constitutes normal labor is an important initial step in the management of labor dystocia as it first dictates when various treatment options are initiated. Variation between providers about definitions or perceptions of "abnormal" labor length may contribute to variations in rates of diagnosis.

There are a number of strategies that may either facilitate earlier diagnosis of labor, directly or indirectly (e.g., choice of pain management strategies) prevent a diagnosis of labor dystocia, or accelerate labor progress after a diagnosis of dystocia. Strategies addressed in this report include:

- Use of graphs of cervical dilation over time ("partograms") to identify patients with slow labor progress, often with an indicator of when intervention is appropriate.

- Timing of the artificial rupture of the amniotic membranes (amniotomy) during labor.
- Various options for maternal positioning, ambulation, and feeding during labor.
- Use of epidural analgesia, or, alternatively, variations in technique (timing, choice of analgesic agents).
- Variations in monitoring labor progress (such as frequency of cervical examination or use of intrauterine pressure catheters) and fetal well-being (fetal heart rate monitoring).
- Variations in strategies for how oxytocin is used during labor augmentation including timing of augmentation relative to labor progress and variation in dosing regimens.
- Variations in strategies for reducing the length of the second stage of labor (after cervical dilation is complete but before the baby has delivered), including different approaches to maternal pushing.

The overall goal of treating labor dystocia is to optimize delivery outcomes for mother and child, while reducing excess cesarean delivery.

Scope and Key Questions

This systematic review evaluates the comparative effectiveness of different strategies for treating labor dystocia in women with otherwise uncomplicated pregnancies. We also limit our review to women in spontaneous labor and exclude those who are undergoing induced labor. In addition, one potential source of uncertainty in the available evidence may be variability in the definitions for different phases of labor, and what constitutes "normal" labor across studies and likely in practice as well. In order to better understand the impact of this variability on the evidence on specific interventions, we also review the evidence on the definition of "normal" labor progression.

We explicitly excluded studies which included women with other potential indications for cesarean section (e.g., multiple pregnancies, prior cesarean) or other conditions which might affect either the likelihood of diagnosis of dystocia (e.g., use of magnesium sulfate in preeclampsia) or lead to contraindications to some interventions (e.g., HIV and amniotomy). We also did not include interventions such as estimation of fetal size or clinical pelvimetry which might affect physician perception of the risk of labor dystocia.

The specific Key Questions (KQs) addressed in this review are listed below, and Figure A displays the analytic framework that guided our work.

KQ 1: Do delivery outcomes for management of abnormal labor differ based on the criteria used to define protracted or arrested labor at different stages of the labor process?

KQ 2: What are the benefits and harms of amniotomy in women in spontaneous labor?

KQ 3: What are the benefits and harms of supportive care measures, including emotional support, ambulation, nutrition, and hydration, during spontaneous labor?

KQ 4: What are the benefits and harms of epidural analgesia in labor, particularly in terms of the risk of a diagnosis of prolonged labor?

KQ 5: How does the frequency of cervical examination affect the probability of specific benefits and harms?

KQ 6: What are the benefits and harms of intrauterine pressure catheters in the diagnosis and management of labor dystocia?

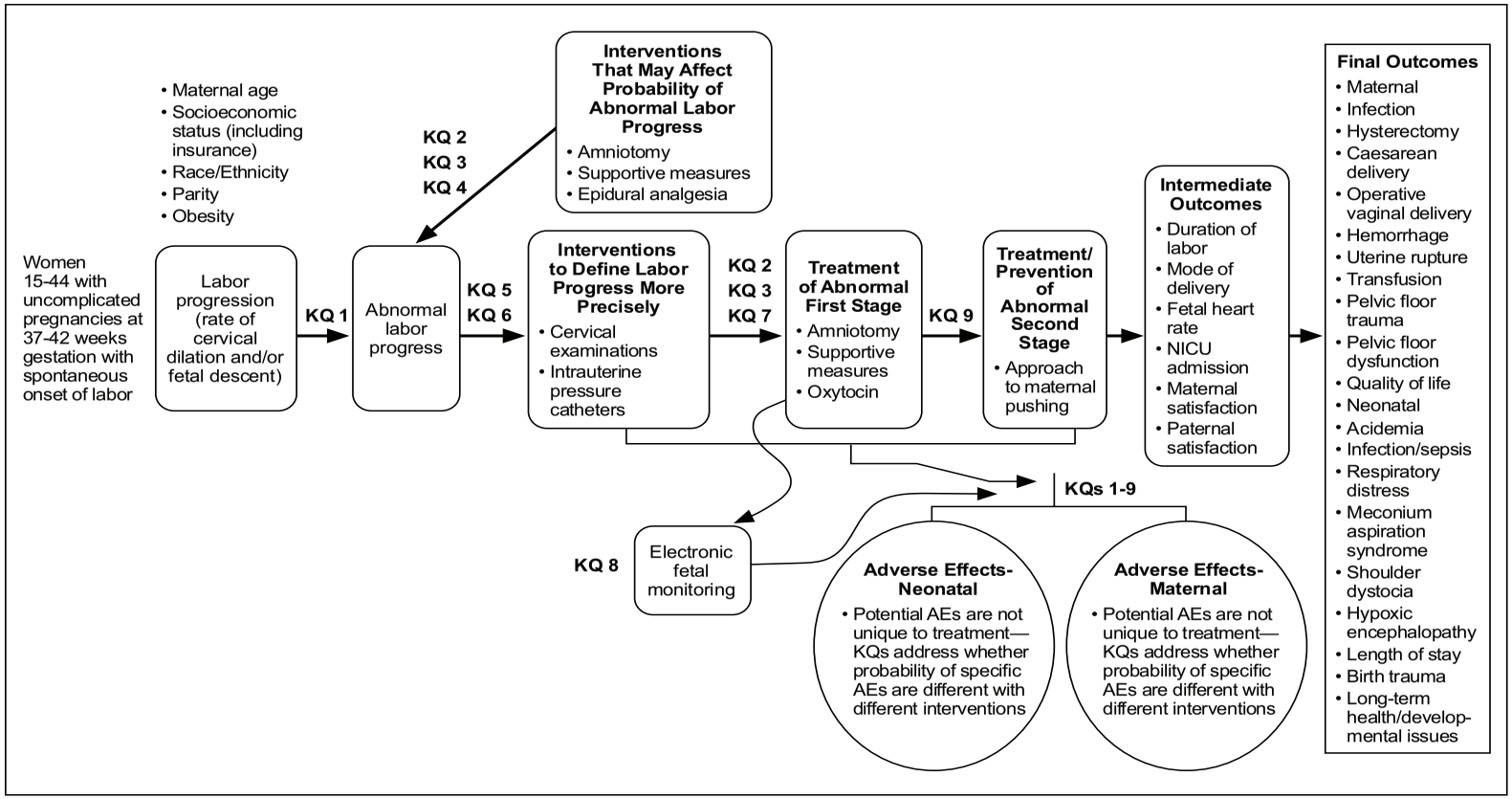
KQ 7: For women with abnormal labor, what are the relative benefits and harms of high- versus low-dose oxytocin protocols (including nipple stimulation)?

KQ 8: For women in spontaneous labor undergoing augmentation with oxytocin, what are the relative benefits and harms

(in terms of both maternal and neonatal outcomes) of electronic fetal monitoring versus intermittent auscultation?

KQ 9: For women in the second stage of labor, is there a benefit from delayed or Valsalva pushing for time to delivery or mode of delivery?

Figure A. Analytic framework



Abbreviations: AEs=adverse effects; KQ=Key Question; NICU=neonatal intensive care unit

Methods

Detailed methods are available in the full report and the posted protocol (https://effectivehealthcare.ahrq.gov/products/labor-dystocia/research-protocol). Our literature search was limited to studies published in English from January 1, 2005, to February 15, 2019, depending on the database. We also completed manual searches of citations from a set of key primary and review articles. Additionally, we attempted to identify relevant grey literature. We graded the strength of evidence for each outcome assessed using the approach described in the Agency for Healthcare Research and Quality (AHRQ) Methods Guide for Effectiveness and Comparative Effectiveness Reviews.[14-16] A more detailed description of our search and our risk of bias and strength of evidence calculations can be found in the full report.

Literature Search Strategy

To identify relevant published literature, we searched PubMed®, Embase®, CINAHL®, and the Cochrane Database of Systematic Reviews (CDSR), limiting the searches to studies published in English from January 1, 2005, to February 15, 2019. These databases were selected based on internal expert opinion that they would identify most of the relevant literature on this topic and that they reflect the databases used in related systematic reviews (SRs), particularly reviews conducted by the Cochrane Pregnancy and Childbirth Group. An experienced search librarian guided all searches. The exact search strings used are given in Appendix A.

We supplemented the electronic searches with a manual search of citations from a set of key primary and review articles. The reference lists for identified key articles were manually searched and cross-referenced against our database, and additional relevant articles not already under consideration were retrieved for screening.

All citations were imported into an electronic bibliographical database (EndNote® Version X7; Thomson Reuters, Philadelphia, PA).

To identify relevant gray literature, the EPC Scientific Resource Center notified stakeholders that the EPC was interested in receiving information relevant to the KQs. We also searched ClinicalTrials.gov for two purposes: (1) to identify relevant articles from completed studies that may not have appeared through other search strategies and (2) as one mechanism to ascertain publication bias in recent studies. For the latter goal, we sought to identify completed but unpublished studies that could impact the findings of the review. We also explored the possibility of publication bias specifically in our quantitative synthesis of the included literature through meta-analysis (MA) techniques such as funnel plots when appropriate. Further gray literature assessment included searching the World Health Organization International Clinical Trials Registry Platform search portal and the National Guidelines Clearinghouse to identify potentially relevant study records; we subsequently searched for relevant articles from among the completed studies.

We specified our inclusion and exclusion criteria based on the PICOTS (populations, interventions, comparators, outcomes, timing, and settings) identified for each question. For citations retrieved from PubMed, Embase, and the Cochrane Database of Systematic Reviews, two reviewers independently screened each title and abstract for potential relevance to the research questions using prespecified inclusion/exclusion criteria. Articles included by either reviewer underwent full-text screening. Articles meeting eligibility criteria at the full-text stage were included for data abstraction. Based on their clinical and methodological expertise, a pair of researchers were assigned to abstract data from each of the eligible articles. One researcher abstracted the data, and the second over-read the article and the accompanying abstraction to check for accuracy

and completeness. Disagreements were resolved by consensus or by obtaining a third reviewer's opinion if consensus could not be reached.

Risk of Bias Assessment of Individual Studies

We assessed methodological quality, or risk of bias, for randomized and nonrandomized individual study designs using a components approach, assessing each study for specific aspects of design or conduct (such as allocation concealment for randomized controlled trials (RCTs), or use of methods to address potential confounding), as detailed in AHRQ's Methods Guide for Effectiveness and Comparative Effectiveness Reviews.[14] Briefly, we rated each study as being of good, fair, or poor quality based on its adherence to well-accepted standard methodologies. For each study, one investigator assigned a summary quality rating, which was then reviewed by a second investigator; disagreements were resolved by consensus or by a third investigator if agreement could not be reached.

Data Synthesis

We began by summarizing key features of the included studies for each KQ. To the degree that data were available, we abstracted information on study design; patient characteristics; clinical settings; interventions; and intermediate, final, and adverse event outcomes.

We then determined the feasibility of completing a quantitative synthesis (i.e., meta-analysis, decision analysis, or simulation model). For a meta-analysis, feasibility depends on the volume of relevant literature (requiring at least three relevant studies), conceptual homogeneity of the studies (similar intervention comparisons and outcome definitions), completeness of the reporting of results, and the adequacy and completeness of any existing meta-analyses (MAs).

Strength of the Body of Evidence

We graded the strength of evidence for each outcome assessed using the approach described in AHRQ's Methods Guide.[14-16] We also discussed the consistency of our findings with recent SRs, along with possible causes for disagreement and impact on strength of evidence ratings, in the results. Newly identified studies are presented separately from the results of existing reviews. Overall strength of evidence findings are based on the primary evidence. Existing SRs were incorporated into the summary strength of evidence (SOE) when available. Only good- and fair-quality SRs were considered, with heavier weighting to findings from good-quality SRs. A summary rating of high, moderate, or low strength of evidence was assigned for each outcome after discussion by two reviewers. When no evidence was available, or when evidence on the outcome was too weak, sparse, or inconsistent to permit any conclusion to be drawn, a grade of "insufficient" was assigned.

Results

We briefly summarize the results of our literature searches, description of included studies, key points, and strength of evidence for each KQ.

Summary of Studies

The literature search yielded 11,746 unique citations. In total, 1,082 full-text articles were retrieved and screened. Of these, 915 were excluded at the full-text screening stage, leaving 167 articles for data abstraction. These 167 articles described 158 unique studies. The relationship of studies to the review questions is as follows: 25 studies relevant to KQ 1, 12 studies relevant to KQ 2, 75 studies relevant to KQ 3, 25 studies relevant to KQ 4, 1 study relevant to KQ 5, 1 study relevant to KQ 6, 17 studies relevant to KQ 7, 1 study relevant to KQ 8, and 7 studies relevant to KQ 9 (some studies were relevant to more than one KQ).

In all tables, criteria for downgrading SOE are described as "Rationale;" when these criteria are insufficient for understanding the final SOE, additional explanation is provided. Abbreviations common to all tables include RCT for randomized controlled trial, SOE for strength of evidence, and SR for systematic review.

Key Question 1. Criteria Used To Define Abnormal Labor

We identified 19 individual studies that examined whether labor outcomes among women in spontaneous labor differed based on the criteria used to define abnormal labor.[17-33] Key findings include:

- No differences were seen in postpartum hemorrhage rates (moderate SOE), neonatal acidemia rates (low SOE), or vaginal delivery rates (moderate SOE) between women managed with varying partogram strategies.
- Maternal satisfaction was also no different between partogram strategies (low SOE).
- Modern labor curves constructed from the Consortium on Safe Labor (CSL) demonstrate significantly different rates of cervical change, duration of labor, and appearance of the curve (absence or presence of an inflection point) between nulliparous and parous women.
- Modern labor curves constructed from the CSL cohort vary significantly from curves constructed from historical cohorts (Friedman or National Collaborative Perinatal Project [NCPP]), with modern curves suggesting a longer duration of the first stage of labor.
- Maternal age influences the duration of the first and second stage of labor among nulliparous women (older women having longer labors).

Table A summarizes the SOE for the use of partograms. In general, the SOE was reduced for outcomes because the evidence was based on findings from non-U.S. settings (and several studies focused on low-resource settings).

Table A. Partogram use: Evidence summary for major outcomes and adverse events

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Operative Vaginal Delivery	1 RCT[24] (1,929) 1 SR[34] (1,813 patients, 3 studies)	**No difference**: No difference in operative vaginal delivery rates between women managed with varying partogram strategies.	Moderate (non-U.S. setting) Findings consistent with SR
	Process Related Outcomes – Parental Preferences	1 RCT[24] (1,929)	**No difference**: An RCT in the UK demonstrated no difference in maternal satisfaction scores between women managed with a two-hour action line partogram compared to women managed with a four-hour action line partogram.	Low (non-U.S. setting, 1 study)
Adverse Events	Maternal Outcomes – Hemorrhage	3 RCTs[24,25,29] (3,700)	**No difference**: No difference postpartum hemorrhage rates among women managed with varying partogram strategies.	Moderate (non-U.S. setting)
	Neonatal Outcomes – Acidemia	1 RCT[24] (1,929)	**No difference**: No difference in neonatal acidemia rates between women managed with varying partogram strategies.	Low (non-U.S. setting, 1 study)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Key Question 2. Amniotomy

We identified nine RCTs that examined the benefits and harms of amniotomy (± oxytocin) in women in spontaneous labor.[35-43] Key findings include:

- Amniotomy decreases the total duration of labor in nulliparous women (moderate SOE) and those with unspecified parity (low SOE).
- There was no difference in the rate of cesarean delivery for early amniotomy versus control in women with unspecified parity (moderate SOE)
- There were no differences in rates of maternal infection, hemorrhage, or trauma to the pelvic floor (moderate SOE) for early amniotomy versus control.
- Routine amniotomy plus oxytocin decreases the duration of labor and has a similar effect in both nulliparous and parous women (high SOE).
- Routine amniotomy plus oxytocin does not differ compared with control treatment in cesarean delivery rates in both nulliparous and parous women (high SOE).

Tables B–F summarize the SOE for amniotomy (± oxytocin) versus control treatment.

Table B. Early amniotomy versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Total Labor	5 RCTs[35-37,40,42] (1,593) 1 SR (379 patients, 4 studies)[44]	**Improvement with early amniotomy**: All trials demonstrated a decrease in the duration of labor in women randomized to early amniotomy.	Moderate (Medium risk of bias, Inconsistent, Indirect) SOE was reduced given inconsistency with existing SR which found no difference in less contemporary RCTs
Adverse Events	Maternal Outcomes - Infection	3 RCTs[36,37,42] (1,593)	**No difference**: Two good quality RCTs and one fair-quality RCT support no increased risk of infection	Moderate (imprecise)
	Maternal Outcomes – Trauma to pelvic floor	3 RCTs[36,37,40] (437)	**No difference**: Three good quality RCTs support no evidence of increased risk of pelvic floor trauma	Moderate (imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table C. Early amniotomy versus control: Evidence summary in women with unspecified parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Total Labor	4 RCTs[36,38,41,43] (912)	**Improvement with early amniotomy**: Three studies suggest shorter duration of total labor with early amniotomy. One study from the middle east did not find a difference.	Low (Indirect, inconsistent)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	4 RCTs[36,38,41,43] (912) 1 SR (874 patients, 3 studies)[44]	**No difference**: There was no difference in the rate of cesarean delivery between women randomized to early amniotomy versus control.	Moderate (Indirect, consistent) Existing SR was consistent with RCT findings
Adverse Events	Maternal Outcomes – Infection	2 RCTs[36,37] (973)	**No difference**: There was no evidence of increased risk of infection associated with early amniotomy versus control.	Moderate (Imprecise)

Table C. Early amniotomy versus control: Evidence summary in women with unspecified parity (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Adverse Events (continued)	Maternal Outcomes – Hemorrhage	2 RCTs[36,37] (973)	**No difference**: There was no evidence of increased risk of maternal hemorrhage associated with early amniotomy.	Moderate (Imprecise)
	Maternal Outcomes – Trauma to Pelvic Floor	3 RCTs[36,37,40] (683)	**No difference**: There was no evidence of increased risk of trauma to the pelvic floor associated with early amniotomy.	Moderate (Medium risk of bias)
	Neonatal Outcomes – Infection	1 RCT[37] (690)	No difference: There was no evidence of increased risk of neonatal infection associated with early amniotomy.	Low (1 study)
	Process Related Outcomes – Mode of Delivery (Operative Vaginal Delivery)	3 RCTs[36,38,40] (611)	No difference: There was no evidence of increased risk of operative vaginal delivery associated with early amniotomy.	Low (Indirect, imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table D. Amniotomy plus oxytocin versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	2 SRs[45,46] (2,431 patients, 4 studies)	**Improvement with amniotomy plus oxytocin**: Amniotomy plus oxytocin decreased the duration of the first stage of labor.	High
	Process Related Outcomes – Duration of 2nd Stage Labor	1 SR[45] (2,737 patients, 5 studies)	**No difference**: There was no difference in the duration of second stage of labor between groups.	Moderate (Imprecise)
	Process Related Outcomes – Duration of Total Labor	2 SRs[45,46] (4,675 patients, 7 studies)	**Improvement with amniotomy plus oxytocin**: The duration of labor was shortened in women randomized to amniotomy plus oxytocin as compared to routine care.	High
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 SRs[45,46] (7,653 patients, 11 studies)	**No difference**: There was no difference in cesarean delivery rates between amniotomy plus oxytocin compared with control.	High

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table E. Amniotomy plus oxytocin versus control: Evidence summary in women with unspecified parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	2 SRs[45,46] (2,431 patients, 4 studies)	**Improvement with amniotomy plus oxytocin**: Amniotomy plus oxytocin decreased the duration of the first stage of labor.	High
	Process Related Outcomes – Duration of 2nd Stage Labor	1 SR[45] (2,737 patients, 5 studies)	**No difference**: There was no difference in the duration of the second stage of labor in the amniotomy plus oxytocin group as compared with control.	Moderate (Imprecise)
	Process Related Outcomes – Duration of Total Labor	2 SRs[45,46] (4,675 patients, 7 studies)	**Improvement with amniotomy plus oxytocin**: Amniotomy plus oxytocin decreased the total duration of labor.	High
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 SRs[45,46] (7,653 patients, 11 studies)	**No difference**: There was no difference in cesarean delivery rates between amniotomy plus oxytocin compared with control.	High
Adverse Events	Maternal Outcomes – Infection	3 RCTs[37] (1,933) 2 SRs[44-46] (3,475 patients, 6 studies)	No difference: There was no difference in risk of infection between groups.	High Findings from existing SR consistent with RCT evidence
	Maternal Outcomes – Hemorrhage	2 SRs[44-46] (2,674 patients, 4 studies)	No difference: No difference in risk of hemorrhage between groups.	High
	Maternal Outcomes – Trauma to the Pelvic Floor	1 RCT[36] (283)	No difference: One RCT examined active management of labor with early amniotomy and oxytocin as compared with routine care, there was no difference in risk of trauma to the pelvic floor between groups.	Low (1 study)
	Process Related Outcomes – Mode of Delivery (Operative Vaginal Delivery	1 SR[44,46] (5,738 patients, 9 studies)	No difference: There was no difference in risk of operative vaginal delivery between groups.	High
	Process Related Outcomes – Parental Preferences	2 SRs[44-46] (2,436 patients, 2 studies)	No difference: No difference between the two groups in scores of maternal/parental satisfaction.	Moderate (Imprecise, varying metrics)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table F. Amniotomy plus oxytocin versus control: Evidence summary in parous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	2 SRs[45,46] (2,431 patients, 4 studies)	**Improvement with amniotomy**: Amniotomy decreased the duration of the first stage of labor compared with control	Moderate (Imprecise)
	Process Related Outcomes – Duration of 2nd Stage Labor	1 SR[45] (2,737 patients, 5 studies)	**No difference**: No difference in the duration of second stage of labor between groups.	Moderate (Imprecise)
	Process Related Outcomes – Duration of Total Labor	2 SRs[45,46] (4,675 patients, 7 studies)	**Improvement with amniotomy plus oxytocin**: Modest decrease in duration of labor in the intervention group as compared with controls.	Moderate (Imprecise)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 SRs[45,46] (7,653 patients, 11 studies)	**No difference**: No difference in the rate of cesarean delivery between groups.	Moderate (Imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Key Question 3. Supportive Care

We identified 64 articles[47-110] representing 61 individual RCTs that examined the benefits and harms of supportive care measures in women during spontaneous labor. Supportive care measures included interventions such as continuous emotional support, perineal massage, water birth, acupuncture, ambulation and positioning strategies.

Key findings include:

- Supportive care measures during labor encompass a wide variety of interventions and within individual categories of interventions, there is considerable heterogeneity in the nature and timing of the interventions.
- Although supportive care therapies are often seen as increasing parental satisfaction with the birthing process, these outcomes were only assessed in five of the included RCTs with sparse evidence. An earlier SR of 11 studies however did find that women receiving continuous emotional support were less likely to rate their birth experience negatively (moderate SOE).
- Two studies addressing continuous emotional support included in the present review did not show a benefit in reducing 1st or 2nd stage labor duration, although prior SR/MAs of 12 studies (including these two studies) indicated a benefit for total labor duration (moderate SOE).

- Emotional support interventions reduced cesarean deliveries (low SOE for doula support, moderate SOE for continuous emotional support) and instrumental deliveries (moderate SOE).
- There was no difference in rates of cesarean deliveries for women receiving perineal compresses or massage (low SOE), but severe perineal trauma was reduced in nulliparous women (low SOE).
- There was no difference in duration of labor in women using water birth (low SOE).
- Women undergoing acupuncture/acupoint nerve stimulator did not experience differences in labor duration or rates of maternal hemorrhage (low SOE for both outcomes).
- Ambulation was associated with shorter duration of labor (low SOE).
- No differences were found in duration of labor (low SOE) or cesarean delivery rates (moderate SOE) for women using differing positioning interventions. Women in kneeling position were more likely than women in sitting position to have reduced trauma to the pelvic floor (low SOE).
- Administration of intravenous fluids compared with oral intake alone demonstrated a reduction in the duration of labor (low SOE), while not increasing cesarean delivery rates (moderate SOE), maternal hemorrhage (low SOE), or operative vaginal delivery rates (moderate SOE).

Table G summarizes the SOE for continuous emotional support versus control in nulliparous women. Strength of evidence for continuous emotional support versus control in women of mixed parity was rated as insufficient for all outcomes.

Table G. Continuous emotional support versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	2 RCTs[79,90] (326)	**No difference**: Good-quality studies of nulliparous women found that continuous emotional support did not reduce duration of 1st stage labor.	Moderate (Indirect)
	Process Related Outcomes – Duration of 2nd Stage Labor	2 RCTs[79,90] (326)	**No difference**: Good-quality studies of nulliparous women found that continuous emotional support did not reduce duration of 2nd stage labor.	Moderate (Indirect)
	Process Related Outcomes – Duration of Total Labor	1 SR[111] (5,366 patients, 12 studies)	**Improvement with continuous emotional support**: Systematic review of 12 studies found shorter total duration of labor	Moderate (Indirect)

Table G. Continuous emotional support versus control: Evidence summary in nulliparous women (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes (continued)	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 RCTs[70,79] (599) Doula support: 1 SR[111,112] (2,008 patients, 5 studies) Continuous emotional support: 1 SR[111] (5,366 patients, 12 studies)	**Improvement with Doula support**: Doula support reduced cesarean deliveries as compared to control therapy. **Improvement with continuous emotional support**: Continuous emotional support lowered risk of cesarean delivery (RR 0.78, 95% CI 0.67 to 0.91) based on SR of 22 studies.	Low – Doula (Indirect) Inconsistency between SRs and included RCTs Moderate – Continuous Emotional Support (Indirect)
	Process Related Outcomes – Mode of Delivery (Instrumental Delivery)	Doula support: 1 SR[111,112] (1,587 patients, 4 studies) Continuous emotional support: 1 SR[111] (14,118 patients, 19 studies)	**Improvement with Doula support**: Doula support reduced risk of instrumental vaginal delivery **Improvement with continuous emotional support**: Continuous emotional support lowered risk of instrumental vaginal delivery based on SR of 19 studies.	Moderate (Indirect)
Adverse Events	Process Related Outcomes – Abnormal Fetal Heat Tracing	1 RCTs[79] (212)	**No difference**: Supportive care was not associated with significant differences in fetal heart tracings.	Low (Indirect, imprecise, 1 study)
	Process Related Outcomes – Parental Preferences	1 SR[111] (11,133 patients, 11 studies)	**Improvement with continuous emotional support**: SR of 11 studies found women receiving continuous emotional support less likely to rate their birth experience negatively	Moderate

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; hr=hours; RCT=randomized controlled trial; RR=relative risk; SOE=strength of evidence; SR=systematic review

Tables H–K summarize the SOE for perineal compresses or massage versus control in nulliparous women and women of mixed parity. In general the SOE was rated as low given evidence from only one study.

Table H. Perineal compresses or massage versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 RCT[87] (717)	**No difference**: No significant differences in the proportion of cesarean deliveries was reported for the massage/compress group.	Low (Indirect, 1 study)
Adverse Events	Maternal Outcomes – Trauma to the Pelvic Floor	1 RCT[87] (717)	**Improvement with massage/compress**: Severe perineal trauma (third- and fourth-degree perineal laceration) was lower incidence for the massage/compress group.	Low (1 study)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table I. Perineal compresses or massage versus control: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	1 RCT[76] (1,211)	**No difference**: Duration of 2nd stage labor was not statistically significantly different between the intervention and usual care groups.	Low (Indirect, 1 study)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 RCT[76] (1,211)	**No difference**: No significant differences in the proportion of cesarean deliveries was reported for the massage/compress group.	Low (Indirect, 1 study)
Adverse Events	Maternal Outcomes – Trauma to the Pelvic Floor	1 RCT[76] (1,211)	**No difference**: No significant differences in perineal trauma were reported between the intervention and control groups.	Low (1 study)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table J. Massage during labor versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Total Labor	2 RCTs[56,57] (123)	**No difference**: Total duration of labor was not significantly different in the massage group compared to usual care.	Low (Indirect, Imprecise)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 RCTs[56,57] (123)	**No difference**: The proportion of cesarean deliveries was not significantly different between the massage group and control group.	Low (Indirect, Imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table K. Water birth versus control: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	1 RCT[68] (106) 1 SR[113] (291 patients, 2 studies)	**No difference**: No difference in duration of 2nd stage labor was reported.	Low (Medium risk of bias, indirect, imprecise) SOE was increased to low given findings from SR which also demonstrated no difference between water birth versus control

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

For the studies which compared acupressure versus control, although findings were consistent between studies, the SOE was rated as insufficient for all outcomes given the small number of patients, the potential risk of bias, and the imprecision of the findings.

Tables L and M summarize the SOE for acupuncture/acupoint nerve stimulator versus control therapy. Other than the outcomes listed below, the SOE was rated as insufficient for all other outcomes given inconsistent findings from studies with variability in interventions.

Table L. Acupuncture/acupoint nerve stimulator versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	4 RCTs[47,66,104,110] (601)	**No difference**: in 2nd stage labor between the acupuncture and control groups was reported.	Low (Medium risk of bias, indirect, Imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table M. Acupuncture/acupoint nerve stimulator versus control: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	2 RCTs[47,66] (350)	No difference: No significant difference in 2nd stage labor between the acupuncture and control groups was reported.	Low (Medium risk of bias, indirect, imprecise)
Adverse Events	Maternal Outcomes – Hemorrhage	1 RCT[53] (253)	No difference: No significant difference in hemorrhage was reported for the intervention group compared to the control.	Low (High risk of bias, imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

The SOE findings for all outcomes comparing aromatherapy and control treatment was rated as insufficient given the potential risk of bias, small study size, and inconsistent findings. The SOE findings for outcomes comparing Anetheum graveolens seeds (dill) and control treatment was rated as insufficient.

Tables N–P summarize the SOE for ambulation or positioning versus control therapy. Overall the SOE was reduced given the potential risk of bias in the included studies.

Table N. Ambulation versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	2 RCTs[77,80] (271)	**Improvement with ambulation**: 1 good-quality[80] and 1 poor-quality study[77] found that ambulation was associated with significantly reduced duration of the first stage and total duration of labor.	Low (Medium risk of bias, indirect, imprecise, inconsistent with SR)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table O. Positioning versus control: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	5 RCTs[65,71,74,86,91] (798)	**No difference**: None of the studies examining use of a birth ball, kneeling, sitting, or semi-sitting laboring positions found statistically significant differences in duration of active labor.	Low (High risk of bias, indirect, imprecise, inconsistent with SR)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	5 RCTs[59,74,96,100,101] (4,546) 1 SR[114] (2,079 patients, 8 studies)	**No difference**: No significant differences were found between the intervention and control groups in mode of delivery.	Moderate (Medium risk of bias, indirect, imprecise, consistent) The SOE was increased given the support of a SR of 11 studies.
Adverse Events	Maternal Outcomes – Trauma to the Pelvic Floor	1 RCT[74] (271)	**Improvement with kneeling**: Women in kneeling position were more likely than women in sitting position to have an intact perineum (51 vs. 37%) and fewer 3rd or 4th degree tears (3 vs. 6%).	Low (Imprecise, one study)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table P. Positioning versus control: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	3 RCTs72,[81,98] (1,287)	Improvement with positioning: Second stage of labor was significantly shorter in women using either a peanut ball or a squatting position.	Low (Medium risk of bias, indirect, Imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table Q summarizes the SOE for nutritional intervention and oral or parenteral hydration intervention in nulliparous women. The SOE was insufficient for outcomes in women of mixed parity.

Table Q. Specific nutritional intervention and oral or parenteral hydration intervention recommendations or limitations: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Total Labor	3 RCTs[55,60,73] (861) 1 SR[115] (1,781 patients, 9 studies)	**Improvement with intravenous fluids**: Administration of intravenous fluids compared with oral intake alone demonstrated a reduction in the duration of labor.	Low (Indirect, inconsistent, imprecise) The SOE was reduced given the inconsistency in the findings of individual trials and with the SR and the variability in hydration strategies.
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	6 RCTs[55,61,64,67,69,73] (1,373)	**No difference**: No significant differences were found between groups of women receiving oral hydration versus high-level intravenous hydration (OR 1.26, 95% CI 0.08 to 18.84).	Moderate (Indirect, Imprecise)
Adverse Events	Maternal Outcomes – Hemorrhage or Infection	2 RCTs[60,69] (539)	**No difference**: No significant differences in rates of maternal hemorrhage or infection were found between groups of women receiving infusions of 5% or 10% dextrose and normal saline.	Low (Imprecise)

Table Q. Specific nutritional intervention and oral or parenteral hydration intervention recommendations or limitations: Evidence summary in nulliparous women (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Adverse Events (continued)	Process Related Outcomes – Mode of Delivery (Operative Vaginal Delivery)	5 RCTs[55,60,67,73] (1,234)	**No difference**: No difference in operative vaginal delivery rates amongst 5 studies using varying methods of hydration.	Moderate (Indirect, Imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; OR=odds ratio; RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Key Question 4. Epidural Analgesia

We identified 26 articles[47,104,110,116-138] representing 22 individual RCTs that examined the benefits and harms of epidural analgesia (EA) in labor. Key findings included:

- For nulliparous women, a meta-analysis showed no significant differences between EA and combined spinal epidural (CSE) in duration of the first stage of labor (low SOE) or duration of the second stage of labor (low SOE). However, total duration of labor (from time of intervention to delivery) was significantly longer for EA relative to CSE (moderate SOE). There were no differences between EA and CSE in rates of cesarean delivery (moderate SOE).
- For women of mixed parity, there was no difference between EA and CSE for total duration of labor (low SOE), or rates of cesarean delivery (moderate SOE).
- For women of mixed parity, there were no differences between EA and patient-controlled intravenous analgesia (PCIA) in duration of labor or rates of cesarean delivery (low SOE for both outcomes).
- For nulliparous women, there was no difference in duration of first or second stage labor or rates of cesarean delivery for early versus late EA (moderate SOE for all outcomes).
- For women of mixed parity, there was no evidence of a difference between EA and no EA for the duration of the first stage of labor or rates of cesarean delivery. There was a slight increase in the duration of the second stage for women with EA (moderate SOE for all outcomes).

Tables R and S summarize the SOE for EA versus CSE. In general, meta-analysis of the included studies resulted in low and moderate SOE for major outcomes of interest.

Table R. Epidural analgesia versus combined spinal epidural: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	5 RCTs[119,123,125,131,136] (1,424)	**No difference**: Meta-analysis showed no significant differences between EA and CSE in duration of the first stage of labor (mean difference [MD] 32.7 minutes; 95% CI -19.3 to 84.7).	Low (Medium risk of bias, indirect, inconsistent, imprecise)
	Process Related Outcomes – Duration of 2nd Stage Labor	5 RCTs[119,123,125,131,136] (1,424)	**No difference**: Meta-analysis showed no significant differences between EA and CSE in duration of the second stage of labor (MD -0.2 minutes; 95% CI -21.9 to 21.6).	Low (Medium risk of bias, indirect, inconsistent, imprecise)
	Process Related Outcomes – Total Duration of Labor	5 RCTs[119,123,125,131,136] (1,424)	**Worsening with EA**: Meta-analysis showed total duration of labor (from time of intervention to delivery) was significantly longer for EA relative to CSE, with an MD of 62.0 minutes (95% CI 7.2 to 116.7).	Moderate (Medium risk of bias, imprecise)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	5 RCTs[119,123,129,131,136] (1,604)	**No difference**: Meta-analysis of the data from 1604 patients in these 5 RCTs showed no statistically significant difference in cesarean delivery rates between EA and CSE (OR 1.1; 95% CI 0.9 to 1.2).	Moderate (Indirect)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; CSE=combined spinal epidural; EA=epidural analgesia; MD=mean difference; OR=odds ratio; RCT=randomized controlled trial; SOE=strength of evidence

Table S. Epidural analgesia versus combined spinal epidural: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Total Duration of Labor	2 RCTs[118,125] (258)	**No difference**: No significant difference between EA and CSE for total duration of labor.	Low (Medium risk of bias, imprecise)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	4 RCTs[118,125,128,130] (374)	**No difference**: Meta-analysis generated an estimate of the odds ratio of cesarean delivery associated with CSE relative to EA of 0.8 (95% CI: 0.5 to 1.3).	Moderate (Medium risk of bias)
Adverse Events	Process Related Outcomes – Abnormal Fetal Heart Tracing	2 RCTs[118,130] (190)	**Improvement with EA**: CSE was associated with a higher proportion of patients with abnormal fetal heart rate tracings than EA in one study and a risk ratio of 2.28 (95% CI: 0.64 to 8.16) for an abnormal fetal heart tracing in another study.	Low (Medium risk of bias, imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; CSE=combined spinal epidural; EA=epidural analgesia; RCT=randomized controlled trial; SOE=strength of evidence

Table T summarizes the SOE for EA versus patient-controlled intravenous analgesia. In general, the SOE was judged insufficient for outcomes given the imprecision of the findings, findings for specific outcomes from just one study, and the non-U.S. settings. Low SOE was reported for duration of labor and cesarean delivery in women with mixed or unspecified parity.

Table T. Epidural analgesia versus patient-controlled intravenous analgesia: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Total Duration of Labor	3 RCTs[47,122,127] (177)	**No difference**: Meta-analysis did not identify differences in duration of labor, with the estimated mean after EA administration minus duration after PCIA being -10.1 minutes (95% CI -134.3 to 114.1).	Low (Medium risk of bias, imprecise, non-U.S. settings)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	3 RCTs[47,122,127] (17)	**No difference**: Meta-analysis generated an estimate of the odds ratio for cesarean delivery of EA relative to PCIA of 1.3 (95% CI 0.3 to 5.6).	Low (Medium risk of bias, imprecise, non-U.S. settings)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; EA=epidural analgesia; PCIA=patient-controlled intravenous analgesia; RCT=randomized controlled trial; SOE=strength of evidence

The SOE findings for EA versus intravascular tramadol in women of mixed parity was rated as insufficient for all outcomes. Table U summarizes the SOE for early versus late epidural analgesia.

The SOE was rated as moderate for all outcomes based on evidence from the SR. The SOE was lowered given that the included studies from the SR spanned 1994 to 2006.

Table U. Early versus late epidural analgesia: Evidence summary in nulliparous women[a]

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 1st Stage Labor	1 SR[139] (1,739 patients, 6 studies)	**No difference**: No differences between early and late EA with an odds ratio of 0.95 (95% CI 0.81 to 1.10).	Moderate
	Process Related Outcomes – Duration of 2nd Stage Labor	1 SR[139] (1,739 patients, 6 studies)	**No difference**: No differences between early and late EA with a weighted mean difference of 0.52 minutes (95% CI -5.03 to 6.06 minutes)	Moderate
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 SR[139] (1,739 patients, 6 studies)	**No difference**: No differences between early and late EA (odds ratio=1.00, 95% CI 0.83 to 1.21)	Moderate

[a] Early epidural was defined as immediate initiation of EA at first request (< 4 cm), and late initiation consisted of delay of EA until the cervix was dilated to at least 4 cm.

[b] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Strength of evidence was rated as insufficient for all outcomes of these comparisons:

- Routine EA versus analgesia on request
- CSE versus nonpharmacologic pain relief
- EA versus intravenous meperidine
- EA versus low-dose infusion EA
- EA acupuncture point nerve stimulation
- EA versus no EA in nulliparous women

Table V summarizes the SOE for outcomes comparing EA versus no EA in women of mixed parity. The SOE was rated as moderate for major outcomes of labor duration and cesarean delivery based on the findings from a large SR.

Table V. Epidural analgesia versus no epidural analgesia: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – 1st Stage of Labor	1 RCT[47] (120) 1 SR[140] (2,981 patients, 11 studies)	**No difference**: No evidence of a significant difference between EA and no EA (MD 18.51 minutes, 95% CI -12.91 to 49.42).	Moderate Consistent with SR findings.
	Process Related Outcomes – 2nd Stage of Labor	1 RCT[47] (120) 1 SR[140] (4,233 patients, 13 studies)	**Worsening with EA**: Women with epidural analgesia had a statistically significant longer second stage of labor (average MD 13.66 minutes, 95% CI 6.67 to 20.66).	Moderate Consistent with SR findings.
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 RCT[47] (120) 1 SR[140] (8,417 patients, 27 studies)	**No difference**: No evidence of a significant difference in the risk of caesarean section overall (RR 1.10, 95% CI 0.97 to 1.25).	Moderate Consistent with SR findings.

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; EA=epidural analgesia; MD=mean difference: RCT=randomized controlled trial; RR=relative risk; SOE=strength of evidence; SR=systematic review

Key Question 5. Frequency of Cervical Examination

We identified no RCTs and only one good-quality SR[141] that met the inclusion criteria for this KQ. The focus of the SR was to compare different methods of assessing labor progression through the use of vaginal examinations. The objective was to compare digital vaginal examinations for assessing progress of labor to other strategies or different timings. There was insufficient SOE for all outcomes regarding the frequency of cervical examination.

Key Question 6. Intrauterine Pressure Catheters

We did not identify any RCTs that met the inclusion criteria for this KQ. One good-quality SR addressed the benefits and harms of intrauterine pressure catheters in the diagnosis and management of labor dystocia.[142] There were no statistically significant differences between intrauterine pressure catheters and external uterine monitoring for the outcomes of mode of delivery, mean time to delivery, neonatal acidemia, or admission to the neonatal intensive care unit (moderate SOE for all outcomes).

Table W summarizes the SOE for intrauterine pressure catheters versus external monitoring. The SOE was rated as moderate for all outcomes assessed given consistent findings from good-quality RCTs included in the SR.

Table W. Intrauterine pressure catheters versus external monitoring: Evidence summary in women of unspecified parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Total Labor	1 SR[142] (1,456 patients, 2 studies)	**No difference**: No differences in mean time to delivery with intrauterine pressure catheters compared to external monitoring	Moderate (Indirect)
	Process Related Outcomes – Mode of Delivery	1 SR[142] (750 patients, 2 studies)	**No difference**: Comparing intrauterine pressure catheters to external monitoring, there was no difference in delivery by operative vaginal delivery (RR 1.25, 95% CI 0.91 to 1.73) or by cesarean deliver (RR 1.25, 95% CI 0.91 to 1.71).	Moderate (Indirect)
Adverse Events	Maternal Outcomes – Infection	1 SR[142] (1,456 patients, 2 studies)	**No difference**: No differences in signs of infection in labor in women with intrauterine pressure catheters compared to external monitoring (RR 0.69, 95% CI 0.44 to 1.08).	Moderate (Indirect)
	Neonatal Outcomes – Acidemia	1 SR[142] (1,456 patients, 2 studies)	**No difference**: No differences in neonatal acidemia (pH<7.15) in infants of women with intrauterine pressure catheters compared to external monitoring (RR 1.31, 95% CI 0.95 to 1.79).	Moderate (Indirect)
	Neonatal Outcomes – Admission to NICU	1 SR[142] (489 patients, 2 studies)	**No difference**: No differences in admission to NICU in infants of women with intrauterine pressure catheters compared to external monitoring (RR 0.34, 95% CI 0.07 to 1.67).	Moderate (Indirect)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: CI=confidence interval; NICU=neonatal intensive care unit; RCT=randomized controlled trial; RR=relative risk; SOE=strength of evidence; SR=systematic review

Key Question 7. High-Dose Versus Low-Dose Oxytocin Protocols

We identified 12 articles[36,39,143-152] representing 11 individual RCTs that examined the benefits and harms of high-dose versus low-dose oxytocin protocols for women with abnormal labor. Key findings include:

- In nulliparous women, high-dose oxytocin is associated with a lower cesarean delivery rate (moderate SOE) compared with low-dose oxytocin protocols with no difference in maternal hemorrhage (low SOE).
- Early administration of oxytocin is associated with a shorter duration of labor (moderate SOE) but does not affect the overall cesarean delivery rate compared with delayed administration (moderate SOE). There is no difference in adverse events of maternal outcomes of hemorrhage or transfusion (low SOE) or in mode of delivery (low SOE).
- Pulsatile administration of oxytocin is associated with a longer duration of labor compared with continuous administration (low SOE).
- There is no difference in cesarean delivery rate between women managed with oxytocin and those with expectant management (moderate SOE).

Tables X–AA summarize the SOE for varying oxytocin protocols strategies. For many outcomes the SOE was rated as insufficient or low except where existing SRs were able to add to the evidence base.

Table X. High-dose versus low-dose oxytocin protocols: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	3 RCTs[39,143,152] (1,052) 2 SRs[153,154] (945 patients, 9 studies)	**Improvement with high-dose oxytocin**: High-dose oxytocin augmentation was associated with a reduction in the risk of cesarean section.	Moderate (inconsistent, imprecise) Findings supported by 2 RCTs and 2 SRs increasing SOE. Inconsistency with a third study not showing a difference and substantial heterogeneity.
Adverse Events	Maternal Outcomes – Infection	2 RCTs[39,143] (1,052)	**No difference**: No difference in the rate of maternal infection between high-and low-dose oxytocin as part of an active management of labor protocol compared to a conventional management of labor protocol.	Low (Imprecise)

Table X. High-dose versus low-dose oxytocin protocols: Evidence summary in nulliparous women (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Adverse Events (continued)	Maternal Outcomes – Hemorrhage	2 RCTs[143,152] (1,387)	**No difference**: SOE was low given imprecise findings from 2 non-U.S. setting studies.	Low (imprecise, non-U.S. setting)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Table Y. Early versus delayed oxytocin protocols: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Labor	2 RCTs[145,147] (1,042) 2 SRs[155,156] (2,583 patients, 10 studies)	**Improvement with early administration of oxytocin**: shorter duration of labor in early oxytocin group.	Moderate (non-U.S. setting, potential risk of bias) Consistent with SR findings
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	2 RCTs[145,147] (1,042) 2 SRs[155,156] (2,583 patients, 10 studies)	**No difference**: no difference in mode of delivery given early oxytocin group.	Moderate (non-U.S. setting, potential risk of bias) Consistent with SR findings
Adverse Events	Maternal Outcomes – Transfusion	2 RCTs[145,147] (1,042)	**No difference**: No difference between women managed with early versus delayed oxytocin administration.	Low (non-U.S. setting, potential risk of bias)
	Maternal Outcomes – Hemorrhage	2 RCTs[145,147] (1,042)	**No difference**: No difference between women managed with early versus delayed oxytocin administration.	Low (non-U.S. setting, potential risk of bias)
	Process Related Outcomes – Mode of Delivery (Instrumental Delivery)	2 RCTs[145,147] (1,042)	**No difference**: No difference between women managed with early versus delayed oxytocin administration.	Low (non-U.S. setting, potential risk of bias)

Table Y. Early versus delayed oxytocin protocols: Evidence summary in nulliparous women (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Adverse Events (continued)	Process Related Outcomes – Mode of Delivery (Spontaneous)	2 RCTs[145,147] (1,042)	No difference: No difference between women managed with early versus delayed oxytocin administration.	Low (non-U.S. setting, potential risk of bias)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; RR=relative risk; SOE=strength of evidence; SR=systematic review

Table Z. Pulsatile versus continuous oxytocin protocols: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of 2nd Stage Labor	1 RCT[144] (487)	**No difference**: No difference in the duration of the second stage of labor among women managed with pulsatile compared to continuous oxytocin for augmentation of labor.	Low (Indirect, imprecise)
	Process Related Outcomes – Duration of Labor	3 RCTs[144,148,150] (1,488)	**Improvement with continuous oxytocin**: Women managed with pulsatile compared to continuous oxytocin for augmentation of labor had a longer duration of labor.	Low (Indirect, imprecise, non-U.S. setting, high risk of bias)
Adverse Events	Process Related Outcomes – Mode of Delivery (Operative delivery)	1 RCT[144] (500)	**No difference**: No difference in operative delivery rate between women managed with pulsatile compared to continuous oxytocin for augmentation of labor. The cesarean delivery rate was not reported.	Low (Indirect, imprecise)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table AA. Oxytocin versus expectant management: Evidence summary in women of mixed parity

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 RCT[36] (99) 2 SRs[156,157] (457 patients, 5 studies)	**No difference**: No difference in cesarean delivery rate between women managed with oxytocin compared to expectant management.	Moderate (Imprecise, consistency with SR SOE was increased to moderate given findings from SRs which also found no difference in cesarean delivery rates.
Adverse Events	Process Related Outcomes – Mode of Delivery (Instrumental Delivery)	1 RCT[36] (99) 1 SR[156] (138 patients, 3 studies)	**No difference**: No difference in operative vaginal delivery rate between women managed with oxytocin compared to expectant management.	Low (Imprecise) Consistent with SR findings

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence; SR=systematic review

Key Question 8. Electronic Fetal Monitoring Versus Intermittent Auscultation

We were unable to identify any relevant RCTs that met our inclusion criteria for this KQ. We identified 4 potential SRs that compared electronic fetal monitoring with intermittent auscultation,[158-161] but these were ultimately excluded because the studies included in the SRs utilized interventions that are not currently used in the United States.

Key Question 9. Timing of Pushing in the Second Stage

We identified six articles[162-167] representing five RCTs that examined pushing techniques. Key findings include:

- Valsalva/coached and spontaneous/uncoached pushing have similar risks of trauma to the pelvic floor (low SOE).
- There is limited evidence that immediate pushing has a shorter labor duration when compared to delayed pushing in nulliparous women (low SOE).
- There was limited evidence of no difference in neonatal outcomes for immediate versus delayed pushing (low SOE).

Table BB summarizes the SOE for spontaneous pushing versus Valsalva pushing. In general, SOE was judged insufficient for all outcomes, with the exception of the process related outcome of Cesarean delivery.

Table BB. Spontaneous pushing versus Valsalva pushing: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	3 RCT[163,165,166] (508)	**No difference**: Three RCTs reported no difference in the rate of cesarean deliveries between coached pushing and uncoached pushing.	Low (Medium risk of bias, Imprecise)

a Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Table CC summarizes the SOE for immediate versus delayed pushing. In general, SOE was judged low for all outcomes, given findings from just one study.

Table CC. Immediate versus delayed pushing: Evidence summary in nulliparous women

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Intermediate or Final Outcomes	Process Related Outcomes – Duration of Labor (from intervention to delivery)	1 RCT[167] (2,404)	**Improvement with immediate pushing**: shorter mean duration of the second stage of labor in women randomized to immediate pushing compared to delayed pushing.	Low (one study)
	Process Related Outcomes – Mode of Delivery (Cesarean Delivery)	1 RCT[167] (2,404)	**No difference**: No difference in cesarean delivery rate between women randomized to immediate pushing compared to delayed pushing.	Low (one study)
Adverse Events	Maternal Outcomes – Postpartum Hemorrhage	1 RCT[167] (2,404)	**Improvement with immediate pushing**: Postpartum hemorrhage was significantly greater in the delayed vs the immediate pushing group.	Low (one study)
	Maternal Outcomes – Chorioamnionitis	1 RCT[167] (2,404)	**Improvement with immediate pushing**: Chorioamnionitis was significantly greater in the delayed vs the immediate pushing group.	Low (one study)

Table CC. Immediate versus delayed pushing: Evidence summary in nulliparous women (continued)

Category	Outcome	Study Design (Sample Size)	Conclusion	SOE (Rationale)[a]
Adverse Events (continued)	Process Related Outcomes – Mode of Delivery (Instrumental Delivery)	1 RCT[167] (2,404)	**No difference**: No different in mode of delivery with delayed vs immediate pushing.	Low (one study)
	Neonatal Outcomes – Neonatal Death, major birth injury, respiratory distress transient tachypnea	1 RCT[167] (2,404)	**No difference**: No different in neonatal death with delayed vs immediate pushing.	Low (one study)
	Neonatal Outcomes – Neonatal Acidemia	1 RCT[167] (2,404)	**Improvement with immediate pushing**: In prespecified exploratory analyses, a lower rate of acidemia with immediate and delayed pushing groups	Low (one study)
	Neonatal Outcomes – Neonatal Infection/ Sepsis	1 RCT[167] (2,404)	**Improvement with immediate pushing**: The proportion of suspected sepsis was higher in the delayed versus immediate pushing group	Low (one study)

[a] Criteria for downgrading SOE are described as Rationale; when these criteria are insufficient for understanding the final SOE, additional explanation is provided.

Abbreviations: RCT=randomized controlled trial; SOE=strength of evidence

Discussion

In general, the findings of the review were consistent with current understanding of the overall strength of evidence for different strategies for management of labor. Estimates of the rate of progress of "normal" labor derived from contemporary data in the United States are quite different from the classic curves described by Friedman.[13] These differences may be attributable to a number of factors, including secular trends in patient characteristics (e.g., increasing age at first birth and increasing rates of obesity) and increasing use of interventions such as induction of labor or the use of oxytocin to augment labor. More recent data suggest that the transition to active labor occurs later in the course of labor than originally described, which is reflected in more recent guidelines suggesting a higher threshold for observing labor duration before intervention with cesarean delivery.

The definition of "normal" labor is fundamental in evaluating the evidence related to managing "abnormal" labor progression, analogous to the threshold value used to define "normal" for a continuous laboratory value. Ideally, the definition would be derived based on data from a large group of women who were followed without intervention and had optimal maternal and neonatal outcomes, but there are obvious practical and ethical barriers to this. The sensitivity and specificity of the test will vary depending on the choice of threshold, but so will the estimates of the effectiveness of

interventions based on that threshold. Comparing results across studies requires a common definition for such "normal" labor and permeates our review.

There is evidence that partograms are useful in low-resource settings, but they have not been shown to improve labor outcomes in high-resource settings. This may be due in part to differences in the data sources for generating labor curves and thresholds. Feasibility and ethical challenges with obtaining a large, contemporary sample of women laboring with minimal to no intervention limits our fundamental scientific understanding of normal labor, normal labor progress, and when durations of labor lead to worse maternal/child outcomes.

In general, our findings that "normal" labor in modern settings is generally longer than earlier guidance are consistent with current guidelines,[3] which are largely informed by the CSL data and encourage allowing longer durations for both first and second stages of labor before intervening with cesarean delivery. However, as noted, over half of women in the "normal" group received augmentation in the Consortium on Safe Labor (CSL) data, and the data are not informative about optimal timing of augmentation. Routine amniotomy is not specifically recommended, although the recommendations note that amniotomy may be helpful in the transition from latent to active labor. Based on the same Cochrane review finding, improved satisfaction and lower cesarean and operative vaginal delivery rates, emotional support is recommended. The potential effect of epidural analgesia on duration of labor is noted as a potential consideration in allowing longer durations before intervention, but there are no recommendations about specific techniques. Cervical exam frequency, intrauterine pressure monitoring, oxytocin dosing protocols, methods for routine fetal monitoring, or timing of pushing in the second labor are not discussed, consistent with the relative paucity of evidence.

The impact of regional anesthesia on the length of the first stage of labor is uncertain, leading to conflicting recommendations from different professional societies. Our findings do not provide greater clarity.

Applicability

Two broad issues relate to the overall applicability of the available evidence to clinical practice in the United States—one geographic and one temporal. Many of the RCTs meeting our criteria were performed outside of the United States. Aside from issues related to differences in study oversight or reporting, the populations of these studies may differ from U.S. women in labor in terms of health systems, patient preferences and expectations, provider perceptions of risk, availability of resources, and so on. This is particularly relevant to studies that directly compared management strategies based on explicit criteria for defining abnormal labor and studies that attempted to define a "normal" duration of labor (KQ 1). Particularly for studies where the primary outcome is cesarean delivery, factors that affect the threshold for performing cesarean—both the explicit "cutpoint" for duration of labor used and broader factors ranging from the relative safety of surgery versus vaginal delivery in low resource settings to cultural expectations to legal concerns—may affect the estimates of effectiveness of an intervention.

A number of studies included the use of a partogram—a graphical comparison of a woman's labor progress compared to a standard—with thresholds for intervention clearly identified. Strength of evidence was judged to be low, with one major factor being a lack of U.S.-based studies. In low-resource settings, the use of a partogram was associated with lower overall cesarean delivery rates compared with labor managed without a partogram, and earlier interventions were associated with lower cesarean delivery rates. In high-resource settings, the use of a partogram that included an assessment of latent phase duration, and which had a threshold for

action at 3 hours compared to 4 hours, had higher cesarean delivery rates; but otherwise the use of a partogram compared with no partogram, or other time intervals for action lines, did not affect mode of delivery, duration of labor, indication for cesarean delivery, or complications including postpartum hemorrhage, maternal infection, or neonatal acidemia. Outside of U.S.-based settings, populations, health systems, and management of both prenatal and intrapartum care are quite different—and the impact of these differences on both the relative effectiveness and the absolute difference in outcomes is likely substantial.

Even more fundamentally, use of a tool such as a partogram, or specific interventions such as amniotomy, requires evidence on "normal" labor in order to define requires evidence on "normal" labor in order to define appropriate thresholds for action. The studies we reviewed that attempted to define "normal" labor differed based on parity, the time period in which the studies were conducted, and, among nulliparous women, maternal age. Evidence from the CSL, representing the most recent available large-scale population data[19] suggest a longer duration of first stage of labor compared to earlier studies, including the National Collaborative Perinatal Project (NCPP).[22] However, the most striking difference between these two studies was the proportion of women who received oxytocin augmentation (14.6% in the NCPP cohort from 1959 to 1966 compared with 45.9% in the CSL cohort from 2002 to 2008).

The CSL population that was used to generate new labor curves consists of women who had spontaneous onset of labor and a vaginal delivery, and thus the labor curves presented provide an estimate of "normal" labor that does not end in a cesarean delivery. Since such a large proportion of women received augmentation, these data do not provide insight into the range of rates of labor progression among women who do not receive augmentation, and cannot provide insight into the relative harms and benefits of augmentation, or the most appropriate thresholds for the timing or dosing of augmentation. The association between a longer duration of the first stage of labor and the greater use of oxytocin among women with a vaginal delivery is consistent with the possibility that greater use of oxytocin may avoid cesarean delivery, but not with observed secular trends in cesarean delivery rates. One would expect that any changes in the threshold for cesarean delivery caused by greater "patience" (allowing a longer duration) and/or "medical management" (greater use of oxytocin) would lead to decreases in cesarean delivery rates.

In summary, evidence suggests that the specific criteria used to define "normal" labor, or a specific threshold for intervention, may affect cesarean delivery rates but not other maternal or neonatal outcomes in some settings. Yet there is no available evidence for the United States. Among women in the United States with spontaneous onset of labor and vaginal delivery, labor progression is slower for women having their first baby compared to women with prior deliveries, but the high proportion of women receiving oxytocin augmentation prevents drawing any inferences about the "normal" labor curve in women with spontaneous onset of labor, no interventions to augment labor, and no adverse maternal or neonatal outcomes.

Research Recommendations

We identified several areas of needed future research:

- It would be extremely useful to have separate labor curves derived from contemporary U.S. data for women with spontaneous onset of labor, no augmentation with oxytocin or other pharmacologic agents, and vaginal delivery of healthy baby, stratified by parity, as well as for women with augmented labor. Such labor curves would provide a better understanding of the modern natural course of labor and may provide better information on when to initiate agents to augment labor and when to proceed with cesarean delivery. Such studies could

also potentially include laboring women with cesareans for non-labor diagnoses, although the threshold for intervention might be influences by perceptions of the effect of labor duration on the condition leading to the intervention (e.g., women with pre-eclampsia).

- Evaluation of specific labor management strategies (including the use of partograms) derived from contemporary data sources such as the CSL should be a priority. This evaluation should include comparison of different methods for integrating decision support into existing technologies, such as methods and timing of augmenting labor (oxytocin administration, artificial rupture of the membranes), fetal monitoring, tools to monitor uterine contraction strength and frequency, and the impact of supportive therapies (massage, fluids, nutrition, positioning) on mode of delivery. This evaluation would help generate best practice recommendations for safe reduction of the primary cesarean delivery rate while balancing maternal and neonatal outcomes. Given the potential difficulties in recruiting patients into randomized trials, consideration should be given to both high-quality observational studies as well as research designs that combine randomization with allowance for patient preferences.[168,169]
- Given the importance of the labor process to patient preferences and their birthing experience and the lack of evidence about the impact of available interventions on these preferences, the development of tools for estimating patient preferences for both the process and maternal and neonatal outcomes of labor should be a priority. Discrete choice experiments would be one method appropriate for estimating preferences for these complex tradeoffs.
- Comparison of patient preferences of nulliparous to parous women are of great interest as preferences may vary based on prior labor experiences and expectations.
- Studies of these tools/methods should also explore the complexity of decision making that needs to incorporate both maternal and paternal preferences, as well as preferences where parents are acting as surrogates for infants. For example, in a study which elicited preferences for an adverse neonatal outcome with long-term health implications for the purposes of economic analysis, each parent would have preferences that reflect the impact of the condition on their roles as parents, and could provide a preference acting as a surrogate for the child, but the child might have quite different preferences.[170-172] Validated measures should be incorporated into clinical trials and prospective studies as specific outcomes.
- Encouragement of use of core outcome sets, such as those developed as part of the CROWN (Core Outcomes in Women's Health) initiative.[173]

Conclusions

Dystocia is a common indication for cesarean delivery. Recent data demonstrate that the normal progress of labor with current practice is quite different from curves originally described, although there is still uncertainty about the duration of "normal" labor in the absence of augmentation. Amniotomy and oxytocin decrease duration of labor without increasing cesarean delivery. Emotional support reduces operative delivery rates and patient satisfaction. Further work is needed to identify strategies for management of labor that optimize maternal and neonatal outcomes and patient preferences while minimizing cesarean delivery rates.

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Full Report

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