Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term (Review)

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Background
Vaginal examinations have become a routine intervention in labour as a means of assessing labour progress. Used at regular intervals, either alone or as a component of the partogram (a pre-printed form providing a pictorial overview of the progress of labour), the aim is to assess if labour is progressing physiologically, and to provide an early warning of slow progress. Abnormally slow progress can be a sign of labour dystocia, which is associated with maternal and fetal morbidity and mortality, particularly in low-income countries where appropriate interventions cannot easily be accessed. However, over-diagnosis of dystocia can lead to iatrogenic morbidity from unnecessary intervention (e.g. operative vaginal birth or caesarean section). It is, therefore, important to establish whether or not the routine use of vaginal examinations is an effective intervention, both as a diagnostic tool for true labour dystocia, and as an accurate measure of physiological labour progress.

Objectives
To compare the effectiveness, acceptability and consequences of digital vaginal examination(s) (alone or within the context of the partogram) with other strategies, or different timings, to assess progress during labour at term.

Search methods
We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (28 February 2013) and reference lists of identified studies.

Selection criteria
We included randomised controlled trials (RCTs) of vaginal examinations (including digital assessment of the consistency of the cervix, and the degree of dilation and position of the opening of the uterus (cervical os); and position and station of the fetal presenting part, with or without abdominal palpation) compared with other ways of assessing progress of labour. We also included studies assessing different timings of vaginal examinations. We excluded quasi-RCTs and cross-over trials. We also excluded trials with a primary focus on assessing progress of labour using the partogram (of which vaginal examinations is one component) as this is covered by another Cochrane review. However, studies where vaginal examinations were used within the context of the partogram were included if the studies were randomised according to the vaginal examination component.
Data collection and analysis

Three review authors assessed the studies for inclusion in the review. Two authors undertook independent data extraction and assessed the risk of bias of each included study. A third review author also checked data extraction and risk of bias. Data entry was checked.

Main results

We found two studies that met our inclusion criteria but they were of unclear quality. One study, involving 307 women, compared vaginal examinations with rectal examinations, and the other study, involving 150 women, compared two-hourly with four-hourly vaginal examinations. Both studies were of unclear quality in terms of risk of selection bias, and the study comparing the timing of the vaginal examinations excluded 27% (two hourly) to 28% (four hourly) of women after randomisation because they no longer met the inclusion criteria.

When comparing routine vaginal examinations with routine rectal examinations to assess the progress of labour, we identified no difference in neonatal infections requiring antibiotics (risk ratio (RR) 0.33, 95% confidence interval (CI) 0.01 to 8.07, one study, 307 infants). There were no data on the other primary outcomes of length of labour, maternal infections requiring antibiotics and women’s overall views of labour. The study did show that significantly fewer women reported that vaginal examination was very uncomfortable compared with rectal examinations (RR 0.42, 95% CI 0.25 to 0.70, one study, 303 women). We identified no difference in the secondary outcomes of augmentation, caesarean section, spontaneous vaginal birth, operative vaginal birth, perinatal mortality and admission to neonatal intensive care.

Comparing two-hourly vaginal examinations with four-hourly vaginal examinations in labour, we found no difference in length of labour (mean difference in minutes (MD) -6.00, 95% CI -88.70 to 76.70, one study, 109 women). There were no data on the other primary outcomes of maternal or neonatal infections requiring antibiotics, and women’s overall views of labour. We identified no difference in the secondary outcomes of augmentation, epidural for pain relief, caesarean section, spontaneous vaginal birth and operative vaginal birth.

Authors’ conclusions

On the basis of women’s preferences, vaginal examination seems to be preferred to rectal examination. For all other outcomes, we found no evidence to support or reject the use of routine vaginal examinations in labour to improve outcomes for women and babies. The two studies included in the review were both small, and carried out in high-income countries in the 1990s. It is surprising that there is such a widespread use of this intervention without good evidence of effectiveness, particularly considering the sensitivity of the procedure for the women receiving it, and the potential for adverse consequences in some settings.

The effectiveness of the use and timing of routine vaginal examinations in labour, and other ways of assessing progress in labour, including maternal behavioural cues, should be the focus of new research as a matter of urgency. Women’s views of ways of assessing labour progress should be given high priority in any future research in this area.

Plain Language Summary

Routine vaginal examinations in labour

For a baby to be born, the mother’s cervix needs to change from being closed to being open to about 10 centimetres (‘dilated’). Vaginal examinations provide information on how widely dilated the cervix is, how much it has thinned and the position of the presenting part of the baby in the mother’s pelvis. This is part of assessing the woman’s progress in labour, although knowing the dilation of the woman’s cervix is a poor predictor of when she will give birth. Patterns and speed of labour can vary substantially between different women, and in the same woman in different labours. Very slow labours can be associated with difficulties for both the mother and baby. Abnormally slow labours (dystocia) can sometimes lead to neurological problems in the baby and long-term urinary and fecal incontinence in the mother, especially in low-income countries. Vaginal examinations aim to reassure the woman (and staff) that the woman is labouring normally, and to provide early warning if this is not the case. In low-income countries, it can take some time to get help, and vaginal examinations may enable appropriate transfer from community settings to hospital care. If labours that are slow, but not abnormal, are mis-diagnosed as being abnormal, this can lead to unnecessary interventions such as drugs to try to speed labour on or caesarean section or forceps for giving birth. There are also concerns about introducing infection to the uterus and to the baby, especially in low-income countries where disposable gloves, or reusable gloves and disinfectants, are not readily available. In addition, some women find the process of vaginal examinations uncomfortable or distressing, and so it is important that there is good evidence...
for its use. We looked for studies to see how effective routine vaginal examinations in labour are at reducing problems for mothers and babies.

We found two studies, undertaken in the 1990s in high-income countries, but their quality was unclear. One study, involving 307 women, compared routine vaginal and rectal examinations in labour. Here, fewer women reported that vaginal examinations were very uncomfortable compared with rectal examinations. The other study, involving 150 women, compared two-hourly and four-hourly vaginal examinations, but no difference in outcomes was seen.

We identified no convincing evidence to support, or reject, the use of routine vaginal examinations in labour, yet this is common practice throughout the world. More research is needed to find out if vaginal examinations are a useful measure of both normal and abnormal labour progress. If vaginal examination is not a good measure of progress, there is an urgent need to identify and evaluate an alternative measure to ensure the best outcome for mothers and babies.

**BACKGROUND**

Formal assessment of progress in labour is one of the primary tools used in intrapartum care, and it is often combined with other assessments in the partogram (Lavender 2012). The main rationale for monitoring progress is that this provides reassurance where labour is progressing as expected, and that it identifies deviation from normal labour progress early enough to intervene to prevent maternal or fetal morbidity. This may be particularly important where women are labouring remotely from specialist units, as early diagnosis of developing problems can enable timely transfer from community settings to hospital care. Such situations are most likely to arise in low-income countries. Dilation of the cervical os (opening of the uterus), as measured by digital vaginal examination, is used almost universally to guide decision making on labour progress. It can be the sole measure of progress, but it is more usually used with other clinical observations such as the consistency and position of the cervix, and the position and level of descent of the fetal head in the maternal pelvis. In most, but not all settings, the findings from the vaginal examination are plotted on a partogram (a tool that is usually a preprinted paper document used by clinician to record graphically the observations on both mother and baby) and this tool is then used to guide decision making (Lavender 2008). The partogram displays a range of clinical information. This covers three parameters namely maternal condition, fetal condition and labour progress. The labour progress section usually includes dilation of the cervical os, and fetal descent and position (Lavender 2012). The latter two parameters can also be assessed externally. Dilation of the cervical os is usually assessed routinely by digital examination via the vagina. In some countries, such as China, rectal examination is still used (Gao 2008).

This review is designed to compare the timing and outcomes of vaginal examination as a specific clinical measure of labour progress, with other labour progress assessment tools. It complements the findings of the existing Cochrane review on the use of the partogram in labour, which is focused on the graphical representation of a range of labour parameters assessed through a variety of methods (Lavender 2012). Specifically, this review addresses the effectiveness, acceptability and consequences of digital vaginal examinations (alone or within the context of the partogram) for assessing the progress of labour to improve outcomes for women and babies at term. It will not include studies where the use of the partogram is the primary intervention, as this is the subject of the separate Cochrane partogram review (Lavender 2012).

**Description of the condition**

Abnormally slow labour (dystocia) is associated with maternal and fetal morbidity and mortality, particularly in low-income countries where access to specialist emergency care is difficult for many women (Neilson 2003). Untreated dystocia can lead to fetal neurological damage, and long-term maternal morbidity such as urinary and fecal incontinence (Neilson 2003). Abnormally fast labours can also affect the well-being of mother and or baby. An effective tool to assess labour progress should also encompass this possibility (Sheiner 2004).

Regular assessment of labour progress can act as an early warning system for labours that are becoming pathological. This may allow for timely referral for specialist assessment, intervention, or both, including where necessary, physical transfer to centres where such care is provided. Early intervention for women and babies in this situation may contribute to well-being for the mother and baby in the current labour, minimise negative maternal and child sequelae, and improve outcomes in future childbearing. It is also argued that labour progress assessment and subsequent interventions, such as adopting a more upright position and focusing on relaxation, may reduce the use of unnecessary intervention (such as caesarean section for lack of progress) in normal physiological labour and birth, with a consequent reduction in iatrogenic (caused by medical treat-
Defining normal progress of labour

Progress in labour tends to be formally defined by the nature of uterine activity and cervical dilation over time, but the evidence to support such descriptions is poor, and it has proven difficult to define the length of normal labour. Both first and second stages of labour are considered to have a latent (passive) phase then an active phase (Downe 2003; Downe 2004; Walsh 2004). Friedman made an attempt to define normal labours back in the 1950s, suggesting that progress in labour followed a sigmoid curve with a slow latent phase, then a quicker active phase, and finally a slowing down towards the end of first stage (Friedman 1954; Friedman 1955; Friedman 1956a; Friedman 1956b; Friedman 1963). More recently, Zhang has challenged the Friedman curves and suggested that these criteria for normal progress may be too restrictive (Zhang 2002; Zhang 2010a; Zhang 2010b).

The UK National Institute of Health and Clinical Excellence (NICE) guidelines for intrapartum care attempt to define the normal length of labour for nulliparous and multiparous women (NICE 2007). Here, first stage progress is described in phases. The latent phase is characterised as painful contractions with cervical dilation up to four centimetres. The active or established phase is described as activity after four centimetres of cervical dilation. It is suggested that for primiparous women, established first stage of labour lasts an average of eight hours (and is unlikely to be greater than 18 hours) and for multiparous women, first stage lasts on average five hours (and is unlikely to last more than 12 hours). Second stage is defined as activity beyond full dilation (defined as 10 centimetres of cervical dilation) and ending with the birth of the baby. NICE suggests the birth of the baby usually takes place within three hours of active second stage in primiparous women and within two hours for multiparous women (NICE 2007). The current NICE intrapartum guidelines suggest that professionals should "... be sure that the vaginal examination is really necessary, and will add important information to the decision making process" (NICE 2007). NICE also recommends the use of the partogram to pictorially record progress in labour, although the guideline acknowledges that the evidence to support this is scarce (NICE 2007).

The World Health Organization (WHO) in 1996 described cervical dilation as the most accurate measure of the assessment of progress in labour and advocates using the partogram with the alert and action lines (WHO 1996). These guidelines state that a second stage of labour greater than two hours in nulliparous women and greater than one hour in multiparous women, decreases the chance of a spontaneous birth in a reasonable time. The authors suggest that, beyond these timepoints, clinical staff should consider the benefits of intervening to end the labour. Regarding vaginal examination, WHO states the number of vaginal examinations should be limited to those that are strictly necessary and that once every four hours is sufficient (WHO 1996). The authors describe two approaches: one a routine four-hourly approach and the other an approach based on indication. They state that while something can be said for each of these approaches, the second approach sits better with the theorem that in normal childbirth there should be a valid reason to interfere with the natural process. Indeed, they go on to observe that if labour ‘passes off smoothly’, experienced birth attendants can sometimes limit the number of vaginal examinations to one. They do, however, recommend that guidelines should be country specific (WHO 1996).

The American College of Obstetrics and Gynecology (ACOG) suggests that women enter the active phase of labour at three to four centimetres dilation. At this point, they expect that normal progress will be evidenced by three or more uterine contractions in 10 minutes, or a measured contraction intensity greater than 25 mm Hg above baseline, or both (ACOG 2003). These authoritative definitions are considered controversial by some for three reasons. Firstly, the time limits are challenged by a number of empirical studies (Albers 1996; Albers 1999; Zhang 2002; Zhang 2010a; Zhang 2010b). Secondly, some professionals maintain that the use of cervical dilation and uterine activity as the primary indicators of progress are insufficient to judge the likely future progress of labour. Recent evidence suggests that this observation may be correct (Incerti 2011). Thirdly, there are known variations in maternal physiology that can affect the progress in normal labour in different population groups (Duignan 1975), women of varying parity, and women in whom oxytocin is used to start or accelerate labour (Neal 2010).

There is evidence that patterns of labour following induction, augmentation or administration of epidural analgesia are different from those experienced by women in spontaneous labour (Duff 2005; McKay 1994). Duff 2005 found that women who experienced labour induction had smaller degrees of cervical dilation at...
Assessing progress in labour

In practice, approaches to assess progress in labour fall into three general categories:

1. those based specifically on direct clinical or technical measurement of the degree of dilatation of the cervical os;
2. those based on proxy measures of cervical dilatation, such as observation of the ‘purple line’; and
3. those based on a composite of other indicators. These composite measures themselves tend to fall into two categories: (a) physiological measures such as the level and degree of flexion of the fetal presenting part in relation to the maternal ischial spines, and the position and length strength and frequency of contractions (Friedman 1954; Philpott 1972a; Philpott 1972b; Studd 1972) and (b) those based on proxy signs and symptoms, such as maternal behavioural cues (Duff 2009).

Digital cervical examination as a component of the partogram to assess progress in labour

The norms of cervical dilatation and fetal descent can be captured in a pictorial display on the partogram, or partograph, (Lavender 2006; Lavender 2012; Walsh 2004). The partogram originated from Friedman’s work on graphically analysing labour (Friedman 1954; Friedman 1955; Friedman 1956a). Inclusion of action and alert lines were suggested by Philpott (Philpott 1972a; Philpott 1972b; Philpott 1972c) and developed further in Studd’s work on cervicographs (Studd 1973). More recent data from women labouring in relatively uninterrupted circumstances have suggested that some of these norms are overly restrictive (Albers 1996; Albers 1999; Duff 2002; Neal 2010).

The partogram is a pre-printed form, the aim of which is to provide a pictorial overview of the progress of labour and to alert health professionals to any problems with the mother or baby (Lavender 2012). Documentation of cervical dilatation and station are two components of the vaginal examination plotted on the partogram. In clinical practice, it is cervical dilatation that appears to influence much of the decision making regarding progress in labour and whether action is taken in response to information plotted on the partogram. For example, the alert line used in many partograms represents the mean cervical dilatation of the slowest 10% of primigravid women in the active stages of labour. Some midwives and institutions do not use the partogram in their care of women in established labour (Lavender 2008) and in a recent Cochrane systematic review, the authors stated that on the basis of the formal evidence they located, they could not recommend the routine use of the partogram as part of standard labour management and care (Lavender 2012). While there is some evidence that the partogram may be useful in low-income countries (WHO 1994), its effectiveness has been questioned in high-income countries (Groeschel 2001; Lavender 2012; Walsh 1994). In theory, any measure could be plotted on to a partogram, including behavioural cues, as it is in essence just a visual record of the range of signs and symptoms that can be used to make a clinical judgement about labour progress, and to transmit summary information between different caregivers. For this reason, this review is not focused on the partogram as a composite tool, but on the specific component of vaginal examination as a cardinal measure of labour progress, when compared to other means of assessment (which could then also be plotted graphically).

Description of the intervention

Vaginal examination

Vaginal examination is performed digitally with a sterile gloved hand. In many maternity settings, it is held that a vaginal examination must be performed at the time of admission to the labour ward, to confirm labour onset, and then, once active labour is established, at regular intervals thereafter. The formal timing of regular routine assessment varies between two- and four-hourly (Lavender 1999; NICE 2007; O’Driscoll 1973), though midwives and caregivers report that unrecorded assessment is undertaken more frequently (Stewart 2008).

The digital vaginal examination primarily assesses how far the uterine cervix has thinned and dilated. It also allows for an assessment of how far the fetal presenting part has descended into the maternal pelvis, if the fetal membranes are intact, how closely they are applied to the fetal presenting part, how far they come under pressure with a contraction, and, if the membranes are very well applied or absent, what the position and degree of flexion of the fetal presenting part is in relation to the maternal pelvis.

The full components of the vaginal examination, as described in detail by Simkin (Simkin 2011) can be summed up as follows.

The cervix:
- position of the cervical os (posterior to anterior);
- consistency of the cervix (from hard to soft, or ‘ripe’);
- effacement of the cervix (from thick to thin);
- dilatation of the cervical os (from 0 to 10 centimetres, nominally).

The fetal presenting part:
- degree of rotation (to the anterior);
- degree of flexion (from deflexed to flexed);
- amount of moulding (if cephalic);
- degree of descent into the maternal pelvis.
State of the amnion:
- intact or not;
- degree of application to the presenting part of the fetus;
- degree of bulging when under pressure from a contraction.

State of the mother:
- any obvious contraction of the maternal pelvis.

Text books recommend that the information from the vaginal examination should always be weighed with an abdominal assessment, and attention to the maternal responses to labour (for example, McCormick 2003).

Accuracy of the examination
There is evidence that, in general, reliability is not high for assessment of dilation of the cervical os using models (Huhn 2004; Nizard 2009; Phelps 1995). However, if the assessment is made by the same carer throughout, accuracy is believed to be higher suggesting that individual variation of both the physiology of the labouring woman and the assessment norms of the labour attendant are relevant. Prediction of labour progress seems to be less a feature of precise measurement than of the relative differences between one assessment period and the next. Indeed, patterns of labour based on the speed of cervical dilation that are believed to predict physiological or pathological progress have been widely disputed and debated (Albers 1996; Albers 1999; Zhang 2002; Zhang 2010a; Zhang 2010b). Knowing the precise amount of cervical dilation does not appear to be a good predictor of how labour progress may proceed.

Impact of vaginal examination on labour progress
There is evidence that vaginal examination may in itself have an impact on labour progress in some women by raising their anxiety and interrupting their focus (NICE 2007; Winter 2002). Another possible mechanism through which vaginal examination could affect labour is through increasing production of plasma prostaglandin consequent on cervical stimulation (Mitchell 1977). This may limit the power of vaginal examinations as a standardised measurement technique.

Women’s views of vaginal examinations
Some studies suggest that most women are happy with how vaginal examinations are conducted in labour even if they are performed as frequently as two hourly (Lavender 1999). Fear of a long labour may lead to some women preferring more frequent vaginal examinations with the accompanying interventions, or a more regular examination schedule may lead to women seeing their caregiver more often (Lavender 1999). Other women see vaginal examinations as necessary part of labour, even though some report pain and embarrassment. Trusting their caregiver to respect them as individuals and maintain their dignity can mitigate these disadvantages (Lai 2002). However, some authors report the potential for women to perceive the vaginal examination as uncomfortable, painful or even abusive (Bergstrom 1992; Buckley 2003; Clements 1994; Devane 1996; Flessig 1993; McKay 1991; Roberts 1996; Winter 2002). This is particularly the case when there has been previous sexual abuse (Bergstrom 1992; Murphy 1986; Swahnberg 2011). Proposed solutions have included more behavioural/observational approaches (Burville 2002; Duff 2005; Hobbs 1998; Shepherd 2010), as the more technical approaches (see below) would appear not to address these specific problems (Lucidi 2000). A multi-centred study found that while most women were satisfied with their experience of vaginal examination (notional satisfaction index score of 74%), there was scope for improvement in areas such as associated pain, opportunities to refuse examinations and more detailed information giving (Lewin 2005).

Adverse effects of vaginal examination
Infection. There are serious concerns about the possible risks of infection associated with vaginal examination (El-Mahally 2004; Imseis 1999) through introducing infection to the uterine cavity and to the baby, especially in low-income countries where disposable gloves, or reusable gloves and disinfectants, are not readily available (Imseis 1999; Schuttle 1983; Seaward 1998). There is a reported link between the numbers of vaginal examinations a woman has and the risk of puerperal sepsis (Imseis 1999; Maharaj 2007a; Maharaj 2007b; Seaward 1998). As puerperal infection generally manifests itself beyond 24 hours after birth, it can go unrecorded in data collection and can be particularly dangerous in low-income countries where it can result in severe morbidity and mortality due to limited access to antibiotics (Maharaj 2007a; Maharaj 2007b). A recent retrospective cohort study in the US found no association between the number of vaginal examinations and infection during labour and up to six hours postpartum, but this study adjusted for length of labour and it did not assess infections beyond six hours postpartum (Cahill 2012). In high-income countries, there are concerns about the overuse of antibiotics for treating infections, so any increased risk of untreatable puerperal infection needs to be taken into account. Chlorhexidine has been used in a range of doses as an anti-infective agent in labour, usually at the time of vaginal examination, and at the time of birth. However, the most recent Cochrane review, and a more recent trial in this area have not demonstrated a reduction in risk of infection with the use of chlorhexidine (Lumbiganon 2004; Saleem 2010). 

Allergy. Caution is also needed in relation to possible allergy to latex gloves in some staff and labouring women (Santos 1997).

Maternal distress. See ‘Women’s views of vaginal examination’ above.

Other techniques for assessing progress in labour (as comparators in this review)
A range of techniques has been proposed as an alternative to digital vaginal examination. Some, such as rectal examination of the cervix, were used for many decades, but have largely (but not completely) fallen out of favour (Gao 2008). Others, such as ultrasonographic and electromechanical methods are currently in development or undergoing testing. Most of these techniques are currently not used in routine practice, but they offer some theoretical advantages (and disadvantages) when compared to digital vaginal examination. For this reason, any trials of these techniques that compare them with vaginal examination will be included as comparators in the review.

1) Rectal examinations

It appears that rectal examinations to assess progress of labour were introduced in Germany in 1894 (Peterson 1965) after suggestions that the clinician’s contaminated hands introduced into the vagina during a vaginal examination might cause puerperal fever (Murphy 1986). By 1920, rectal examination of the cervix had become widespread and remained so until the 1950s when studies showed there was no difference in infection rates between vaginal and rectal routes (Bertelsen 1963; Faro 1956; Jara 1956; Manning 1961; Peterson 1965; Prystowsky 1954). Friedman, O’Driscoll and Murphy all used both rectal and vaginal examination in their studies (Friedman 1954; Murphy 1986; O’Driscoll 1973). The disadvantages included maternal distress and pain (sometimes due to the examination being done at the height of a contraction). The technique finally fell out of favour completely over the next decade or so. However, there are some countries, such as China, where rectal examination is still used (Gao 2008). In a study undertaken of practices in the Shanxi Province in China, eight out of nine hospitals studied used rectal examination to assess the progress of labour. The reasons given for this by practitioners were that the technique was in the medical textbook used by doctors (Gao 2008).

2) Cervical technologies

In their review of methods of assessment of cervical dilation published between 1951 and 1978, van Dessel and colleagues report that 19 different cervimetric techniques were documented, though some were never applied in clinical studies (Van Dessel 1991). Today cervical assessment technologies are still being developed (Molina 2010; Nizard 2009). They tend to fall into four categories: 1) mechanical methods; 2) electromechanical methods; 3) electromagnetic methods; 4) ultrasound methods (Molina 2010) (Table 1). The disadvantages include the lack of reliability and the invasive nature of some of the interventions. Pain is reported to be associated with some of the techniques, and there may be unknown effects on the fetus from the intensive use of imaging technologies. In addition, there are the potential economic implications of purchasing new equipment, and the risk of infection where the measurement technique includes the introduction of devices into the vagina or cervix.

3) Anal cleft line or purple line

A letter published in the Lancet in 1990 noted that an “…increase in intrapelvic pressure causes congestion in the … veins around the sacrum, which, in conjunction with the lack of subcutaneous tissue over the sacrum, results in this line of red purple discoloration…” (Byrne 1990). Subsequently, this technique was applied to assessing the progress of labour (Hobbs 1998). A recent observational study has noted that the purple line does exist, probably due to venous congestion in the sacral area as the fetal presenting part descends, and that it might be an effective guide to labour progress (Shepherd 2010). Although, there appear to be few disadvantages for women and babies of using this technique, the purple line is not universally seen and its usefulness in assessing progress in labour has not yet been established.

4) Maternal behavioural cue taxonomies

There are suggestions that the progress of labour can be assessed by observing women’s behavioural cues (Bleier 1971; Gaskin 1980; Winter 2009). Taxonomies of these cues are based on prospective studies of a range of observed behaviours typically exhibited by women during a range of different labours, with a range of different clinical manifestations and outcomes. The cues reported in the literature include vocalisation (Baker 1993), skin discoloration (Byrne 1990) and behavioural changes (including changes in breathing, conversation, mood, energy and movement and posture over the periods of late pregnancy, latent/prelabour, early labour, early active labour and active labour) (Burville 2002). Following an examination of 69 textbooks, and an observational study of 94 primiparous women and 85 multiparous women, Duff developed a model for labour assessment based on ‘observed’ behaviour (how the woman responds to her external environment and internal environment) and ‘communicated’ behaviour (how the woman uses words or makes sounds) and then into subgroups of ‘between’ and ‘during’ contraction behaviours (Duff 2005). These were further differentiated for behaviours in spontaneous and induced labours. Again, there appear to be few disadvantages for women and babies in the use of this approach, but its effectiveness in assessing progress in labour is not yet established.

How the intervention might work

Clinical and technical measurement

Vaginal examinations
The utility of the vaginal examination is based on the assumption that the degree of dilation of the cervical os, with or without the other clinical features of the vaginal examination, are predictive of the future progress of the labour of an individual woman, whether in spontaneous or an induced labour. While a one-off examination is believed to contribute to this diagnosis, a series of examinations over time are believed to offer more information on the general pattern of a specific woman’s labour, particularly when the cervical dilation and the descent of the fetal head are plotted, as in the partogram. The use of action and alert lines on the partogram offer visual cues for the use of interventions, such as oxytocin to accelerate the progress of labour or the need to transfer a labouring woman to higher levels of care. However, the accuracy of this diagnosis depends on an effective assessment of the beginning of active labour.

The outcomes of the use of this intervention, where labour is indeed pathologically prolonged, depend on the availability and appropriate and timely use of interventions to address dystocia. These include techniques to speed up labour, such as oxytocin for augmentation, and caesarean section for bringing the birth forward. Immersion in water has also been suggested as an alternative to oxytocin augmentation for dystocia (Cluett 2004). Artificial rupture of membranes is still widely used, but there is no evidence to suggest that this is an effective intervention (Neilson 2008; Smyth 2007). The availability of transport to more specialised care facilities for births that commence in the community settings, particularly in low-income countries, may also be required for effective intervention. There is good evidence that organisational culture might be a strong determinant of appropriate use of emergency and elective caesarean section in relation to assessment of labour progress (Bragg 2010).

Why it is important to do this review

Murray Enkin, one of the editors of ‘Effective Care In Pregnancy and Childbirth’ (Chalmers 1989) stated that ‘“repeated vaginal examinations are an invasive intervention of as yet unproven value ...” on the basis of the research evidence that was available then (Enkin 1992). Although assessment of cervical dilation remains the central feature of labour progress assessment, the evidence Enkin drew on to reach his conclusion has not been updated. Women have the right to accept or decline vaginal examinations, and to discuss with their caregivers how their labour progress might be assessed. Both need good information on the benefits and harms of vaginal examinations, and of alternative assessment techniques, in order to offer information and to make informed decisions. Given the need to diagnose labour dystocia before it results in overt pathology, especially in settings where specialist intervention requires long transfer times, the uncertainties around digital assessment of the cervical os, the risks of infection in some settings, and the potential creeping introduction of alternative technical and behavioural means of assessment of labour progress, this review is necessary to determine the effects and consequences of using digital vaginal examination to assess labour progress, when compared with alternative methods.

This review will address the effectiveness, acceptability and consequences of digital vaginal examinations (with or without a partogram) for assessing the progress of labour to improve outcomes for women and babies at term. It will not include studies where the use of the partogram is the main focus of interest, as this is the subject of a separate Cochrane review (Lavender 2012).

OBJECTIVES

To compare the effectiveness, acceptability and consequences of digital vaginal examination(s) (alone or within the context of the partogram) with other strategies, or different timings, to assess progress during labour at term.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials (RCTs). Cluster-RCTs were also eligible for inclusion. Cross-over designs were excluded as they are inappropriate for this topic. We also excluded quasi-RCTs. We planned to include conference abstracts and we would have written to authors to seek further information where appropriate.

Types of participants

Women entering labour at term, either spontaneously or with induction. Women booked for elective caesarean section, women in preterm labour and women with multiple pregnancies were excluded.

Types of interventions

Vaginal examinations (including digital assessment of the consistency of the cervix, and the degree of dilation and position of the cervical os; and position and station of the fetal presenting part, with or without abdominal palpation) were assessed for effectiveness. We included any frequency of vaginal examinations and recorded this information in the review. We planned to assess the effect of frequency of the vaginal examination in direct comparisons and subgroup analyses where appropriate.

Studies focused on assessment of the effectiveness of the partogram (in which the vaginal examination is not the primary focus of interest) were excluded as these studies comprise the existing Cochrane
partogram review (Lavender 2012). Studies where vaginal examinations were used within the context of the partogram were included if they randomised according to the vaginal examination component. We planned to compare digital vaginal examinations with no intervention and with other interventions for assessing progress in labour, namely:

1. no intervention;
2. rectal examination;
3. cervical technical assessment (including: mechanical; electromechanical; electromagnetic; ultrasound);
4. anal cleft/purple line observation;
5. maternal behavioural cues.

In addition, we compared different timings for routine vaginal examinations.

Types of outcome measures

Primary outcomes

1. Length of labour.
2. Maternal infection requiring antibiotics.
3. Neonatal infection requiring antibiotics.
4. Very positive views of intrapartum care, which is a composite outcome, defined as the highest category of rating (such as 'very satisfied'), in whatever measure was used by trial authors. If trial authors used more than one measure of women's views, the one assessing satisfaction with intrapartum care would be chosen.

Secondary outcomes

1. Maternal mortality or severe morbidity (composite of ruptured uterus, haemorrhage, severe perineal damage, infection requiring antibiotics, organ failure, admission to intensive care).
2. Infant mortality or severe morbidity (composite of birth asphyxia, neonatal encephalopathy, birth trauma, infection requiring antibiotics, childhood disability, admission to intensive care).
3. Augmentation (rupture of membranes, or syntocinon, or both).
4. Epidural for pain relief.
5. Narcotics for pain relief.
7. Haemorrhage (greater than 1000 mL).
8. Severe perineal damage.
9. Apgar less than seven at five minutes.
11. Ruptured uterus.
15. Birth asphyxia.
17. Birth trauma (e.g. fractured skull, fractured clavicle, Erbs palsy, cephalohaematoma).
18. Admission to neonatal intensive care.
19. Prolonged hospital stay (as defined by trialists) for mothers.
20. Prolonged hospital stay (as defined by trialists) for infants.
22. Re-admission to hospital for infants.
23. Maternal distress.
24. Mothers' willingness to accept the technique for future births.
25. Maternal incontinence after six weeks postnatal.

Search methods for identification of studies

Electronic searches

We contacted the Trials Search Co-ordinator to search the Cochrane Pregnancy and Childbirth Group's Trials Register (28 February 2013)
The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:

1. monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. weekly searches of MEDLINE;
3. weekly searches of Embase;
4. handsearches of 30 journals and the proceedings of major conferences;
5. weekly current awareness alerts for a further 44 journals plus monthly BioMed Central email alerts.

Details of the search strategies for CENTRAL, MEDLINE and Embase, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Specialized Register' section within the editorial information about the Cochrane Pregnancy and Childbirth Group.

Trials identified through the searching activities described above are each assigned to a review topic (or topics). The Trials Search Co-ordinator searches the register for each review using the topic list rather than keywords.

Searching other resources

We searched the reference section of studies identified. We did not apply any language restrictions.
Data collection and analysis

Selection of studies
Three review authors (S Downe (SD), H Dahlen (HD), G Gyte (GG)) independently assessed for inclusion all the potential studies we identified as a result of the search strategy. We were in agreement on selection but would have resolved any disagreement through discussion or, if required, would have consulted the fourth member of the team. We would have included studies published in abstract only had we identified any, and we would have tried to contact authors for further information.

Data extraction and management
We designed a form to extract data. For eligible studies, two review authors (GG, HD) extracted the data using the agreed form. We resolved discrepancies through discussion and consultation with a third member of the team (SD). We entered data into Review Manager software (RevMan 2012) and checked for accuracy (GG and HD).

When information regarding any of the above was unclear, we attempted to contact authors of the original reports to provide further details.

Assessment of risk of bias in included studies
Two review authors (GG, HD) independently assessed risk of bias for each included study using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2011). We resolved the uncertainties by discussion with a third assessor (SD). To date, we have found no cluster-randomised trials, but should we identify any in future updates, we will include them and we shall use the guidance in the Cochrane Handbook for assessing their risk of bias (Higgins 2011).

(1) Sequence generation (checking for possible selection bias)
We describe for each included study the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.
We assessed the method as:
- low risk of bias (any truly random process, e.g. random number table; computer random number generator);
- high risk of bias (any non-random process, e.g. odd or even date of birth; hospital or clinic record number);
- unclear risk of bias.

(2) Allocation concealment (checking for possible selection bias)
We describe for each included study the method used to conceal the allocation sequence and determine whether intervention allocation could have been foreseen in advance of, or during recruitment, or changed after assignment.
We assessed the methods as:
- low risk of bias (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- high risk of bias (open random allocation; unscaled or non-opaque envelopes, alternation; date of birth);
- unclear risk of bias.

(3) Blinding (checking for possible performance bias)
We describe for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. We consider that studies are at low risk of bias if they were blinded, or if we judge that the lack of blinding could not have affected the results. We assessed blinding separately for different outcomes or classes of outcomes.
We assessed the methods as:
- low, high or unclear risk of bias for participants;
- low, high or unclear risk of bias for personnel;
- low, high or unclear risk of bias for outcome assessors.

(4) Incomplete outcome data (checking for possible attrition bias through withdrawals, dropouts, protocol deviations)
We describe for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We state whether attrition or exclusions were reported, the numbers included in the analysis at each stage (compared with the total randomised participants), reasons for attrition or exclusion where reported, and whether missing data were balanced across groups or were related to outcomes. Where sufficient information was reported, we re-included missing data in the analyses which were undertaken. If further information can be supplied from the trial authors, we will include the data in future updates. We assessed methods as:
- low risk of bias;
- high risk of bias;
- unclear risk of bias.

Where there were missing data greater than 20%, we have discussed the possible impact. Where in future updates of this review this may occur with long-term outcomes, we acknowledge that such data may be difficult to attain.

(5) Selective reporting bias
We describe for each included study how we investigated the possibility of selective outcome reporting bias and what we found.
We assessed the methods as:

- low risk of bias (where it is clear that all of the study’s pre-specified outcomes and all expected outcomes of interest to the review have been reported);
- high risk of bias (where not all the study’s pre-specified outcomes have been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest are reported incompletely and so cannot be used; study fails to include results of a key outcome that would have been expected to have been reported);
- unclear risk of bias.

(6) Other sources of bias

We describe for each included study any important concerns we have about other possible sources of bias, e.g. whether the study was stopped early and reporting the reason; baseline imbalances; and differential diagnoses.

We assessed whether each study was free of other problems that could put it at risk of bias:

- low risk of bias;
- high risk of bias;
- unclear risk of bias.

(7) Overall risk of bias

We have made explicit judgements about whether studies are at high risk of bias, according to the criteria given in the Cochrane Handbook (Higgins 2011). With reference to (1) to (6) above, we assessed the likely magnitude and direction of the bias and whether we considered it is likely to impact on the findings. We would have explored the impact of this level of bias through undertaking sensitivity analyses (Sensitivity analysis) if necessary.

Measures of treatment effect

We conducted the statistical analysis using the Review Manager software (RevMan 2012).

Dichotomous data

For dichotomous data, we present results as summary risk ratio with 95% confidence intervals.

Continuous data

For continuous data, we used the mean difference if outcomes are measured in the same way between trials. We used the standardised mean difference to combine trials that measured the same outcome, but used different methods.

Unit of analysis issues

Cluster-randomised trials

For future updates, we will include cluster-randomised trials in the analyses along with individually-randomised trials. We will apply the methods described in the Cochrane Handbook using an estimate of the intraclass correlation co-efficient (ICC) derived from the trial (if possible), from a similar trial or from a study of a similar population. If we use ICCs from other sources, we will report this and conduct sensitivity analyses to investigate the effect of variation in the ICC. If we identify both cluster-randomised trials and individually-randomised trials, we plan to synthesise the relevant information with the help of a statistician. We will consider it reasonable to combine the results from both if there is little heterogeneity between the study designs and the interaction between the effect of intervention and the choice of randomisation unit is considered to be unlikely. We will also acknowledge heterogeneity in the randomisation unit and perform a sensitivity analysis to investigate the effects of the randomisation unit.

Dealing with missing data

For included studies, we noted levels of attrition. We would have explored the impact of including studies with high levels of missing data in the overall assessment of treatment effect by using sensitivity analysis; however, we found only one study in each of two comparisons, so sensitivity analyses were not possible.

For all outcomes, we carried out analyses, as far as possible, on an intention-to-treat basis, i.e. we attempted to include all participants randomised to each group in the analyses, and all participants were analysed in the group to which they were allocated, regardless of whether or not they received the allocated intervention. The denominator for each outcome in each trial was the number randomised minus any participants whose outcomes were known to be missing.

We identified one study where more than 20% of data were lost due to exclusions (Abukhalil 1996), but in neither study were participants analysed in the wrong groups. We could not explore this by sensitivity analyses (see Sensitivity analysis) because this was the only study in that comparison (Comparison 6).

Assessment of heterogeneity

In future updates we will assess statistical heterogeneity in each meta-analysis using the $T^2$, $I^2$ and $\chi^2$ statistics. We will regard heterogeneity as substantial if the $T^2$ is greater than zero and either the $I^2$ is greater than 30% or there is a low $P$ value (less than 0.10) in the $\chi^2$ test for heterogeneity.
Assessment of reporting biases

In future updates, if there are 10 or more studies in the meta-analysis, we will investigate reporting biases (such as publication bias) using funnel plots. We will assess funnel plot asymmetry visually, and use formal tests for funnel plot asymmetry. For continuous outcomes we will use the test proposed by Egger 1997, and for dichotomous outcomes we will use the test proposed by Harbord 2006. If asymmetry is detected in any of these tests or is suggested by a visual assessment, we will perform exploratory analyses to investigate it.

Data synthesis

We have carried out statistical analysis using the Review Manager software (RevMan 2012). For future updates, we will use fixed-effect meta-analysis for combining data where it is reasonable to assume that studies are estimating the same underlying treatment effect: i.e. where trials are examining the same intervention, and the trials’ populations and methods are judged sufficiently similar. If there is clinical heterogeneity sufficient to expect that the underlying treatment effects differ between trials, or if substantial statistical heterogeneity is detected, we will use random-effects meta-analysis to produce an overall summary if an average treatment effect across trials is considered clinically meaningful. The random-effects summary will be treated as the average range of possible treatment effects and we will discuss the clinical implications of treatment effects differing between trials. If the average treatment effect is not clinically meaningful, we will not combine trials.

For future updates, where we use random-effects analyses, we will present the results as the average treatment effect with its 95% confidence interval, and the estimates of T², Chi² P value and I² (Higgins 2009).

Subgroup analysis and investigation of heterogeneity

In future updates, if we identify substantial heterogeneity, we will investigate it using subgroup analyses and sensitivity analyses. We will consider whether an overall summary is meaningful, and if it is, use random-effects analysis to produce it.

We planned to carry out the following subgroup analyses:

1. Different timing regimens for undertaking vaginal examination (all outcomes).
2. Primiparous women versus multiparous women (primary outcomes).
3. Women in low- and middle-income countries versus women in high-income countries (primary outcomes).

We intended to assess subgroup differences using interaction tests available within RevMan (RevMan 2012) and report the results of subgroup analyses quoting the χ² statistic and P values, and the interaction test I² value, but there were insufficient data.

We found data to compare two-hourly and four-hourly vaginal examinations, and we are trying to contact the authors of one study to see if they have their data separated by parity and will include these in a future update if the data exist. Both the included studies were undertaken in high-income settings, so subgroup analysis by country type was not undertaken. In future updates, we will include this subgroup analysis if the data are available and relevant. We will also look at possible differences of effect by various ethnic groups if the data permit.

Sensitivity analysis

In future updates, we will perform sensitivity analysis based on trial quality, separating high-quality trials from trials of lower quality. 'High quality' will, for the purposes of this sensitivity analysis, be defined as a trial having adequate allocation concealment and a reasonably expected loss to follow-up classified as less than 20%, given the stated importance of attrition as a quality measure (Tierney 2005).

RESULTS

Description of studies

See Characteristics of included studies and Characteristics of excluded studies.

Results of the search

The search of the Pregnancy and Childbirth Group’s Trials Register retrieved nine reports of seven studies. We searched the reference section of the included studies and only identified reports with historical and non-randomised concurrent controls (Figure 1).
Figure 1. Study flow diagram.

PCG Trials Register = 7 trials (9 reports)

Searching reference lists of retrieved studies = 0

7 trials (9 reports) after duplicates removed

9 reports screened

9 full-text articles assessed for eligibility

0 of studies included in qualitative synthesis

2 trials (3 reports) included in quantitative synthesis (meta-analysis)

0 of records excluded

5 trials (6 reports) excluded, with reasons
Included studies

We included two of the studies identified by the search (Abukhalil 1996; Murphy 1986). One compared vaginal examinations with rectal examinations (Murphy 1986) and the other compared differing times of doing vaginal examinations, two hourly versus four hourly (Abukhalil 1996). We were unable to combine the studies in meta-analyses because the two included studies looked at different comparisons.

Excluded studies

We excluded five studies (see Characteristics of excluded studies).

Risk of bias in included studies

See Figure 2

Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.
Allocation
Risk of selection bias was unclear in both studies, with Murphy 1986 not reporting on how the randomised sequence was generated but using adequate allocation concealment and Abukhalil 1996 using good randomisation but providing no information on allocation concealment.

Blinding
It was not possible to blind participants and clinicians in either study, and there was no attempt to blind assessors.

Incomplete outcome data
We identified low risk of attrition bias in the Murphy 1986 study. However, the Abukhalil 1996 randomised women at 32 weeks and then withdrew 27% of women who developed criteria for exclusion, such as, hypertension, pre-eclampsia, placenta praevia, intrauterine growth restriction, preterm labour, post term labour and breech presentation. Although a similar number of women were excluded from each group, we considered this could potentially introduce a high risk of bias.

Selective reporting
We did not assess the trial protocols for either study and so are unable to say if there was selective reporting bias.

Other potential sources of bias
We identified no other sources of bias in either included study.

Effects of interventions
Vaginal examinations versus no intervention
(Comparison 1: no studies)
We found no studies assessing this comparison.

Vaginal examination versus rectal examination
(Comparison 2: one study, 307 women)
We found one study with 307 women assessing this comparison (Murphy 1986). This study was of unclear quality overall because there was no information provided on how the randomisation sequence was generated and it was not possible to blind the study.

Primary outcomes
We identified no evidence of a difference in infections requiring antibiotics for the baby, between vaginal and rectal examinations, although there were insufficient data for a proper analysis (risk ratio (RR) 0.33 95% confidence interval (CI) 0.01 to 8.07, one study, 307 women, Analysis 2.3). We also assumed that the group B streptococcus (GBS) infection identified in one baby was treated with antibiotics, although this information was not provided. Group B Strep (GBS) is considered a serious infection in a baby, but it normally colonises the vaginal tract of some women with no signs or symptoms, so it is not considered an infection in women. There were no data on our other primary outcomes of length of labour and women feeling very positive about intrapartum care.

Secondary outcomes
We identified no difference in effect between vaginal and rectal examinations in terms of augmentation of labour (RR 1.03, 95% CI 0.63 to 1.68, one study, 307 women, Analysis 2.7), caesarean section (RR 0.33, 95% CI 0.03 to 3.15, one study, 307 women, Analysis 2.10), spontaneous vaginal birth (RR 0.98, 95% CI 0.90 to 1.06, one study, 307 women, Analysis 2.11), operative vaginal birth (RR 1.38, 95% CI 0.70 to 2.71, one study, 307 women Analysis 2.12), perinatal mortality (RR 0.99, 95% CI 0.06 to 15.74, one study, 307 infants Analysis 2.20) and admission to neonatal intensive care (RR 1.32, 95% CI 0.47 to 3.73, one study, 307 infants, Analysis 2.24).

Not pre-specified outcomes
We identified no difference in infections where there was no information about whether treatment was needed or not, either for the mother (RR 0.50, 95% CI 0.22 to 1.13, one study, 307 women, Analysis 2.33) or for the infant (RR 0.99, 95% CI 0.14 to 6.96, one study, 307 infants, Analysis 2.34). Fewer women found vaginal examinations very uncomfortable compared with rectal examinations (RR 0.42, 95% CI 0.25 to 0.70, one study, 303 women, Analysis 2.35).

Vaginal examination versus cervical technical assessment (Comparison 3: no studies)
We found no studies assessing this comparison.

Vaginal examination versus anal cleft/purple line (Comparison 4: no studies)
We found no studies assessing this comparison.

Vaginal examination versus maternal behavioural cues (Comparison 5: no studies)
We found no studies assessing this comparison.

Vaginal examinations, two hourly versus four hourly
(Comparison 6: one study, 150 women)
We found one study with 150 women assessing this comparison (Abukhalil 1996). This study was considered to be of poor quality due to: (1) the authors not reporting on whether there was allocation concealment in the randomisation process and (2) the authors excluded 27% (two-hourly group) and 28% (four-hourly group) of participants following randomisation because women were randomised at 32 weeks’ gestation and many women then developed exclusion criteria prior to labour. Mode of birth data were reported for all women as randomised at 32 weeks’ gestation, but the other outcomes are reported following these exclusions. The exclusions appeared justified and were similar in each group; however, we considered these exclusions to be a serious design flaw which increased the risk of bias.

**Primary outcomes**

We identified no difference in the length of labour between routine vaginal examinations at two-hourly and four-hourly intervals (mean difference (MD) in minutes -6.00, 95% CI -88.70 to 76.70) one study, 109 women, Analysis 6.1). There were no data on our other primary outcomes of maternal and infant infections requiring antibiotics.

**Secondary outcomes**

We identified no difference between routine vaginal examination at two-hourly and four-hourly intervals in the outcomes of augmentation of labour (RR 1.03, 95% CI 0.64 to 1.67, one study, 109 women, Analysis 6.7), epidural for pain relief (RR 0.77, 95% CI 0.39 to 1.55, one study, 109 women, Analysis 6.8), caesarean section (RR 0.77, 95% CI 0.36 to 1.64, one study, 150 women, Analysis 6.10), spontaneous vaginal birth (RR 0.98, 95% CI 0.80 to 1.21, one study, 150 women, Analysis 6.11) and operative vaginal birth (RR 1.44, 95% CI 0.66 to 3.17, one study, 150 women, Analysis 6.12).

**Discussion**

As we have noted above, it has been more than two decades since Chalmers and colleagues concluded in their systematic review of interventions in pregnancy and childbirth that the vaginal examination was an intervention with very little evidence of effectiveness (Chalmers 1989). On the basis of our findings in the current review, we conclude that there are still no well-designed, currently relevant studies that assess the effect of using vaginal examination, or any other intervention to assess labour progress, on important childbirth outcomes for mother and baby. There is some suggestion from one study in a high-income country that, if offered a choice between vaginal and rectal examinations, significantly more women preferred vaginal to rectal examination in labour on the basis of comfort, if the procedure is carried out with sensitivity (Murphy 1986). Given the range of new technical and behavioural approaches to assessment of labour progress that have been reported (Dahlen 2013), the lack of well-designed comparative studies is surprising. This is especially surprising given that the use of the vaginal examination is so ubiquitous, and that, even in a very recent study, it is reported to be undertaken too frequently, and to be experienced as painful and distressing for some women (Hassan 2012).

We recognise that an early warning system is vital for women who are labouring remotely from emergency obstetric maternity care, especially where rapid access to such support is difficult or impossible. The problem of detecting incipient or actual labour dystocia, and of differentiating this from labour that is slower than average but still physiological for a specific woman and baby, remains a vitally important one. Given the complex physiology and psychology of labour progress, it is likely that the optimal tool will combine clinical and behavioural data. As yet, this tool does not appear to exist.

**Summary of main results**

The two small studies that met the inclusion criteria for this review were both undertaken before 1995. Only two of the pre-specified comparisons of interest were addressed: the frequency of routine vaginal examination, and rectal versus vaginal procedures. Evidence of effect could not be confirmed for any of the comparisons pre-specified for this review, including length of labour, augmentation of labour rates, use of epidural for pain relief, mode of birth, perinatal mortality, infection needing antibiotics, and admission to neonatal unit.

Ratings of maternal comfort were measured for the use of rectal versus vaginal examination in the study undertaken by Murphy and colleagues (Murphy 1986). Women randomised to the rectal techniques group were more likely to find the examination ‘very uncomfortable’ than those randomised to the vaginal examination (11% versus 28%: inferential statistics not given). Although the data were not separated by parity, the authors state that post hoc analysis demonstrated similar findings for both nulliparous and primiparous women. They conclude that vaginal examination appears to be preferable, but that, whichever technique is used, it needs to be undertaken with due consideration for women’s feelings. Infection rates are reported in the narrative of the study, with no mention of antibiotic use. There were three diagnoses of neonatal infection: two were ‘sticky eye’ (one in each group) and one was Group B streptococcus (rectal examination group). There were six cases of maternal intrapartum pyrexia (five in the rectal group, one in the vaginal group) and 18 of puerperal pyrexia (11 in the rectal group, seven in the vaginal group). One case of persistent maternal pyrexia is reported in the Abukhalil study (Abukhalil 1996).
Overall completeness and applicability of evidence

Most of the comparisons planned for the review were not assessed in the included papers, and therefore there is no clear evidence on the effectiveness of vaginal examination for assessing labour progress in comparison to any of these alternatives. In the Murphy 1986 study, none of the primary outcomes of interest to the review were recorded, although one baby was diagnosed with Group B Streptococcus and we assumed would have had antibiotic treatment, though this was not specified in the paper. Length of labour was noted in the Abukhalil study (Abukhalil 1996). Although Murphy and colleagues measured woman's comfort, neither study recorded our primary maternal outcome of women's overall views of intrapartum care, which is currently a more commonly used measure in systematic reviews of interventions in pregnancy and childbirth.

In the Abukhalil 1996 study, all the women were nulliparous, and therefore the findings do not apply to multiparous women. Murphy combined outcomes for both nulliparous and multiparous women (Murphy 1986), and so it is not possible to assess variation in effect between these two groups of women, other than through author statements of similar findings between the two groups. In most settings, the findings relating to rectal examination are largely academic, as it has been almost universally replaced with vaginal techniques. However, in a recent study undertaken of practices in the Shanxi Province in China, eight out of nine hospitals studied used rectal examination to assess the progress of labour. The reason given for this by practitioners was that it was in the medical textbook used by doctors (Gao 2008). This suggests that the lack of formal evidence in this area still has important implications for practice.

The main limitation in the applicability of the evidence is the fact that both studies were undertaken over 20 years ago and both in high-income settings (Ireland and the UK) where most women are (and were, even at the time of the studies) admitted to hospital as a matter of routine, relatively early in labour, and attended by professional midwives and obstetric staff. This means that the findings cannot be applied to settings where different kinds of routine labour monitoring take place, to middle- and lower-income countries, to out-of-hospital settings, or to locations where professional maternity care is not available.

Quality of the evidence

The quality of the Abukhalil study was compromised in a number of areas. Women were randomised at the 32-week antenatal visit, and the group allocation was then recorded in the woman's case note. This meant that systematic bias based on known group allocation in the two months between group allocation and the onset of labour could have affected the integrity of the study. The long gap between randomisation and the onset of labour meant that 41/150 of the women randomised became ineligible, which is a higher proportion than that of 20% anticipated by the study protocol. Mode of birth is reported on all the women who were randomised, but the other outcome measures are not. The rationale for an intention-to-treat (ITT) analysis is to understand the likely effects of the introduction of a new intervention on a whole population, rather than on individuals who actually receive the intervention. This assumes two factors; that the study assesses the introduction of the intervention at the point where, in practice, it is likely to become active (in this case, during labour); and that all outcomes of interest should be reported for the whole population after the point at which the intervention becomes active. Neither of these elements holds true for the Abukhalil study (Abukhalil 1996).

The quality of the Murphy 1986 study is reasonable. However, as for the Abukhalil 1996 study, blinding was not possible due to the nature of the intervention. Even though women in the Murphy 1986 study were appropriately randomised at the onset of labour, there was still a risk that labour ward staff with particular views may have been assigned to women on the basis of their study group. Neither study reports detailed assessment of fidelity to address this potential for bias.

Potential biases in the review process

We have tried to minimise bias in the review process by undertaking the methodology using two independent assessments at every stage of the process. We needed some discussions with a third author to make some decisions. We believe we carried out a comprehensive search but there may be missing data in the published papers. We are trying to contact the study authors to try to obtain comprehensive data.

Agreements and disagreements with other studies or reviews

The vaginal examination is an intrinsic element in the use of the partogram. The Cochrane review on the routine use of the partogram concludes that “... on the basis of the findings of this review, we cannot recommend routine use of the partogram as part of standard labour management and care.” (Lavender 2012). The data from this review further suggest that there is, as yet, no good quality evidence available to determine best practice in terms of the frequency of the vaginal examination, or of its use as a routine assessment of either physiological labour progress or of incipient or actual labour dystocia. We, therefore, conclude that there is, as yet, no evidence to support or to reject routine vaginal examination as a part of standard labour management and care, or, in agreement with Lavender and colleagues (Lavender 2012), as an intrinsic element of the partogram. There do not appear to be any qualitative studies of women's views of rectal examination in labour. This review suggests that, in the very few places where rectal examination is still performed, a large minority of women might prefer vaginal examination on the
grounds of comfort. As we have noted in the introduction, qualitative studies of women’s views of vaginal examination indicate variation from positive appreciation of the technique as a way of knowing how their labour is progressing (Lavender 1999; Lewin 2005) to acknowledgement that it is a necessary part of labour, even though it might involve some pain and embarrassment (Lai 2002), to the potential for some women to perceive the technique as abusive and (re)traumatising, especially where there has been previous sexual abuse, or where women are already highly stressed and disempowered (Bergstrom 1992; Duddle 1991; Hassan 2012; Menage 1993; Menage 1996; Murphy 1986; Swahnberg 2011). Many of these authors concur with the conclusion of the study undertaken by Murphy et al (Murphy 1986) that “...whichever method of assessment is used, great consideration should be given to women’s feelings during the examination” (p97).

**AUTHORS’ CONCLUSIONS**

**Implications for practice**

We found no randomised controlled trial evidence to support or reject the routine use of vaginal examinations during labour. The two studies identified, one comparing vaginal and rectal examinations in labour and the other comparing two-hourly with four-hourly vaginal examinations, were both conducted over 20 years ago in hospitals staffed with professional midwives and obstetricians in high-income settings. One study found significantly more women reported rectal examinations as very uncomfortable, hence it appears that women prefer vaginal examinations, but their effectiveness still needs to be assessed. The effectiveness of the partogram, of which the vaginal examination is one component, is addressed in another Cochrane review (Lavender 2012).

**Implications for research**

There is global concern about excessive maternal and fetal mortality and morbidity due to prolonged and obstructed labour (McClure 2009; Wäll 2006), about the adverse consequences for mother and infant of over diagnosis and treatment of prolonged labour (Neal 2012), and about the global economic unsustainability of over-treatment in maternity care (Conrad 2010; Gibbons 2010). As a consequence, there is an urgent need for large-scale, definitive research to establish both sensitive and specific measures of labour progress.

We believe it is now critical for researchers to definitively establish an effective means of assessing labour progress, based on good physiological and behavioural principles. We recommend that this work commences with a systematic review of observational studies of the full range of the normal physiology of labour, and of important behavioural cues, across populations from different ethnic and cultural groups, labouring in different kinds of birth settings, and in low-, middle- and high-income countries. Remaining gaps in this evidence base need to be filled rapidly, ideally with a well-designed, large, multi-centred randomised controlled trial that also include alongside qualitative data, collection of the views and experiences of women and staff. An understanding of what works for whom, in what circumstances, will allow the development and testing of labour progress assessment tools and techniques that are acceptable to women and caregivers, and that are both sensitive and specific enough to identify pathological labour progress in time for it to be managed appropriately, while avoiding over diagnosis and over treatment of healthy women and babies who have unusual but physiological labour patterns. This assessment process should include new, non-invasive assessment tools that have already been proposed, but not yet tested rigorously (Burville 2002; Duff 2005; Hobbs 1998; Shepherd 2010), and personalised approaches (Neal 2012). The best method of integrating effective physical and behavioural assessment techniques into graphical displays (such as the partogram) should be a component of this study. Testing of the resulting tools should be carried out as a matter of urgency in the full range of high-, medium- and low-income settings.

**ACKNOWLEDGEMENTS**

As part of the pre-publication editorial process, the review will be commented on by three peers (an editor and two referees who are external to the editorial team), a member of the Pregnancy and Childbirth Group’s international panel of consumers and the Group’s Statistical Adviser.

The National Institute for Health Research (NIHR) is the largest single funder of the Cochrane Pregnancy and Childbirth Group. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the NIHR, NHS or the Department of Health.
References to studies included in this review

Abukhalil 1996 [published data only]

Murphy 1986 [published data only]

Chanrachakul 2001 [published data only]

Dupuis 2005 [published data only]

Foong 2000 [published data only]

Fuentes 1995 [published data only]

Peterson 1965 [published data only]

Additional references

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Flessig A. Are women given enough information by staff during labour and delivery?. *Midwifery* 1993;9:70–5.

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Gao Y. *A Study of Accessibility, Quality of Services and Other Factors that Contribute to Maternal Death in the Shanxi Province.* Darwin: Charles Darwin University, 2008.
Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term (Review)

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Gaskin 1980

Gibbons 2010

Groeschel 2001

Harbord 2006

Hassan 2012

Higgins 2009

Higgins 2011

Hobbs 1998

Huhn 2004

Imseis 1999

Incerti 2011

Jara 1956


Kok 1976

Kriewall 1977

Lai 2002

Lavender 1999

Lavender 2006

Lavender 2008

Lavender 2012

Lewin 2005

Lewin 1992

Lucidi 2000

Lumbiganon 2004

Maharaj 2007a
Makahaj 2007b

Manning 1961

McClure 2009

McCormick 2003

McKay 1991

McKay 1994

Menage 1993

Menage 1996

Mitchell 1977

Molina 2010

Neal 2010

Neal 2012

Neilson 2003

Neilson 2008

NICE 2007

Nizard 2009

O’Driscoll 1973

 Phelps 1995

Philpott 1972a

Philpott 1972b

Philpott 1972c

Prystowsky 1954

RevMan 2012

Richardson 1978
Roberts 1996

Saleem 2010

Santos 1997

Schutte 1983

Seaward 1998

Sharf 2007

Sheiner 2004

Shepherd 2010

Siener 1963

Simkin 2011

Smyth 2007
Winter 2009

Zador 1976

Zahalka 2005

Zhang 2002

Zhang 2010a

Zhang 2010b

* Indicates the major publication for the study
### Characteristics of included studies  
**[ordered by study ID]**

**Abukhalil 1996**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Methods</strong></td>
<td>RCT</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Inclusion criteria</td>
</tr>
<tr>
<td></td>
<td>● Nulliparous women in labour with singleton pregnancy.</td>
</tr>
<tr>
<td></td>
<td>● Women were recruited at 32 weeks if they had no fetal or maternal indicators precluding vaginal birth. Women were subsequently withdrawn if any of the exclusion criteria arose.</td>
</tr>
<tr>
<td></td>
<td>● 150 women were randomised but 41 were withdrawn due to development of exclusion criteria, leaving 109 women for whom data were collected.</td>
</tr>
<tr>
<td></td>
<td>● Exclusion criteria</td>
</tr>
<tr>
<td></td>
<td>● Multiple pregnancy; preterm labour (&lt; 37 weeks); elective CS; induction of labour (though these women seemed to be included); post-term (&gt; 42 weeks); PET/PIH; IUGR; breech; placenta praevia.</td>
</tr>
<tr>
<td><strong>Interventions</strong></td>
<td>Intervention: Vaginal examinations every 2 hours.</td>
</tr>
<tr>
<td></td>
<td>● Progress of labour reported on partogram.</td>
</tr>
<tr>
<td></td>
<td>● VEs could be done at other times as indicated, e.g. prior to epidural or pethidine; if full dilation was suspected; application of fetal scalp electrode or taking fetal blood sample.</td>
</tr>
<tr>
<td></td>
<td>● Total number randomised = 75 women.</td>
</tr>
<tr>
<td></td>
<td>● Then 20 (27%) withdrawals for PET/PIH IUGR; preterm labour; breech; post term; placenta praevia.</td>
</tr>
<tr>
<td></td>
<td>● So data on 55 women and infants, except mode of birth for which data were available for all women who were randomised.</td>
</tr>
<tr>
<td></td>
<td>Comparison: Vaginal examinations every 4 hours.</td>
</tr>
<tr>
<td></td>
<td>● Progress of labour reported on partogram.</td>
</tr>
<tr>
<td></td>
<td>● VEs could be done at other times as indicated, e.g. prior to epidural or pethidine; if full dilation was suspected; application of fetal scalp electrode or taking fetal blood sample.</td>
</tr>
<tr>
<td></td>
<td>● Total number randomised: n = 75 women.</td>
</tr>
<tr>
<td></td>
<td>● Then 21 (28%) withdrawals for PET/PIH IUGR; preterm labour; breech; post term; placenta praevia.</td>
</tr>
<tr>
<td></td>
<td>● So data on 54 women and infants, except mode of birth for which data were available for all women who were randomised.</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Length of labour; oxytocin; epidural; spontaneous labour; induced labour; spontaneous vaginal birth; operative vaginal birth; CS</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td>Setting: Not specifically stated but authors from North Staffordshire Maternity Unit, UK with 6000 births/year</td>
</tr>
<tr>
<td></td>
<td>May 1992 to April 1993</td>
</tr>
<tr>
<td></td>
<td>Subgroups:</td>
</tr>
<tr>
<td></td>
<td>1. Timing of VEs: compared 2 vs 4 hourly</td>
</tr>
<tr>
<td></td>
<td>2. Primiparous/multiparous/both</td>
</tr>
<tr>
<td></td>
<td>3. Low- and middle-income countries/high-income country</td>
</tr>
</tbody>
</table>
### Additional information

- ARM not mandatory as long as progress at 1cm/hr. If progress not satisfactory then ARM or oxytocin.
- Women encouraged to be ambulant in 1st stage and routine CTG not considered essential unless obstetrician indicated.

We are trying to contact the authors to ask about their randomisation process, to see if they have more information on the incidence and treatment of infection, and to ask if they have data on other outcomes

### Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors’ judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Low risk</td>
<td>“... computer derived using random number allocation ...”</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Unclear risk</td>
<td>“... group allocated stated on case notes ...” so no information to suggest allocation concealment</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>High risk</td>
<td>150 women were randomised then 27% of women in the 2-hourly arm and 28% of women in the 4-hourly arm were withdrawn because they developed exclusion criteria after randomisation</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Unclear risk</td>
<td>We did not assess the trial protocol.</td>
</tr>
<tr>
<td>Other bias</td>
<td>Low risk</td>
<td>We identified no other potential biases.</td>
</tr>
<tr>
<td>Blinding of participants and personnel (performance bias)</td>
<td>High risk</td>
<td>No information provided but it was not possible to blind women or personnel</td>
</tr>
<tr>
<td>Blinding of outcome assessment (detection bias)</td>
<td>High risk</td>
<td>No report of any attempt to blind assessors.</td>
</tr>
</tbody>
</table>

### Murphy 1986

<table>
<thead>
<tr>
<th>Methods</th>
<th>RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>Inclusion criteria</td>
</tr>
<tr>
<td></td>
<td>Women in labour at term with recent rupture of membranes.</td>
</tr>
<tr>
<td></td>
<td>Total number randomised = 307.</td>
</tr>
<tr>
<td></td>
<td>Exclusion criteria</td>
</tr>
<tr>
<td></td>
<td>None specified.</td>
</tr>
<tr>
<td>Interventions</td>
<td>Intervention: Vaginal examination.</td>
</tr>
<tr>
<td></td>
<td>VE to assess progress in labour.</td>
</tr>
</tbody>
</table>
Women examined on entry, 1 hour later then every 2 hours unless more frequent examinations were prompted by slow progress in labour.
- Woman in dorsal position.
- Hands scrubbed and sterile surgical gloves worn.
- Drapes and antiseptics solutions not employed and Hibitane cream used as lubricant.
- Total number randomised to VE = 154.

Comparison: Rectal examination.
- Rectal examination to assess progress in labour.
- Rectal examinations done in the usual way using disposable polythene glove.
- Drapes and antiseptics solutions not employed and Hibitane cream used as lubricant.
- Total number randomised to rectal examination = 153.

Outcomes

Comfort of the pelvic examination (categorical question, 10 cm linear analogue scale, open question); infection, various aspects of labour (CS; vaginal birth; augmentation). The authors also measured ‘Admission to NICU’ although this was not stated as an outcome in their methods section.

Notes

Setting: National Maternity Hospital Dublin from February to April 1984
Sub groups
1. Timing of VEs. Women examined on entry, 1 hour later then every 2 hours unless more frequent examinations were prompted by slow progress in labour.
2. Primiparous/multiparous/both (data not separated).
3. Low- and middle-income countries/high-income country only.

We are trying to contact the authors to ask about their randomisation process, to see if they are able to provide their data by parity and to ask if they have on other outcomes. Of the two perinatal mortalities, one was a stillbirth in the rectal examination group, and the other a neonatal death in the vaginal examination group.

Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors' judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Unclear risk</td>
<td>“… randomly allocated … but no information provided on sequence generation</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Low risk</td>
<td>”... serially numbered, sealed, opaque envelopes ...”</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias) All outcomes</td>
<td>Low risk</td>
<td>Out of 307 women, 3 were 'incorrectly labelled'; 1 in rectal group and 3 in vaginal group missed the questionnaire but still had clinical outcomes assessed</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Unclear risk</td>
<td>We did not assess the trial protocol.</td>
</tr>
<tr>
<td>Other bias</td>
<td>Low risk</td>
<td>We identified no other potential biases.</td>
</tr>
</tbody>
</table>
Blinding of participants and personnel (performance bias)  
All outcomes  
High risk  
It was not possible to blind participants or personnel.

Blinding of outcome assessment (detection bias)  
All outcomes  
High risk  
Women's comfort was assessed using self-administered questionnaires, and women could not be blinded. Similarly, clinicians made the decisions on augmentation, CS and OVB and there was no information to say they were blinded.

ARM: artificial rupture of membranes  
CS: caesarean section  
CTG: cardiotocography  
IUGR: intrauterine growth restriction  
NICU: neonatal intensive care unit  
OVB: operative vaginal birth  
PET: pre-eclamptic toxemia  
PIH: pregnancy-induced hypertension  
RCT: randomised controlled trial  
VE: vaginal examination  
vs: versus

**Characteristics of excluded studies** [ordered by study ID]

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chanrachakul 2001</td>
<td>This study compared use of 'sweeping membranes alongside VEs' versus 'no sweeping membranes and VEs alone' to speed up labour</td>
</tr>
<tr>
<td>Dupuis 2005</td>
<td>This study compared the kind of practitioners who undertook VEs, and assessed whether a senior resident was more accurate at assessing position of baby's head than the attending physician. It is not about progress of labour as all women had a fully dilated cervical os when the examination was undertaken</td>
</tr>
<tr>
<td>Foong 2000</td>
<td>This study was a trial of membrane sweeping for induction of labour</td>
</tr>
<tr>
<td>Fuentes 1995</td>
<td>This study compared two different types of gel used to reduce infection when VEs are undertaken</td>
</tr>
<tr>
<td>Peterson 1965</td>
<td>This was a quasi-RCT with women allocated to groups alternately</td>
</tr>
</tbody>
</table>

RCT: randomised controlled trial  
VE: vaginal examination
**DATA AND ANALYSES**

Comparison 1. Vaginal examination versus no intervention

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Length of labour (primary outcome) [minutes]</td>
<td>0</td>
<td>0</td>
<td>Mean Difference (IV, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>2 Maternal infection requiring antibiotics (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>3 Neonatal infection requiring antibiotics (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>4 Very positive views of intrapartum care (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>5 Maternal mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>6 Infant mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>7 Augmentation of labour</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>8 Epidural for pain relief</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>9 Narcotics for pain relief</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>10 Caesarean section</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>11 Spontaneous vaginal birth</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>12 Operative vaginal birth</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>13 Haemorrhage (&gt; 1000 mL)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>14 Severe perineal damage</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>15 Apgar &lt; 7 at 5 minutes</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>16 Maternal mortality</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>17 Ruptured uterus</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>18 Maternal organ failure</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>19 Maternal admission to intensive care</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>20 Perinatal mortality</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>21 Birth asphyxia</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>22 Neonatal encephalopathy</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>23 Neonatal birth trauma</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>24 Admission to neonatal intensive care unit</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>25 Prolonged hospital stay for mothers</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>26 Prolonged hospital stay for infant</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>27 Re-admission to hospital for mothers</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>28 Re-admission to hospital for infants</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>29 Maternal distress</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
</tbody>
</table>
Comparison 2. Vaginal examination versus rectal examination

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
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<tbody>
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<td>0</td>
<td>0</td>
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<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>2 Maternal infection requiring antibiotics (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>3 Neonatal infection requiring antibiotics (primary outcome)</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.33 [0.01, 8.07]</td>
</tr>
<tr>
<td>4 Very positive views of intrapartum care (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>5 Maternal mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>6 Infant mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>7 Augmentation of labour</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.03 [0.63, 1.68]</td>
</tr>
<tr>
<td>8 Epidural for pain relief</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>9 Narcotics for pain relief</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>10 Caesarean section</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.33 [0.03, 3.15]</td>
</tr>
<tr>
<td>11 Spontaneous vaginal birth</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.98 [0.90, 1.06]</td>
</tr>
<tr>
<td>12 Operative vaginal birth</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.38 [0.70, 2.71]</td>
</tr>
<tr>
<td>13 Haemorrhage (&gt; 1000 mL)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>14 Severe perineal damage</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>15 Apgar &lt; 7 at 5 minutes</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>16 Maternal mortality</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>17 Ruptured uterus</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>18 Maternal organ failure</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>19 Maternal admission to intensive care</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>20 Perinatal mortality</td>
<td>1</td>
<td>307</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.99 [0.06, 15.74]</td>
</tr>
<tr>
<td>21 Birth asphyxia</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>22 Neonatal encephalopathy</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>23 Neonatal birth trauma</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>Outcome or subgroup title</td>
<td>No. of studies</td>
<td>No. of participants</td>
<td>Statistical method</td>
<td>Effect size</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------------</td>
<td>---------------------</td>
<td>---------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1 Length of labour (primary outcome)</td>
<td>1</td>
<td>109</td>
<td>Mean Difference (IV, Fixed, 95% CI)</td>
<td>-6.0 [-88.70, 76.70]</td>
</tr>
<tr>
<td>2 Maternal infection requiring antibiotics (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>3 Neonatal infection requiring antibiotics (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>4 Very positive views of intrapartum care (primary outcome)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>5 Maternal mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>6 Infant mortality or severe morbidity (composite)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>7 Augmentation of labour</td>
<td>1</td>
<td>109</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.03 [0.64, 1.67]</td>
</tr>
<tr>
<td>8 Epidural for pain relief</td>
<td>1</td>
<td>109</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.77 [0.39, 1.55]</td>
</tr>
<tr>
<td>9 Narcotics for pain relief</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>10 Caesarean section</td>
<td>1</td>
<td>150</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.77 [0.36, 1.64]</td>
</tr>
<tr>
<td>11 Spontaneous vaginal birth</td>
<td>1</td>
<td>150</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.98 [0.80, 1.21]</td>
</tr>
<tr>
<td>12 Operative vaginal birth</td>
<td>1</td>
<td>150</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.44 [0.66, 3.17]</td>
</tr>
<tr>
<td>13 Haemorrhage (&gt;1000 mL)</td>
<td>0</td>
<td>0</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.0 [0.0, 0.0]</td>
</tr>
<tr>
<td>Event</td>
<td>Reference</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------</td>
<td>---------------------------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>14 Severe perineal damage</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Apgar &lt; 7 at 5 min</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Maternal mortality</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Ruptured uterus</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Maternal organ failure</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Maternal admission to intensive</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Perinatal mortality</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Birth asphyxia</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Neonatal encephalopathy</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 Neonatal birth trauma</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Admission to neonatal intensive</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Prolonged hospital stay for mothers</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 Prolonged hospital stay for infant</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 Re-admission to hospital for mothers</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 Re-admission to hospital for infants</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 Maternal distress</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Mother willing to accept same intervention in future births</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Maternal incontinence after 6 weeks</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Childhood disability</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 Maternal infection with unknown treatment - not pre-specified</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34 Infant infection with unknown treatment - not pre-specified</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 Very uncomfortable (not pre-specified)</td>
<td></td>
<td>0.0 [0.0, 0.0]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Analysis 2.3. Comparison 2 Vaginal examination versus rectal examination, Outcome 3 Neonatal infection requiring antibiotics (primary outcome).

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

**Comparison:** 2 Vaginal examination versus rectal examination.

**Outcome:** 3 Neonatal infection requiring antibiotics (primary outcome).

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk ratio</th>
<th>Weight</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal examination</td>
<td>Rectal examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murphy 1986</td>
<td>0/154</td>
<td>1/153</td>
<td>100.0 %</td>
<td>0.33 [0.01, 8.07]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>154</td>
<td>153</td>
<td>100.0 %</td>
<td>0.33 [0.01, 8.07]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 0 (Vaginal examination), 1 (Rectal examination).

Heterogeneity: not applicable.

Test for overall effect: Z = 0.68 (P = 0.50).

Test for subgroup differences: Not applicable.

### Analysis 2.7. Comparison 2 Vaginal examination versus rectal examination, Outcome 7 Augmentation of labour.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

**Comparison:** 2 Vaginal examination versus rectal examination.

**Outcome:** 7 Augmentation of labour.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk ratio</th>
<th>Weight</th>
<th>Risk ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal examination</td>
<td>Rectal examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murphy 1986</td>
<td>27/154</td>
<td>26/153</td>
<td>100.0 %</td>
<td>1.03 [0.63, 1.68]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>154</td>
<td>153</td>
<td>100.0 %</td>
<td>1.03 [0.63, 1.68]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 27 (Vaginal examination), 26 (Rectal examination).

Heterogeneity: not applicable.

Test for overall effect: Z = 0.12 (P = 0.90).

Test for subgroup differences: Not applicable.
### Analysis 2.10. Comparison 2 Vaginal examination versus rectal examination, Outcome 10 Caesarean section.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 2 Vaginal examination versus rectal examination

**Outcome:** 10 Caesarean section

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>1/154</td>
<td>3/153</td>
<td></td>
<td></td>
<td>100.0 % 0.33 [ 0.03, 3.15 ]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td></td>
<td><strong>100.0 % 0.33 [ 0.03, 3.15 ]</strong></td>
</tr>
</tbody>
</table>

Total events: 1 (Vaginal examination), 3 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 0.96 (P = 0.34)

Test for subgroup differences: Not applicable

---

### Analysis 2.11. Comparison 2 Vaginal examination versus rectal examination, Outcome 11 Spontaneous vaginal birth.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 2 Vaginal examination versus rectal examination

**Outcome:** 11 Spontaneous vaginal birth

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>135/154</td>
<td>137/153</td>
<td></td>
<td></td>
<td>100.0 % 0.98 [ 0.90, 1.06 ]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td></td>
<td><strong>100.0 % 0.98 [ 0.90, 1.06 ]</strong></td>
</tr>
</tbody>
</table>

Total events: 135 (Vaginal examination), 137 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 0.52 (P = 0.60)

Test for subgroup differences: Not applicable
### Analysis 2.12. Comparison 2 Vaginal examination versus rectal examination, Outcome 12 Operative vaginal birth.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 2 Vaginal examination versus rectal examination

**Outcome:** 12 Operative vaginal birth

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Murphy 1986</td>
<td>18/154</td>
<td>13/153</td>
<td>1.38 [0.70, 2.71]</td>
<td>100.0 %</td>
<td>1.38 [0.70, 2.71]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td>100.0 %</td>
<td>1.38 [0.70, 2.71]</td>
</tr>
</tbody>
</table>

Total events: 18 (Vaginal examination), 13 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 0.92 (P = 0.36)

Test for subgroup differences: Not applicable

---

### Analysis 2.20. Comparison 2 Vaginal examination versus rectal examination, Outcome 20 Perinatal mortality.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 2 Vaginal examination versus rectal examination

**Outcome:** 20 Perinatal mortality

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Murphy 1986 (1)</td>
<td>1/154</td>
<td>1/153</td>
<td>0.99 [0.06, 15.74]</td>
<td>100.0 %</td>
<td>0.99 [0.06, 15.74]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td>100.0 %</td>
<td>0.99 [0.06, 15.74]</td>
</tr>
</tbody>
</table>

Total events: 1 (Vaginal examination), 1 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 0.00 (P = 1.0)

Test for subgroup differences: Not applicable

---

(1) Of the two perinatal mortalities, one was a stillbirth in the rectal examination group, and the other a neonatal death in the vaginal examination group.
Analysis 2.24. Comparison 2 Vaginal examination versus rectal examination, Outcome 24 Admission to neonatal intensive care unit.

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

Comparison: 2 Vaginal examination versus rectal examination

Outcome: 24 Admission to neonatal intensive care unit

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>8/154</td>
<td>6/153</td>
<td>1.32 [0.47, 3.73]</td>
<td>100.0%</td>
<td>1.32 [0.47, 3.73]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td>100.0%</td>
<td>1.32 [0.47, 3.73]</td>
</tr>
</tbody>
</table>

Total events: 8 (Vaginal examination), 6 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 0.53 (P = 0.59)

Test for subgroup differences: Not applicable

Analysis 2.33. Comparison 2 Vaginal examination versus rectal examination, Outcome 33 Maternal infection with unknown treatment (not pre-specified).

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

Comparison: 2 Vaginal examination versus rectal examination

Outcome: 33 Maternal infection with unknown treatment (not pre-specified)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination</th>
<th>Rectal examination</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>8/154</td>
<td>16/153</td>
<td>0.50 [0.22, 1.13]</td>
<td>100.0%</td>
<td>0.50 [0.22, 1.13]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td></td>
<td>100.0%</td>
<td>0.50 [0.22, 1.13]</td>
</tr>
</tbody>
</table>

Total events: 8 (Vaginal examination), 16 (Rectal examination)

Heterogeneity: not applicable

Test for overall effect: Z = 1.68 (P = 0.094)

Test for subgroup differences: Not applicable
Analysis 2.34. Comparison 2 Vaginal examination versus rectal examination, Outcome 34 Infant infection with unknown treatment (not pre-specified).

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

Comparison: 2 Vaginal examination versus rectal examination.

Outcome: 34 Infant infection with unknown treatment (not pre-specified).

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination n/N</th>
<th>Rectal examination n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight %</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>2/154</td>
<td>2/153</td>
<td>100.0 % 0.99 [0.14, 6.96]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>154</strong></td>
<td><strong>153</strong></td>
<td><strong>100.0 % 0.99 [0.14, 6.96]</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 2 (Vaginal examination), 2 (Rectal examination).
Heterogeneity: not applicable.
Test for overall effect: Z = 0.01 (P = 0.99).
Test for subgroup differences: Not applicable.

Analysis 2.35. Comparison 2 Vaginal examination versus rectal examination, Outcome 35 Very uncomfortable (not pre-specified).

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

Comparison: 2 Vaginal examination versus rectal examination.

Outcome: 35 Very uncomfortable (not pre-specified).

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Vaginal examination n/N</th>
<th>Rectal examination n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight %</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murphy 1986</td>
<td>17/151</td>
<td>41/152</td>
<td>100.0 % 0.42 [0.25, 0.70]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>151</strong></td>
<td><strong>152</strong></td>
<td><strong>100.0 % 0.42 [0.25, 0.70]</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 17 (Vaginal examination), 41 (Rectal examination).
Heterogeneity: not applicable.
Test for overall effect: Z = 3.30 (P = 0.00096).
Test for subgroup differences: Not applicable.
### Analysis 6.1. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 1 Length of labour (primary outcome).

#### Review:
Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

#### Comparison:
6 Vaginal examinations 2 hourly versus 4 hourly

#### Outcome:
1 Length of labour (primary outcome)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly</th>
<th>VE 4-hourly</th>
<th>Mean Difference</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean(SD)[minutes]</td>
<td>N</td>
<td>Mean(SD)[minutes]</td>
</tr>
<tr>
<td>Abukhalil 1996</td>
<td>55</td>
<td>399.5 (192.6)</td>
<td>54</td>
<td>405.5 (244.4)</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>55</strong></td>
<td><strong>54</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: not applicable
Test for overall effect: Z = 0.14 (P = 0.89)
Test for subgroup differences: Not applicable

### Analysis 6.7. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 7 Augmentation of labour.

#### Review:
Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

#### Comparison:
6 Vaginal examinations 2 hourly versus 4 hourly

#### Outcome:
7 Augmentation of labour

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly</th>
<th>VE 4-hourly</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Abukhalil 1996</td>
<td>21/55</td>
<td>20/54</td>
<td>1.03 [0.64, 1.67]</td>
<td>100.0 %</td>
<td>1.03 [0.64, 1.67]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>55</strong></td>
<td><strong>54</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 21 (VE 2-hourly), 20 (VE 4-hourly)
Heterogeneity: not applicable
Test for overall effect: Z = 0.12 (P = 0.90)
Test for subgroup differences: Not applicable
**Analysis 6.8. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 8 Epidural for pain relief.**

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

Comparison: 6 Vaginal examinations 2 hourly versus 4 hourly.

Outcome: 8 Epidural for pain relief.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly n/N</th>
<th>VE 4-hourly n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abukhalil 1996</td>
<td>11/55</td>
<td>14/54</td>
<td>0.77 [0.39, 1.55]</td>
<td>100.0 %</td>
<td>0.77 [0.39, 1.55]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>55</td>
<td>54</td>
<td>100.0 %</td>
<td>0.77 [0.39, 1.55]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 11 (VE 2-hourly), 14 (VE 4-hourly).
Heterogeneity: not applicable.
Test for overall effect: Z = 0.73 (P = 0.46).
Test for subgroup differences: Not applicable.

---

**Analysis 6.10. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 10 Caesarean section.**

Review: Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term.

Comparison: 6 Vaginal examinations 2 hourly versus 4 hourly.

Outcome: 10 Caesarean section.

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly n/N</th>
<th>VE 4-hourly n/N</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H,Fixed,95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abukhalil 1996</td>
<td>10/75</td>
<td>13/75</td>
<td>0.77 [0.36, 1.64]</td>
<td>100.0 %</td>
<td>0.77 [0.36, 1.64]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>75</td>
<td>75</td>
<td>100.0 %</td>
<td>0.77 [0.36, 1.64]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 10 (VE 2-hourly), 13 (VE 4-hourly).
Heterogeneity: not applicable.
Test for overall effect: Z = 0.68 (P = 0.50).
Test for subgroup differences: Not applicable.
### Analysis 6.11. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 11 Spontaneous vaginal birth.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 6 Vaginal examinations 2 hourly versus 4 hourly

**Outcome:** 11 Spontaneous vaginal birth

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly</th>
<th>VE 4-hourly</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Abukhalil 1996</td>
<td>52/75</td>
<td>53/75</td>
<td>100.0 %</td>
<td>0.98 [ 0.80, 1.21 ]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>75</strong></td>
<td><strong>75</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>0.98 [ 0.80, 1.21 ]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 52 (VE 2-hourly), 53 (VE 4-hourly)
Heterogeneity: not applicable
Test for overall effect: Z = 0.18 (P = 0.86)
Test for subgroup differences: Not applicable

### Analysis 6.12. Comparison 6 Vaginal examinations 2 hourly versus 4 hourly, Outcome 12 Operative vaginal birth.

**Review:** Routine vaginal examinations for assessing progress of labour to improve outcomes for women and babies at term

**Comparison:** 6 Vaginal examinations 2 hourly versus 4 hourly

**Outcome:** 12 Operative vaginal birth

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>VE 2-hourly</th>
<th>VE 4-hourly</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Abukhalil 1996</td>
<td>13/75</td>
<td>9/75</td>
<td>100.0 %</td>
<td>1.44 [ 0.66, 3.17 ]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>75</strong></td>
<td><strong>75</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>1.44 [ 0.66, 3.17 ]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events: 13 (VE 2-hourly), 9 (VE 4-hourly)
Heterogeneity: not applicable
Test for overall effect: Z = 0.92 (P = 0.36)
Test for subgroup differences: Not applicable
### Table 1. Cervical technologies

<table>
<thead>
<tr>
<th>Cervical technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td><strong>Cervimeter</strong>&lt;br&gt;One of the earliest technologies developed for verification of cervical dilation (vaginally) was developed by Friedman in 1956 in order to objectively measure cervical dilatation and confirm the results from his previous studies (Friedman 1956b). The device adapted dressing forceps that had bulldog clips attached at one end and a hinged ruler at the other. The clips were applied to the cervix and as the cervix dilated the handles on the forceps would close. The device had a number of disadvantages described by Friedman, such as trauma to the cervix if the woman moved, discomfort for the women and a need to remain supine. Friedman concluded that digital examination was more expedient despite the accuracy of the cervimeter (Friedman 1956b).</td>
</tr>
<tr>
<td><strong>Electromechanical</strong></td>
<td><strong>Electromechanical cervicometers</strong>&lt;br&gt;Friedman continued to try and modify the cervimeter by developing an electromechanical device. This device consisted of a row of retractable needles that held onto the cervix and were attached to a pair of lever arms. A small volt was applied to one of the lever arms and a graphic amplifier and recorder at another point. An alarm sounded when a preset dilation point had been reached (Friedman 1963). Again, while reportedly accurate, the machine tended to dislodge easily and Friedman concluded that digital examinations were faster and thus more useful than instruments. Electromechanical cervicometers were also introduced by other researchers (Richardson 1978; Siener 1963) but the devices were bulky, distorted the cervix and interfered with vaginal examinations and birth (Nizard 2009).</td>
</tr>
<tr>
<td><strong>Electromagnetic</strong></td>
<td><strong>Electromagnetic cervicometer</strong>&lt;br&gt;An electromagnetic cervicometer was developed in 1977 but had problems with magnetic distortion (Kriewall 1977). When dilation was greater than 6 cm, the earth’s magnetic field interfered with the measurements.</td>
</tr>
<tr>
<td><strong>Ultrasound</strong></td>
<td><strong>Ultrasound</strong>&lt;br&gt;Ultrasound cervimetry was described in the USA (Zador 1976), Netherlands (Eijskoot 1977; Kok 1976), Spain and the UK (Molina 2010). Ultrasound was applied to the abdomen and receivers were attached to the cervix. Dupuis studied the correlation between digital vaginal and transabdominal ultrasonographic examination of the fetal head position during labour in 110 women and found in 20% of cases ultrasound and clinical results differed significantly (&gt; 45°) (Dupuis 2005). Chou showed similar results in their study (Chou 2004). Zahalk compared transvaginal sonography and transabdominal sonography and vaginal examination in 60 women in the second stage of labour and found transvaginal sonography was the most accurate in determining position of the fetal presenting part (Zahalka 2005).</td>
</tr>
<tr>
<td><strong>Position tracking systems</strong></td>
<td><strong>Position tracking systems</strong>&lt;br&gt;The Barnev cervicometer (BirthTrack) uses an ultrasound-based position tracking system and sensors hooked to the cervix (Farine 2006; Sharf 2007). Developments are underway into the use of a magnetic position tracking system that uses a flat magnetic field placed under the mattress of the delivery bed (LaborPro System) and an attachment of a sensor to the examiners index fingertip under the sterile glove. The fingertips then touch each side of the cervical margin and the distance between is measured, reflecting the cervical dilatation (Nizard 2009). The LabourPro system is described as providing information on head station, head position, head descent, pelvic diameters, cervical dilatation and length and 3-D visualisation of vacuum extraction (Trigmed 2009). A prospective study of this technology was undertaken in three centres (France, USA, Israel) taking 333 measurements in 188 women during the active stage of labour (excluding full dilation). Smaller errors were seen when dilation was between 0 to 4 cm and &gt; 8 cm but there were larger errors for the 6.1 to 8 cm group. This first evaluation of the position tracking system shows limited precision (Nizard 2009).</td>
</tr>
</tbody>
</table>
CONTRIBUTIONS OF AUTHORS
S Downe (SD), G Gyte (GG), H Dahlen (HD), M Singata (MS) conceived, designed and wrote the protocol, with SD, HD, MS providing a clinical perspective and a policy perspective, and with GG providing a methodological perspective and also a consumer perspective. HD and GG undertook the main eligibility assessments, data extraction, data entry and checking accuracy. SD drafted the discussion and the text was commented on by all authors.

DECLARATIONS OF INTEREST
None known.

SOURCES OF SUPPORT
Internal sources
- University of Central Lancashire, UK.
- University of Western Sydney, Australia.
- University of Liverpool, UK.
- University of Fort Hare, South Africa.
- University of Witwatersrand, South Africa.

External sources
- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW
We modified the background section slightly to improve understanding.
We clarified the objectives by changing the wording “(with or without a partogram)” to “(alone or within the context of the partogram)”, and adding “... or different timings ...”.
We changed the outcome of ‘neonatal mortality’ to ‘perinatal mortality’.
We added the following ’Not-pre-specified outcomes’: “maternal comfort”; “maternal infection”; and “neonatal infection”.

INDEX TERMS
Medical Subject Headings (MeSH)
*Pregnancy Outcome; *Term Birth; Dystocia [*diagnosis]; Gynecological Examination [*methods]; Infant, Newborn; Labor, Obstetric [*physiology]; Palpation [*methods]; Vagina
MeSH check words

Female; Humans; Pregnancy