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Effect of partogram use on outcomes for women in spontaneous labour at term

Tina Lavender[1], **Anna Hart**[2], and **Rebecca MD Smyth**[1]

[1]School of Nursing, Midwifery and Social Work, The University of Manchester, Manchester, UK

[2]Faculty of Health, University of Central Lancashire, Preston, UK

Abstract

Background—The partogram (sometimes known as partograph) is usually a pre-printed paper form on which labour observations are recorded. The aim of the partogram is to provide a pictorial overview of labour, to alert midwives and obstetricians to deviations in maternal or fetal wellbeing and labour progress. Charts often contain pre-printed alert and action lines. An alert line represents the slowest 10% of primigravid women's labour progress. An action line is placed a number of hours after the alert line (usually two or four hours) to prompt effective management of slow progress of labour.

Objectives—To determine the effect of use of partogram on perinatal and maternal morbidity and mortality.

To determine the effect of partogram design on perinatal and maternal morbidity and mortality.

Search methods—We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (31 May 2012).

Selection criteria—Randomised and quasi-randomised controlled trials involving a comparison of partogram with no partogram, or comparison between different partogram designs.

Data collection and analysis—Three review authors independently assessed eligibility, quality and extracted data. When one review author was also the trial author, the two remaining authors assessed the studies independently.

Main results—We have included six studies involving 7706 women in this review; two studies assessed partogram versus no partogram and the remainder assessed different partogram designs. There was no evidence of any difference between partogram and no partogram in caesarean

Contact address: Tina Lavender, School of Nursing, Midwifery and Social Work, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK. tina.lavender@manchester.ac.uk.
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section (risk ratio (RR) 0.64, 95% confidence interval (CI) 0.24 to 1.70); instrumental vaginal delivery (RR 1.00, 95% CI 0.85 to 1.17) or Apgar score less than seven at five minutes (RR 0.77, 95% CI 0.29 to 2.06) between the groups. When compared to a four-hour action line, women in the two-hour action line group were more likely to require oxytocin augmentation (RR 1.14, 95% CI 1.05 to 1.22). When the three- and four-hour action line groups were compared, caesarean section rate was lowest in the four-hour action line group and this difference was statistically significant (RR 1.70, 95% CI 1.07 to 2.70, n = 613, one trial). When a partogram with a latent phase (composite) and one without (modified) were compared, the caesarean section rate was lower in the partograph without a latent phase (RR 2.45, 95% CI 1.72 to 3.50, n = 743, one trial).

Authors' conclusions—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. Given the fact that the partogram is currently in widespread use and generally accepted, it appears reasonable, until stronger evidence is available, that partogram use should be locally determined. Further trial evidence is required to establish the efficacy of partogram use.

Medical Subject Headings (MeSH)

Pregnancy Outcome; Cesarean Section [utilization]; Delivery, Obstetric [methods]; Labor, Obstetric [physiology]; Randomized Controlled Trials as Topic; Term Birth [* physiology]; Uterine Inertia [diagnosis]; Uterine Monitoring [* methods]

MeSH check words

Female; Humans; Pregnancy

BACKGROUND

Description of the condition

Detection of prolonged labour is important as both postpartum haemorrhage and infection are more common in women with long labours (Neilson 2003). These risks are greater in developing countries with poorly-resourced health services.

Description of the intervention

The partogram (or partograph) is a simple, inexpensive tool to provide a continuous pictorial overview of labour. The partogram is a pre-printed form, usually in paper version, on which midwives and obstetricians record labour observations. Most partograms have three distinct sections where observations are entered on maternal condition, fetal condition and labour progress; this last section assists in the detection of prolonged labour (Figure 1).

The first obstetrician to describe the progress of labour graphically was Friedman (Friedman 1954) following his study of the cervical dilatation of 100 African primigravidae at term. The women were given frequent rectal examinations and their progress was recorded in centimetres of dilatation per hour, producing a slope resembling a sigmoid curve ('S' shaped). This became know as the cervicograph. In an attempt to utilise midwives efficiently in a hospital and clinic service in Zimbabwe (then Rhodesia), where doctors were in short supply, Philpott 1972a developed a partogram from this original cervicograph. This

provided a practical tool for recording all intrapartum details, not just cervical dilatation. An 'alert line' was added following the results of a prospective study of 624 women (Philpott 1972b). The alert line was straight not curved and was a modification of the mean rate of cervical dilatation of the slowest 10% of primigravid women who were in the active phase of labour. This line represented a progress rate of 1 cm per hour. Should a woman's cervical dilatation progress more slowly, it would cross this alert line and arrangements were made to transfer her from a peripheral unit to a central unit where prolonged labour could be managed. The next stage of partogram development was the introduction of an 'action line', four hours to the right of the alert line (Philpott 1972c). This line was developed to identify primary inefficient uterine activity to prompt appropriate management. Correction of primary inefficient uterine activity would usually be with an intervention such as amniotomy or oxytocin infusion, or both.

There have been a number of challenges associated with partograph completion, including shortages of human resources, low status within labour wards and inadequate training (Fatusi 2007; Lavender 2011). These challenges has resulted in a number of adaptations to the original partograph, one of which is the simplified partograph (WHO 2003). In a small cross-over trial, this partograph was shown to be more 'user-friendly' (Mathews 2007). More recently, a randomised controlled trial, in India (Kenchaveeriah 2011), comparing the modified with the traditional partograph, confirmed a preference amongst medical staff of using the simplified version.

How the intervention might work

The partogram has been heralded as one of the most important advances in modern obstetric care (Safe Motherhood 1990); however, this was prior to any rigorous evaluation. Furthermore, the majority of early studies took place in hospital settings where most maternal deaths occur among women admitted with severe complications and often neglected labour (Lennox 1995). More than 20 years after its introduction, and using a partogram adapted from that formulated by Philpott and Castle (Philpott 1972b; Philpott 1972c) the World Health Organization (WHO 1994) conducted a prospective non-randomised study of 35,484 women in South East Asia and concluded that the partogram was a necessary tool in the management of labour and recommended its universal application. In this study, four pairs of hospitals participated (two pairs in Indonesia, one each in Thailand and Malaysia). A staged approach was adopted, whereby for the first five months of the study all eight centres collected baseline data; after five months the partogram was randomly introduced into one of each pair; in the remaining five months the partogram was introduced into all hospital sites. Introduction of the partogram, and agreed management protocol, reduced prolonged labour (from 6.4% to 3.4%), the proportion of labours requiring augmentation (20.7% to 9.1%), emergency caesarean section (from 9.9% to 8.3%) and stillbirths (from 0.5% to 0.3%).

A belief that partogram use is not affected by racial, cultural and socioeconomic differences, led to the approach finding favour in both high-income and low- to middle-income countries. However, in practice, it is conceivable that such variations in care between countries, and even units, may alter the use of the partogram and subsequent effectiveness,

in terms of maternal and neonatal outcomes. As a consequence, some practitioners have questioned its effectiveness, particularly when used in high-income countries (Groeschel 2001; Walsh 1994).

There is some evidence to suggest that midwives find the partogram to have practical benefits in terms of ease of use, time resourcefulness, continuity of care and educational assistance (Lavender 1999). These positive aspects may contribute to improving maternal and fetal outcomes. On the other hand, it has also been reported that the partogram's status within some obstetric units is such that they may restrict clinical practice, reduce midwife autonomy and limit the flexibility to treat each woman as an individual (Lavender 1999), factors which could also impact on clinical and psychological outcomes. Conversely, in a qualitative study in Kenya (Lavender 2011, student midwives reported the lack of status held by the partogram amongst midwives and obstetricians; this, they suggested created a barrier to partogram use.

Furthermore, there are worries that the use of the partogram can create unnecessary interference (Walraven 1994). This is because by assuming that all women will progress in labour at the same rate, partogram use could have adverse effects such as increased rates of artificial rupture of the membranes, oxytocin augmentation and use of analgesia resulting in a more negative labour experience.

Why it is important to do this review

The partogram has become an integral part of routine labour care in most parts of the world; assessment of its efficacy is therefore imperative.

Different designs of partogram exist, and Cartmill 1992 hypothesised that the way a partograph is presented may affect an obstetrician's perception of the labour progress and thus influences decision-making. This hypothesis has received some support from others (Lavender 1998b; Tay 1996) who have suggested that the slope and position of the action line have an impact on caesarean section, intervention and maternal satisfaction.

The aim of this review is to assess the benefits and harms of partogram use on women in labour to enable women and clinicians to make informed evidence-based decisions.

OBJECTIVES

Objective 1: the primary objective of this review is to determine the effect of use of partogram on perinatal and maternal morbidity and mortality.

Objective 2: to determine the effect of partogram design on perinatal and maternal morbidity and mortality.

METHODS

Criteria for considering studies for this review

Types of studies—We included in this review all published, unpublished and ongoing randomised controlled trials that compared outcomes, as listed below, between partogram

use and non-use. Randomised controlled trials of different designs of partogram were included for secondary analysis. We included trials that used quasi-random allocations (e.g. alternation). Studies reported in abstract form, without sufficient information on study methods or where results were not clear, were excluded only after an unsuccessful attempt to contact the study author for further information.

Types of participants—All women with singleton pregnancies and cephalic presentations, in spontaneous labour at term.

Types of interventions—Labour management using a partogram was compared with labour management where no partogram was used. The two groups had to differ only in the partogram usage and not in other labour ward interventions, such as psychological support, early amniotomy or use of analgesia.

To meet the second objective, studies reporting comparisons between different designs of partogram were included.

These are complex interventions. The partogram will be used in a way dictated by the accompanying guidelines and this may influence outcomes. Therefore, wherever possible, we have contextualised trial findings by describing the associated clinical guidelines.

Types of outcome measures

Primary outcomes

Outcomes for mother

1. Caesarean section
2. Oxytocin augmentation
3. Duration of first stage of labour (length of labour greater than 18 hours, length of labour greater than 12 hours)
4. Maternal experience of childbirth (as defined by trial authors)

Outcome for baby: 5. Low Apgar score (less than seven at five minutes)

Secondary outcomes

Outcomes for mother

6 Serious maternal morbidity or death (e.g. ruptured uterus, admission to intensive care unit, septicaemia, organ failure)

7 Instrumental vaginal delivery

8 Vaginal birth not achieved within 24 hours, from onset of labour (as defined by trial authors)

9 Postpartum haemorrhage (as defined by the trial authors)

10 Blood transfusion

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11 Regional analgesia

12 Opioid use

13 Duration of rupture of the membranes at the time of delivery

14 Performance of artificial rupture of the membranes during labour

15 Deep venous thrombosis

16 Pulmonary embolism

17 Antibiotic use

18 Duration of second stage of labour

19 Number of vaginal examinations in labour

20 Episiotomy

21 Third- and fourth-degree tears

22 Shoulder dystocia

23 Postnatal depression (as defined by trial authors)

24 Breastfeeding failure (as defined by trial authors)

25 Fistulae

26 Perineal pain

27 Dyspareunia

28 Abdominal pain

29 Backache reported six weeks postnatal

30 Prolapse or urinary incontinence

31 Faecal incontinence

32 Relationship with baby (as defined by trial authors)

33 Subsequent pregnancy complications

34 Postpartum rehospitalisation

Outcomes for baby

35 Stillbirth or neonatal death or neonatal morbidity, excluding fatal malformations (e.g. seizures, birth asphyxia, neonatal encephalopathy)

36 Admission to special care nursery

37 Need for intubation at delivery

38 Neonatal septicaemia

39 Intrapartum fetal death

40 Jaundice as defined by trial authors

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41 Cord blood arterial pH less than 7.1

42 Birth trauma (e.g. Erb's palsy, fractured skull, cephalhaematoma, fractured clavicle)

43 Childhood disability (as defined by trial author)

Staff

44 Usability

45 Ability to audit

Search methods for identification of studies

Electronic searches—We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (31 May 2012).

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.

We did not apply any language restrictions.

Data collection and analysis

Methods of 'Data collection and analysis' used in previous versions of this review are outlined in Appendix 1.

Selection of studies—Two review authors independently assessed for inclusion all the potential studies identified as a result of the search strategy. We resolved any disagreement through discussion or, if required, consulted a third person.

Data extraction and management—We designed a form to extract data. For eligible studies, at least two review authors extracted the data using the agreed form. We resolved discrepancies through discussion or, if required, we consulted a third person. We entered data into Review Manager software (RevMan 2011) and checked for accuracy.

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 independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We resolved disagreement by discussion or by involving a third assessor (A Hart).

(1) Random sequence generation (checking for possible selection bias): We described 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 described for each included study the method used to conceal allocation to interventions prior to assignment and assessed whether the 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; unsealed or nonopaque envelopes, alternation; date of birth);
- unclear risk of bias.

(3.1) Blinding of participants and personnel (checking for possible performance bias): We described for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Studies were judged at low risk of bias if they were blinded, or if we judged that the lack of blinding would be unlikely to affect results. We assessed blinding separately for different outcomes or classes of outcomes.

We assessed the methods as:

- low, high or unclear risk of bias participants;

- low, high or unclear risk of bias for personnel.

(3.2) Blinding of outcome assessment (checking for possible detection bias): We described for each included study the methods used, if any, to blind outcome assessors from knowledge of which intervention a participant received. We assessed blinding separately for different outcomes or classes of outcomes.

We assessed methods used to blind outcome assessment as:

- low, high or unclear risk of bias.

(4) Incomplete outcome data (checking for possible attrition bias due to the amount, nature and handling of incomplete outcome data): We described for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We stated whether attrition and exclusions were reported and 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, or could be supplied by the trial authors, we re-included missing data in the analyses which we undertook.

We assessed methods as:

- low risk of bias (e.g. no missing outcome data; missing outcome data balanced across groups);
- high risk of bias (e.g. numbers or reasons for missing data imbalanced across groups; ‘as treated” analysis done with substantial departure of intervention received from that assigned at randomisation);
- unclear risk of bias.

(5) Selective reporting (checking for reporting bias): We described 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 was clear that all of the study’s prespecified outcomes and all expected outcomes of interest to the review had been reported);
- high risk of bias (where not all the study’s pre-specified outcomes had been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest were reported incompletely and so could be used; study failed to include results of a key outcome that would have been expected to have been reported);
- unclear risk of bias.

(6) Other bias (checking for bias due to problems not covered by (1) to (5) above): We described for each included study any important concerns we had about other possible sources of bias.

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

- low risk of other bias;
- high risk of other bias;
- unclear whether there is risk of other bias.

(7) Overall risk of bias: We made explicit judgements about whether studies were at high risk of bias, according to the criteria given in the *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 explored the impact of the level of bias through undertaking sensitivity analyses - *see* 'Sensitivity analysis'.

Measures of treatment effect

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

Continuous data: For continuous data, we used the mean difference if outcomes were measured in the same way between trials. If necessary, we would have used the standardised mean difference to combine trials that measured the same outcome, but used different methods.

Unit of analysis issues

Cluster-randomised trials: Cluster-randomised trials were eligible, however, we did not identify any cluster-randomised trials for inclusion.

If cluster-randomised trials become available in future updates, they will be included in the analyses along with individually-randomised trials. We will adjust their sample sizes using the methods described in the *Handbook* using an estimate of the intracluster 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. 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.

Cross-over trials: Cross-over trials were not eligible for inclusion.

Dealing with missing data—For included studies, we noted levels of attrition. The impact of including studies with high levels of missing data in the overall assessment of treatment effect was explored by using sensitivity analysis.

For all outcomes, analyses were carried out, 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. The denominator for each outcome in each trial was the number randomised minus any participants whose outcomes were known to be missing.

Assessment of heterogeneity—We assessed statistical heterogeneity in each meta-analysis using the T^2, I^2 and Chi^2 statistics. We regarded heterogeneity as substantial if the I^2 was greater than 30% and either T^2 was greater than zero, or there was a low P value (less than 0.10) in the Chi^2 test for heterogeneity.

Assessment of reporting biases—If there were 10 or more studies in the meta-analysis, we planned to investigate reporting biases (such as publication bias) using funnel plots. We planned to assess funnel plot asymmetry visually, and to use formal tests for funnel plot asymmetry. For continuous outcomes we would have used the test proposed by Egger 1997, and for dichotomous outcomes we would have used the test proposed by Harbord 2006. If asymmetry was detected in any of these tests or was suggested by a visual assessment, we would have performed exploratory analyses to investigate it.

Data synthesis—We carried out statistical analysis using the Review Manager software (RevMan 2011). We used fixed-effect meta-analysis for combining data where it was reasonable to assume that studies were estimating the same underlying treatment effect: i.e. where trials were examining the same intervention, and the trials' populations and methods were judged sufficiently similar. If there was clinical heterogeneity sufficient to expect that the underlying treatment effects differed between trials, or if substantial statistical heterogeneity was detected, we used random-effects meta-analysis to produce an overall summary if an average treatment effect across trials was considered clinically meaningful. The random-effects summary was treated as the average range of possible treatment effects and we discussed the clinical implications of treatment effects differing between trials. If the average treatment effect was not clinically meaningful, we did not combine trials.

Where we used random-effects analyses, the results are presented as the average treatment effect with 95% confidence intervals, and the estimates of T^2 and I^2.

Subgroup analysis and investigation of heterogeneity—If substantial heterogeneity was identified, we investigated it using subgroup analyses and sensitivity analyses. We considered whether an overall summary was meaningful, and if it was, used random-effects analysis.

We planned to carry out the following subgroup analyses.

- Resource setting: low versus high.

We planned to use the following outcomes in subgroup analyses: caesarean section, oxytocin augmentation, duration of first stage of labour, maternal experience, Apgar score and admission to special care baby unit.

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For future updates for fixed-effect inverse variance meta-analyses, we will assess differences between subgroups by interaction tests. For random-effects and fixed-effect meta-analyses using methods other than inverse variance, we will assess differences between subgroups by inspection of the subgroups' confidence intervals; non-overlapping confidence intervals indicate a statistically significant difference in treatment effect between the subgroups.

Sensitivity analysis—We carried out the following sensitivity analysis. Sensitivity analysis was restricted to the primary outcomes.

- By trial quality, excluding trials with clearly inadequate concealment.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification.

Our search strategy identified 12 studies for potential inclusion. Of those, six studies with 7706 women participating were included (Kenchaveeriah 2011; Lavender 1998a; Lavender 2006; Pattinson 2003; Walss Rodriguez 1987; Windrim 2006) and six were excluded (Cartmill 1992; Fahdhy 2005; Hamilton 2001; Hamilton 2004; Kogovsek 2000; Mathews 2007).

Two studies compared partogram versus no partogram (Walss Rodriguez 1987; Windrim 2006). The Windrim 2006 study took place in Canada and the Walss Rodriguez 1987 study in Mexico; therefore, they were from two very different settings. The Windrim 2006 study and Walss Rodriguez 1987 study both compared their usual descriptive, sequential, recording of intrapartum details, with an experimental arm, i.e. the partogram. In the Windrim 2006 study the partogram used incorporated a two-hour alert line, but no action line. In the quasi-randomised trial by Walss Rodriguez 1987, a 'Friedman' (Friedman 1954) partogram was used. The partogram was not currently in use in either unit. Two studies compared partograms with different placement of action lines (Lavender 1998a; Lavender 2006). Lavender 2006 was a two-arm trial and Lavender 1998a was a three-arm trial. Other than the placement of the action line, labour management remained consistent. If progress crossed the action line, a diagnosis of prolonged labour was made and managed according to standard protocol; this involved clinical assessment and augmentation, as appropriate. Both studies took place in a single hospital in England. One study, in South Africa, compared a partogram with an alert and action line with one which contained an alert line only (Pattinson 2003). In this study, the group that received a partogram with only an alert line received more aggressive intrapartum management; a vaginal examination was carried out every two hours and oxytocin infusion advocated when progress crossed the line. Those with an alert and action line had more expectant management; vaginal examinations every four hours and commencement of oxytocin if progress crossed the four hour action line. The most recent trial Kenchaveeriah 2011, conducted in India, compared two partographs - a composite partograph including the latent phase with a modified one without the latent

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phase. This trial was carried out in India were the use of the partograph has not been incorporated and practiced widely, even at the tertiary level. The plotting of the composite partograph was started as soon as the woman was in labour. In the modified partograph, the plotting of the partograph was started with at least 4 cm of cervical dilatation. Prolonged labour was defined when the woman was in labour for more than 12 hours in the active phase.The papers by Kenchaveeriah 2011 and Walss Rodriguez 1987 generally lacked detail, making assessment of quality and contextualisation of the results difficult. Only two outcomes were reported by all trials; caesarean section rates and Apgar score. Other outcomes were not consistently reported.

Risk of bias in included studies

Included studies were assessed for methodological quality on the basis of sequence generation, allocation concealment, blinding, attrition and other concerns about bias (*see* 'Methods of the review' above). Sequence generation was graded as adequate in five studies (Kenchaveeriah 2011; Lavender 1998a; Lavender 2006; Pattinson 2003; Windrim 2006) and high risk in Walss Rodriguez 1987. Allocation concealment was unclear in two trials (Kenchaveeriah 2011; Pattinson 2003); low risk in three trials (Lavender 1998a;Lavender 2006; Windrim 2006); and high risk in Walss Rodriguez 1987.

Attrition was low, with less than 1% of participants excluded or lost to follow-up in all six trials. In one trial (Lavender 1998a), there were higher levels of missing data (13.5%) for the maternal experience outcome. In this study, maternal experience was only assessed in a sub-set of women (n = 615); this comprised all women recruited over a prespecified 12-month period of whom 519 responded.

Effects of interventions

1. Partogram versus no partogram—Two randomised trials were included in this comparison with 1590 women participating (Walss Rodriguez 1987; Windrim 2006). The Walss Rodriguez 1987 study reported only three outcomes, relevant to this review, therefore results were only pooled for these outcomes. There were no significant differences between groups in caesarean section rates (Analysis 1.1: risk ratio (RR) 0.64, 95% confidence interval (CI) 0.24 to 1.70, n = 1590, two trials); instrumental vaginal delivery (Analysis 1.4: RR 1.00, 95% CI 0.85 to 1.17, n = 1590, two trials) or Apgar score less than seven at five minutes (Analysis 1.2: RR 0.77, 95% CI 0.29 to 2.06). (For the result relating to caesarean section there were high levels of heterogeneity (I^2 = 93%) so this result should be interpreted with caution.) There was insufficient evidence of benefit or harm in any of the other maternal or neonatal outcomes, reported by Windrim 2006. The results for caesarean section rate were different in the two studies. In the study carried out in a low-resource setting (Walss Rodriguez 1987), the caesarean section rate was lower in the partogram group (RR 0.38, 95% CI 0.24 to 0.61). In the high-resource setting (Windrim 2006), there was no difference between groups (RR 1.03, 95% CI 0.82 to 1.28).

Sensitivity analysis: The Walss Rodriguez 1987 study had poor allocation concealment and provided very little information on study methods. In view of the high risk of bias associated

with this study, we carried out a sensitivity analysis excluding it from the analysis. There were no significant differences between groups when this study was removed.

2. Partogram with two-hour action line versus partogram with four-hour action line—Two randomised trials were included in this comparison with 3601 women participating (Lavender 1998a; Lavender 2006). Both studies were carried out in the same high-resource setting. There was no significant difference in caesarean section rates between the groups (Analysis 2.1: RR 1.06, 95% CI 0.85 to 1.32, n = 3601, two trials). Women in the two-hour action line group were more likely to receive oxytocin augmentation (Analysis 2.10: RR 1.14, 95% CI 1.05 to 1.22, n = 3601, two trials). There were no statistically significant differences in any of the remaining maternal or neonatal outcomes.

3. Partogram with two-hour action line versus partogram with three-hour action line—Only one randomised trial (carried out in a high-resource setting) compared a two-hour versus a three-hour action line with 617 women participating (Lavender 1998a). There was no difference in caesarean section rate (Analysis 3.1: RR 0.78, 95% CI 0.51 to 1.18, n = 617, one trial) or any other clinical maternal outcomes. However, women in the two-hour action line group were less likely to report a negative childbirth experience than those in the three-hour action line group (Analysis 3.6: RR 0.49, 95% CI 0.27 to 0.90, n = 348, one trial). There was no difference in neonatal outcomes.

4. Partogram with three-hour action line versus partogram with four-hour action line—Only one randomised trial, again carried out in a high-resource setting, compared a three-hour versus a four-hour action line with 613 women participating (Lavender 1998a). Caesarean section rate was lowest in the four-hour action line group and this difference was statistically significant (Analysis 4.1: RR 1.70, 95% CI 1.07 to 2.70, n = 613, one trial). There were no differences in any of the remaining clinical maternal outcomes or any neonatal outcomes.

5. Partogram with alert line versus partogram with alert and action line—Only one randomised trial compared a partogram with an alert line only versus a partogram with an alert and action line, with 694 women participating (Pattinson 2003). This trial was carried out in a low-resource setting. The caesarean section rate was lower in the alert line only group (Analysis 5.1: RR 0.68, 95% CI 0.50 to 0.93, n = 694, one trial). More oxytocin was used when labour was managed aggressively, with the use of a single line, but the evidence was not significant. There were no differences in any of the remaining maternal or neonatal outcomes.

6. Earlier versus later intervention: pooled results for trials in high- and low-resourced settings—To examine the effect of early or late intervention in high- and low-resource settings, we pooled results from three studies. Two studies examined two- and four-hour action lines (Lavender 1998a;Lavender 2006) in a high-resource setting and one study examined alert line only versus alert and action line in a low-resource setting (Pattinson 2003). When results were pooled, there were no differences between the groups for caesarean section rate, Apgar score or instrumental delivery. However, as stated above, in

the low-resource setting, the early intervention had a positive effect on the caesarean section rate.

7. Partograph with latent phase versus partograph without latent phase—Only one study examined the comparison between partograph with latent phase (composite) versus partograph without latent phase (modified) Kenchaveeriah 2011 and 743 women participated. The caesarean section rate was lower in the partograph without latent phase (modified) condition (Analysis 7.1: 95% RR 2.45, 95% CI 1.72 to 3.50, n = 743, one trial), and the level of cae-sarean section fetal distress was also lower in that group (Analysis 7.2: RR 4.87, 95% CI 2.83 to 8.37, n = 743, one trial).

There was no clear advantage for one condition with respect to instrumental vaginal delivery (Analysis 7.4: RR 1.04, 95% CI 0.61 to 1.77, n = 743, one trial), Apgar score less than seven at five minutes (Analysis 7.5: RR 0.75, 95% CI 0.21 to 2.63, n = 743, one trial).

There were significantly fewer admissions to special care nursery in the partograph without latent phase condition (Analysis 7.6: RR 1.84, 95% CI 1.29 to 2.63, n = 743, one trial), and this condition produced significantly fewer incidences of augmentation of labour (Analysis 7.7: RR 2.18, 95% CI 1.67 to 2.83, n = 743, one trial). In addition, in the modified partograph there was a significantly higher user friendliness score (Analysis 7.8: MD −7.89, 95% CI −8.14 to −7.64, n = 743, one trial); 93% of staff felt the partograph with latent phase (composite) was more difficult to use.

DISCUSSION

Summary of main results

A total of 7706 women were recruited from six trials comparing partogram use; two trials comparing partogram versus no partogram and four trials comparing different partogram formats. There was no evidence of any difference between partogram and no partogram in caesarean section rate; instrumental vaginal delivery or Apgar score less than seven at five minutes between the groups. When compared with a four-hour action line, women in the two-hour action line group were more likely to require oxytocin augmentation. When the three- and four-hour action line groups were compared, caesarean section rate was lowest in the four-hour action line group and this difference was statistically significant. When a partogram with a latent phase (composite) and one without (modified) were compared, the caesarean section rate was lower in the partograph without a latent phase.

Overall completeness and applicability of evidence

Based on the limited evidence from the six trials included in this review, there remains uncertainty regarding the effectiveness of partograph use.

Only two trials compared partograph versus no partograph. These trials were conducted in different settings; one in a high resourced setting (Windrim 2006) and the other in a low resourced setting (Walss Rodriguez 1987). In both studies (Walss Rodriguez 1987;Windrim 2006), the partogram was the experimental arm. These findings can not be extrapolated to

units where the partogram is currently in use; removing the partogram as opposed to introducing it may produce different findings.

Four trials compared the use of different designs of partogram for women in spontaneous labour. Combined evidence from trials comparing the different placement of action lines (Lavender 1998a; Lavender 2006) showed little difference in caesarean section rates and few differences in other maternal outcomes. When the two-hour action line was compared with the four-hour action line, the only difference found was an increase in oxytocin augmentation in the two-hour arm. This is unsurprising given that the associated guidelines advocated earlier use of oxytocin. When the two-hour action line and three-hour action line were compared, differences were found in the self-reported maternal experience with less women in the two-hour arm reporting a negative experience. The relevance of these findings is uncertain, especially as the comparison between the two-hour versus four-hour arm and three-hour versus four-hour arm revealed no differences. It may be that women in the two-hour arm perceived their labours to be shorter, as the three-hour action line was current local policy. Alternatively, it may be that because those women whose labours were managed with the two-hour action line received more intervention, they also received more labour support. There were no differences in any neonatal outcomes. Although the findings of these studies were fairly consistent, both studies were from the same setting, and therefore their generalisability needs consideration.

The fifth trial included in this review (Pattinson 2003) was not combined with the previous trials, as this was a trial which compared a partogram with an alert line and aggressive management versus one with an alert and action line, with more conservative management. This trial described a package of care for labour management alongside the partogram use, which advocated more frequent vaginal examinations (two-hourly) for women in the aggressive management group, thereby suggesting a more complex intervention. This study compared different partogram designs that clearly demonstrated a difference in caesarean section rates; the more aggressive arm having the lower rate. Given that the partogram is a complex intervention, used in conjunction with labour guidelines, the approach used in this study may be more appropriate. Utilising a reductionist approach, to what is in essence a complex intervention, may produce less meaningful findings. The most recent trial included in this review (Kenchaveeriah 2011) compared two partographs - a composite partograph including the latent phase with a modified one without the latent phase. The trial confirmed that a partograph without a latent phase was associated with a lower rate of caesarean section indicating labour can be managed without a latent phase being plotted on the partograph. Only two of the trials (Kenchaveeriah 2011; Walss Rodriguez 1987) included multiparous women, and all trials included women with uncomplicated pregnancies in spontaneous labour. However, in reality, the partograph is used for a wide spectrum of women in the intrapartum period. Consideration needs to be given to the applicability of these review findings to pregnant women who fall outside the inclusion criteria of the included trials. Further research on different populations would be preferable.

Important clinical outcomes were absent from the included trials, particularly in low-resourced setting, e.g. length of first and second stage of labour. None of the trials examined the impact of the partograph on resource utilisation; a factor particularly important in low-

resourced settings. Only the Lavender studies (Lavender 1998a; Lavender 2006) reported measures of maternal childbirth experience.

Quality of the evidence

Evidence from this review is inconclusive. Evidence from trials comparing partogram versus no partogram was limited to only two trials with 1590 women (Walss Rodriguez 1987; Windrim 2006) of differing methodological quality. Four of the six trials were of good quality. In Walss Rodriguez 1987, the method of allocation concealment and the method of randomisation were unclear. In the remaining trial (Kenchaveeriah 2011), no information was provided on how women were allocated to groups following random sequence generation. The strongest study, in terms of quality, was that conducted by Windrim 2006 which showed no differences in any clinical outcomes measured (caesarean section rate, duration of labour, oxytocin augmentation, amniotomy, epidural use, use of antibiotics in labour, Apgar scores, or admissions to neonatal intensive care unit) following introduction of the partogram. However, as acknowledged by the study authors, the findings may have been influenced by the relatively high percentage of non compliance in completing the partogram (20%) or the cross contamination of care by staff, or both.

AUTHORS' CONCLUSIONS

Implications for practice

We are unable to make any explicit recommendations regarding the use of the partogram for the purposes of providing a pictorial overview of labour. However, we acknowledge that many units, in high- and low-income settings, currently use a partogram and have reported quality of care benefits in terms of ease of recording, provision of pictorial overview of progress, auditing of care, training of clinicians and transferring of care (Lavender 1999;Lavender 2007). Furthermore, there has been evidence from nonrandomised trials of potential benefits of partogram use (Bosse 2002; Fawole 2008; WHO 1994). Given the fact that the partogram is currently in widespread use, and generally accepted, it appears reasonable, until stronger evidence is available, for decisions regarding whether or not to use a partograph and which one to use, to be locally determined.

Implications for research

Whether or not there is a need for a trial of partograph versus no partograph is open for debate. However, a recent consensus of international experts (Fistula Care 2011) proposed that this is no longer an important question. A more important question is which partograph should be used, as current evidence, from the included trials, fails to provide robust guidance. Trials comparing different partograph designs, are therefore recommended.

Although the partograph is a low cost, low-invasive intervention, it forms part of the overall management of labour care, making it part of a complex intervention. As such, any future trials should be designed to consider the clinical environment in which it will be used. Standard care should be clearly described to allow for judgments on transferability of findings, to be made. A clusterrandomised trial would be the most appropriate design, as this would enable consideration of key organisational issues (e.g. training of individuals, hospital

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practices and clinical protocols). Using a cluster design would also reduce any contamination between facility-based health professionals who would be supporting many women in labour at the same time; this was an issue raised in the included trials.

Given the limitations of existing trials, future studies should consider the inclusion of both primigravid and multigravid women, as, in most units which use the partograph, the same chart is used irrespective of parity. Any future trials should stratify participants according to parity, services with low (20 or less per 1000) and high perinatal mortality (more than 20) and low versus high intervention rates in the first stage of labour. This clarity would also allow for more accurate comparability, both clinically, and also between trials for the purposes of systematic review by meta-analysis, allowing for more robust conclusions and recommendations.The trials in this review included women at urban hospitals only. Whether the partogram is beneficial for women across all facilities is unclear and needs further investigation.

It is essential to involve consumers in all stages of future trials, and most significantly during the planning stages, in order to identify those outcomes which are deemed most relevant. Important outcomes are absent from the existing trials and should be considered in future protocols. Important clinical outcomes, for example, relate to recognition of prolonged labour and include the length of the first and second stage of labour. Moreover, maternal experience is of crucial importance and should be investigated using recognised validated scores in order to allow women to make informed choices about their care. There was no information in any of the included trials regarding long-term outcomes for women and babies. We propose that future trialists should consider instituting some form of long-term follow-up which is feasible and appropriate for the study population in question. Any future trials should be of adequate size and data on economic outcomes should be obtained, to allow for allocation of resources and service planning.

As detailed earlier, in one study (Windrim 2006), there was a relatively high percentage of non-compliance in completing the partogram; we were unable to draw any conclusions about why this may have happened. In future trials, consideration should be given to the inclusion of a nested qualitative study, which would enable the capture of comprehensive information on the barriers and facilitators to partogram use.

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CHARACTERISTICS OF STUDIES

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

Kenchaveeriah 2011

Methods	1-year randomised controlled trial.
Participants	743 women with uncomplicated pregnancy in spontaneous labour with term, singleton, vertex gestation
Interventions	Composite partograph including the latent phase versus a modified partograph without the latent phase
Outcomes	Rate of caesarean section, augmentation of labour, labour crossing the alert and action line, perinatal outcome, user friendliness and maternal complications
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated random number table.
Allocation concealment (selection bias)	Unclear risk	No information on how women were allocated to groups following random sequence generation
Blinding (performance bias and detection bias) Clinical Staff	Unclear risk	Blinding not reported.
Blinding (performance bias and detection bias) Women	Unclear risk	Blinding not reported.
Blinding (performance bias and detection bias) Oucome assessors	Unclear risk	Blinding not reported.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent loss to follow-up.
Other bias	Low risk	Additional analysis performed, not pre-specified in methods section of publication regarding indication for caesarean section

Lavender 1998a

Methods	Prospective randomised clinical trial. Random allocation by sealed, opaque envelopes
Participants	928 primigravid women from the North West of England, with uncomplicated pregnancies who presented in spontaneous labour at term
Interventions	Women were randomised to have their progress of labour recorded on a partogram with an action line 2, 3 or 4 hours to the right of the alert line
Outcomes	Caesarean section rate, maternal satisfaction, instrumental delivery rate, need for augmentation, randomisation to delivery interval, use of epidural, cord blood gas analysis, blood loss > 500 mL, number of vaginal examinations, Apgar score, admission to special care baby unit

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Notes	Maternal satisfaction was only assessed in a sub-set of women, i.e. all women recruited over a prespecified 12 month period (n = 615)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Table of random numbers.
Allocation concealment (selection bias)	Low risk	Consecutively numbered, sealed, opaque envelopes.
Blinding (performance bias and detection bias) Clinical Staff	High risk	Not feasible.
Blinding (performance bias and detection bias) Women	High risk	Not feasible.
Blinding (performance bias and detection bias) Oucome assessors	Low risk	Statistician blind to treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Small loss to follow-up after randomisation (less than 1 % attrition) for outcomes measured in labour There were higher attrition for the maternal satisfaction outcomes measured in the postnatal period
Other bias	Unclear risk	10% (who were otherwise eligible) were not approached (overall, 57% of eligible women were randomised)

Lavender 2006

Methods	Prospective randomised clinical trial. Random allocation by sealed, opaque envelopes
Participants	2975 primigravid women from the North West of England, with uncomplicated pregnancies, in spontaneous labour at term
Interventions	Women were randomised to have their progress of labour recorded on a partogram with an action line 2 or 4 hours to the right of the alert line
Outcomes	Outcomes were stratified according to intended place of birth (midwife led unit or obstetric unit). Caesarean section rate, maternal satisfaction, instrumental delivery rate, need for augmentation, randomisation to delivery interval, use of epidural, cord blood gas analysis, blood loss > 500 mL, number of vaginal examinations, Apgar score, admission to special care baby unit
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Table of random numbers. Randomisation stratified by intended place of birth (2 participating units)
Allocation concealment (selection bias)	Low risk	Consecutively numbered, sealed, opaque envelopes.

Blinding (performance bias and detection bias) Clinical Staff	High risk	Not feasible.
Blinding (performance bias and detection bias) Women	High risk	Not feasible.
Blinding (performance bias and detection bias) Oucome assessors	Low risk	Statistician blind to treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Less than 1 % attrition after randomisation.
Other bias	Unclear risk	Large numbers of women who were otherwise eligible were not approached to participate. The numbers not approached varied depending on the recruiting unit, 26% not approached in the midwifery and 61% in the delivery unit

Pattinson 2003

Methods	Prospective randomised clinical trial. Random allocation by sealed, opaque envelopes	
Participants	694 healthy nulliparous women from South Africa, who were in active spontaneous labour, at term, with a healthy singleton pregnancy and cephalic presentation	
Interventions	Women were randomised to either aggressive or expectant management protocols. Aggressive management entailed using a single line partogram, a vaginal examination every 2 hours and use of oxytocin if the line was crossed. Expectant management entailed using a 2-line partogram, with the alert line and a parallel action line 4 hours to the right, with a vaginal examination every 4 hours. If the action line was reached, oxytocin was started	
Outcomes	Caesarean section rate, operative deliveries, oxytocin use, received analgesia, Apgar score, perinatal death	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated list of random numbers.
Allocation concealment (selection bias)	Unclear risk	Sealed, opaque envelopes.
Blinding (performance bias and detection bias) Clinical Staff	High risk	Not feasible.
Blinding (performance bias and detection bias) Women	High risk	Not feasible.
Blinding (performance bias and detection bias) Oucome assessors	Unclear risk	Not reported.

Incomplete outcome data (attrition bias) All outcomes	Low risk	Low attrition after randomisation (less than 1%). Where women did not receive the allocated intervention, there was intention-to-treat analyses
Other bias	Low risk	Recruitment stopped early due to funding constraints.

Walss Rodriguez 1987

Methods	Prospective study in which women 'at random' were distributed in 1 of 2 groups
Participants	434 women in Mexico, with term pregnancies who presented in labour (cervix 2 cm or more dilated) with live, singleton, cephalic presentation
Interventions	1 group had their labour managed according to the Friedman partogram and the other had labour managed using a non-graphic, descriptive record
Outcomes	Caesarean section, forceps delivery, normal delivery, Apgar score
Notes	This study was translated into English.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Quasi-randomised study. No information on how randomisation was achieved
Allocation concealment (selection bias)	High risk	No information on how women were allocated to groups, not clear that group allocation was truly random
Blinding (performance bias and detection bias) Clinical Staff	High risk	Not feasible.
Blinding (performance bias and detection bias) Women	High risk	Not feasible.
Blinding (performance bias and detection bias) Oucome assessors	Unclear risk	Not reported.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No apparent loss to follow-up.
Other bias	Unclear risk	Very little information on study methods was provided.

Windrim 2006

Methods	Prospective randomised clinical trial. Computerised allocation, by telephone
Participants	1932 primiparous women, in Toronto, Canada, with uncomplicated pregnancies at term, with contractions every 3-5 minutes and cervix at least 3 cm dilated. Outcomes were stratified according to whether labour was spontaneous or induced. Only data from women not induced were included (n = 1156)
Interventions	Women were randomised to 1 of 2 groups: the standard group, who had the progress of labour charted in written notes, or the partogram group, whose progress in labour was recorded using a bedside graphical partogram as well as written notes
Outcomes	Rate of caesarean section, operative vaginal delivery, spontaneous vaginal delivery, duration of first stage of labour, duration of second stage of labour, number of vaginal examinations, epidural analgesia use, artificial rupture of membranes, oxytocin augmentation, evaluation for non-reassuring fetal heart tracing, maternal and neonatal morbidity

Notes	Only data from those in spontaneous labour are included in the review

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Stratified randomisation by off-site computerised randomisation service
Allocation concealment (selection bias)	Low risk	By telephone to off-site service.
Blinding (performance bias and detection bias) Clinical Staff	High risk	Not feasible. Bedside charts.
Blinding (performance bias and detection bias) Women	High risk	Not feasible.
Blinding (performance bias and detection bias) Oucome assessors	Unclear risk	Not reported.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data apparent.
Other bias	Unclear risk	No information on the number of women approached or the numbers of eligible women declining participation

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

Study	Reason for exclusion
Cartmill 1992	A report of a hypothetical study. No research conducted and no data presented
Fahdhy 2005	This was a cluster-randomised trial in which midwives were randomised to receive training, alongside using the partogram. The intervention was therefore the training and not the partogram. There is no description of what midwives in the control group received
Hamilton 2001	This study was presented in abstract form only and lacked detail. It was particularly unclear whether participants were in spontaneous labour and whether they were at term. Attempts were made to contact the trial author, without success
Hamilton 2004	The study intervention was a computerised reference range not a partogram
Kogovsek 2000	It was unclear from the presentation of data which outcome data were from women in spontaneous labour. We were unable to contact any of the authors
Mathews 2007	This was a cross-over trial comparing 2 partographs, 1 which included a latent phase and 1 which did not. In this study all physicians posted to the labour ward used the first partograph (composite or simplified depending on the random allocation) for 10 days. After 1 week's break, all physicians used the second partograph. Study participants were therefore physicians and not women

Characteristics of studies awaiting assessment [*ordered by study ID*]

Ajoodani 2011

Methods	Currently awaiting translation of this trial. Appears from very limited available information to be a prospective randomised controlled trial
Participants	200 primigravid women in Karaj, Iran.
Interventions	Partogram compared with routine care without partogram.
Outcomes	Length of first stage of labour, length of second stage of labour, rate of caesarean sections and Apgar scores at 5 minutes
Notes	

WHO 1994

Methods	This study was not designed as an RCT. However, part of the study, i.e. the 5-month period where centres where randomised either to the first 5 months of partogram use or the same 5-month period pre-implementation, is essentially equivalent to a cluster-RCT. Published data relating to this part of the trial were not available. Despite contacting 2 members of the original research team, we have not, so far, been able to obtain such data
Participants	35,484 women in South East Asia. All labours over 34 weeks' gestation, including inductions, malpresentations, and multiple pregnancies were included
Interventions	Partogram, intensive teaching of midwives and medical staff, presence of WHO consultant
Outcomes	Caesarean section, labour >18 hours, duration of labour, labour augmented, postpartum sepsis
Notes	

RCT: randomised controlled trial

DATA AND ANALYSES

Comparison 1
Partogram versus no partogram (studies carried out in high- and low-resource settings)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Casearean section (overall)	2	1590	Risk Ratio (M-H, Random, 95% CI)	0.64 [0.24, 1.70]
1.1 Low-resource setting	1	434	Risk Ratio (M-H, Random, 95% CI)	0.38 [0.24, 0.61]
1.2 High-resource setting	1	1156	Risk Ratio (M-H, Random, 95% CI)	1.03 [0.82, 1.28]
2 Apgar score less than 7 at 5 minutes	2	1596	Risk Ratio (M-H, Random, 95% CI)	0.77 [0.29, 2.06]
2.1 Low-resource setting	1	440	Risk Ratio (M-H, Random, 95% CI)	0.46 [0.04, 5.00]
2.2 High-resource setting	1	1156	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.29, 2.52]
3 Epidural analgesia	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.98, 1.05]
3.1 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.98, 1.05]
4 Instrumental vaginal delivery	2	1590	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.85, 1.17]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4.1 Low-resource setting	1	434	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.79, 1.74]
4.2 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.81, 1.15]
5 Duration of first stage of labour	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [−0.21, 0.21]
5.1 High-resource setting	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [−0.21, 0.21]
6 Duration of second stage of labour	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [−0.21, 0.21]
6.1 High-resource setting	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [−0.21, 0.21]
7 Number of vaginal examinations	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.1 High-resource setting	1	1156	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Admission to special care nursery	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.51, 1.75]
8.1 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.51, 1.75]
9 Oxytocin augmentation	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.95, 1.10]
9.1 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.95, 1.10]
10 Performance of artificial rupture of membranes during labour	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.88, 1.11]
10.1 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.88, 1.11]
11 Antibiotic use	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.88, 1.73]
11.1 High-resource setting	1	1156	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.88, 1.73]

Comparison 2

Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall)	2	3601	Risk Ratio (M-H, Random, 95% CI)	1.06 [0.85, 1.32]
2 Caesarean section (distress)	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	1.30 [0.86, 1.96]
3 Caesarean section (delay)	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.77, 1.25]
4 Instrumental vaginal delivery	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.80, 1.03]
5 Serious maternal morbidity or death	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6 Negative childbirth experience	2	2269	Risk Ratio (M-H, Random, 95% CI)	0.61 [0.28, 1.35]
7 Cord pH less than 7.1	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.73 [0.44, 1.22]
8 Apgar score less than 7 at 5 minutes	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.50, 1.35]
9 Admission to special care nursery	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.46, 1.31]
10 Oxytocin augmentation	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	1.14 [1.05, 1.22]
11 Performance of artificial rupture of the membranes during labour	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	1.07 [0.99, 1.15]
12 Serious neonatal morbidity or perinatal death	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Blood loss > 500 mL	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	1.07 [0.90, 1.26]
14 Epidural use	2	3601	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.95, 1.14]
15 Vaginal examinations	2	3601	Mean Difference (IV, Fixed, 95% CI)	−0.14 [−0.27, −0.02]

Comparison 3

Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall)	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.51, 1.18]
2 Caesarean section (distress)	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.44, 2.10]
3 Caesarean section (delay)	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.42, 1.19]
4 Instrumental vaginal delivery	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.69, 1.26]
5 Serious maternal morbidity or death	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Negative childbirth experience	1	348	Risk Ratio (M-H, Fixed, 95% CI)	0.49 [0.27, 0.90]
7 Cord pH less than 7.1	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.38 [0.07, 1.96]
8 Apgar score less than 7 at 5 minutes	1	617	Risk Ratio (M-H, Fixed, 95% CI)	1.44 [0.41, 5.05]
9 Admission to special care nursery	1	617	Risk Ratio (M-H, Fixed, 95% CI)	3.83 [0.43, 34.12]
10 Oxytocin augmentation	1	617	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.85, 1.21]
11 Performance of artificial rupture of membranes during labour	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.77, 1.15]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
12 Serious neonatal morbidity or perinatal death	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Blood loss > 500 mL	1	617	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.63, 1.45]
14 Epidural use	1	617	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.94, 1.44]
15 Vaginal examinations	i	617	Mean Difference (IV, Fixed, 95% CI)	0.0 [−0.29, 0.29]

Comparison 4

Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall)	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.70 [1.07, 2.70]
2 Caesarean section (distress)	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.77 [0.70, 4.42]
3 Caesarean section (delay)	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.68 [0.97, 2.91]
4 Instrumental vaginal delivery	1	613	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.72, 1.28]
5 Serious maternal morbidity or death	1	613	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Negative childbirth experience	1	340	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.51, 1.27]
7 Cord pH less than 7.1	1	613	Risk Ratio (M-H, Fixed, 95% CI)	2.57 [0.50, 13.17]
8 Apgar score less than 7 at 5 minutes	1	613	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.22, 3.04]
9 Admission to special care nursery	1	613	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.05, 5.65]
10 Oxytocin augmentation	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.09 [0.91, 1.30]
11 Performance of artificial rupture of membranes during labour	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.85, 1.26]
12 Serious neonatal morbidity or perinatal death	1	613	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Blood loss > 500 mL	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.03 [0.68, 1.56]
14 Epidural use	1	613	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.80, 1.27]
15 Number of vaginal examinations in labour	1	613	Mean Difference (IV, Fixed, 95% CI)	0.10 [−0.19, 0.39]

Comparison 5

Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall)	1	694	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.50, 0.93]
2 Instrumental vaginal delivery	1	694	Risk Ratio (M-H, Fixed, 95% CI)	0.87 [0.66, 1.15]
3 Oxytocin augmentation	1	694	Risk Ratio (M-H, Fixed, 95% CI)	0.81 [0.62, 1.05]
4 Low Apgar Score (less than 7 at 5 minutes)	1	2	Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Perinatal death	1	694	Risk Ratio (M-H, Fixed, 95% CI)	7.12 [0.37, 137.36]

Comparison 6

Earlier versus later intervention: combined analysis for trials in high- and low-resource settings

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall) (New Outcome)	3	4295	Risk Ratio (M-H, Random, 95% CI)	0.94 [0.67, 1.31]
1.1 Low-resource setting	1	694	Risk Ratio (M-H, Random, 95% CI)	0.68 [0.50, 0.93]
1.2 High-resource setting	2	3601	Risk Ratio (M-H, Random, 95% CI)	1.06 [0.85, 1.32]
2 Apgar score low at 5 or 10 minutes	3	4295	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.48, 1.86]
2.1 Low-resource setting	1	694	Risk Ratio (M-H, Random, 95% CI)	7.12 [0.37, 137.36]
2.2 High-resource setting	2	3601	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.50, 1.35]
3 Instrumental delivery	3	4295	Risk Ratio (M-H, Random, 95% CI)	0.90 [0.80, 1.02]
3.1 Low-resource setting	1	694	Risk Ratio (M-H, Random, 95% CI)	0.87 [0.66, 1.15]
3.2 High-resource setting	2	3601	Risk Ratio (M-H, Random, 95% CI)	0.91 [0.80, 1.03]

Comparison 7

Partograph with latent phase versus partograph without latent phase

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Caesarean section (overall)	1	743	Risk Ratio (M-H, Fixed, 95% CI)	2.45 [1.72, 3.50]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 Caesarean section (distress)	1	743	Risk Ratio (M-H, Fixed, 95% CI)	4.87 [2.83, 8.37]
3 Caesarean section (delay)	1	743	Risk Ratio (M-H, Fixed, 95% CI)	1.35 [0.59, 3.08]
4 Instrumental vaginal delivery	1	743	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.61, 1.77]
5 Apgar score less than 7 at 5 minutes	1	743	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.21, 2.63]
6 Admission to special care nursery	1	743	Risk Ratio (M-H, Fixed, 95% CI)	1.84 [1.29, 2.63]
7 Oxytocin augmentation	1	743	Risk Ratio (M-H, Fixed, 95% CI)	2.18 [1.67, 2.83]
8 User friendliness score	i	743	Mean Difference (IV, Fixed, 95% CI)	−7.89 [−8.14, −7.64]

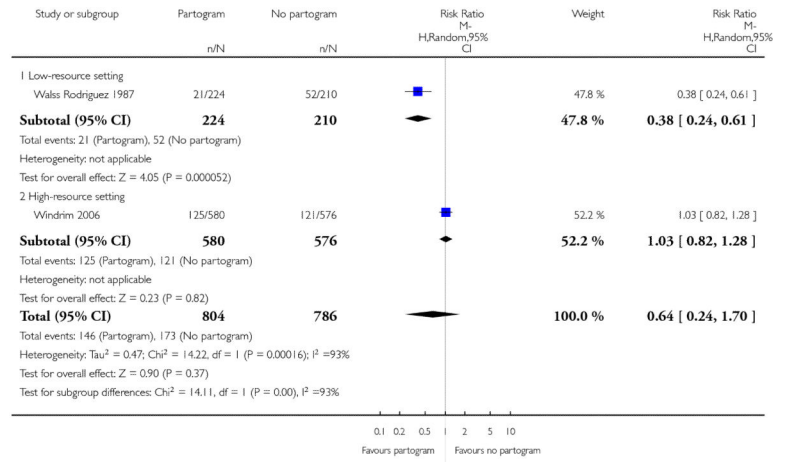
Analysis 1.1

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 1 Casearean section (overall)

Review: Effect of partogram use on outcomes for women in spontaneous labour at term

Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)

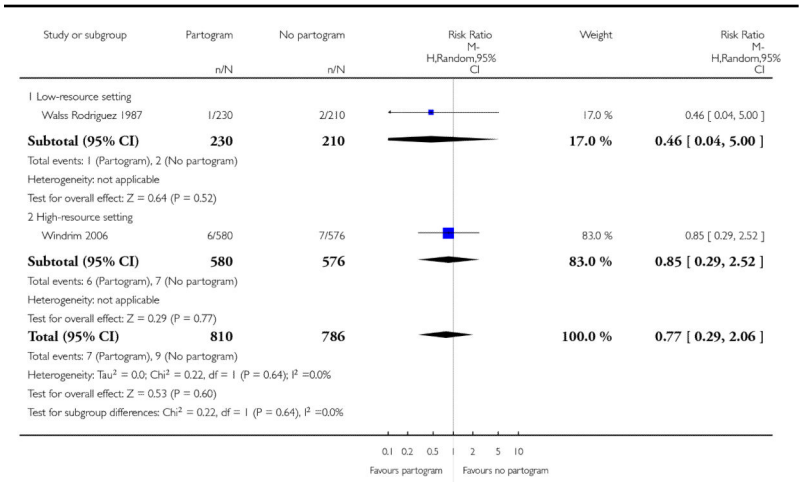
Outcome: 1 Casearean section (overall)



Analysis 1.2

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 2 Apgar score less than 7 at 5 minutes

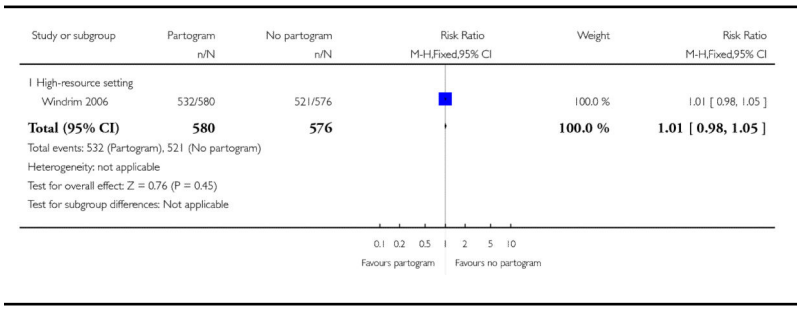
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 2 Apgar score less than 7 at 5 minutes



Analysis 1.3

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 3 Epidural analgesia

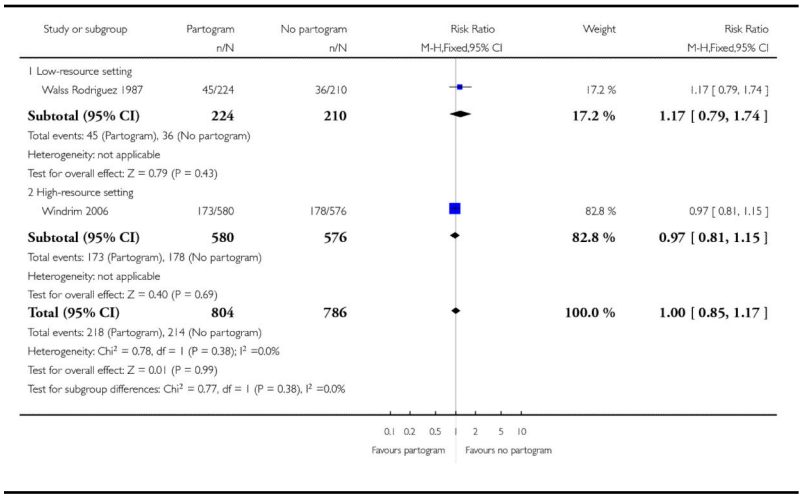
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 3 Epidural analgesia



Analysis 1.4

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 4 Instrumental vaginal delivery

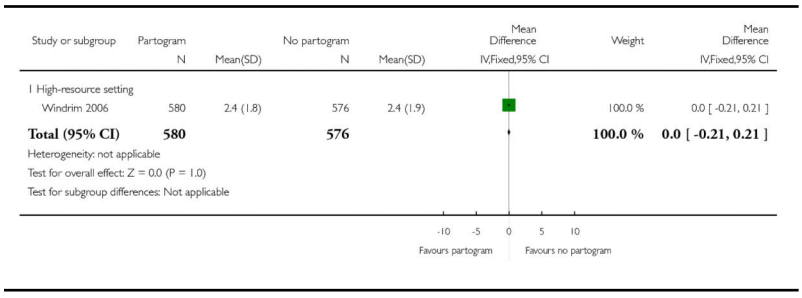
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 4 Instrumental vaginal delivery



Analysis 1.5

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 5 Duration of first stage of labour

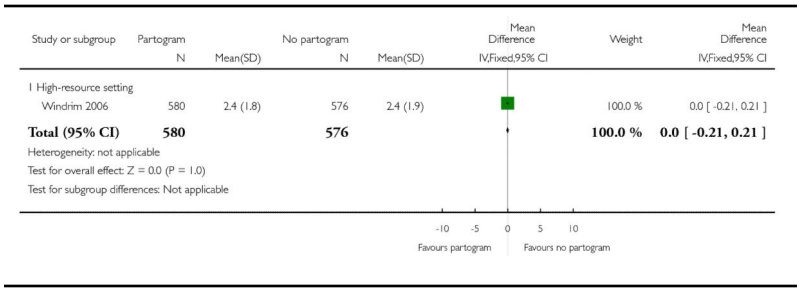
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 5 Duration of first stage of labour



Analysis 1.6

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 6 Duration of second stage of labour

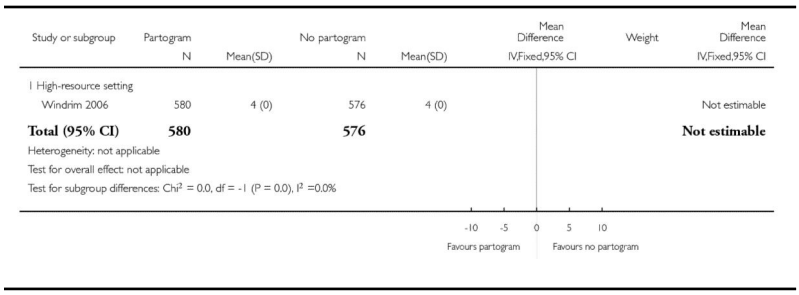
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 6 Duration of second stage of labour



Analysis 1.7

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 7 Number of vaginal examinations

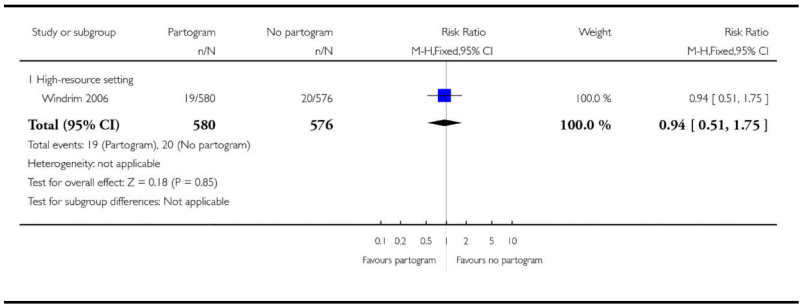
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 7 Number of vaginal examinations



Analysis 1.8

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 8 Admission to special care nursery

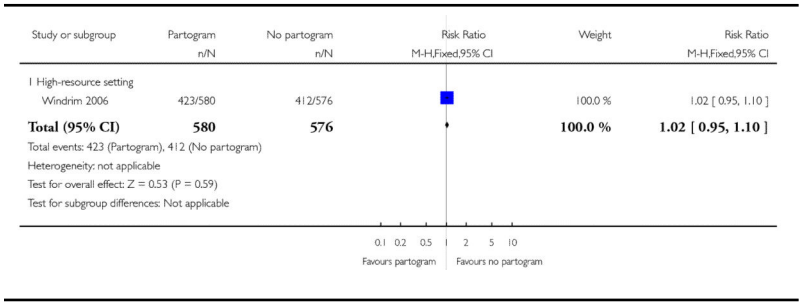
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 8 Admission to special care nursery



Analysis 1.9

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 9 Oxytocin augmentation

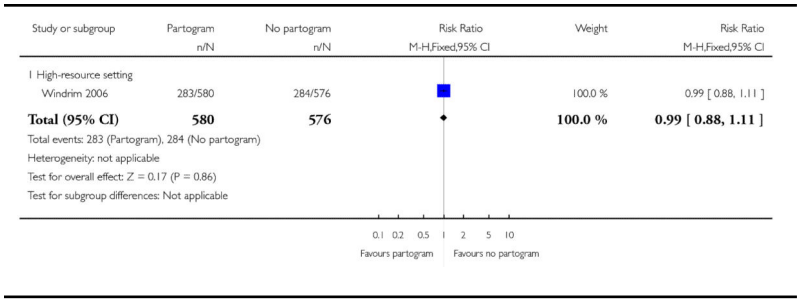
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 9 Oxytocin augmentation



Analysis 1.10

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 10 Performance of artificial rupture of membranes during labour

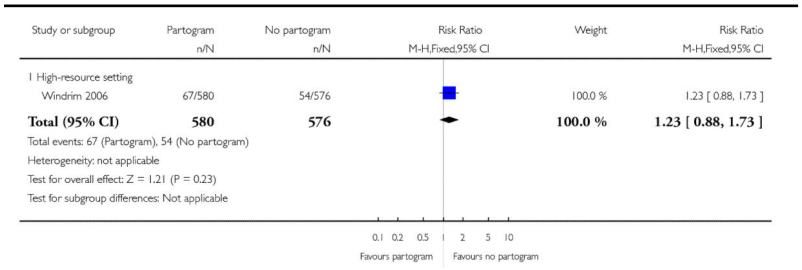
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 10 Performance of artificial rupture of membranes during labour



Analysis 1.11

Comparison 1 Partogram versus no partogram (studies carried out in high- and low-resource settings), Outcome 11 Antibiotic use

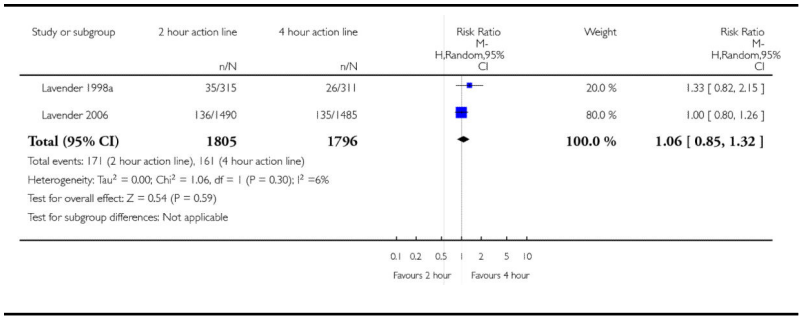
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 1 Partogram versus no partogram (studies carried out in high- and low-resource settings)
Outcome: 11 Antibiotic use



Analysis 2.1

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 1 Caesarean section (overall)

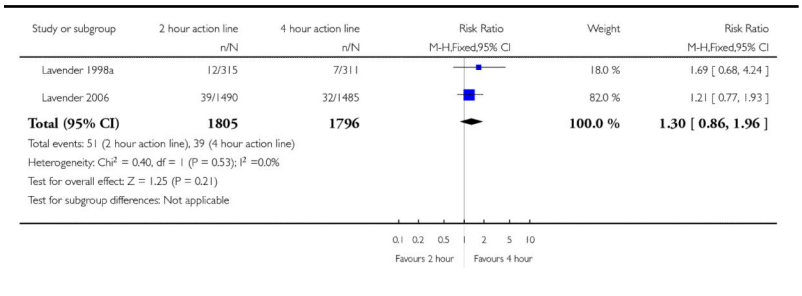
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 1 Caesarean section (overall)



Analysis 2.2

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 2 Caesarean section (distress)

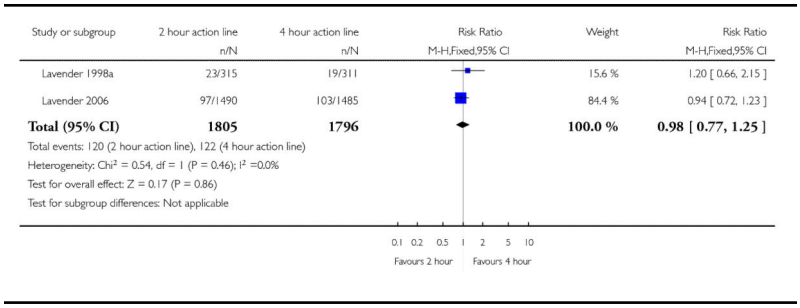
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 2 Caesarean section (distress)



Analysis 2.3

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 3 Caesarean section (delay)

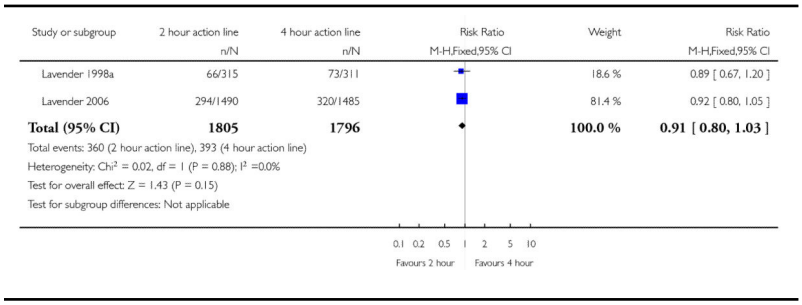
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 3 Caesarean section (delay)



Analysis 2.4

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 4 Instrumental vaginal delivery

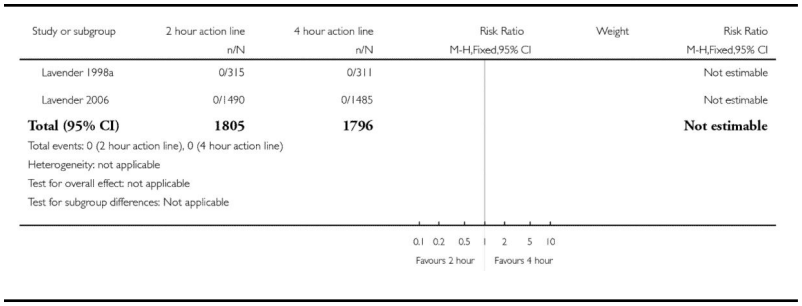
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 4 Instrumental vaginal delivery



Analysis 2.5

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 5 Serious maternal morbidity or death

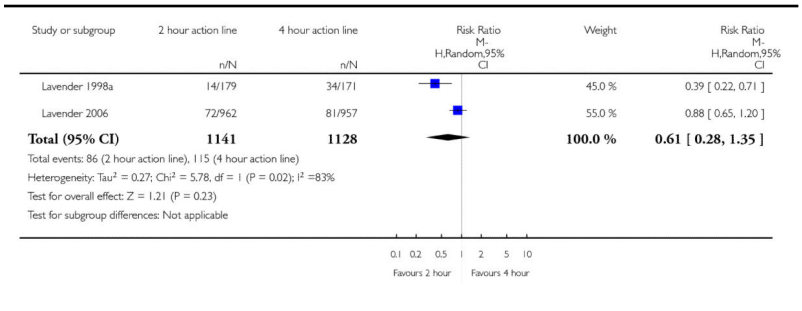
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 5 Serious maternal morbidity or death



Analysis 2.6

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 6 Negative childbirth experience

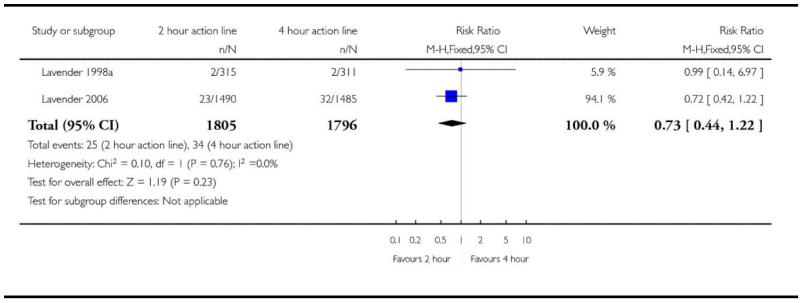
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 6 Negative childbirth experience



Analysis 2.7

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 7 Cord pH less than 7.1

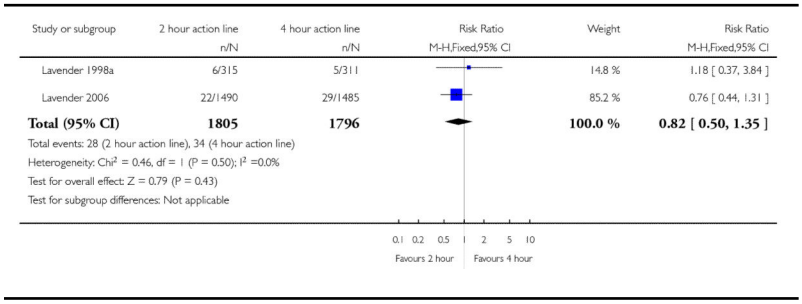
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 7 Cord pH less than 7.1



Analysis 2.8

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 8 Apgar score less than 7 at 5 minutes

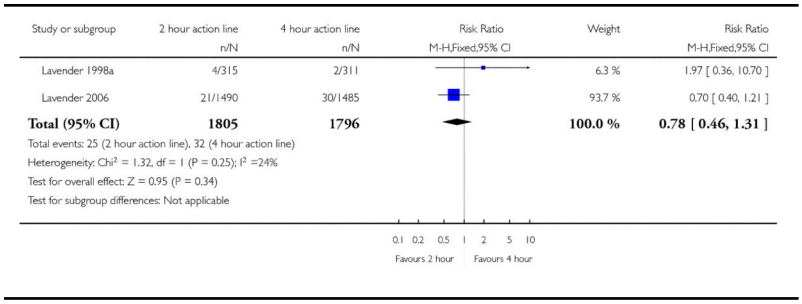
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 8 Apgar score less than 7 at 5 minutes



Analysis 2.9

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 9 Admission to special care nursery

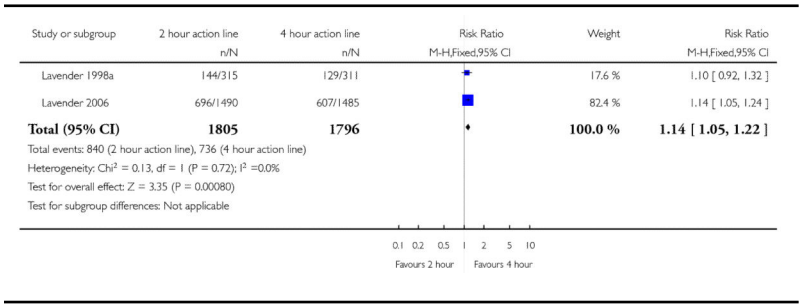
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 9 Admission to special care nursery



Analysis 2.10

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 10 Oxytocin augmentation

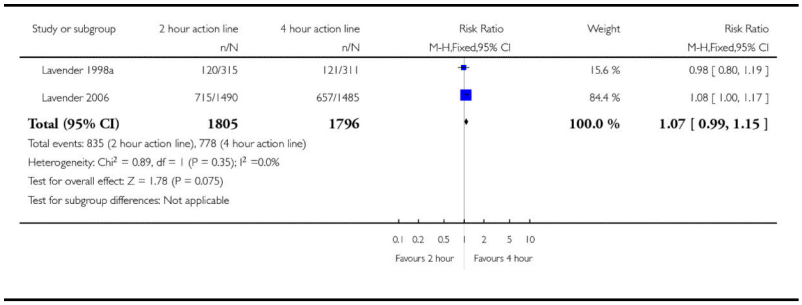
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 10 Oxytocin augmentation



Analysis 2.11

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 11 Performance of artificial rupture of the membranes during labour

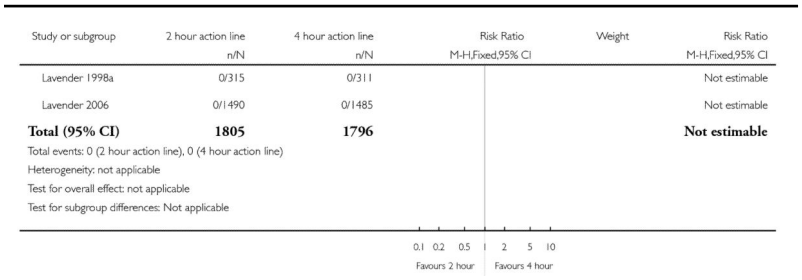
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 11 Performance of artificial rupture of the membranes during labour



Analysis 2.12

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 12 Serious neonatal morbidity or perinatal death

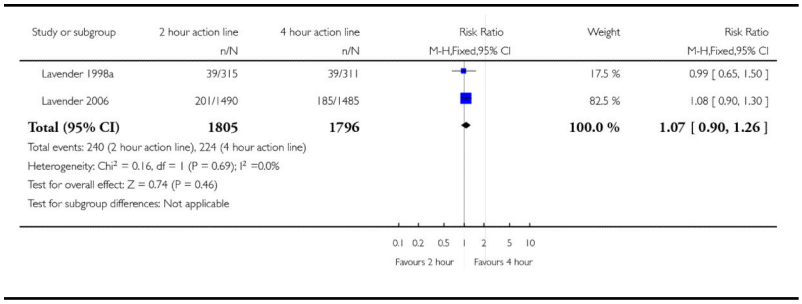
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 12 Serious neonatal morbidity or perinatal death



Analysis 2.13

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 13 Blood loss > 500 mL

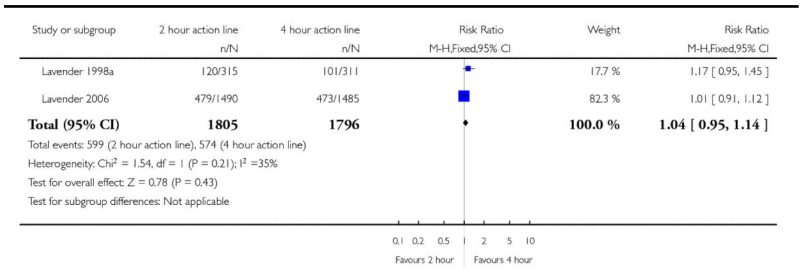
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 13 Blood loss > 500 mL



Analysis 2.14

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 14 Epidural use

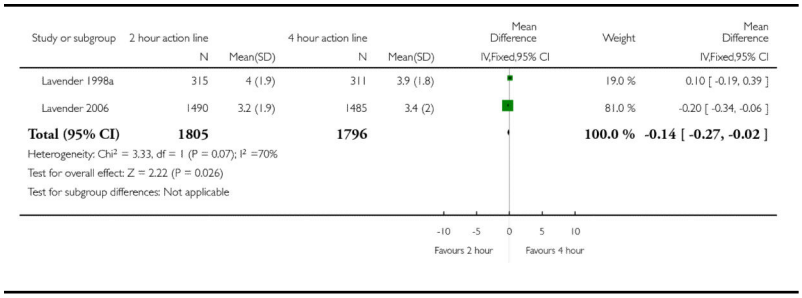
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 14 Epidural use



Analysis 2.15

Comparison 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting), Outcome 15 Vaginal examinations

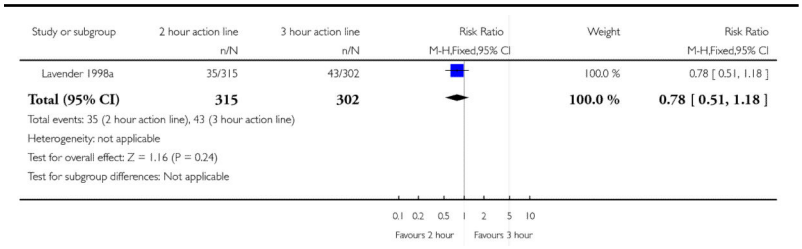
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 2 Partogram with 2-hour action line versus partogram with 4-hour action line (studies carried out in a high-resource setting)
Outcome: 15 Vaginal examinations



Analysis 3.1

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 1 Caesarean section (overall)

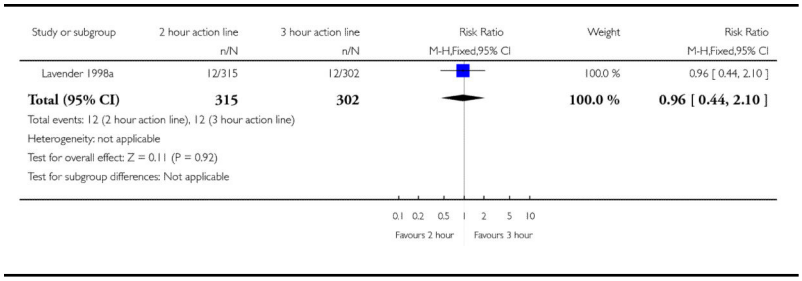
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 1 Caesarean section (overall)



Analysis 3.2

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 2 Caesarean section (distress)

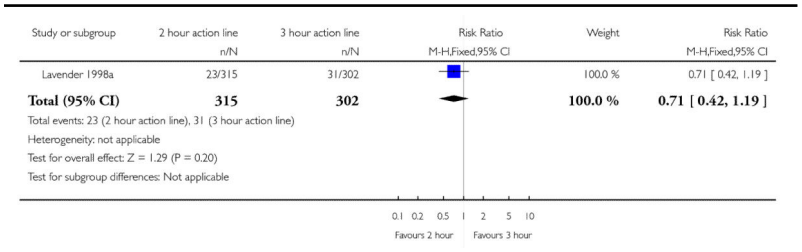
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 2 Caesarean section (distress)



Analysis 3.3

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 3 Caesarean section (delay)

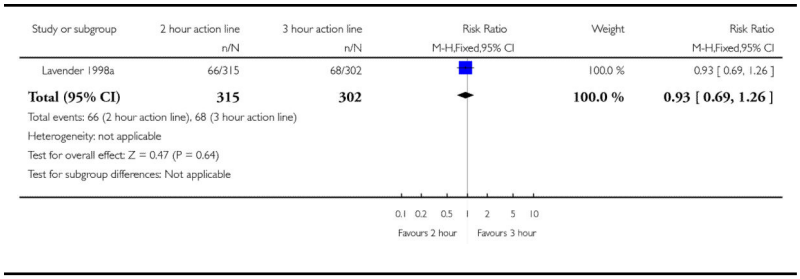
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 3 Caesarean section (delay)



Analysis 3.4

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 4 Instrumental vaginal delivery

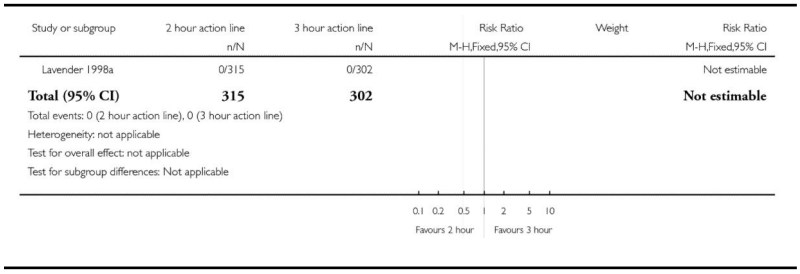
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 4 Instrumental vaginal delivery



Analysis 3.5

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 5 Serious maternal morbidity or death

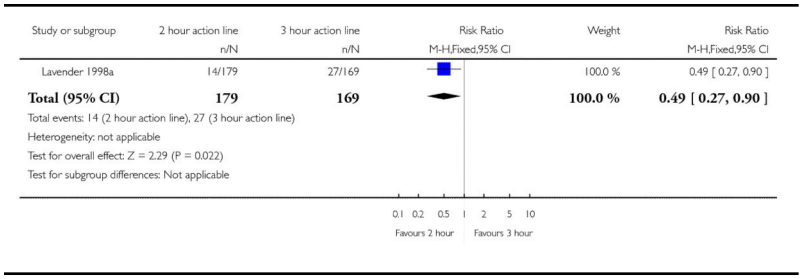
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 5 Serious maternal morbidity or death



Analysis 3.6

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 6 Negative childbirth experience

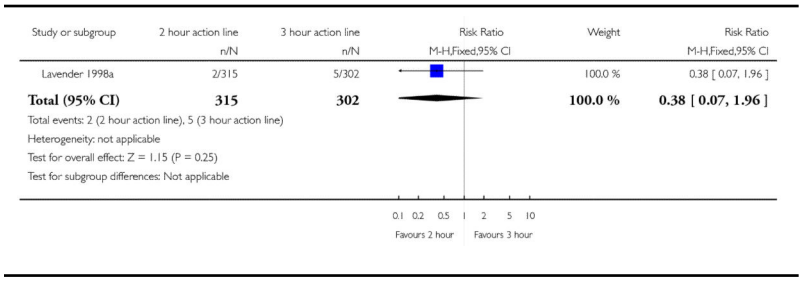
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 6 Negative childbirth experience



Analysis 3.7

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 7 Cord pH less than 7.1

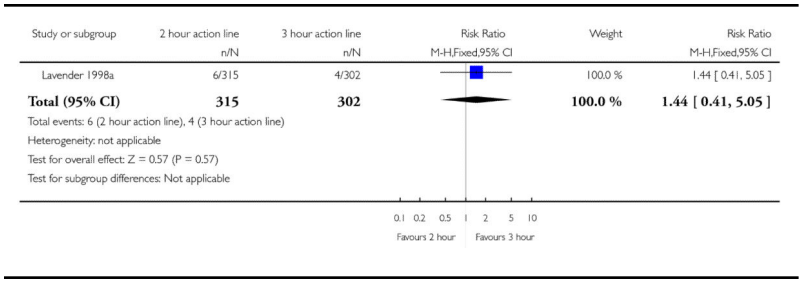
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 7 Cord pH less than 7.1



Analysis 3.8

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 8 Apgar score less than 7 at 5 minutes

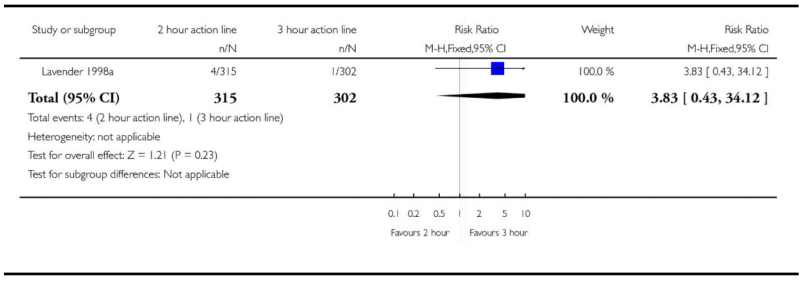
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 8 Apgar score less than 7 at 5 minutes



Analysis 3.9

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 9 Admission to special care nursery

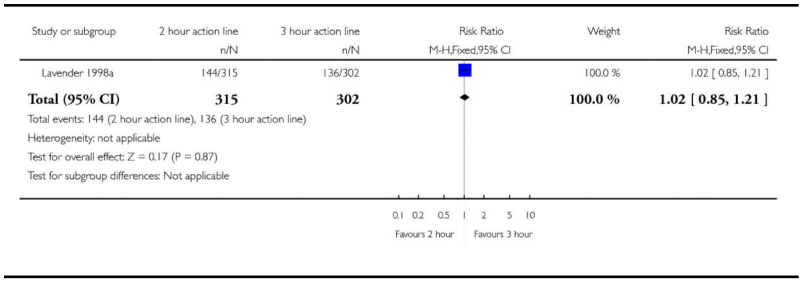
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 9 Admission to special care nursery



Analysis 3.10

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 10 Oxytocin augmentation

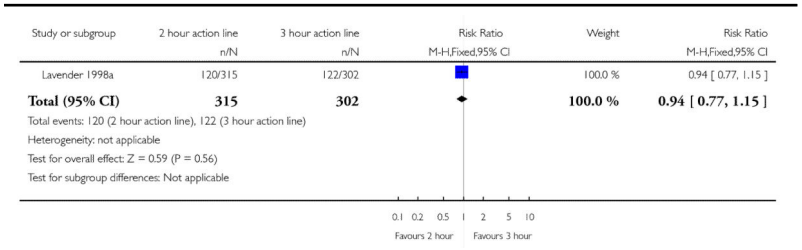
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 10 Oxytocin augmentation



Analysis 3.11

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 11 Performance of artificial rupture of membranes during labour

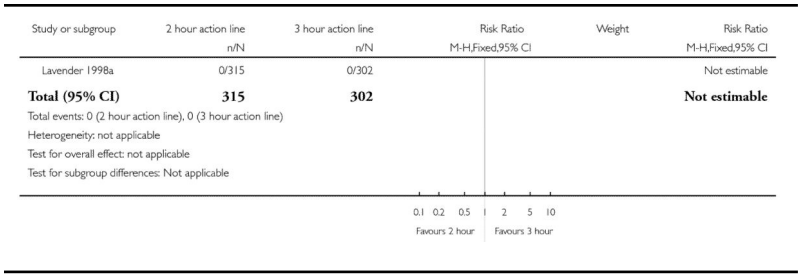
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 11 Performance of artificial rupture of membranes during labour



Analysis 3.12

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 12 Serious neonatal morbidity or perinatal death

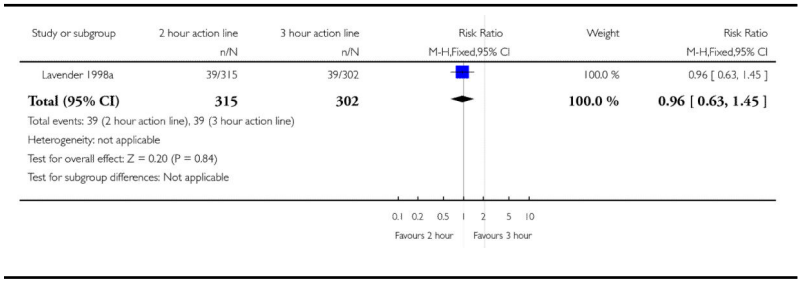
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 12 Serious neonatal morbidity or perinatal death



Analysis 3.13

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 13 Blood loss > 500 mL

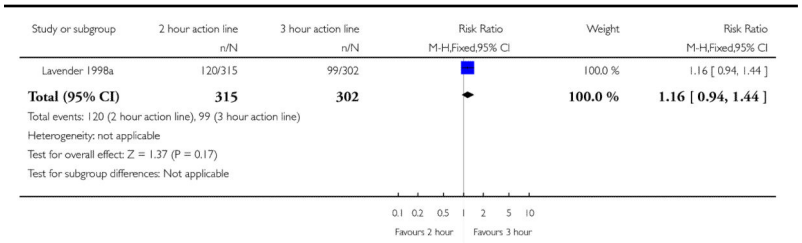
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 13 Blood loss > 500 mL



Analysis 3.14

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 14 Epidural use

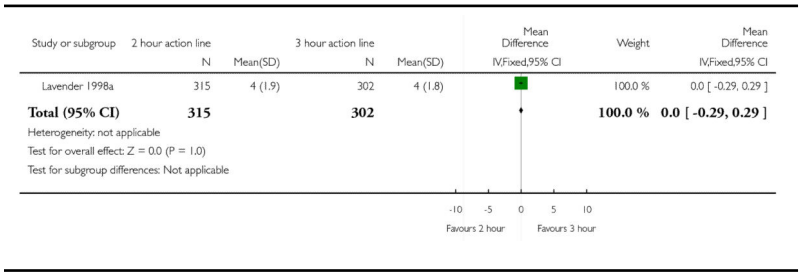
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 14 Epidural use



Analysis 3.15

Comparison 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting), Outcome 15 Vaginal examinations

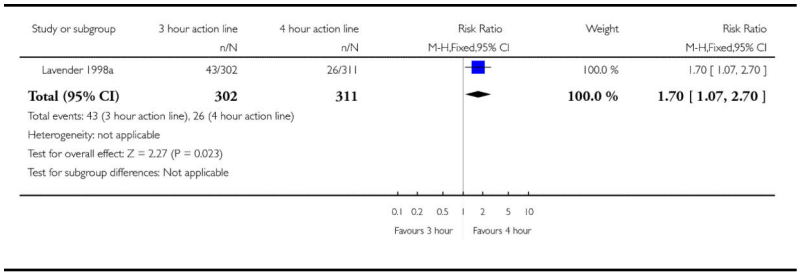
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 3 Partogram with 2-hour action line versus partogram with 3-hour action line (study carried out in a high-resource setting)
Outcome: 15 Vaginal examinations



Analysis 4.1

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 1 Caesarean section (overall)

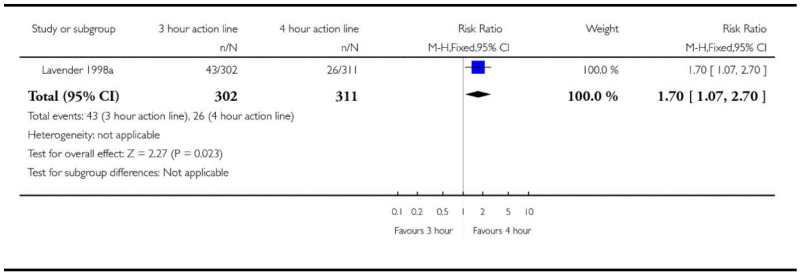
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 1 Caesarean section (overall)



Analysis 4.2

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 2 Caesarean section (distress)

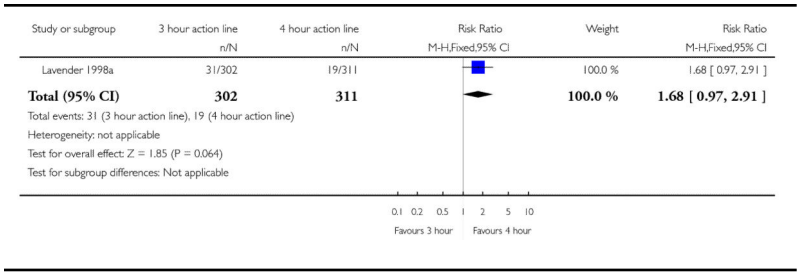
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 2 Caesarean section (distress)



Analysis 4.3

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 3 Caesarean section (delay)

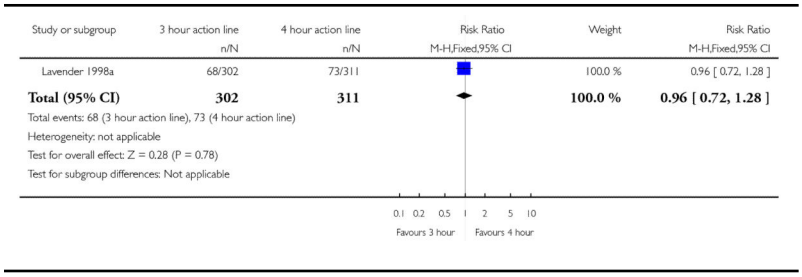
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 3 Caesarean section (delay)



Analysis 4.4

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 4 Instrumental vaginal delivery

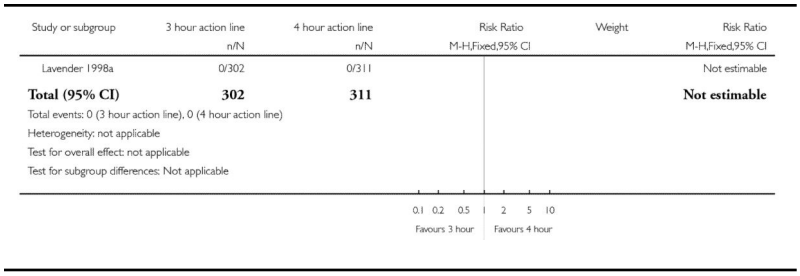
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 4 Instrumental vaginal delivery



Analysis 4.5

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 5 Serious maternal morbidity or death

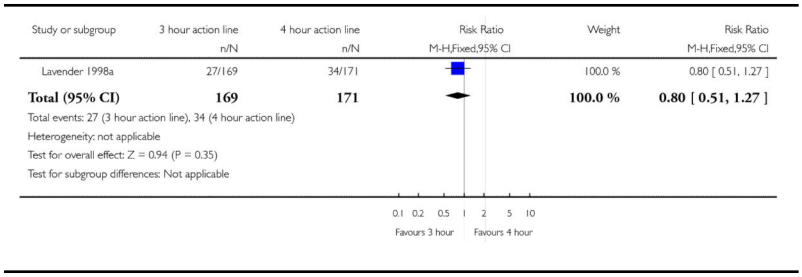
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 5 Serious maternal morbidity or death



Analysis 4.6

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 6 Negative childbirth experience

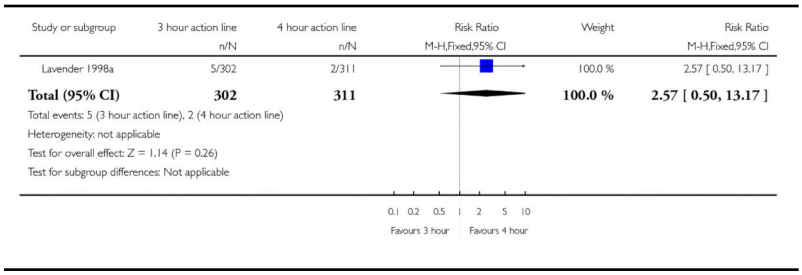
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 6 Negative childbirth experience



Analysis 4.7

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour (study carried out in a high-resource setting), Outcome 7 Cord pH less than 7.1

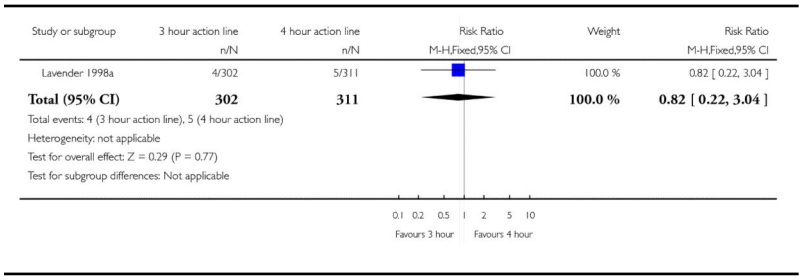
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 7 Cord pH less than 7.1



Analysis 4.8

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 8 Apgar score less than 7 at 5 minutes

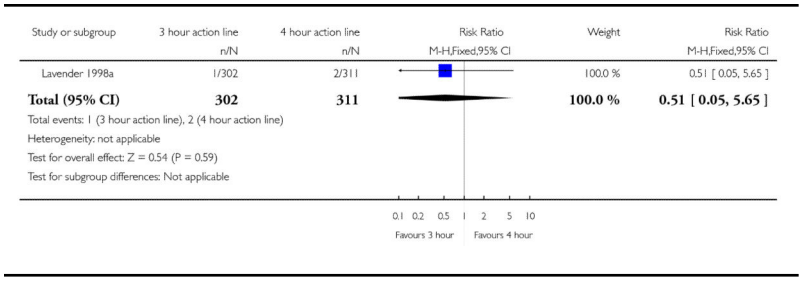
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 8 Apgar score less than 7 at 5 minutes



Analysis 4.9

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 9 Admission to special care nursery

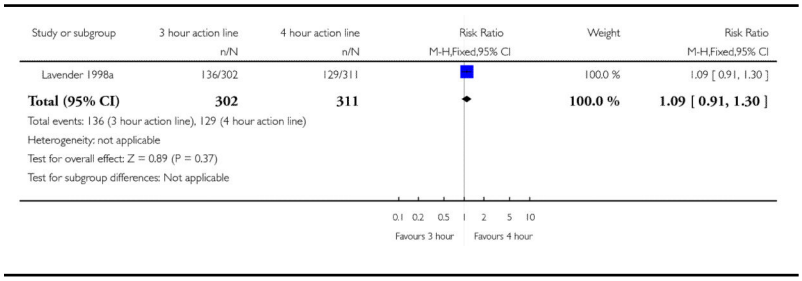
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 9 Admission to special care nursery



Analysis 4.10

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 10 Oxytocin augmentation

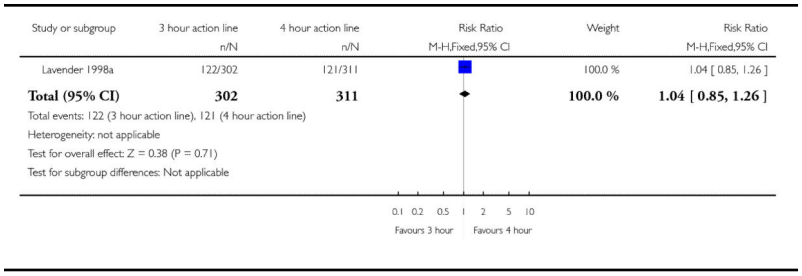
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 10 Oxytocin augmentation



Analysis 4.11

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 11 Performance of artificial rupture of membranes during labour

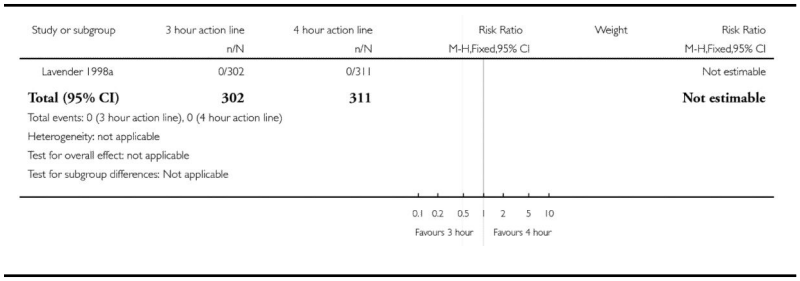
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 11 Performance of artificial rupture of membranes during labour



Analysis 4.12

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 12 Serious neonatal morbidity or perinatal death

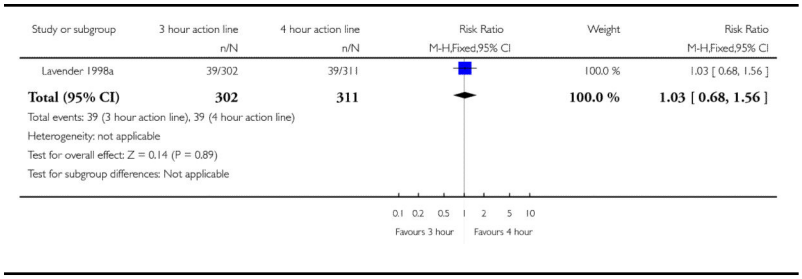
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 12 Serious neonatal morbidity or perinatal death



Analysis 4.13

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 13 Blood loss > 500 mL

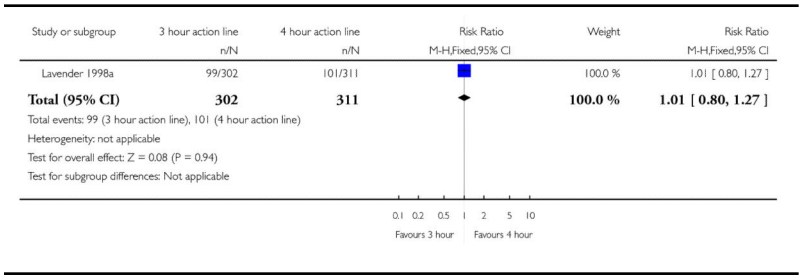
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 13 Blood loss > 500 mL



Analysis 4.14

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 14 Epidural use

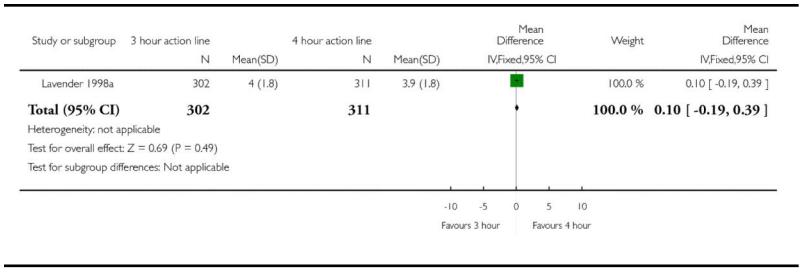
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 14 Epidural use



Analysis 4.15

Comparison 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting), Outcome 15 Number of vaginal examinations in labour

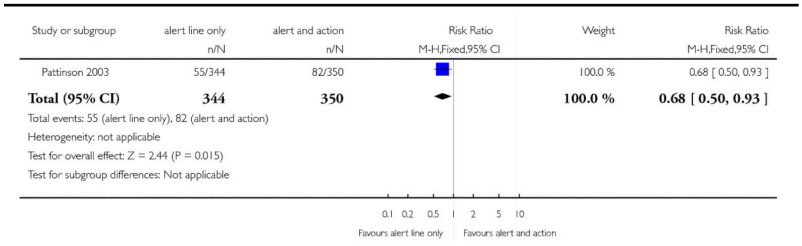
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 4 Partogram with 3-hour action line versus partogram with 4-hour action line (study carried out in a high-resource setting)
Outcome: 15 Number of vaginal examinations in labour



Analysis 5.1

Comparison 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting), Outcome 1 Caesarean section (overall)

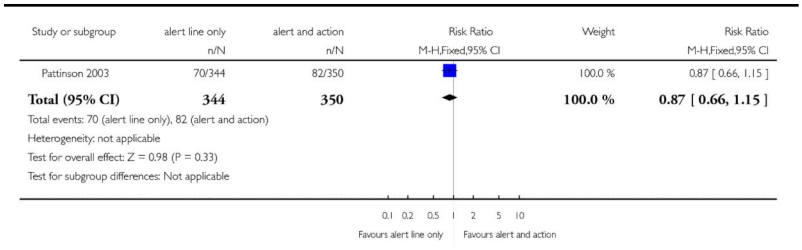
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)
Outcome: 1 Caesarean section (overall)



Analysis 5.2

Comparison 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting), Outcome 2 Instrumental vaginal delivery

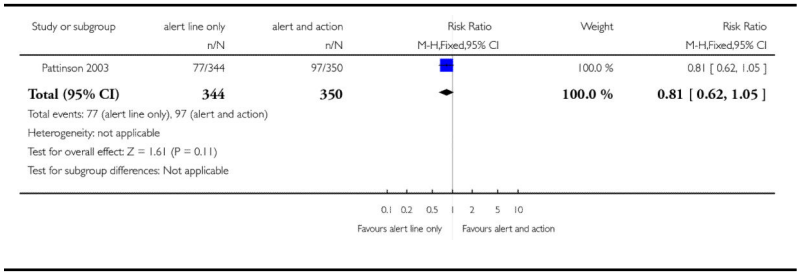
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)
Outcome: 2 Instrumental vaginal delivery



Analysis 5.3

Comparison 5 Partogram with alert line only versus partogram with alert and action (study carried out in a low-resource setting), Outcome 3 Oxytocin augmentation

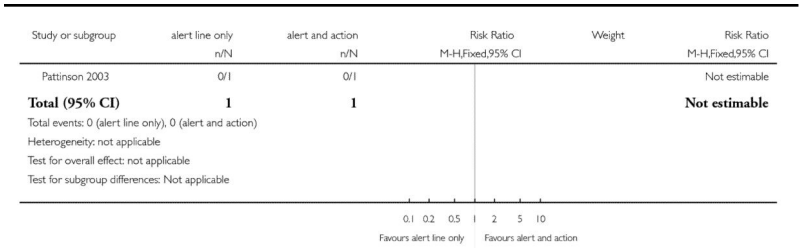
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)
Outcome: 3 Oxytocin augmentation



Analysis 5.4

Comparison 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting), Outcome 4 Low Apgar Score (less than 7 at 5 minutes)

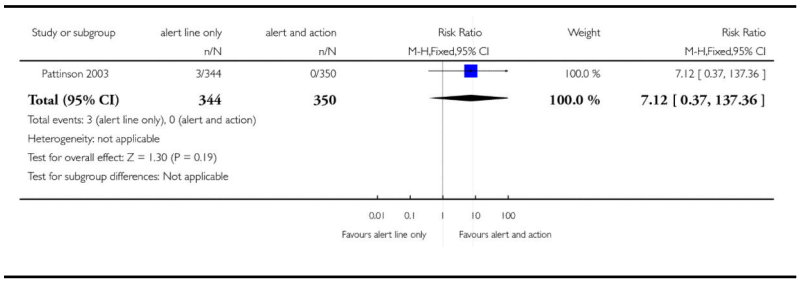
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)
Outcome: 4 Low Apgar Score (less than 7 at 5 minutes)



Analysis 5.5

Comparison 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting), Outcome 5 Perinatal death

Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 5 Partogram with alert line only versus partogram with alert and action line (study carried out in a low-resource setting)
Outcome: 5 Perinatal death



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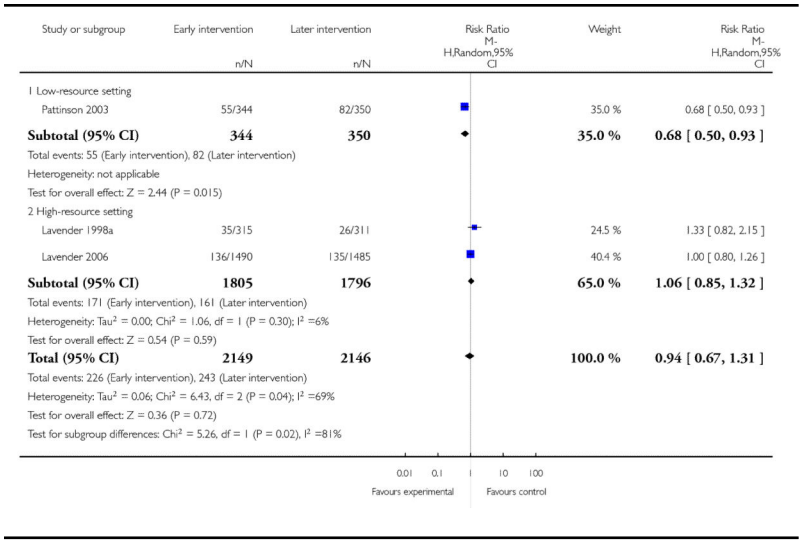
Analysis 6.1

Comparison 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings, Outcome 1 Caesarean section (overall) (New Outcome)

Review: Effect of partogram use on outcomes for women in spontaneous labour at term

Comparison: 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings

Outcome: 1 Caesarean section (overall) (New Outcome)



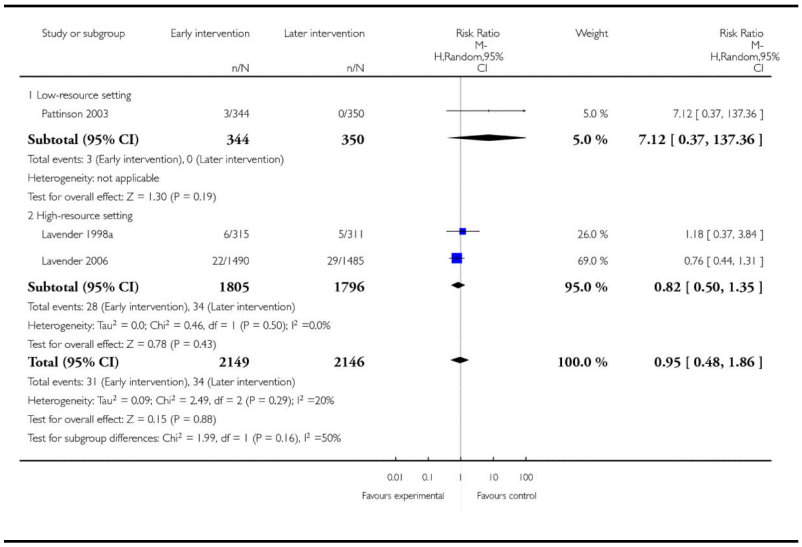
Analysis 6.2

Comparison 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings, Outcome 2 Apgar score low at 5 or 10 minutes

Review: Effect of partogram use on outcomes for women in spontaneous labour at term

Comparison: 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings

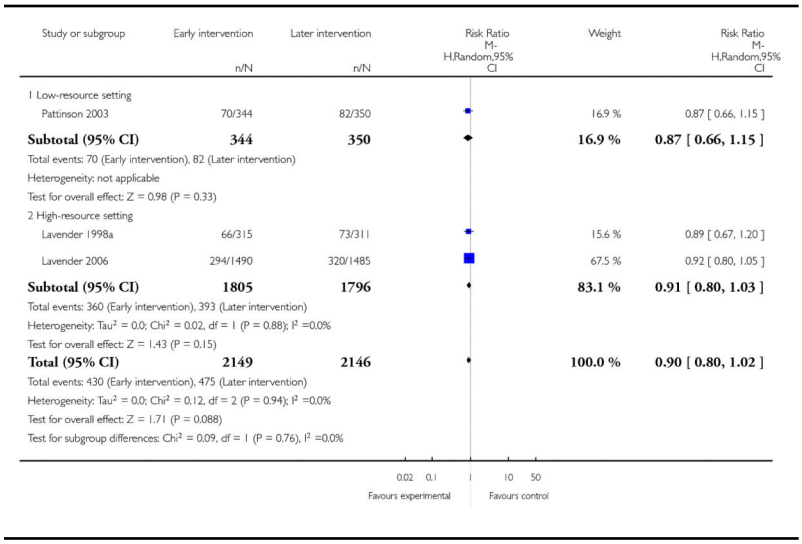
Outcome: 2 Apgar score low at 5 or 10 minutes



Analysis 6.3

Comparison 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings, Outcome 3 Instrumental delivery

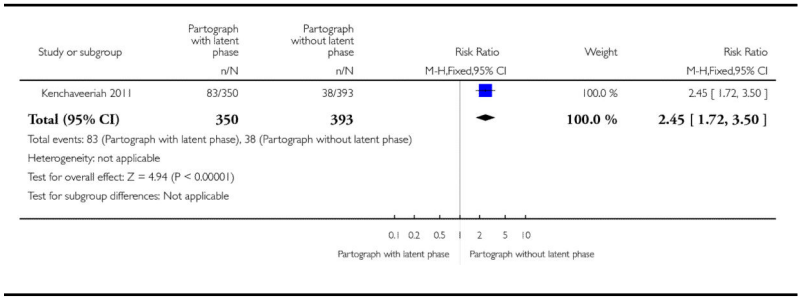
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 6 Earlier versus later intervention: combined Analysis for trials in high- and low-resource settings
Outcome: 3 Instrumental delivery



Analysis 7.1

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 1 Caesarean section (overall)

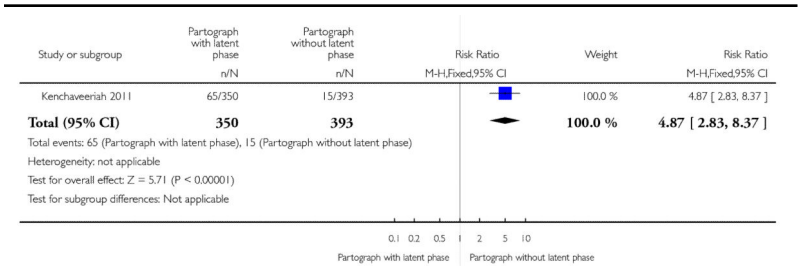
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 1 Caesarean section (overall)



Analysis 7.2

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 2 Caesarean section (distress)

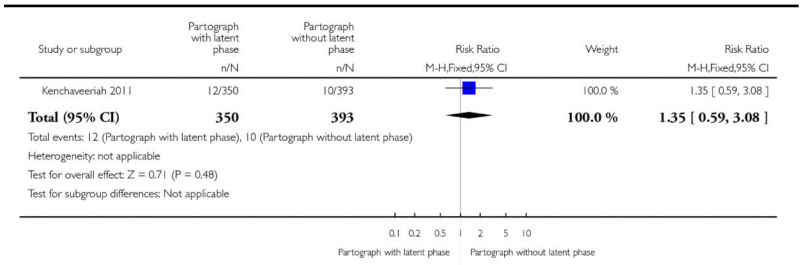
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 2 Caesarean section (distress)



Analysis 7.3

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 3 Caesarean section (delay)

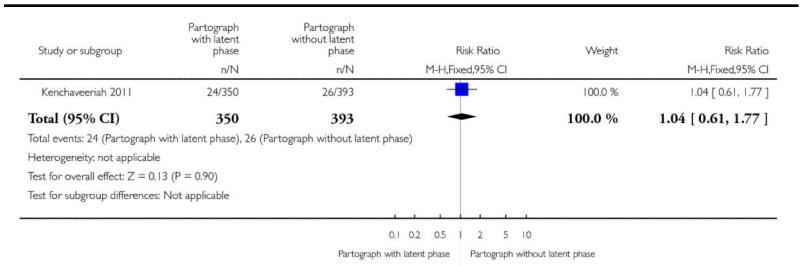
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 3 Caesarean section (delay)



Analysis 7.4

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 4 Instrumental vaginal delivery

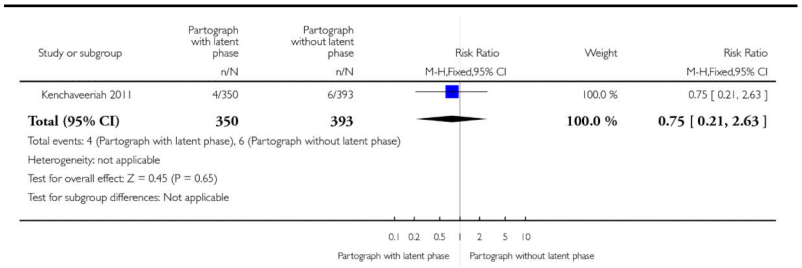
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 4 Instrumental vaginal delivery



Analysis 7.5

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 5 Apgar score less than 7 at 5 minutes

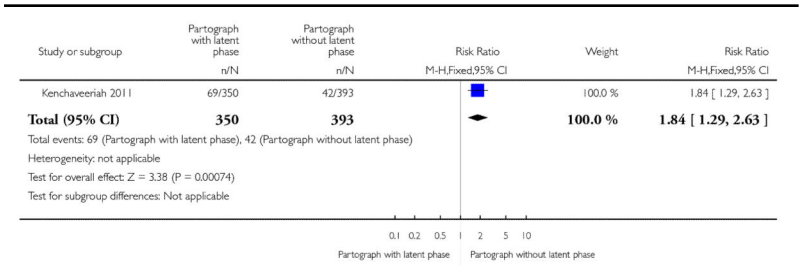
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 5 Apgar score less than 7 at 5 minutes



Analysis 7.6

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 6 Admission to special care nursery

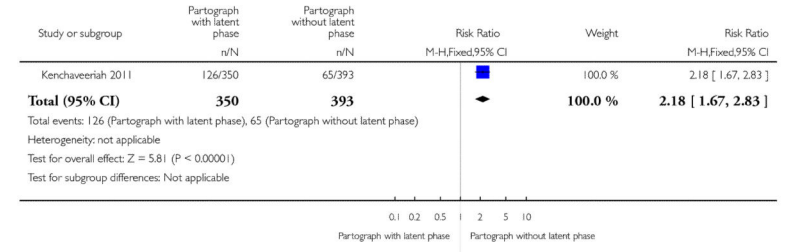
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 6 Admission to special care nursery



Analysis 7.7

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 7 Oxytocin augmentation

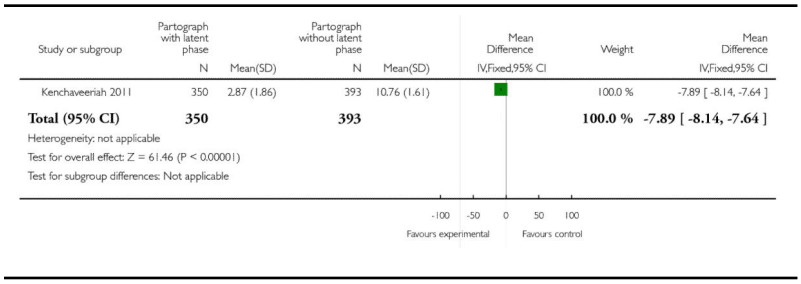
Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 7 Oxytocin augmentation



Analysis 7.8

Comparison 7 Partograph with latent phase versus partograph without latent phase, Outcome 8 User friendliness score

Review: Effect of partogram use on outcomes for women in spontaneous labour at term
Comparison: 7 Partograph with latent phase versus partograph without latent phase
Outcome: 8 User friendliness score



Appendix 1. Methods of data collection and analysis used in the previous version of this review

Data collection and analysis

Selection of studies

We assessed for inclusion all potentially eligible studies. All authors independently evaluated trials for inclusion, without consideration of their results. However, trials to which an author (T Lavender) has contributed, were evaluated by the two other review authors. We were able to gain additional data from contacting one trial author (Windrim 2006), who provided subgroup data for women who met our eligibility criteria.

Assessment of study validity

We assessed the validity of each study using the criteria outlined in the Cochrane Handbook (Higgins 2008). We independently assessed the quality of included trials according to allocation of concealment, completeness to follow up and blinding in the assessment of outcomes. We resolved differences of opinion as to eligibility and quality by consensus.

(1) Allocation concealment—We assigned a quality score for each trial, using the following criteria:

- adequate concealment of allocation, such as telephone randomisation, consecutively numbered sealed opaque envelopes;
- unclear whether there was adequate concealment of allocation; such as a list or table used, only specifying that sealed envelopes were used, or study does not report any concealment approach;

- inadequate concealment of allocation, such as use of case record numbers, dates of birth or days of the week, and any procedure that is entirely transparent before allocation such as open list of random numbers.

(2) Completeness to follow up—We assessed completeness to follow up and have noted levels of attrition; levels of attrition were assessed as adequate, unclear or inadequate. For outcomes measured in labour, we rated attrition levels as adequate if they were less than 20%.

(3) Blinding—We have noted where there had been any attempt to blind study participants, caregivers or outcome assessors to group allocation. With a complex intervention such as a partogram it is often not feasible to blind women or staff to group assignment.

(4) Data extraction—We designed a form to extract data. At least two authors extracted the data using the agreed form. We resolved minor discrepancies through discussion. We used the Review Manager software (RevMan 2008) to enter the data, and these were then independently double checked.

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

(5) Statistical analyses—We carried out statistical analysis using the Review Manager software (RevMan 2008). For those outcomes measured in labour, we only included trials with at least 80% complete follow up for the outcome measure of interest. We used fixed-effect meta-analysis for combining data when trials were sufficiently similar.

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

For continuous outcomes the mean difference is used if outcomes are measured in the same way between trials. We used the standardised mean difference to combine trials that measure the same outcome, but use different methods. We have reported where there was evidence of skewness.

We analysed data on an intention-to-treat basis. Therefore, all participants with available data were included in the analysis in the group to which they were allocated, regardless of whether or not they received the allocated intervention.

Measures of heterogeneity between trials were applied when appropriate using the I^2 statistic. When we identified high levels of heterogeneity among the trials (exceeding 50%), we used random-effects models. We did not carry out subgroup analyses because insufficient data on subgroups was provided.

WHAT'S NEW

Last assessed as up-to-date: 14 June 2012.

Date	Event	Description
14 June 2012	New search has been performed	Search updated in May 2012. Three new trials identified. One has been included (Kenchaveeriah 2011), one has been excluded (Hamilton 2004) and one is awaiting classification (Ajoodani 2011). This review is now comprised of six included studies (involving 7706 women)
14 June 2012	New citation required but conclusions have not changed	Review updated.

HISTORY

Protocol first published: Issue 3, 2005

Review first published: Issue 4, 2008

Date	Event	Description
12 May 2009	Amended	Corrected typographical error in results section.
10 November 2008	Amended	Contact details edited.
29 April 2008	Amended	Converted to new review format.

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* *Indicates the major publication for the study*

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PLAIN LANGUAGE SUMMARY

Effect of partogram use on outcomes for women in spontaneous labour at term

A partogram is usually a pre-printed form, the aim of which is to provide a pictorial overview of labour progress and to alert health professionals to any problems with the mother or baby. It has been unclear whether a partogram should be used and, if so, which design of partogram is better for women and babies. The review authors identified six randomised controlled trials involving 7706 women in spontaneous labour at term. Two studies, with 1590 women, assessed introducing the use of a partogram versus routine care without a partogram. Four studies, involving 6116 women, compared different types of partograms. Overall, there was no evidence from this review that using a partogram reduced or increased caesarean section rates or had any effect on other aspects of care in labour. Where different types of partogram were compared, no design appeared better than others. A single centre study, conducted in India, however, comparing a partogram with a latent phase (composite) and one without, demonstrated more favourable outcomes for the mother and baby when the modified chart was used. It is possible that partograms may be useful in settings with poorer access to healthcare resources, as studies in Mexico and Africa also showed some reduction in caesarean section rates with partogram use and early intervention for delayed progress in labour.

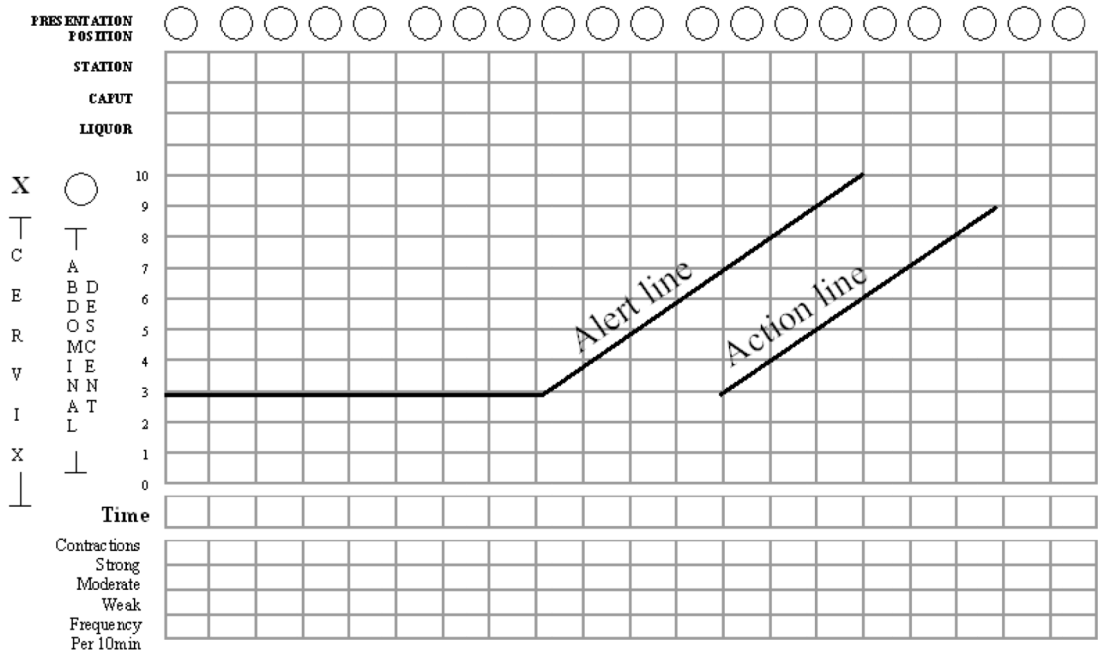

Figure 1. Section of partogram where labour progress is recorded

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