Non-clinical interventions for reducing unnecessary caesarean section

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TABLE OF CONTENTS

[Intervention Review]

Non-clinical interventions for reducing unnecessary caesarean section

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ABSTRACT

Background

Caesarean section rates are increasing globally. The factors contributing to this increase are complex, and identifying interventions to address them is challenging. Non-clinical interventions are applied independently of a clinical encounter between a health provider and a patient. Such interventions may target women, health professionals or organisations. They address the determinants of caesarean births and could have a role in reducing unnecessary caesarean sections. This review was first published in 2011. This review update will inform a new WHO guideline, and the scope of the update was informed by WHO's Guideline Development Group for this guideline.

Objectives

To evaluate the effectiveness and safety of non-clinical interventions intended to reduce unnecessary caesarean section.

Search methods

We searched CENTRAL, MEDLINE, Embase, CINAHL and two trials registers in March 2018. We also searched websites of relevant organisations and reference lists of related reviews.

Selection criteria

Randomised trials, non-randomised trials, controlled before-after studies, interrupted time series studies and repeated measures studies were eligible for inclusion. The primary outcome measures were: caesarean section, spontaneous vaginal birth and instrumental birth.

Data collection and analysis

We followed standard methodological procedures recommended by Cochrane. We narratively described results of individual studies (drawing summarised evidence from single studies assessing distinct interventions).

Main results

We included 29 studies in this review (19 randomised trials, 1 controlled before-after study and 9 interrupted time series studies). Most of the studies (20 studies) were conducted in high-income countries and none took place in low-income countries. The studies enrolled a mixed population of pregnant women, including nulliparous women, multiparous women, women with a fear of childbirth, women with high levels of anxiety and women having undergone a previous caesarean section.

Overall, we found low-, moderate- or high-certainty evidence that the following interventions have a beneficial effect on at least one primary outcome measure and no moderate- or high-certainty evidence of adverse effects.

Interventions targeted at women or families

Childbirth training workshops for mothers alone may reduce caesarean section (risk ratio (RR) 0.55, 95% confidence interval (CI) 0.33 to 0.89) and may increase spontaneous vaginal birth (RR 2.25, 95% CI 1.16 to 4.36). Childbirth training workshops for couples may reduce caesarean section (RR 0.59, 95% CI 0.37 to 0.94) and may increase spontaneous vaginal birth (RR 2.13, 95% CI 1.09 to 4.16). We judged this one study with 60 participants to have low-certainty evidence for the outcomes above.

Nurse-led applied relaxation training programmes (RR 0.22, 95% CI 0.11 to 0.43; 104 participants, low-certainty evidence) and psychosocial couple-based prevention programmes (RR 0.53, 95% CI 0.32 to 0.90; 147 participants, low-certainty evidence) may reduce caesarean section. Psychoeducation may increase spontaneous vaginal birth (RR 1.33, 95% CI 1.11 to 1.61; 371 participants, low-certainty evidence). The control group received routine maternity care in all studies.

There were insufficient data on the effect of the four interventions on maternal and neonatal mortality or morbidity.

Interventions targeted at healthcare professionals

Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication slightly reduces the risk of overall caesarean section (mean difference in rate change -1.9%, 95% CI -3.8 to -0.1; 149,223 participants). Implementation of clinical practice guidelines combined with audit and feedback also slightly reduces the risk of caesarean section (risk difference (RD) -1.8%, 95% CI -3.8 to -0.2; 105,351 participants). Physician education by local opinion leader (obstetrician-gynaecologist) reduced the risk of elective caesarean section to 53.7% from 66.8% (opinion leader education: 53.7%, 95% CI 46.5 to 61.0%; control: 66.8%, 95% CI 61.7 to 72.0%; 2496 participants). Healthcare professionals in the control groups received routine care in the studies. There was little or no difference in maternal and neonatal mortality or morbidity between study groups. We judged the certainty of evidence to be high.

Interventions targeted at healthcare organisations or facilities

Collaborative midwifery-labourist care (in which the obstetrician provides in-house labour and delivery coverage, 24 hours a day, without competing clinical duties), versus a private practice model of care, may reduce the primary caesarean section rate. In one interrupted time series study, the caesarean section rate decreased by 7% in the year after the intervention, and by 1.7% per year thereafter (1722 participants); the vaginal birth rate after caesarean section increased from 13.3% before to 22.4% after the intervention (684 participants). Maternal and neonatal mortality were not reported. We judged the certainty of evidence to be low.

We studied the following interventions, and they either made little or no difference to caesarean section rates or had uncertain effects.

Moderate-certainty evidence suggests little or no difference in caesarean section rates between usual care and: antenatal education programmes for physiologic childbirth; antenatal education on natural childbirth preparation with training in breathing and relaxation techniques; computer-based decision aids; individualised prenatal education and support programmes (versus written information in pamphlet).

Low-certainty evidence suggests little or no difference in caesarean section rates between usual care and: psychoeducation; pelvic floor muscle training exercises with telephone follow-up (versus pelvic floor muscle training without telephone follow-up); intensive group

therapy (cognitive behavioural therapy and childbirth psychotherapy); education of public health nurses on childbirth classes; role play (versus standard education using lectures); interactive decision aids (versus educational brochures); labourist model of obstetric care (versus traditional model of obstetric care).

We are very uncertain as to the effect of other interventions identified on caesarean section rates as the certainty of the evidence is very low.

Authors' conclusions

We evaluated a wide range of non-clinical interventions to reduce unnecessary caesarean section, mostly in high-income settings. Few interventions with moderate- or high-certainty evidence, mainly targeting healthcare professionals (implementation of guidelines combined with mandatory second opinion, implementation of guidelines combined with audit and feedback, physician education by local opinion leader) have been shown to safely reduce caesarean section rates. There are uncertainties in existing evidence related to very-low or low-certainty evidence, applicability of interventions and lack of studies, particularly around interventions targeted at women or families and healthcare organisations or facilities.

PLAIN LANGUAGE SUMMARY

Non-clinical interventions for reducing unnecessary caesarean section

What is the aim of this review?

The aim of this Cochrane Review was to find out whether non-clinical interventions, which aim to reduce unnecessary caesarean sections, such as providing education to healthcare workers and mothers, are safe and effective. This review was first published in 2011. This review update will inform a new WHO guideline, and the scope of the update was informed by WHO's Guideline Development Group for this guideline.

Key messages

We studied a wide range of non-clinical interventions that aim to reduce unnecessary caesarean sections, mostly in high-income countries. Based on high-quality evidence, few interventions have been shown to reduce caesarean section rates without adverse effects on maternal or neonatal outcomes. These interventions are mainly aimed at healthcare professionals (nurses, midwives, physicians) and involve using: clinical guidelines combined with mandatory second opinion for caesarean section indication; clinical guidelines combined with audit and feedback about caesarean section practices; and opinion leaders (obstetrician/gynaecologist) to provide education to healthcare professionals.

What was studied in this review?

Caesarean section is an operation used to prevent and reduce complications of childbirth. While it can be a life-saving procedure for both the mother and baby, caesarean section is not without harm and should only be carried out when necessary. Caesarean sections increase the likelihood of bleeding, maternal infections and infant breathing problems, among other complications. The number of caesarean sections performed has been increasing worldwide. Whilst there may be medical reasons for this increase, other factors, such as clinician convenience and maternal fears, may also be responsible.

What are the main results of the review?

We included 29 studies in this review. Most of the studies (20 studies) were conducted in high-income countries; none in low-income countries.

We rated the quality of the evidence from studies using four levels: very low, low, moderate, or high. Very low-quality means that we are very uncertain about the results. High-quality evidence means that we are very confident in the results.

Overall, we found eight of the 29 interventions included in the review to have a beneficial effect on at least one of our main outcomes with low-, moderate- or high-quality evidence, and no moderate- or high-quality evidence of harm:

Interventions aimed at women or families: providing childbirth training workshops for mothers and couples; relaxation training programmes led by nurses; psychosocial couple-based prevention programmes; and psychoeducation. The interventions were compared to routine practice. The quality of evidence from the studies was low.

Interventions aimed at healthcare professionals: using clinical guidelines combined with mandatory second opinion for caesarean section indication; using clinical guidelines combined with audit and feedback about caesarean section practices; and having opinion leaders (obstetrician/gynaecologist) provide education to healthcare professionals. The interventions were compared to routine practice. The quality of evidence was high.

Interventions aimed at healthcare organisations or facilities: collaborative midwifery-labourist model of care (in which the obstetrician provides in-house labour and delivery coverage, 24 hours a day, without competing clinical duties) compared to a private model of care. The quality of evidence was low.

We studied a number of other interventions and they either made little or no difference to caesarean section rates, or had uncertain effects.

Limited data were available on possible harms associated with the interventions examined in this review.

How up-to-date is this review?

The evidence is current to March 2018.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [*Explanation*]

Patients or population: mixed population (women with a fear of childbirth; women with high levels of anxiety; husbands of pregnant women; pregnant women and couples; and pregnant women with no particular health condition)						
Intervention	**Primary outcome measure**	**Plain language summary**	**Absolute effect**		**Relative effect (95% CI)**	**Certainty (GRADE)**
			with control	**with intervention (95% CI)**		
Education, birth preparation classes and support programmes						
Childbirth training workshop (Iran) (Valiani 2014, randomised trial)	Caesarean section	Childbirth training workshop may reduce the caesarean section rate compared to routine maternity care	73 per 100	40 per 100 (24 to 65)	Mothers alone versus control: RR 0.55 (0.33 to 0.89) (1 study, 60 women)	⨁⨁◯◯ **LOW**[a,b]
			73 per 100	43 per 100 (27 to 69)	Couple versus control: RR 0.59 (0.37 to 0.94) (1 study, 60 women)	
	Spontaneous vaginal birth	Childbirth training workshop may increase spontaneous vaginal birth compared to routine maternity care	27 per 100	61 per 100 (31 to 118)	Mothers alone versus control: RR 2.25 (1.16 to 4.36) (1 study, 60 women)	
			27 per 100	58 per 100 (29 to 112)	Couple versus control: RR 2.13 (1.09 to 4.16) (1 study, 60 women)	
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-

	Neonatal mortality or morbidity	NR	-	-	-	-
Nurse-led applied relaxation training programme (Iran) (Bastani 2006, randomised trial)	Caesarean section	Nurse-led applied relaxation training programme may reduce caesarean section rate compared to routine maternity care	404 per 1000	89 per 1000 (44 to 174)	RR 0.22 (0.11 to 0.43) (1 study, 104 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	Nurse-led applied relaxation training programme may reduce instrumental vaginal births compared to routine maternity care	481 per 1000	212 per 1000 (115 to 385)	RR 0.44 (0.24 to 0.80) (1 study, 104 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Psychosocial couple-based prevention programme (USA) (Feinberg 2015, randomised trial)	Caesarean section	Psychosocial couple-based prevention programme may reduce caesarean section rate compared to routine maternity care	394 per 1000[c]	209 per 1000 (126 to 355)	RR 0.53 (0.32 to 0.90)[c] (1 study, 147 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	NR	-	-	-	-

	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Psychoeducation (Finland) (Rouhe 2013, randomised trial)	Caesarean section	Psychoeducation may lead to little or no difference in caesarean section rate compared to routine maternity care	325 per 1000	228 per 1000 (159 to 328)	RR 0.70 (0.49 to 1.01) (1 study, 371 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	Psychoeducation may increase spontaneous vaginal birth compared to routine maternity care	475 per 1000	632 per 1000 (527 to 765)	RR 1.33 (1.11 to 1.61) (1 study, 371 women)	
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Antenatal education programme for physiologic childbirth (Iran) (Masoumi 2016, randomised trial)	Caesarean section	Antenatal education programme for physiologic childbirth probably leads to little or no difference in caesarean section rate compared to routine maternity care	437 per 1000	450 per 1000 (315 to 651)	RR 1.03 (0.72 to 1.49) (1 study, 150 women)	⊕⊕⊕⊖ **MODERATE**[a]

	Spontaneous vaginal birth - physiologic birth	Antenatal education programme for physiologic childbirth probably increases rates of physiologic birth compared to routine maternity care	0 per 1000	80 per 1000 (CI not estimable)	Relative effect not estimable (1 study, 150 women)	
	Spontaneous vaginal birth - normal vaginal birth	Antenatal education programme for physiologic childbirth probably leads to little or no difference in normal vaginal birth compared to routine maternity care	570 per 1000	479 per 1000 (353 to 650)	RR 0.84 (0.62 to 1.14) (1 study, 150 women)	
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Pelvic floor muscle training exercises (China) (Wang 2014, randomised trial)	Caesarean section	Pelvic floor muscle training exercises with telephone follow-up may lead to little or no difference in caesarean section rate compared to pelvic floor muscle training without telephone follow-up	49 per 100	43 per 100 (18 to 100)	RR 0.87 (0.37 to 2.04) (1 study, 90 women)	⊕⊕◯◯ **LOW**[a,b]

	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques (Sweden) (Bergstrom 2009, randomised trial)	Caesarean section - elective	Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques probably leads to little or no difference in elective caesarean section rate compared to routine maternity care	630 per 1000	599 per 1000 (365 to 983)	RR 0.95 (0.58 to 1.56) (1 study, 977 women)	⊕⊕⊕⊖ **MODERATE**[d]
	Caesarean section - emergency	Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques probably leads to little or no difference in emergency caesarean section rate compared to routine maternity care	152 per 1000	138 per 1000 (102 to 187)	RR 0.91 (0.67 to 1.23) (1 study, 977 women)	

	Spontaneous vaginal birth	Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques probably leads to little or no difference in spontaneous vaginal birth rate compared to routine maternity care	663 per 1000	663 per 1000 (603 to 723)	RR 1.00 (0.91 to 1.09) (1 study, 977 women)	
	Instrumental vaginal birth	Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques probably leads to little or no difference in instrumental vaginal birth rate compared to routine maternity care	122 per 1000	139 per 1000 (100 to 192)	RR 1.14 (0.82 to 1.57) (1 study, 977 women)	
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Computer-based decision aids (information programme, decision analysis) (UK) (Montgomery 2007, randomised trial)	Caesarean section - elective	**Information group versus usual care**: computer-based decision aids (information programme) probably leads to little or no difference in elective caesarean section rate compared to usual	496 per 1000	486 per 1000 (407 to 585)	RR 0.98 (0.82 to 1.18) (1 study, 478 women)	⊕⊕⊕⊖ **MODERATE**[d]

	care			
Caesarean section - elective	**Decision analysis group versus usual care**: computer-based decision aids (decision analysis) probably leads to little or no difference in elective caesarean section rate compared to usual care	496 per 1000	412 per 1000 (337 to 506)	RR 0.83 (0.68 to 1.02) (1 study, 478 women)
Caesarean section - emergency	**Information group versus usual care**: computer-based decision aids (information programme) probably leads to little or no difference in emergency caesarean section rate compared to usual care	202 per 1000	220 per 1000 (156 to 313)	RR 1.09 (0.77 to 1.55) (1 study, 478 women)
Caesarean section - emergency	**Decision analysis group versus usual care**: computer-based decision aids (decision analysis) probably leads to little or no difference in emergency caesarean section rate compared to usual care	202 per 1000	212 per 1000 (150 to 303	RR 1.05 (0.74 to 1.50) (1 study, 478 women)
Spontaneous vaginal birth	**Decision analysis versus usual care**: computer-based decision aids (decision analy-	303 per 1000	376 per 1000 (291 to 485)	RR 1.24 (0.96 to 1.60) (1 study, 478 women)

		sis) probably leads to little or no difference in spontaneous vaginal birth rate compared to usual care				
	Spontaneous vaginal birth	**Information group versus usual care**: computer-based decision aids (information programme) probably leads to little or no difference in spontaneous vaginal birth rate compared to usual care	303 per 1000	291 per 1000 (221 to 385)	RR 0.96 (0.73 to 1.27) (1 study, 478 women)	
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Decision aid booklet (Australia) (Shorten 2005, randomised trial)	Caesarean section - elective repeat	Decision aid booklet probably leads to little or no difference in elective repeat caesarean section compared to routine maternity care	Baseline: 23.2% Follow-up: 49.4% Change from baseline: 26.2%	Baseline: 29.6% Follow-up: 52.2% Change from baseline: 22.6%	Relative effect not reported Difference in absolute change from baseline: -3.6% (NS) (1 study, 227 women)	⊕⊕⊕⊖ **MODERATE**[a]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-

	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy) (Finland) (Saisto 2001, randomised trial)	Caesarean section	Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy) may lead to little or no difference in caesarean section rate compared to routine maternity care	484 per 1000	436 per 1000 (315 to 600)	RR 0.90 (0.65 to 1.24) (1 study, 176 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Caesarean section - for psychological reasons	Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy) may lead to little or no difference in caesarean section rate for psychological reasons compared to routine maternity care	286 per 1000	235 per 1000 (143 to 389)	RR 0.82 (0.50 to 1.36) (1 study, 176 women)	
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-

	Neonatal mortality or morbidity	NR	-	-	-	-
Psychoeducation sessions by telephone (Australia) (Fenwick 2015, randomised trial)	Caesarean section - overall	The effect of psychoeducation sessions by telephone (compared to routine maternity care) on overall caesarean section rate is uncertain	419 per 1000	339 per 1000 (235 to 494)	RR 0.81 (0.56 to 1.18) (1 study, 184 women)	⊕⊖⊖⊖ **VERY LOW**[a,b,e]
	Caesarean section - emergency	The effect of psychoeducation sessions by telephone (compared to routine maternity care) on emergency caesarean section rate is uncertain	247 per 1000	173 per 1000 (96 to 304)	RR 0.70 (0.39 to 1.23) (1 study, 182 women)	
	Spontaneous vaginal birth	The effect of psychoeducation sessions by telephone (compared to routine maternity care) on spontaneous vaginal birth rate is uncertain	419 per 1000	482 per 1000 (352 to 666)	RR 1.15 (0.84 to 1.59) (1 study, 184 women)	
	Instrumental vaginal birth	The effect of psychoeducation sessions by telephone (compared to routine maternity care) on instrumental vaginal birth rate is uncertain	161 per 1000	176 per 1000 (92 to 333)	RR 1.09 (0.57 to 2.07) (1 study, 184 women)	
	Maternal mortality or morbidity	NR	-	-	-	-

	Neonatal mortality or morbidity	NR	-	-	-	-
Prenatal education for husbands of pregnant women (Iran) (Sharifirad 2013, randomised trial)	Caesarean section	The effect of prenatal education for husbands of pregnant women (compared to routine maternity care) on caesarean section rate is uncertain	50.0% (number of events not reported)	29.5% (number of events not reported)	Relative effect not reported P < 0.05 (1 study, 88 women)	⊕⊖⊖⊖ **VERY LOW**[b,c,f]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Different formats of educational interventions						
Role play versus standard education using lectures (Iran) (Navaee 2015, randomised trial)	Caesarean section	Role play may lead to little or no difference in caesarean section rate compared to education using lectures	56 per 100	37 per 100 (22 to 63)	RR 0.66 (0.39 to 1.12) (1 study, 67 women)	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-

	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Interactive decision aid versus educational brochures (USA) (Eden 2014, randomised trial)	Caesarean section - VBAC	Interactive decision aid may lead to little or no difference in VBAC rate compared to educational brochures	37% Number of events unclear	41% Number of events unclear	P = 0.72 Number of participants unclear	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Individualised prenatal education and support programme versus written information in pamphlet (Canada, USA) (Fraser 1997, randomised trial)	Caesarean section - scheduled	Individualised prenatal education and support programme probably leads to little or no difference in scheduled caesarean section rate compared to written information in pamphlet	237 per 1000	213 per 1000 (175 to 263)	RR 0.90 (0.74 to 1.11) (1 study, 1275 women)	⊕⊕⊕⊖ **MODERATE**[a]
		Individualised prenatal education and support programme probably leads to little or	690 per 1000	607 per 1000 (400 to 918)	RR 0.88 (0.58 to 1.33) (1 study, 1275 women)	

		no difference in urgent caesarean section rate compared to written information in pamphlet				
	Caesarean section - VBAC	Individualised prenatal education and support programme probably leads to little or no difference in VBAC rate compared to written information in pamphlet	490 per 1000	529 per 1000 (475 to 593)	RR 1.08 (0.97 to 1.21) (1 study, 1275 women)	
	Instrumental vaginal birth	NR	-	-	-	-
	Spontaneous vaginal birth	NR	-	-	-	-
	Maternal mortality	NR	-	-	-	-
	Maternal morbidity, neonatal morbidity or mortality	Individualised prenatal education and support programme probably leads to little or no difference in maternal morbidity, neonatal morbidity or mortality compared to written information in pamphlet	Rates of maternal morbidity and neonatal outcomes were similar in the study groups (maternal-uterine rupture or dehiscence, hysterectomy, blood transfusion; neonatal-perinatal deaths, Apgar score less than 7 at 5 minutes, admission to NICU)			⊕⊕⊕⊖ **MODERATE**[a]

The **corresponding risk (absolute effect with intervention)** (and its 95% confidence interval) is based on the assumed risk in the comparison group ((i.e. risk with control) and the **relative effect** of the intervention (and its 95% CI).

About the certainty of the evidence (GRADE)*

High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.

Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.

Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.

Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.

*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'

†Substantially different = a large enough difference that it might affect a decision

CI: confidence interval; **NICU**: neonatal intensive care unit; **NR**: not reported; **NS**; not significant; **RR**: risk ratio; VBAC: vaginal birth after caesarean.

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[a]Downgraded one level for serious risk of bias (due to inadequate randomisation processes)

[b]Downgraded one level for serious imprecision (due to small sample size and few events)

[c]Reanalysed, based on: control event rate (40%, n = 71); intervention event rate (21%, n = 76); odds ratio (OR) 0.36, 95% CI 0.15 to 0.86)

[d]Downgraded one level due to serious imprecision (95% CI includes appreciable benefit and harm)

[e]Downgraded one level for serious indirectness (follow-up analyses, not described in the trial report, indicated that the impact on caesarean sections was due to reduced birth complications arising from foetal position (e.g. breech birth) and labour progression)

[f]Downgraded two levels for very serious risk of bias (due to inadequate randomisation processes and reporting issues)

BACKGROUND

This is the first update of the original review (Khunpradit 2011).

Description of the condition

Caesarean section is an intervention to reduce complications associated with childbirth. While it can be a life-saving procedure for both the mother and the baby, there is no evidence showing the benefits of caesarean delivery for women or babies who do not require the procedure. As with any surgery, caesarean sections are associated with short- and long-term risks which can extend many years beyond the current delivery and affect the health of the woman, baby and future pregnancies. Maternal risks include infections, haemorrhage, other organ injury, and complications related to use of anaesthesia or blood transfusion (Cook 2013; Marshall 2011). There is also a higher risk of complications in subsequent pregnancies, such as uterine rupture, placental implantation problems and need for hysterectomy (Keag 2018; Timor-Tritsch 2012). Infant risks include respiratory problems, asthma and obesity in childhood (Keag 2018).

Given the balance of risks and benefits, national clinical societies recommend that in the absence of maternal or foetal indications for caesarean section, a plan for vaginal delivery is safe and recommended (ACOG 2013). The National Institute for Health and Care Excellence (NICE) in its 2013 evidence update "recommends that if a woman requests a CS [caesarean section] when there is no other indication; discuss the overall risks and benefits of CS compared with vaginal birth. If necessary, a discussion should be held with other members of the obstetric team (including the obstetrician, midwife and anaesthetist) if necessary to explore the reasons for the request, and ensure the woman has accurate information. If after discussion and offer of support (including perinatal mental health support for women with anxiety about childbirth), a vaginal birth is still not an acceptable option, offer a planned CS." (NICE 2013).

Worldwide, reported caesarean section rates vary widely, especially between high- and low-income countries. However, the rise in caesarean section rates is a global phenomenon. From 1990 to 2014, the global average caesarean section rate increased three-fold from 6.7% to 19.1%, with an average rate increase of 4.4% per year. On average, caesarean section rates increased from 22.8% to 42.2% in Latin American and the Caribbean, 18.5% to 32.6% in Oceania, 22.3% to 32.3% in North America, 11.2% to 25% in Europe, 4.4% to 19.5% in Asia, and 2.9% to 7.4% in Africa (Betrán 2016a).

In 1985, the World Health Organization (WHO) issued a consensus statement suggesting there were unlikely to be any additional health benefits associated with caesarean section rates above 10% to 15% (WHO 1985). More recently in 2015, the WHO published the results of a systematic review of population-based studies to help determine an ideal caesarean section rate at a population level (Betrán 2016b). Based on this review, the WHO found that while caesarean sections are effective in saving maternal and infant lives and should be provided for medically indicated reasons, caesarean rates greater than 10% at a population level are not associated with reductions in maternal and newborn mortality. The result of this systematic review was confirmed by a complementary global longitudinal ecological study (Ye 2015).

The factors affecting the rate of caesarean section births are complex, and identifying interventions to reduce this rate is challenging. The decision to perform a caesarean section may be made before conception, earlier in pregnancy or during a perinatal emergency. The decision may be made by a doctor or the mother, and may be affected by a range of other factors. Factors independently associated with caesarean births include: maternal age, body weight (NCC-WCH 2011), women increasingly wanting to determine how and when their child is born (Lo 2003), cultural beliefs about the birthing process that make caesarean sections more or less attractive (Hsu 2008), beliefs about the impact of caesarean section (Dweik 2014), primiparity (Pang 2008), generational shifts in work and family responsibilities (Scioscia 2008), physician and organisational factors (Hoxha 2017; Ji 2015; Lin 2004; Luthy 2003; Mi 2014; Thomas 2001; Zwecker 2011). Indeed, some have argued that simple policy options are unlikely to effectively address the many different factors involved (Scioscia 2008), and that multicomponent interventions that address a range of determinants are desired.

Description of the intervention

Clinical interventions that could help to reduce caesarean section rates have been assessed in a number of systematic reviews and include: active management in labour (Brown 2013; Catling-Paull 2011b; Hartmann 2012), use of a partogram with a four-hour action line in labour, foetal blood sampling before caesarean section for abnormal cardiotocograph in labour, and support for women who choose vaginal birth after caesarean section (NICE 2013), improved and standardised foetal heart rate interpretation and management, external cephalic version for breech presentation after 36 weeks (NICE 2013), and a trial of labour for women with twin gestations when the first twin is in cephalic presentation (ACOG SMFM 2014). These are clinical decisions and are not included in this review.

This review examines non-clinical interventions (i.e. interventions applied independent of a clinical encounter between a healthcare provider and a patient in the context of patient care) to reduce unnecessary caesarean section rates (i.e. those performed in the absence of medical indications (Kabir 2004; Koroukian 1998)). These interventions may target women (e.g. birth preparation classes), healthcare professionals (e.g. implementation of clinical practice guidelines) or healthcare organisations (e.g. different payment systems for caesarean section) (Table 1).

How the intervention might work

The different interventions intended to reduce caesarean section births might work by addressing determinants of caesarean births. Table 2 shows examples of interventions targeting healthcare recipients, healthcare professionals, or healthcare organisations that contribute to increasing caesarean section rates.

Why it is important to do this review

A reliable synthesis of the evidence will help determine the effectiveness and safety of existing interventions that aim to reduce unnecessary caesarean sections, and help decision makers select the most appropriate interventions to implement. In 2011, we found evidence from 16 studies that non-clinical interventions may have a role in reducing unnecessary caesarean sections (Khunpradit 2011). As the prevention of unnecessary caesarean sections continues to be a global priority and the body of evidence continues to increase, an update of this review is warranted to provide up-to-date evidence to guide policy and practice decisions to reduce caesarean births. This review update will inform a new WHO guideline, and the scope of the update was informed by WHO's Guideline Development Group for this guideline.

OBJECTIVES

To determine the effectiveness and safety of non-clinical interventions intended to reduce unnecessary caesarean section.

METHODS

Criteria for considering studies for this review

Types of studies

The following studies were eligible for inclusion (EPOC 2017).

- Randomised trials.
- Non-randomised trials.
- Controlled before-after studies (with at least two intervention sites and two control sites).
- Interrupted time series studies (where the time of intervention is clearly defined and there are at least three data points before and three after the intervention).
- Repeated measures studies (an interrupted time series study where measurements are made in the same individuals at each time point).

Types of participants

Studies involving the following groups of participants were eligible for inclusion.

- Pregnant women seeking maternity care during pregnancy, labour and delivery.
- Families of pregnant women.
- Healthcare providers who work with pregnant women (nurses, midwives, physicians).
- Healthcare facilities that provide maternity care to pregnant women.
- Communities and advocacy groups involved in maternity care.

Types of interventions

Studies involving the following interventions were eligible for inclusion (Table 1).

- Interventions targeted at women, the community or the general public (e.g. birth preparation classes).
- Interventions targeted at healthcare professionals (e.g. implementation of clinical practice guidelines).
- Interventions targeted at healthcare organisations or facilities (e.g. different payment systems for caesarean section).

We compared the interventions above to the following.

- No intervention.
- Usual care or practice in accordance with local protocols.
- Another intervention, as reported in the studies.

In order to avoid duplication, we have not included other related interventions addressed in related reviews: midwife-led continuity of care (Sandall 2016); continuous labour support (Bohren 2017); physical activity-based interventions (i-WIP 2017); alternative institutional birth environment (Hodnett 2012); and planned hospital birth versus planned home birth (Olsen 2012). Furthermore, we only included non-clinical interventions specifically designed to reduce caesarean section rates. Interventions not specifically designed to reduce caesarean section rates are not included, even if they may incidentally reduce caesarean section rates.
As noted above, this review update will inform a new WHO guideline, and the scope of the update was informed by WHO's Guideline Development Group for this guideline.

Types of outcome measures

Primary outcomes

- Caesarean section
- Spontaneous vaginal birth
- Instrumental vaginal birth

Secondary outcomes

- Maternal mortality and morbidity
- Neonatal mortality and morbidity
- Maternal birth experience
- Healthcare resource utilisation

Details of the outcome measures are summarised in Table 3. We excluded studies that only reported secondary outcomes without data on primary outcomes.

Search methods for identification of studies

Electronic searches

We searched the following databases (Appendix 1):

- The Cochrane Pregnancy and Childbirth Group specialised register (March 2010 to August 2014) (searched August 2014)
- Cochrane Central Register of Controlled Trials (CENTRAL;2018, Issue 2) in the Cochrane Library (searched 8 March 2018)
- MEDLINE Ovid (including Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Versions) (to 7 March 2018) (searched 8 March 2018)
- EMBASE Ovid (to 7 March 2018) (searched 8 March 2018)
- CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature; to 8 March 2018) (searched 8 March 2018)

Search strategies are comprised of keywords and controlled vocabulary terms. We applied no language limits. Searches for this update aimed to retrieve material published since 2010; the date of the searches in the previous version of the review. The search terms were revised to increase specificity by analysing the titles, abstracts and MEDLINE index terms of the included studies from the previous version of the review using various text analysis tools (TerMine; Voyant Tools; Yale MeSH Analyzer).

Prior to the above, we ran updated searches in August 2014 (Appendix 2) and February 2017 (Appendix 3). The February 2017 searches were supplementary searches run in MEDLINE and Embase for interventions relating to environmental modifications (i.e. physical or sensory environment of labour or delivery room), organisational goals (i.e. setting predetermined caesarean section rates) and organisational change (i.e. strategies to change organisational culture).

Searching other resources

Grey literature

Since the Cochrane Pregnancy and Childbirth Group Specialised Register includes extensive handsearching of journals and conference proceedings, we did not perform additional handsearching of journals or conference proceedings. We searched reference lists of trials and related reviews, websites of relevant organisations, and contacted authors for additional articles.

Trials registries

We searched the following two clinical trials registries for ongoing trials or completed trials that have not been published on 8 March 2018:

- International Clinical Trials Registry Platform (ICTRP), Word Health Organization (WHO) (www.who.int/ictrp/en/).
- ClinicalTrials.gov, US National Institutes of Health (NIH) (clinicaltrials.gov/).

Data collection and analysis

Selection of studies

We entered the identified records into Covidence after removing duplicates (www.covidence.org). Seven review authors, working in pairs, independently screened titles, abstracts and full texts of identified records and selected studies meeting review inclusion criteria. We resolved disagreements by discussion.

Data extraction and management

Five review authors, working in pairs, independently extracted data on the following aspects from the included studies. We entered data into a pilot-tested data extraction form. We resolved disagreements by discussion.

- Study design and unit of allocation.
- Study setting (e.g. community, hospital, single or multicentre).
- Participants (e.g. parity, gestational age).
- Intervention and control (e.g. duration and frequency of training).
- Outcome measures (e.g. caesarean section).

Assessment of risk of bias in included studies

Five review authors, working in pairs, independently assessed study risk of bias using the Cochrane EPOC 'Risk of bias' criteria for randomised trials, non-randomised trials, controlled before-after studies and interrupted time series studies (EPOC 2017). We classified findings into three categories: low - low risk of bias for key quality domains; high - high risk of bias for one or more of the key domains; or unclear - unclear risk of bias for one or more of the key domains. We resolved disagreements by discussion.

Measures of treatment effect

For dichotomous outcomes, we assessed the effect of interventions using risk ratios (RRs), odds ratios (ORs) or risk differences (RDs). We used the mean difference (MD) measure for continuous outcomes. For interrupted time series studies, we used two effect sizes to measure the intervention effect: change in level (also called 'step change') and change in trend (also called 'change in slope') before and after the intervention (Bernal 2017). Change in level is the difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend is the difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in the event. Where these effect measures were not estimable (e.g. owing to insufficient data), we reported results in natural units as reported in the studies.

Unit of analysis issues

We checked whether appropriate analysis was conducted to adjust for clustering in cluster-randomised trials. If there was a unit of analysis error and reanalysis was not possible, we reported only the point estimate without a measure of variance (such as confidence intervals (CIs)).

Three of the included studies had three arms and therefore contributed multiple comparisons (Lomas 1991; Montgomery 2007; Valiani 2014). A unit of analysis error did not arise from these studies as we did not pool effect estimates from the studies.

Dealing with missing data

We contacted authors of included studies where needed data were missing, or where we required further clarification on the reported data. Where data were not available from the authors, we reported the data as missing and analysed only the available data. We did not impute or extrapolate values for missing data.

Assessment of heterogeneity

We did not conduct statistical tests for heterogeneity (differences in study designs and interventions precluded meta-analysis).

Assessment of reporting biases

We assessed potential reporting bias due to selective outcome reporting as one component of 'Risk of bias' assessment. In addition, we checked whether prespecified outcomes were reported, based on the information provided in trials registry records or protocols, where these were available.

Data synthesis

We grouped interventions into four categories and prepared evidence tables for each category.

- Interventions targeted at women or families (Table 4; Table 5).
- Interventions targeted at healthcare professionals (Table 6; Table 7).
- Interventions targeted at healthcare organisations or facilities (Table 8; Table 9).
- 'Cross-cutting' interventions (i.e. multifaceted interventions with components targeted at women, healthcare professionals or healthcare organisations) (Table 10; Table 11).

GRADE and summary of findings

We assessed the certainty of evidence (confidence in the estimate of effect) using GRADE (Guyatt 2008). The GRADE assessments were conducted by one review author (NO) and checked by at least one other review author.

According to GRADE, evidence from randomised trials starts at high certainty while that from observational studies starts at low certainty. We downgraded certainty of evidence from randomised trials in consideration of five factors: risk of bias or study limitations, directness, consistency of results, precision of effect estimates and publication bias. Quality of evidence from observational studies can be upgraded in consideration of three factors: magnitude of effect, dose-response gradient and influence of residual plausible confounding. We did not upgrade the quality of evidence from any of the included observational studies as none met the upgrading criteria.

We prepared four 'Summary of findings' tables (one each for the four intervention categories) summarising effects of the interventions on the primary outcome measures (caesarean section, spontaneous vaginal birth, and instrumental vaginal birth) and adverse effects (maternal and neonatal mortality or morbidity).

Subgroup analysis and investigation of heterogeneity

We did not conduct a subgroup analysis to explore if effects of interventions varied by factors such as parity, socioeconomic status or geographical regions (there was insufficient data for these analyses).

Sensitivity analysis

We did not conduct a sensitivity analysis as we did not pooled the data.

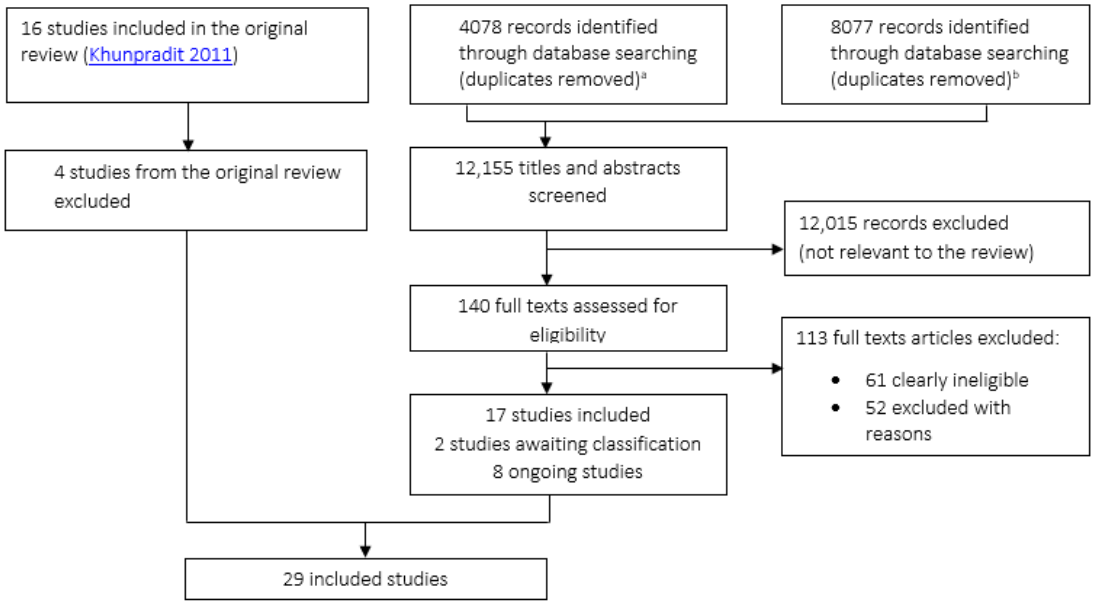
RESULTS

Description of studies

Results of the search

Details of the search results are presented in Figure 1. We identified 12,155 records from electronic databases, clinical trials registries and other resources. We excluded 12,015 records following a review of titles and abstracts. We retrieved the full texts of the remaining 140 records for detailed eligibility assessment. We excluded 113 records; two studies are awaiting classification and will be considered for inclusion in the next update of this review (Characteristics of studies awaiting classification), and eight trials are ongoing (Characteristics of ongoing studies).

Figure 1. [a]Searches run in March 2018 (Appendix 1). [b]Searches run in August 2014 (Appendix 2) and February 2017 (Appendix 3).



Overall, 29 studies fulfilled the review inclusion criteria (17 new studies and 12 studies from the original review (Khunpradit 2011)).

Included studies

The 29 included studies form the basis of the findings summarised in this review (Characteristics of included studies).

These studies were conducted in 18 different countries.

- North America (7 studies in USA; 2 studies in Canada).
- Europe (3 studies in Finland; 1 study each in UK, Portugal, Sweden).
- Latin America (1 study in Chile; 1 multicentre study in Argentina, Brazil, Cuba, Guatemala, Mexico).
- Western Asia (6 studies in Iran).
- East Asia (2 studies in China; 2 studies in Taiwan).
- Oceania (2 studies in Australia).

Caesarean section rates in the control groups (or prior to intervention in other study designs) ranged from 12% in Hemminki 2008 to 73.3% in Valiani 2014.

Eight studies included only nulliparous women (Bastani 2006; Bergstrom 2009; Feinberg 2015; Navaee 2015; Rouhe 2013; Sharifirad 2013; Valiani 2014; Wang 2014). Five studies included only women having undergone a previous caesarean section (Eden 2014; Fraser 1997; Lomas 1991; Montgomery 2007; Shorten

2005); the remaining 16 studies included a mixed population of women.

Twenty-three studies were supported by grants from various funding agencies (international funding agencies, national research councils, universities, among others); two studies received no specific financial support. No information about funding was available from four studies.

1. Interventions targeted at women or families

Fifteen studies (4459 participants) were included in this category: 12 studies compared specific educational interventions to routine maternity care (Bastani 2006; Bergstrom 2009; Feinberg 2015; Fenwick 2015; Masoumi 2016; Montgomery 2007; Rouhe 2013; Saisto 2001; Sharifirad 2013; Shorten 2005; Valiani 2014; Wang 2014). Three studies compared different formats of educational interventions (Eden 2014; Fraser 1997; Navaee 2015). All of the studies were randomised trials.

Participants in the included studies comprised: women with a fear of childbirth (Fenwick 2015; Navaee 2015; Rouhe 2013; Saisto 2001); women with high levels of anxiety (Bastani 2006); husbands of pregnant women (Sharifirad 2013); pregnant women and couples (Valiani 2014); and pregnant women with no particular health condition in the remaining studies.

The majority of studies were conducted in high-income countries: USA (Eden 2014; Feinberg 2015; Fraser 1997); UK (Montgomery 2007); Australia (Fenwick 2015; Shorten 2005); Canada (Fraser 1997); Sweden (Bergstrom 2009); and Finland (Rouhe 2013; Saisto 2001). Six studies were conducted in middle-income countries: China (Wang 2014); Iran (Bastani 2006; Masoumi 2016; Navaee 2015; Sharifirad 2013; Valiani 2014). No studies were carried out in low-income countries.

The specific educational interventions assessed were the following.

- Antenatal education programme for physiologic childbirth (birth preparation training) (Masoumi 2016).
- Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques (Bergstrom 2009).
- Childbirth training workshop (Valiani 2014)
- Prenatal education for husbands of pregnant women (Sharifirad 2013).
- Pelvic floor muscle training exercises with telephone follow-up (Wang 2014).
- Nurse-led applied relaxation training programme (Bastani 2006).
- Psychosocial couple-based prevention programme (Feinberg 2015).
- Psychoeducation by telephone (Fenwick 2015).
- Psychoeducation (Rouhe 2013).
- Two computer-based decision aids (information programme, decision analysis) (Montgomery 2007).
- Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy) (Saisto 2001).
- Decision aid booklet (Shorten 2005).

Women in the control group received routine maternity care. Pelvic floor muscle training with telephone follow-up was compared to Pelvic floor muscle training without telephone follow-up. The different formats of educational interventions assessed were the following.

- Role play education versus standard education using lectures (Navaee 2015).
- Interactive decision aid versus educational brochures (Eden 2014).
- Individualised prenatal education and support programme versus written information in pamphlets (Fraser 1997).

Details of the interventions are summarised in Table 4.

2. Interventions targeted at healthcare professionals

We included eight studies in this category (Althabe 2004; Chaillet 2015; Hemminki 2008; Liang 2004; Lomas 1991; Mohammadi 2012; Poma 1998; Scarella 2011). Study designs were varied: cluster-randomised trials (Althabe 2004; Chaillet 2015; Hemminki 2008; Lomas 1991); controlled before-after studies (reanalysed using interrupted time series methods) (Mohammadi 2012); and interrupted time series studies (Liang 2004; Poma 1998; Scarella 2011).

Six studies were conducted in high-income countries: USA (Poma 1998); Canada (Chaillet 2015; Lomas 1991); Finland (Hemminki 2008); Chile (Scarella 2011); and Taiwan (Liang 2004). Two studies were conducted in middle-income countries: Iran (Mohammadi 2012); multicountry - Mexico, Argentina, Brazil, Cuba, Guatemala and Mexico (Althabe 2004). No studies were carried out in low-income countries.

Health professionals studied were: physicians (obstetrician-gynaecologist) (Althabe 2004; Liang 2004; Lomas 1991; Mohammadi 2012; Poma 1998); physicians and nurses (Chaillet 2015; Scarella 2011); and public health nurses (Hemminki 2008).

The interventions assessed were the following.

- Education of public health nurses on childbirth classes (Hemminki 2008).
- Peer review plus mandatory second opinion (Liang 2004).
- Evidence-based guidelines plus mandatory second opinion (Althabe 2004).
- Evidence-based guidelines plus audit and feedback (Chaillet 2015).
- Audit and feedback using Robson classification (Scarella 2011).
- Audit and feedback plus financial incentive (Mohammadi 2012).
- Audit and feedback plus 24-hour in-house physician coverage (Poma 1998).

- Audit and feedback plus local opinion leader education (Lomas 1991).

Details of the interventions are summarised in Table 6.

3. Interventions targeted at healthcare organisations or facilities

3.1 Financial interventions targeted at healthcare professionals

We included two interrupted time series studies in this category (Keeler 1996; Lo 2008). The studies were conducted in the USA (Keeler 1996), and Taiwan (Lo 2008). Both assessed insurance reforms equalising physician fees for vaginal births and caesarean sections. Details of the interventions are summarised in Table 8.

3.2 Different staffing models of care

We included two studies in this category. The interventions assessed were the following.

- Labourist model of obstetric care versus routine delivery care (Srinivas 2016). ('Labourist' generally refers to an obstetrician who provides in-house labour and delivery coverage without competing clinical duties).
- Midwifery-labourist model of care versus private practice care model (Rosenstein 2015).

Details of the interventions are summarised in Table 8.
Study designs were varied: controlled before-after study (Srinivas 2016); interrupted time series study (Rosenstein 2015). Both studies were conducted in the USA.

4. 'Cross-cutting' interventions

We included the following two interventions in this category.

- Multifaceted programme comprising an education programme for hospital staff and women, audit of surgeon practices, public health campaign, monitoring rates of caesarean section and neonatal outcomes (Runmei 2012).
- Multifaceted programme comprising transmission of information on caesarean section to health professionals, training of health workers on best obstetric practices and inclusion of caesarean section rates as a criterion for hospital funding (Ayres-De-Campos 2015).

Details of the interventions are summarised in Table 10.
Study design and settings were varied: interrupted time series study (Ayres-De-Campos 2015); controlled before-after study (Runmei 2012). Ayres-De-Campos 2015 was conducted in Portugal, while Runmei 2012 was conducted in China.

Excluded studies

We excluded 52 studies because of ineligible study designs, interventions and outcome measures (see Characteristics of excluded studies).

Risk of bias in included studies

Randomised trials, non-randomised trials and controlled before-after studies (20 studies)

Allocation

We judged random sequence generation and allocation concealment to be adequate (indicating low risk of selection bias) in eight trials (Althabe 2004; Chaillet 2015; Eden 2014; Fenwick 2015; Fraser 1997; Masoumi 2016; Montgomery 2007; Shorten 2005). We judged Srinivas 2016 to be at high risk of selection bias. The risk of selection bias in the remaining trials was unclear (insufficient information was available regarding allocation concealment).

Blinding

We judged blinding of study participants and personnel to be adequate (indicating low risk of performance bias) in four trials (Althabe 2004; Chaillet 2015; Eden 2014; Fenwick 2015). The risk of performance bias was unclear in the remaining trials. Blinding of primary outcome measures was not feasible (caesarean and vaginal births are objective outcomes).

Incomplete outcome data

We judged the risk of attrition bias (due to incomplete outcome data) to be low in 14 trials, high in one trial (Hemminki 2008), and unclear in five trials (Feinberg 2015; Lomas 1991; Navaee 2015; Valiani 2014; Wang 2014).

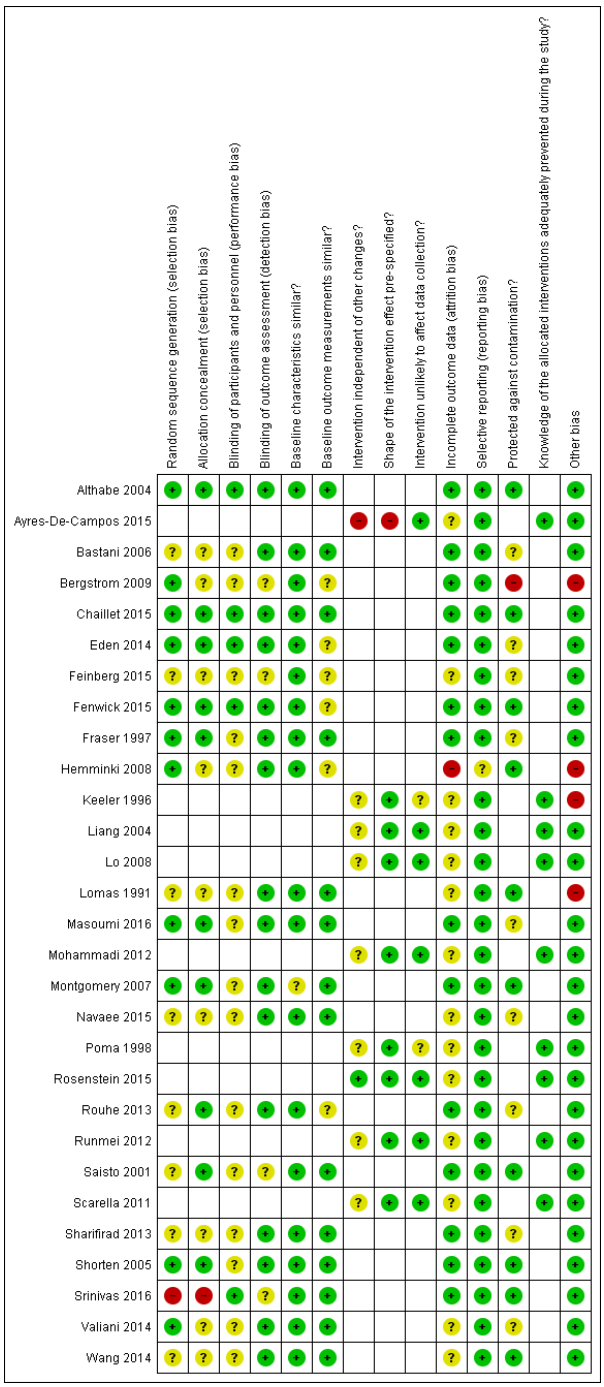
Selective reporting

We judged all trials to be at low risk of reporting bias (due to selective reporting), except in one trial (Hemminki 2008), where the likelihood of reporting bias was unclear.

Other potential sources of bias

We judged three trials to be at risk of other biases due to unit of analysis issues (Bergstrom 2009; Lomas 1991), and lack of a priori sample size calculation (Hemminki 2008).
Details of the risk of bias judgements are summarised in Characteristics of included studies and Figure 2.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Interrupted time series studies (9 studies)

We judged all of the interrupted time series studies to be at unclear risk of attrition bias and free of reporting bias. The shape of the intervention effect was prespecified in all except two studies (Ayres-De-Campos 2015; Poma 1998). It was not clear if the intervention was independent of other changes in all except one study (Rosenstein 2015). The intervention seemed unlikely to affect data collection in all except two studies (Keeler 1996; Poma 1998). We considered knowledge of the allocated interventions to be adequately prevented in all studies (main outcomes of interests are objective). We judged one study to be at high risk of other bias (due to inadequate analysis) (Keeler 1996).

Details of the risk of bias judgements are summarised in Characteristics of included studies and Figure 2.

Effects of interventions

See: **Summary of findings for the main comparison** Interventions targeted at women or families; **Summary of findings 2** Interventions targeted at healthcare professionals; **Summary of findings 3** Interventions targeted at healthcare organisations or facilities; **Summary of findings 4** 'Cross-cutting' interventions[a]

1. Interventions targeted at women or families

See: Summary of findings for the main comparison

1.1 Education, birth preparation classes and support programmes

Data from three of the 15 studies included in this category, suggest that the following interventions may reduce caesarean section rates.

- Childbirth training workshop (mothers alone versus control: risk ratio (RR) 0.55, 95% confidence interval (CI) 0.33 to 0.89; 60 participants, low-certainty evidence); (couple versus control: RR 0.59, 95% CI 0.37 to 0.94; 60 participants, low-certainty evidence; Valiani 2014, randomised trial).
- Nurse-led applied relaxation training programme (RR 0.22, 95% CI 0.11 to 0.43; 104 participants, low-certainty evidence; Bastani 2006, randomised trial).
- Psychosocial couple-based prevention programme (RR 0.53, 95% CI 0.32 to 0.90, reanalysed; 147 participants, low-certainty evidence; Feinberg 2015, randomised trial).

Data from two studies suggest that the following two interventions may increase rates of vaginal births.

- Childbirth training workshop (mothers alone versus control: RR 2.25, 95% CI 1.16 to 4.36; 60 participants, low-certainty evidence); (couple versus control: RR 2.13, 95% CI 1.09 to 4.16; 60 participants, low-certainty evidence; Valiani 2014, randomised trial).
- Psychoeducation (RR 1.33, 95% CI 1.11 to 1.61; 371 participants, low-certainty evidence; Rouhe 2013, randomised trial).

Limited data were available on the effect of the four interventions on maternal and neonatal mortality or morbidity.

There was little or no difference in caesarean section rates between standard maternity care and the following seven interventions.

- Antenatal education programme for physiologic childbirth (RR 1.03, 95% CI 0.72 to 1.49; 150 participants, moderate-certainty evidence; Masoumi 2016, randomised trial).
- Pelvic floor muscle training exercises with telephone follow-up versus pelvic floor muscle training exercises without telephone follow-up (RR 0.87, 95% CI 0.37 to 2.04; 90 participants, low-certainty evidence; Wang 2014, randomised trial).
- Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques:
  - elective caesarean section: RR 0.95, 95% CI 0.58 to 1.56; 977 participants, moderate-certainty evidence;
  - emergency caesarean section: RR 0.91, 95% CI 0.67 to 1.23; 977 participants, moderate-certainty evidence (Bergstrom 2009, randomised trial).
- Psychoeducation (RR 0.70, 95% CI 0.49 to 1.01; 371 participants, low-certainty evidence; Rouhe 2013, randomised trial).
- Computer-based decision aids (information programme, decision analysis):
  - information group versus usual care group, elective caesarean section: RR 0.98, 95% CI 0.82 to 1.18, 478 participants, moderate-certainty evidence;
  - information group versus usual care group, emergency caesarean section: RR 1.09, 95% CI 0.77 to 1.55, 478 participants, moderate-certainty evidence;
  - decision analysis group versus usual care group, elective caesarean section: RR 0.83, 95% CI 0.68 to 1.02, 478 participants, moderate-certainty evidence;
  - decision analysis group versus usual care group, emergency caesarean section: RR 1.05, 95% CI 0.74 to 1.50, 478 participants, moderate-certainty evidence (Montgomery 2007, randomised trial).
- Decision aid booklet (absolute change from baseline 26.2% versus control 22.6%; 227 participants, moderate-certainty evidence; Shorten 2005, randomised trial).
- Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy): RR 0.90, 95% CI 0.65 to 1.24; 176 participants, low-certainty evidence (Saisto 2001, randomised trial).

The effect of psychoeducation sessions by telephone (Fenwick 2015, randomised trial), and prenatal education for husbands of pregnant women on caesarean section rates is uncertain (very low-certainty evidence) (Sharifirad 2013, randomised trial).
Details of the effect estimates and GRADE certainty ratings are summarised in Table 5.

1.2 Different formats of educational interventions

Data from three studies assessing different formats of educational interventions showed little or no differences in rates of caesarean section or vaginal birth after caesarean between formats.

- Role play versus standard education using lectures (caesarean section: RR 0.66, 95% CI 0.39 to 1.12; 67 participants, low-certainty evidence; Navaee 2015, randomised trial).
- Interactive decision aid versus educational brochures (vaginal birth after caesarean: 41% versus 37%; number of participants unclear, low-certainty evidence; Eden 2014, randomised trial).
- Individualised prenatal education and support programme versus written information in pamphlet (caesarean section: RR 0.92, 95% CI 0.82 to 1.03); (vaginal birth after caesarean, RR 1.08, 95% CI 0.97 to 1.21; 1275 participants, moderate-certainty evidence; Fraser 1997, randomised trial).

Maternal and neonatal mortality or morbidity, where reported, were similar between study groups.
Details of the effect estimates and GRADE certainty ratings are summarised in Table 5.

2. Interventions targeted at healthcare professionals

See: Summary of findings 2
Among the eight interventions targeted at healthcare professionals, we found two that slightly reduced caesarean section rates (Althabe 2004; Chaillet 2015) and one that reduced caesarean section rate (Lomas 1991).

- Implementation of clinical guidelines combined with mandatory second opinion for caesarean section indication versus routine maternity care (overall caesarean section, mean difference in rate change -1.9, 95% CI -3.8 to -0.1; high-certainty evidence; Althabe 2004, cluster-randomised trial).
- Implementation of clinical guidelines combined with audit and feedback versus routine maternity care (overall caesarean section, risk difference (RD) -1.8%, 95% CI -3.8 to -0.2; high-certainty evidence; Chaillet 2015, cluster-randomised trial).
- Physician education by local opinion leader versus routine maternity care (elective caesarean section, opinion leader education: 53.7%, 95% CI 46.5 to 61.0%; control: 66.8%, 95% CI 61.7 to 72.0%; high-certainty evidence; Lomas 1991, cluster-randomised trial).

There was little or no difference in maternal and neonatal mortality or morbidity between study groups, where reported, in the three studies (Table 7).
An economic evaluation of a multifaceted intervention implemented by Chaillet and colleagues showed that the intervention group experienced per-patient reductions of 0.005 caesarean sections (95% CI - 0.015 to 0.004, P = 0.09), which translated to CAD 180 (95% CI -277 to -83, P < 0.001; Chaillet 2015). The intervention was "dominant" (effective in reducing caesarean section rates and less costly than usual care) in 86.08% of simulations. It reduced costs in 99.99% of simulations. Cost reductions were driven by lower rates of neonatal complications in the intervention group (CAD -190, 95% CI -255 to-125, P < 0.001). The authors estimated that given 88,000 annual provincial births, a similar intervention could save CAD 15.8 million (range: 7.3 to 24.4 million) in Quebec annually (Johri 2017, economic evaluation of Chaillet 2015). Further prospective analysis to measure the budget impact of the multifaceted intervention showed that it led to savings of CAD 27 million in Quebec over four years, and that in the short to medium term, extending the intervention nationwide could lead to savings of CAD 150.5 million (Bermúdez-Tamayo 2018, economic evaluation of Chaillet 2015).
There was little or no difference in caesarean section rates between the following two interventions and control.

- Education of public health nurses on childbirth classes (odds ratio (OR) 1.29, 95% CI 0.99 to 1.67; 1568 participants, Low-certainty evidence; Hemminki 2008, cluster-randomised trial).
- Audit and feedback and local opinion leader education:
    - elective caesarean section, audit and feedback: 69.7%, 95% CI 62.4 to 77.0;
    - unscheduled caesarean section, audit and feedback: 18.6%, 95% CI 13.9 to 23.2;
    - opinion leader education: 21.4%, 95% CI 16.8 to 26.1; control: 18.7%, 95% CI 15.4 to 22.1; high-certainty evidence (Lomas 1991, cluster-randomised trial).

The effect of the following interventions on caesarean section rates is uncertain (very low-certainty evidence).

- Peer review plus mandatory second opinion (Liang 2004, interrupted time series study).
- Audit and feedback using the Robson classification (Scarella 2011, interrupted time series study).
- Audit and feedback plus a financial incentive (Mohammadi 2012, controlled before-after studies (reanalysed using interrupted time series methods)).
- Audit and feedback plus 24-hour in-house coverage by a dedicated physician (Poma 1998, interrupted time series study).

Details of the effect estimates and GRADE certainty ratings are summarised in Table 7.

3. Interventions targeted at healthcare organisations or facilities

See: Summary of findings 3

3.1 Financial interventions targeted at healthcare professionals

Two studies involving insurance reforms equalising physician fees for vaginal births and caesarean sections were included in this category. The effect of these strategies on caesarean section rates is uncertain (very low-certainty evidence) (Keeler 1996; Lo 2008, both interrupted time series studies). Maternal and neonatal mortality or morbidity were not reported.
Details of the effect estimates and GRADE certainty ratings are summarised in Table 9.

3.2 Different staffing models of delivery care

The collaborative midwifery-labourist model of care (in which the obstetrician provides in-house labour and delivery coverage, 24 hours a day, without competing clinical duties) may reduce caesarean section rates, and may increase rates of vaginal birth after caesarean section, compared to the private model of care (Rosenstein 2015, interrupted time series study).

- The primary caesarean section rate among privately insured women decreased from 31.7% to 25.0% (OR 0.56, 95% CI 0.39 to 0.81). The interrupted time series analysis estimated a 7% drop in the primary caesarean rate in the year after the intervention, and a decrease of 1.7% per year thereafter (low-certainty evidence).
- The rate of vaginal births after caesarean section increased from 13.3% before to 22.4% after the intervention (OR 2.03, 95% CI 1.08 to 3.80; low-certainty evidence).

Maternal and neonatal mortality or morbidity were not reported.
The labourist model of obstetric care, compared to routine delivery care, may lead to little or no difference in the following outcomes (Srinivas 2016, controlled before-after study).

- Caesarean section (OR 1.02, 95% CI 0.97 to 1.1; low-certainty evidence).
- Maternal morbidity (chorioamnionitis) (OR 1.07, 95% CI 0.88 to 1.30; low-certainty evidence).
- Neonatal morbidity (birth asphyxia) (OR 0.75, 95% CI 0.48 to 1.18; low-certainty evidence).

Maternal and neonatal mortality were not reported.
Details of the effect estimates and GRADE certainty ratings are summarised in Table 9.

4. 'Cross-cutting' interventions

See: Summary of findings 4
The effect of the following two multifaceted interventions on caesarean section rate and maternal and neonatal morbidity is uncertain (the certainty of available evidence is very low).

- Programme comprising education for hospital staff and women, audit of surgeon practices, public health campaign, monitoring rates of caesarean sections and neonatal outcomes (Runmei 2012, controlled before-after study).
- Programme comprising transmission of information on caesarean section, training of healthcare workers on best obstetric practices and inclusion of caesarean section rates as a criterion for hospital funding (Ayres-De-Campos 2015, interrupted time series study).

Maternal or neonatal mortality were not reported in either studies. Details of effect estimates and GRADE certainty ratings are summarised in Table 11.

ADDITIONAL SUMMARY OF FINDINGS [*Explanation*]

Patients or population: nurses, midwives, physicians						
Intervention	**Primary outcome measure**	**Plain language summary**	**Absolute effect**		**Relative effect (95% CI)**	**Certainty (GRADE)**
			with control	**with intervention (95% CI)**		
Implementation of clinical practice guidelines combined with mandatory second opinion (Argentina, Brazil, Cuba, Guatemala and Mexico) (Althabe 2004, cluster-randomised trial)	Caesarean section - all	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication slightly reduces the caesarean section rate compared to routine maternity care	Mean baseline rate: 24.6 (39,175 women) Mean follow-up rate: 24.9 (39,638 women) Mean rate change: 0.3	Mean baseline rate: 26.3 (34,735 women) Mean follow-up rate: 24.7 (35,675 women) Mean rate change: -1.6	Mean difference in rate change: -1.9 (-3.8 to -0.1)	⊕⊕⊕⊕ **HIGH**
	Caesarean section - elective	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication results in little or no difference in elective caesarean section rate compared to routine maternity care	Mean baseline rate: 9.1 (39,175 women) Mean follow-up rate: 9.0 (39,638 women) Mean rate change: -0.1	Mean baseline rate: 8.9 (34,735 women) Mean follow-up rate: 9.1 (35,675 women) Mean rate change: 0.1	Mean difference in rate change: 0.2 (-1.4 to 1.8)	
	Caesarean section - intrapartum	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication slightly reduces intrapartum caesarean section compared to	Mean baseline rate: 15.4 (39,175 women) Mean follow-up rate: 15.9 (39,638 women) Mean rate change: 0.4	Mean baseline rate: 17.4 (34,735 women) Mean follow-up rate: 15.6 (35,675 women) Mean rate change: -1.8	Mean difference in rate change: -2.2 (-4.3 to -0.1)	

	routine maternity care				
Spontaneous vaginal birth	NR	-	-	-	-
Instrumental vaginal birth	NR	-	-	-	-
Maternal mortality	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication results in little or no difference in maternal mortality compared to routine maternity care	Mean baseline rate per 10,000 livebirths (39 175 women): 5.9 Mean follow-up rate per 10,000 livebirths (39 638 women): 7.5	Mean baseline rate per 10,000 livebirths (34 735 women): 3.2 Mean follow-up rate per 10,000 livebirths (35 675 women): 4.3	Mean difference in rate change: 0.66 (-4.0 to 5. 3) (re-analysed)	⊕⊕⊕⊕ **HIGH**
Maternal morbidity	NR	-	-	-	-
Neonatal mortality	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication results in little or no difference in neonatal mortality compared to routine maternity care	Mean baseline rate (39, 175 women): 1.1 Mean follow-up rate (39,638 women): 1.0 Mean rate change: -0.1	Mean baseline rate (34, 735 women): 1.1 Mean follow-up rate per 10,000 livebirths (35 675 women): 0.9 Mean rate change: -0.2	Mean difference in rate change (95% CI): -0.1 (-0.4 to 0.3)	⊕⊕⊕⊕ **HIGH**
Neonatal morbidity	Implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication results in lit-	Mean baseline rate (39, 175 women): 3.1 Mean follow-up rate (39,638 women): 3.1 Mean rate change: 0.0	Mean baseline rate (34, 735 women): 4.3 Mean follow-up rate per 10,000 livebirths (35 675 women): 3.4	Mean difference in rate change (95% CI): -0·9 (-1·9 to -0·0)	⊕⊕⊕⊖ **HIGH**

		tle or no difference in Intrapartum foetal distress compared to routine maternity care		Mean rate change: -1.0		
Implementation of clinical practice guidelines combined with audit and feedback (Canada) (Chaillet 2015, cluster-randomised trial)	Caesarean section - overall	Implementation of clinical practice guidelines combined with audit and feedback slightly reduces the overall caesarean section rate compared to routine maternity care	Baseline: 6671/28,698 (23.2%) Post-intervention: 6767/28,781 (23.5%)	Baseline: 5484/24,388 (22.5%) Post-intervention: 5128/23,484 (21.8%)	RD -1.8% (-3.8 to -0.2)	⊕⊕⊕⊕ **HIGH**
	Caesarean section - low risk group	Implementation of clinical practice guidelines combined with audit and feedback slightly reduces caesarean section rate compared to routine maternity care	Baseline: 1256/14,717 (8.5%) Post-intervention: 1172/13,019 (9.0%)	Baseline: 971/11,478 (8.5%) Post-intervention: 763/10,067 (7.6%)	RD -1.7% (-3.0 to -0.3)	
	Elective repeat caesarean section	Implementation of clinical practice guidelines plus audit and feedback results in little or no difference in elective repeat caesarean section rate compared to routine maternity care groups	Baseline: 2404/28,698 (8.4%) Post-intervention: 2598/28,781 (9.0%)	Baseline: 1995/24,388 (8.2%) Post-intervention: 1931/23,484 (8.2%)	RD - 0.6% (-0.07 to 1.28)	
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-

Major maternal morbidity	Implementation of clinical practice guidelines combined with audit and feedback results in little or no difference in major maternal morbidity compared to routine maternity care	Baseline: 138/28,698 (0.48%) Post-intervention: 141/28,781 (0.49%)	Baseline: 161/24,388 (0.66%) Post-intervention: 167/23,484 (0.71%)	RD 0.03% (-0.11 to 0.23)	⊕⊕⊕⊕ **HIGH**
Minor maternal morbidity	Implementation of clinical practice guidelines combined with audit and feedback results in little or no difference in minor maternal morbidity compared to routine maternity care	Baseline: 3869/28,698 (13.5%) Post-intervention: 4244/28,781 (14.7%)	Baseline: 3293/24,388 (13.5%) Post-intervention: 3576/23,484 (15.2%)	RD 0.3% (-1.2 to 1.8)	
Major neonatal morbidity	Implementation of clinical practice guidelines combined with audit and feedback results in little or no difference in major neonatal morbidity compared to routine maternity care	Baseline: 1018/29,107 (3.5%) Post-intervention: 1156/29,211 (4.0%)	Baseline: 1172/24,823 (4.7%) Post-intervention: 1070/23,902 (4.5%)	RD -0.7% (-1.3 to -0.1)	
Minor neonatal morbidity	Implementation of clinical practice guidelines combined with audit and feedback results in little or no difference in minor neonatal morbidity compared to routine maternity care	Baseline: 3947/29,107 (13.6%) Post-intervention: 5002/29,211 (17.1%)	Baseline: 3936/25,823 (15.9%) Post-intervention: 4261/23,902 (17.8%)	RD -1.7% (-2.6 to -0.9)	

	Intrapartum and neonatal deaths	Implementation of clinical practice guidelines combined with audit and feedback results in little or no difference in intrapartum and neonatal deaths compared to routine maternity care	Baseline: 14/29 107 (0.0%) Post-intervention: 28/29,211 (0.0%)	Baseline: 35/24 823 (0.1%) Post-intervention: 20/23,902 (0.1%)	RD -0.06% (-0.08 to -0.03)	
Physician education by local opinion leader (obstetrician-gynaecologist) Audit and feedback (Canada) (Lomas 1991, cluster-randomised trial)	Caesarean section - elective	Physician education by local opinion leader (obstetrician-gynaecologist) reduced elective caesarean section compared to routine maternity care	Control: 66.8% (61.7 to 72.0)	Opinion leader education: 53.7% (46.5 to 61.0)	-	⊕⊕⊕⊕ **HIGH**
		Audit and feedback results in little or no difference in elective caesarean section compared to routine maternity care	Control: 66.8% (61.7 to 72.0)	Audit and feedback: 69.7% (62.4 to 77.0)	-	
	Caesarean section - unscheduled	There was no difference in unscheduled caesarean section between opinion leader education (obstetrician-gynaecologist) and routine maternity care	Control: 18.7% (15.4 to 22.1)	Opinion leader education: 21.4% (16.8 to 26.1)	-	
		Audit and feedback results in little or no difference in unscheduled caesarean section	Control: 18.7% (15.4 to 22.1)	Audit and feedback: 18.6% (13.9 to 23.2)	-	

	rate compared to routine maternity care				
Spontaneous vaginal birth	Physician education by opinion leader (obstetrician-gynaecologist) increases vaginal birth compared to routine maternity care	Control: 14.5% (10.3 to 18.7)	Opinion leader education: 25.3% (19.3 to 31.2)	-	
	Audit and feedback results in little or no difference in spontaneous vaginal birth rate compared to routine maternity care	Control: 14.5% (10.3 to 18.7)	Audit and feedback: 11.8% (5.8 to 17.7)	-	
Instrumental vaginal birth	NR	-	-	-	-
Maternal mortality or morbidity	NR	-	-	-	-
Neonatal mortality	NR	-	-	-	-
Neonatal morbidity	Physician education by opinion leader (obstetrician-gynaecologist) results in little or no difference in low Apgar score < 7 at 5 minutes compared to routine maternity care	Control: 1.2 (0.0 to 2.4)	Opinion leader education: 0.9 (0.0 to 2.6)	-	⊕⊕⊕⊕ **HIGH**

		Rates of low Apgar score < 7 at 5 minutes were higher in audit and feedback group compared to routine maternity care	Control: 1.2 (0.0 to 2.4)	Audit and feedback: 5.9 (4.2 to 7.6)	-	
Education of public health nurses on childbirth classes (Finland) (Hemminki 2008, cluster-randomised trial)	Caesarean section	Education of public health nurses on childbirth classes may lead to little or no difference in caesarean section rate compared to routine maternity care	160 per 1000	198 per 1000 (159 to 242)	OR 1.29 (0.99 to 1.67)	⊕⊕⊖⊖ **LOW**[a,b]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Peer review plus mandatory second opinion for caesarean section indication (Taiwan) (Liang 2004, interrupted time series study)	Caesarean section	The effect of peer review plus mandatory second opinion for caesarean section indication on caesarean births is uncertain	Change in level of total caesarean deliveries at 12 months[c]: -2.4% (-11.4 to 6.7); change in slope[c]: 1.34% (-2.5 to 5.2).			⊕⊖⊖⊖ **VERY LOW**[d]

	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Audit and feedback using Robson classification (Chile) (Scarella 2011, interrupted time series study)	Caesarean section	The effect of audit and feedback using Robson classification on caesarean section births is uncertain	Change in level of caesarean deliveries during intervention[c]: -11% (-23.2 to 1.2), NS; change in slope[c] -1.1% (-6.4 to 4.2), NS Change in level of caesarean deliveries in the immediate post-intervention period compared with the intervention period[c]: 8.6% (2.1 to 15.2), P = 0.022; change in slope[c]: -0.3% (-1.6 to 0.9), NS	⊕⊖⊖⊖ **VERY LOW**[c]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Audit and feedback plus financial incentive (Iran) (Mohammadi 2012, controlled before-after	Caesarean section	The effect of audit and feedback plus financial incentive on caesarean section births is uncertain	Change in level of caesarean deliveries during the intervention[c]: -14.6% (-24.4 to -4.8), P = 0.02; change in slope[c]: -0.07% (-1.5 to 1.3), NS	⊕⊖⊖⊖ **VERY LOW**[d]

studies (reanalysed using interrupted time series methods))						
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Audit and feedback plus 24-hour in-house coverage by dedicated physician (USA) (Poma 1998, interrupted time series study)	Caesarean section	The effect of audit and feedback plus 24-hour in-house coverage by a dedicated physician on caesarean section births is uncertain	Change in level of total caesarean deliveries (primary and repeat caesarean sections) at 24 months[c]: -6.6% (-10.1 to -3.2); change in slope[c]: -0.11% (-0.25 to 0.02) (data reanalysed)			⊕◯◯◯ **VERY LOW**[d]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-

The **corresponding risk (absolute effect with intervention)** (and its 95% confidence interval) is based on the assumed risk in the comparison group ((i.e. risk with control) and the **relative effect** of the intervention (and its 95% CI).

About the certainty of the evidence (GRADE)*

High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.

Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.

Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.

Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.

*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'

†Substantially different = a large enough difference that it might affect a decision

CI: confidence interval; **NR**: not reported; **NS**: not significant; **RD**: risk difference; **RR**: risk ratio.

[a]Downgraded one level for serious risk of bias (pilot study with no sample size calculation; unit of analysis error)

[b]Downgraded one level for serious imprecision (confidence interval includes null effect)

[c]Two standardised effect sizes are obtained from ITS analysis: change in level (also called 'step change') and change in trend (also called 'change in slope') before and after the intervention. Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; Change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in caesarean section rate

[d]Downgraded one level for possible confounding (unclear whether the intervention occurred independently of other changes over time)

Intervention	Primary outcome measure	Plain language summary	Absolute effect		Relative effect (95% CI)	Certainty (GRADE)
			with control	with intervention (95% CI)		
Financial interventions targeted at healthcare professionals						
Insurance reforms equalising physician fees for vaginal and caesarean section deliveries (USA) (Keeler 1996, interrupted time series study)	Caesarean section	The effect of insurance reforms equalising physician fees for vaginal and caesarean section deliveries on caesarean births is uncertain	Caesarean section rates for non-breech deliveries decreased by 1.2% (22.5% before reform versus 21.3% after reform)			⨁◯◯◯ **VERY LOW**[a]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Insurance reforms equalising physician fees for vaginal and caesarean section deliveries (Taiwan) (Lo 2008, interrupted time series study)	Caesarean section	The effect of insurance reforms equalising physician fees for vaginal and caesarean section deliveries on caesarean births is uncertain	The change in the level of total caesarean section rate following the rise in VBAC fees was -1.68 (95% CI -2.3 to -1.07); the change in slope was -0.004 (95% CI -0.05 to 0.04)[b] The change in the level of total caesarean section rate (for all indications and order of birth) following the rise in vaginal birth fees was 1.19 (95% CI -0.01 to 2.40) and the change in slope was -0.43 (95% CI -0.78 to -0.09)[b]			⨁◯◯◯ **VERY LOW**[a]
	Spontaneous vaginal birth	NR	-	-	-	-

	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-
Different staffing models of delivery care						
Collaborative midwifery-labourist care (versus private model of care) (USA) (Rosenstein 2015, interrupted time series study)	Primary caesarean section	Collaborative midwifery-labourist care may reduce primary caesarean section compared to private model of care	Primary caesarean rate among privately insured women decreased from 31.7% to 25.0% (OR 0.56, 95% CI 0.39 to 0.81). Interrupted time series analysis estimated a 7% drop in the primary caesarean rate in the year after the intervention, and a decrease of 1.7% per year thereafter			⊕⊕⊖⊖ **LOW**[c]
	VBAC	Collaborative midwifery-labourist care may increase VBAC compared to private model of care	VBAC rate increased from 13.3% before to 22.4% after the intervention (OR 2.03, 95% CI 1.08 to 3.80)			
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality or morbidity	NR	-	-	-	-

Labourist model of obstetric care (versus traditional model of obstetric care) (USA) (Srinivas 2016, controlled before-after study)	Caesarean section	Labourist model of obstetric care may lead to little or no difference in caesarean section rate compared to traditional model of obstetric care	Non-labourist before: 28.5% (46,486 births) Non-labourist after: 31.8% (42,348 births)	Labourist before: 32.6% (47,206 births) Labourist after: 33.6% (35,210 births)	OR 1.02 (0.97 to 1.1)	⊕⊕◯◯ **LOW**[c]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality	NR	-	-	-	-
	Maternal morbidity	Labourist model of obstetric care may lead to little or no difference in chorioamnionitis compared to traditional model of obstetric care	Non-labourist before, % (N): 6.2 (10,018) Non-labourist before, % (N): 4.8 (6339)	Labourist before, % (N): 3.8 (5549) Labourist after, % (N): 3.5 (3814)	OR 1.07 (0.88 to 1.30)	⊕⊕◯◯ **LOW**[c]
	Neonatal mortality	NR	-	-	-	-
	Neonatal morbidity	Labourist model of obstetric care may lead to little or no difference in low Apgar (less than 7) at 5 minutes compared to traditional model of obstetric care	Non-labourist before, % (N): 0.4 (557) Non-labourist after, % (N): 0.4 (476)	Labourist before, % (N): 0.2 (216) Labourist after, % (N): 0.2 (223)	OR 1.09 (0.69 to 1.72)	⊕⊕◯◯ **LOW**[c]
		Labourist model of obstetric care may lead to little or no difference in birth asphyxia compared to traditional	Non-labourist before, % (N): 0.3 (398) Non-labourist after, % (N): 0.2 (247)	Labourist before, % (N): 0.2 (310) Labourist after, % (N): 0.2 (171)	OR 0.75 (0.48 to 1.18)	⊕⊕◯◯ **LOW**[c]

model of obstetric care

The **corresponding risk (absolute effect with intervention)** (and its 95% confidence interval) is based on the assumed risk in the comparison group ((i.e. risk with control) and the **relative effect** of the intervention (and its 95% CI).

About the certainty of the evidence (GRADE)*

High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.

Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.

Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.

Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.

*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'

†Substantially different = a large enough difference that it might affect a decision

CI: confidence interval; **NR**: not reported; **OR**: odds ratio; **RR**: risk ratio; **VBAC**: vaginal birth after caesarean.

[a]Downgraded one level for serious risk of bias (due to possible confounding of outcome; unclear whether the intervention occurred independently of other changes over time)

[b]Two standardised effect sizes are obtained from interrupted time series analysis: a change in level (also called 'step change') and a change in trend (also called 'change in slope') before and after the intervention

Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in caesarean section rate

[c]Observational study which start at low certainty evidence according to GRADE (we did not downgrade or upgrade the certainty of evidence)

Intervention	Primary outcome measure	Plain language summary	Absolute effect		Relative effect (95% CI)	Certainty (GRADE)
			with control	with intervention		
Multifaceted programme comprising education programme for hospital staff and women, audit of surgeon practices, public health campaign, monitoring rates of caesarean sections and neonatal outcomes (China) (Runmei 2012, controlled before-after study)	Caesarean section	The effect of multifaceted programme on caesarean section rate is uncertain	Change in level of caesarean deliveries during intervention: -13.4% (95% CI -19.6 to -7.1)[b] Change in slope of caesarean deliveries: -0.72% (95% CI -3 to 1.5)[b]			⊕⊖⊖⊖ **VERY LOW**[c]
	Spontaneous vaginal birth	NR	-	-	-	-
	Instrumental vaginal birth	NR	-	-	-	-
	Maternal mortality	NR	-	-	-	-
	Maternal morbidity	The effect of multifaceted programme on maternal morbidity is uncertain	"We found a significant increase in the incidence of all obstetric complications, with the exception of placental abruption, after 2004"			⊕⊖⊖⊖ **VERY LOW**[c]
	Neonatal morbidity	NR	-	-	-	-
	Neonatal morbidity	The effect of multifaceted programme on neonatal morbidity is uncertain	"The incidence of birth asphyxia did not increase after 2004 (P = 0.303)"			⊕⊖⊖⊖ **VERY LOW**[c]
	Maternal or neonatal mortality	NR	-	-	-	-

Multifaceted programme comprising transmission of information on caesarean section, training of health workers on best obstetric practices and inclusion of caesarean section rates as a criterion for hospital funding (Portugal) (Ayres-De-Campos 2015, interrupted time series study)	Caesarean section	The effect of multifaceted programme on rates of caesarean section, VBAC and instrumental birth is uncertain	In the period between 2009 and 2014, representing the possible influence of the programme: rates of caesarea 20.0% (from 36.0 rates of instrume 13.7% to 18.2%, t rates of VBAC inc			⊕◯◯◯ **VERY LOW**[c]
	VBAC					
	Instrumental vaginal birth					
	Spontaneous vaginal birth	NR	-	-	-	-
	Maternal mortality or morbidity	NR	-	-	-	-
	Neonatal mortality	NR	-	-	-	-
	Neonatal morbidity	The effect of multifaceted programme on hypoxia-related complications is uncertain	The incidence of hypoxia-related complications decreased by 14.1% (from 0.71% to 0.61%, time trend $P < 0.001$)[b]			⊕◯◯◯ **VERY LOW**[c]

The **corresponding risk (absolute effect with intervention)** (and its 95% confidence interval) is based on the assumed risk in the comparison group ((i.e. risk with control) and the **relative effect** of the intervention (and its 95% CI).
About the certainty of the evidence (GRADE)*
High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.
Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.
Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.
Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.
*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'
†Substantially different = a large enough difference that it might affect a decision
CI: confidence interval; **NR**: not reported; **VBAC**: vaginal birth after caesarean.

[a]Multifaceted interventions with components targeted at women, healthcare professionals or healthcare organisations
[b]Two standardised effect sizes are obtained from interrupted time series analysis: a change in level (also called 'step change') and a change in trend (also called 'change in slope') before and after the intervention
Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in caesarean section rate
[c]Downgraded one level for serious risk of bias (due to possible confounding of outcome, unclear whether the intervention occurred independently of other changes over time)

DISCUSSION

Summary of main results

This review examined evidence from 29 studies assessing the effectiveness and safety of non-clinical interventions intended to reduce caesarean section births. The studies assessed a range of interventions, targeting various stakeholders (women, families, healthcare professionals and healthcare organisations or facilities), mostly in high-income countries. The summarised evidence is drawn from single studies assessing distinct interventions. Limited data were available on maternal and neonatal mortality and morbidity.

Overall, we found eight interventions to have a beneficial effect on at least one primary outcome measure with low-, moderate- or high-certainty evidence, and no moderate- or high-certainty evidence of adverse effects: childbirth training workshop; nurse-led applied relaxation training programme; psychosocial couple-based prevention programme; psychoeducation; implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication; implementation of clinical practice guidelines combined with audit and feedback; physician education by local opinion leader (obstetrician-gynaecologist); and collaborative midwifery-labourist model of care.

The review targeted settings with high rates of caesarean section rates, where large numbers of caesarean births are assumed to be unnecessary. However, the proportion of unnecessary caesarean sections was not reported in the included studies and it is unclear whether the observed changes in caesarean section rates occurred exclusively in those considered unnecessary. Given this uncertainty, caution should be exercised when interpreting the findings of this review.

Overall completeness and applicability of evidence

The summarised evidence is derived from a mixed population of pregnant women (nulliparous women, multiparous women, women with a fear of childbirth, women with high levels of anxiety, women having undergone a previous caesarean section, couples, husbands of pregnant women, and pregnant women with no particular health condition).

We did not identify any eligible studies that addressed five prespecified interventions: public dissemination of caesarean section rates; goal-setting for caesarean section rates; policies that limit financial or legal liability in case of litigation of healthcare professionals or organisations; changing the physical or sensory environment of labour and delivery; and strategies to change organisational culture.

There were insufficient data to explore effects across important subgroups (e.g. whether effects of educational interventions varied by format, intensity or duration of birth preparation classes). The absence of evidence on the optimal education format is particularly concerning given that antenatal education is an established component of maternity care worldwide. Given that many women are in contact with the health system for care during pregnancy, interventions targeting women and families appear an appealing strategy with capacity to reach a large proportion of women, ensuring they are informed and that they receive the necessary support for informed decision-making. More research is needed to understand women-related determinants of birth choices so that the content and format of educational interventions can be tailored to relevant determinants of caesarean births.

Limited data were available on maternal and neonatal morbidity and mortality and healthcare resource utilisation. Reliable cost-effectiveness data were available only for one intervention (implementation of clinical practice guidelines combined with audit and feedback) (Johri 2017). We did not find studies that assessed long-term maternal and infant outcomes. Future studies should address this knowledge gap.

Most of the included studies were conducted in high-income countries. The review findings are mostly generalisable to similar settings. However, differences in the determinants of caesarean births and healthcare systems may limit generalisability in some settings (e.g. the labourist model of obstetric care is largely limited to USA settings) (Rosenstein 2015; Srinivas 2016). None of the included studies were conducted in low-income countries.

Certainty of the evidence

The review included 29 studies evaluating a wide range of interventions. We judged the certainty of evidence to be high in only three comparisons (implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication, implementation of clinical practice guidelines combined with audit and feedback, local opinion leader education). The certainty of evidence for the remaining interventions varied from very low (indicating considerable uncertainty in the effect estimates) to moderate (indicating that further research is likely to have an important impact in our confidence in the effect estimate and may change the estimate).

We downgraded the level of evidence for most outcomes, primarily because of study risk of bias (due to inadequate sequence generation and allocation concealment procedures) and imprecision of effect (due to small sample sizes and few numbers of events). Although we cannot entirely exclude the possibility of publication bias, we judged the likelihood of missing relevant studies as low given the comprehensive literature searches implemented.

Potential biases in the review process

The review has a number of limitations. We excluded many studies because of ineligible designs. It is possible that some of these

studies contribute useful data that might complement evidence from the included studies. We were not able to reanalyse data from some studies because insufficient information was available. It is likely that we missed a number of relevant interventions because of lack of clear taxonomy in the classification of non-clinical interventions to reduce caesarean births. In addition, a number of relevant interventions were identified during the peer review process; we will consider these in the next update of the review. We judged that the two studies currently awaiting classification do not have any impact on the review conclusions

Agreements and disagreements with other studies or reviews

We identified six related reviews published in the last 10 years (Boatin 2018; Catling-Paull 2011a; Chaillet 2007; Long 2016; Lundgren 2015; Nilsson 2015).

The reviews addressed a range of strategies intended to reduce caesarean births or increase vaginal birth after caesarean. Similar to our review, most of the studies included in the reviews were from high-income countries and limited data were available on maternal and neonatal mortality and morbidity and costs. There were differences between the reviews and our review regarding search strategies (e.g. search periods covered), study eligibility criteria (e.g. our review excluded cohort studies), and criteria for assessing the certainty of evidence (e.g. our review applied GRADE system). These differences explain some of the differences in the conclusions reached by the reviews. Relevant findings of the reviews are summarised in Table 12.

AUTHORS' CONCLUSIONS

Implications for practice

We evaluated a wide range of non-clinical interventions intended to reduce unnecessary caesarean section births, targeting various stakeholders (women or families, healthcare professionals, healthcare organisations or facilities). Across all categories, we found eight interventions to have a beneficial effect on at least one primary outcome measure with low-, moderate- or high-certainty evidence, and no moderate- or high-certainty evidence of adverse effects: childbirth training workshop; nurse-led applied relaxation training programme; psychosocial couple-based prevention programme; psychoeducation; implementation of clinical practice guidelines combined with mandatory second opinion for caesarean section indication; implementation of clinical practice guidelines combined with audit and feedback; physician education by local opinion leader (obstetrician-gynaecologist); and collaborative midwifery-labourist model of care.

Decisions to implement the interventions in other settings need to take into account: the extent to which routine settings resemble those in the included studies (e.g. determinants of caesarean births), presence of specific groups who might benefit from the intervention (e.g. women having undergone previous caesarean section), organisation of healthcare system (e.g. staffing models of care), baseline rates of caesarean births, financial burden of the interventions, and availability of routine data (Lavis 2009).

Implications for research

We have identified knowledge gaps in primary research based on uncertainty in the available evidence (due to very low- or low-certainty evidence, applicability of evidence or lack of studies, particularly around interventions targeted at women or families and healthcare organisations or facilities). We have also provided recommendations to improve aspects of study methodology and reporting. The research priorities are summarised in Table 13. We identified eight ongoing trials.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Althabe 2004

Methods	Cluster-randomised trial
Participants	34 hospitals* (Argentina, Brazil, Cuba, Guatemala and Mexico) with 149,276 women Hospitals with similar baseline caesarean section rate of 15% or greater and more than 1000 deliveries per year
Interventions	Intervention: implementation of evidence-based guidelines with mandatory second opinion Control: routine care as per local guidelines
Outcomes	Caesarean section rate including elective and intrapartum, maternal length of hospital stay, maternal, perinatal and neonatal complications
Notes	*36 hospitals were randomised but 2 hospitals were excluded due to one hospital closing after randomisation and therefore the matched hospital was also excluded Baseline (control group) CS rate: 24.6% Date of study: October 1998 to June 2000 Funding: European Union; Pan American Health Organization (PAHO/WHO); UNDP/UNFPA/WHO/World Bank Special Programme of Research; Development and Research Training in Human Reproduction of WHO; Research Support Fund of São Paulo State, Brazil; Maternal and Infant Programme, Buenos Aires, Argentina; Population Council-Regional Office for Latin America and the Caribbean; Epidemiological Research Center in Reproductive and Sexual Health, Guatemala; and Center of Studies in Maternal and Child Health of Campinas, Brazil Conflicts of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Paired units randomly assigned...randomisation was independently done in the statistical unit of the UNDP/UNFPA/WHO...with SAS statistical software"
Allocation concealment (selection bias)	Low risk	"Paired units randomly assigned...randomisation was independently done in the statistical unit of the UNDP/UNFPA/WHO...with SAS statistical software"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Impact of possible performance bias on main outcomes considered minimal

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcomes (modes of delivery) objective
Baseline characteristics similar?	Low risk	"6-month period of baseline data collection...hospitals were matched by country, type of hospital and baseline caesarean section rate"
Baseline outcome measurements similar?	Low risk	"6-month period of baseline data collection...hospitals were matched by country, type of hospital and baseline caesarean section rate"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Low risk	Group contamination considered unlikely (allocation by hospital)
Other bias	Low risk	No evidence of other bias

Ayres-De-Campos 2015

Methods	Interrupted time series
Participants	Portugal Births occurring in Portugal between 2000 and 2014
Interventions	Concerted action on transmission of information and training of healthcare professionals, together with the inclusion of CS rates as a criterion for hospital funding
Outcomes	CS rate, perinatal and maternal mortality, instrumental vaginal delivery, VBAC, hypoxia-related complications and perineal lacerations
Notes	Governmental sources were used to obtain data on national CS, perinatal and maternal mortality rates Baseline (control group) CS rate: 30.6% Date of study: 2000 and 2014 Funding: the authors stated that "No funding was received for the conduction of this study. The initial stages of the described concerted action were funded by the North Healthcare Regional Administration." Conflicts of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Ayres-De-Campos 2015 (*Continued*)

Intervention independent of other changes?	High risk	"Concern over rising CS rates has increased in Portugal over the last years and it is impossible to evaluate how much of the observed change was in effect due to the concerted action"
Shape of the intervention effect pre-specified?	High risk	Not stated
Intervention unlikely to affect data collection?	Low risk	"Data for national indicators were retrieved from official sources, whereas those of state-owned hospitals were obtained from a database used for benchmarking and hospital funding, so it is likely that individual hospitals put an effort into the quality of their data"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not stated
Selective reporting (reporting bias)	Low risk	All relevant prespecified outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Bastani 2006

Methods	Randomised trial
Participants	Iran 110 primigravida women with high levels of anxiety (initial state/trait anxiety scores over 30) recruited from 3 prenatal clinics in Iran Inclusion criteria: primigravida women with a wanted pregnancy, aged 18 to 30, between 14 and 28 weeks' gestation, high levels of anxiety, uncomplicated singleton pregnancies and no identified medical or obstetrical risk factors Exclusion criteria: any medical or obstetric complication during the 7 weeks of intervention and elective caesarean section
Interventions	Nurse-led 7-week applied relaxation training in groups Control: routine hospital-based prenatal care
Outcomes	Non-vaginal deliveries (surgical or caesarean section and instrumental deliveries including forceps and vacuum extraction), preterm birth, low birth weight
Notes	Baseline (control group) CS rate: 40% Date of study: October 2002 to February 2003 Funding: Not reported Conflicts of interest: Not reported
Risk of bias	

Bastani 2006 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"Randomly assigned to 2 groups, using a block randomisation method". Unclear on the size of the blocks
Allocation concealment (selection bias)	Unclear risk	"Randomly assigned to 2 groups, using a block randomisation method". Unclear on the size of the blocks
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcomes (modes of delivery) objective
Baseline characteristics similar?	Low risk	"No differences in the demographic variables...or the dependent variables"
Baseline outcome measurements similar?	Low risk	"No significant differences in state/anxiety...and perceived stress between the groups before intervention"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing outcome data
Selective reporting (reporting bias)	Low risk	Prespecified outcomes reported
Protected against contamination?	Unclear risk	Insufficient information available to assess likelihood of contamination
Other bias	Low risk	No evidence of other bias

Bergstrom 2009

Methods	Randomised trial
Participants	Sweden Inclusion criteria: Nulliparous, Swedish-speaking and attending any of the participating clinics. No specific inclusion criteria were defined for the women's partners
Interventions	Intervention: antenatal education focusing on natural childbirth preparation with training in breathing and relaxation techniques (psychoprophylaxis) Control: standard antenatal education focusing on both childbirth and parenthood, without psychoprophylactic training Both groups: four 2-hour sessions in groups of 12 participants during third trimester of pregnancy and one follow-up after delivery

Bergstrom 2009 (*Continued*)

Outcomes	Mode of delivery, epidural analgesia, experience of childbirth, and parental stress in early parenthood
Notes	Baseline (Control group) CS rate: 21% Date of study: October 2005 to February 2007 Funding: Swedish Research Council and Karolinska Institute Conflicts of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"The randomisation was conducted by the computerised algorithm with two priorities: Stratification by (1) equal number of participants per model in all clinics taken together and (2) balancing the numbers of each model within the respective clinic."
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided in the report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Main outcomes (modes of delivery) objective
Baseline characteristics similar?	Low risk	Baseline characteristics in study groups similar (Table 1 in the article)
Baseline outcome measurements similar?	Unclear risk	Baseline measures of main outcomes not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	Numbers lost to follow-up (Figure 1 in the article) unlikely to bias effect estimates
Selective reporting (reporting bias)	Low risk	Prespecified outcomes reported
Protected against contamination?	High risk	Some women in standard care also got psychoprophylaxis education at home
Other bias	High risk	Unit of analysis issues: "We have analysed data of individuals in spite of the fact that exposures was given to groups of individuals. "

Chaillet 2015

Methods	Cluster-randomised trial
Participants	Canada Participants: 32 public hospitals with at least 300 deliveries in the year before initiation of study and a CS rate > 17% and at the time of recruitment, no recent or ongoing quality improvement programmes designed to reduce CS rate All women who delivered at participating centres and whose newborns had a gestational age of at least 24 weeks and weighed at least 500g at delivery
Interventions	Implementation of evidence-based guidelines (onsite training in evidence-based clinical practice, facilitation by local opinion leader, supervision), audits of indications for caesarean delivery and provision of feedback to health professionals
Outcomes	Caesarian section rate, vaginal delivery, pharmacologic induction of labour, artificial rupture of membranes, augmentation with oxytocin during labour, epidural analgesia, and episiotomy; composite risks of minor and major maternal complications; and composite risks of minor and major neonatal complications, excluding lethal congenital abnormalities
Notes	Baseline (control group) CS rate: 23.2% Date of study: April 2008 to October 2011 Funding: Canadian Institutes of Health Research Conflicts of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"To avoid imbalance in the size of the two groups, we used computer-generated, blocked randomization within each stratum, with blocks consisting of four centers or, for strata with fewer than eight hospitals, two centers". Further details in trial protocol
Allocation concealment (selection bias)	Low risk	"To avoid imbalance in the size of the two groups, we used computer-generated, blocked randomization within each stratum, with blocks consisting of four centers or, for strata with fewer than eight hospitals, two centers. Local investigators at each hospital were then immediately informed of the assignment status of their hospital." Further details in trial protocol
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Impact of possible performance bias on main outcomes considered minimal
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcomes of interest (mode of delivery) objective

Chaillet 2015 (*Continued*)

Baseline characteristics similar?	Low risk	Table 1 in the article: baseline characteristics comparable
Baseline outcome measurements similar?	Low risk	Table 2 in the article: baseline outcome measures comparable
Incomplete outcome data (attrition bias) All outcomes	Low risk	No evidence of attrition bias
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Low risk	"By designating hospitals as the units of randomization, we ensured that all women within a given maternity unit were assigned to the same trial group, thereby reducing the risk of contamination of the intervention effect."
Other bias	Low risk	No evidence of other bias

Eden 2014

Methods	Randomised trial
Participants	USA Pregnant women who had one prior caesarean and were eligible for VBAC participated one time between 2005 and 2007
Interventions	Intervention: evidence-based, computerised decision aid Control: two evidence-based educational brochures about caesarean delivery and VBAC
Outcomes	Change in decisional conflict around birth priorities, mode of delivery, birth priorities for women
Notes	Baseline (control group) CS rate: not reported Date of study: 2005 to 2007 Funding: OHSU Foundation; NIH K12 grant (Building Interdisciplinary Research Careers in Women's Health, 5K12HD043488-04); grants 1 R03 HS013959 from the Agency for Healthcare Research and Quality and 1 K08 HS11338-01 from the National Institute of Child Health & Human Development Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"The research assistant logged into the secured, randomization database to obtain the decision tool assignment"
Allocation concealment (selection bias)	Low risk	"The research assistant logged into the secured, randomization database to obtain the decision tool assignment"

Eden 2014 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	"The women were unaware of their intervention assignment."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	"The two groups of women (those who received the brochures and those who used the decision aid) were similar in all demographic, health insurance status, birth intention and obstetric history variables."
Baseline outcome measurements similar?	Unclear risk	Insufficient information provided in the report
Incomplete outcome data (attrition bias) All outcomes	Low risk	"In cases of missing data for decisional conflict questions, a conservative approach was taken by assigning the missing response as unsure that was scored as a 2."
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Protected against contamination?	Unclear risk	Insufficient information available to assess likelihood of contamination
Other bias	Low risk	No evidence of other bias

Feinberg 2015

Methods	Randomised trial
Participants	USA Pregnant women and their partner (couples were aged 18 and above, living together, and expecting a first child at recruitment) The analytic sample consisted of 147 mothers (71 from control, and 76 from the intervention group) who completed interviews when children were 6 months old (wave 2), interviewed from 2004 to 2006
Interventions	Intervention: psychosocial couple-based prevention programme Control: routine care (no educational classes)
Outcomes	Delivery mode, complications of pregnancy and delivery, mother and newborn length of hospital stay
Notes	Baseline (control group) CS rate: 40% Date of study: "The analytic sample consisted of 147 mothers (71 from control, and 76 from the intervention group) who completed interviews when children were 6 months old (wave 2), interviewed from 2004 to 2006." Funding: National Institute of Child Health and Development (K23 HD042575) and

Feinberg 2015 (*Continued*)

	the National Institute of Mental Health (R21 MH064125-01) Conflict of interest: not reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Insufficient information provided
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided
Baseline characteristics similar?	Low risk	In page 4 in the article: "To assess randomization, we performed attrition analysis and baseline equivalence testing by intervention condition. Results showed baseline equivalence across a wide array of pretest"
Baseline outcome measurements similar?	Unclear risk	Insufficient information provided
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Protected against contamination?	Unclear risk	Insufficient information available to assess likelihood of contamination
Other bias	Low risk	No evidence of other bias

Fenwick 2015

Methods	Randomised trial
Participants	Australia Inclusion criteria: women between 12 to 24 weeks gestation, aged 16 years and older, able to read, write and understand English and with capacity to consent were invited to participate. (They should have had higher fear levels (WDEQ-A $\geq$ 66)) Exclusion criteria: women who required an interpreter, or had a foetal diagnosis of major abnormality or incompatibility with life were excluded

Fenwick 2015 (*Continued*)

Interventions	Intervention: psychoeducation by telephone Control: routine maternity care
Outcomes	Caesarean section, induction of labour (amniotomy, prostaglandin or syntocinon), epidural use in labour and neonatal admission to special care or intensive care nursery; Psychosocial outcomes: depressive symptoms, distressing flashbacks of the birth and parenting confidence Women's satisfaction with their ultimate birth mode and feelings of fear
Notes	Baseline (control group) CS rate: 41.9% Date of study: May 2012 to June 2013 Funding: National Health & Medical Research Council, NHMRC grant number APP1025099 Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Participants were allocated in blocks of ten and stratified by hospital site and parity using a centralised web-based service to either intervention or control group"
Allocation concealment (selection bias)	Low risk	"A research assistant not involved in recruitment or provision of the intervention accessed the randomisation service following receipt of participant's written consent and completed baseline measures."
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Likelihood of performance bias considered low given the nature of intervention (psychoeducation by telephone)
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (delivery mode) objective
Baseline characteristics similar?	Low risk	Participant characteristics comparable
Baseline outcome measurements similar?	Unclear risk	Insufficient information provided in the report
Incomplete outcome data (attrition bias) All outcomes	Low risk	"There was no difference in the proportion of women in the intervention group and the control groups that dropped out of the study (46.5% and 45% respectively, P = 0.78)."
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Low risk	Likelihood of contamination considered low given the nature of intervention (psychoeducation by telephone)

Fenwick 2015 (*Continued*)

Other bias	Low risk	No evidence of other bias

Fraser 1997

Methods	Randomised trial
Participants	12 hospitals: 11 Canada and 1 USA Pregnant women with single previous low caesarean birth with gestational age < 28 weeks Exclusion: women with previous VBAC, classic caesarean scar or known multiple pregnancies
Interventions	Prenatal education and support programme (first contact for provision of education and support at randomisation, second contact 8 weeks later)
Outcomes	Attempt vaginal delivery, VBAC, caesarean section scheduled, unsuccessful or urgent, maternal morbidity, neonatal mortality and morbidity
Notes	Baseline (control group) CS rate: 26.3% Date of study: April 1992 to November 1994 Funding: supported by operating grant No. MT 11430 from the Medical Research Council of Canada and by nominal awards (W.F. from the Medical Research Council of Canada, grant No DG-401; E.M. from the National Health Research and Development Program, National Health Research Scholar, No. 6605-2487-47) Conflict of interest: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Likely: "Randomization, which was performed through a centralized telephone answering service, was blocked and stratified by hospital and by the woman's motivation to attempt vaginal delivery."
Allocation concealment (selection bias)	Low risk	"Randomization, which was performed through a centralized telephone answering service, was blocked and stratified by hospital and by the woman's motivation to attempt vaginal delivery. "
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome of interest (mode of delivery) objective

Fraser 1997 (*Continued*)

Baseline characteristics similar?	Low risk	The two groups of women (those who received the brochures and those who used the decision aid) were similar in all demographic, health insurance status, birth intention and obstetric history variables
Baseline outcome measurements similar?	Low risk	Stratified by women's motivation to attempt vaginal birth
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data on outcome measures
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Unclear risk	Insufficient information available to assess likelihood of contamination
Other bias	Low risk	No evidence of other bias

Hemminki 2008

Methods	Cluster-randomised trial
Participants	Public health nurses in maternity health centres, Helsinki Finland
Interventions	Training of public health nurses to focus more on mode of delivery in childbirth classes
Outcomes	Mode of delivery, pain relief, labour induction, use of oxytocin, foetal electronic surveillance, Apgar score, care in neonatal or intensive care units and perinatal and infant deaths
Notes	Pilot testing, no sample size calculation and cluster accommodation. Intervention did not succeed Baseline (control group) CS rate: 12% Date of study: 2002 to 2003 Funding: National Research and Development Centre for Welfare and Health (STAKES) , Helsinki, Finland Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Randomly allocated...on the throw of a dice"
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided in the report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report

Hemminki 2008 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	"Measured by women's background characteristics, the cluster randomisation succeeded relatively well...with the exception of marital status, the pregnant women's background characteristics were very similar." There were no differences in distribution of the number of previous pregnancies
Baseline outcome measurements similar?	Unclear risk	Insufficient information provided in the report
Incomplete outcome data (attrition bias) All outcomes	High risk	High dropout in intervention group
Selective reporting (reporting bias)	Unclear risk	Insufficient information provided in the report
Protected against contamination?	Low risk	Childbirth classes only provided to invited health workers
Other bias	High risk	No a priori sample size calculation

Keeler 1996

Methods	Interrupted time series study
Participants	USA 11,767 deliveries - 5255 cases for the 12 months before and 6515 cases for the 12 months afterwards
Interventions	Equalising physician fees for vaginal and caesarean delivery
Outcomes	Rate of caesarean deliveries, vaginal breech deliveries, caesarean deliveries due to breech
Notes	Baseline (control group) CS rate: 25.3% Date of study: not reported (data set used - 12 months before and 12 months after May 1993) Funding: Agency for Health Care Policy and Research (AHCPR#282-90-0039) Conflict of interest: not stated

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Unclear risk	No information provided in the report

Keeler 1996 (*Continued*)

Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention
Intervention unlikely to affect data collection?	Unclear risk	Insufficient information provided in the report
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Missing outcome data not reported in the report
Selective reporting (reporting bias)	Low risk	All relevant outcomes are reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	High risk	Insufficient data available for appropriate reanalysis

Liang 2004

Methods	Interrupted time series analysis Comparisons of caesarean rates between 1993-96 and 1997-2000
Participants	Taiwan Pregnant women in labour
Interventions	Peer review and mandatory second opinion
Outcomes	Total, primary and repeat caesarean rates, Apgar scores
Notes	Baseline (control group) CS rate: 37% Date of study: 1993 to 2000 Funding: not reported Conflict of interest: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Unclear risk	No statement of another intervention occurring concurrently
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention
Intervention unlikely to affect data collection?	Low risk	Data collection separate from intervention

Liang 2004 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unable to assess if all outcome data included
Selective reporting (reporting bias)	Low risk	Data on all relevant outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Lo 2008

Methods	Interrupted time series study
Participants	Taiwan Pregnant women (2001 to 2005)
Interventions	Financial interventions: 1) Increase in vaginal birth after caesarean (VBAC) fee to the same level as caesarean section (April 2003); 2) Increase in vaginal birth fee to that of caesarean section (May 2005)
Outcomes	Caesarean section and VBAC rates
Notes	Baseline (control group) CS rate: 29% Date of study: 2001 to 2005 Funding: not stated Conflict of interest: not stated

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Unclear risk	Insufficient information provided in the report
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is the point of intervention
Intervention unlikely to affect data collection?	Low risk	Considered unlikely to affect data collection
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No reference to missing data
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective

Lo 2008 (*Continued*)

Other bias	Low risk	No evidence of other bias

Lomas 1991

Methods	Cluster-randomised trial
Participants	Canada 76 physicians in 16 community hospitals
Interventions	Interventions: (1) audit and feedback + distribution of educational materials; (2) Local opinion leaders + distribution of educational materials Control: distribution of educational materials
Outcomes	Trial of labour rates, vaginal births, maternal and neonatal morbidity
Notes	Baseline (control group) CS rate: 20% Date of study: 1988 to 1989 Funding: National Health Research and Development Programme of Health and Welfare Canada Conflict of interest: not stated

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not specified in the paper "randomly selected and assigned"
Allocation concealment (selection bias)	Unclear risk	Insufficient information provided in the report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	No significant differences between groups
Baseline outcome measurements similar?	Low risk	"Small difference in the overall caesarean section and VBAC rates prior to the study were not statistically significant"
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unclear from the study report
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported

Lomas 1991 (*Continued*)

Protected against contamination?	Low risk	Unlikely: unit of allocation is community hospital
Other bias	High risk	Unit of analysis errors

Masoumi 2016

Methods	Randomised trial
Participants	Iran Inclusion criteria: single foetus, no chronic disease such as diabetes, heart and lung chronic diseases, no infertility, no high risk pregnancy and no history of psychiatrist visit, do not use specific drugs, gestational age of 20 weeks Exclusion criteria: any problems or complications during pregnancy, failure to attend more than one session of training
Interventions	Intervention: antenatal education programme for physiologic childbirth in 8 two-hour sessions Control: routine prenatal education
Outcomes	Fear of delivery, rates of physiologic, normal vaginal, CS deliveries
Notes	Baseline (control group) CS rate: 40% Date of study: September 2012 to January 2013 Funding: Hamadan University of Medical Sciences. Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"160 people entered the study and were divided into two equal groups using the table of random numbers"
Allocation concealment (selection bias)	Low risk	"In inside of 160 envelopes, A and B letters were written. The eligible persons were given the envelopes respectively. After opening the envelope, the type of groups was found"
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	"Baseline characteristics of women were similar in both groups"

Masoumi 2016 (*Continued*)

Baseline outcome measurements similar?	Low risk	No important differences present
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportion of missing data unlikely to change main results
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Protected against contamination?	Unclear risk	Allocation was by individual patients (cannot rule out contamination)
Other bias	Low risk	No evidence of other risk of bias

Mohammadi 2012

Methods	Retrospective, before-after study (reanalysed as an interrupted time series study)
Participants	Iran 3494 pregnant women in General hospital, Tehran, Iran from May 2005 to December 2005
Interventions	Clinical audit and feedback process; review of random sample of caesarean section patients for indication with financial incentive to practitioners who met the criteria
Outcomes	Caesarean section rates
Notes	Baseline (control group) CS rate: 40% Date of study: 2004 to 2005 Funding: Faculty of Medicine, Uppsala University Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Unclear risk	Insufficient information provided in the report
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention
Intervention unlikely to affect data collection?	Low risk	Retrospective cohort study of all deliveries
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Missing data not reported
Selective reporting (reporting bias)	Low risk	All relevant data reported

Mohammadi 2012 (*Continued*)

Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Montgomery 2007

Methods	Randomised trial
Participants	UK 742 pregnant women from 4 maternity units with one previous lower segment caesarean section. Recruited by research midwife at antenatal clinic 10 to 20 weeks gestation
Interventions	Two patient decision-aids: information programme providing information on the outcomes associated with planned vaginal delivery, elective caesarean section and emergency caesarean section; and a decision analysis containing information on descriptions of outcomes for mother and baby of each delivery method and women are asked to consider a value to these outcomes. This provides a recommended 'preferred option' based on maximised expected utility
Outcomes	Primary: decisional conflict scale and actual mode of delivery Secondary: anxiety, knowledge of the decisional conflict scale and satisfaction
Notes	Baseline (control group) CS rate: 24% Date of study: May 2004 to August 2006 Funding: BUPA Foundation; UK Department of Health National Coordinating Centre for Research Capacity Development Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"One member of the of the study team generated the randomisation sequence by computer..."
Allocation concealment (selection bias)	Low risk	"...another member of staff with no involvement in the trial performed the allocation"
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective

Montgomery 2007 (*Continued*)

Baseline characteristics similar?	Unclear risk	Insufficient information in the report
Baseline outcome measurements similar?	Low risk	Outcomes measured before intervention and no important differences reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportion of missing data similar for each group
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Low risk	Decision aids only provided to those women randomised to that arm
Other bias	Low risk	No evidence of other bias

Navaee 2015

Methods	Randomised trial
Participants	Iran Inclusion criteria: no experience of acute psychological emotions, delivery and childbirth fear score > 28, primiparous, single pregnancy, gestational age of 34-36 weeks, age of 18-35 years, no history of infertility, no indication for CS, and not having passed educational course for delivery methods
Interventions	Role play education versus standard education using lectures
Outcomes	Fear of natural delivery, mode of delivery
Notes	Baseline (control group) CS rate: 56.2% Date of study: not reported. Funding: Mashhad University of Medical Sciences, Iran Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No information provided in the report
Allocation concealment (selection bias)	Unclear risk	The unit of allocation was health centre (however, no information was reported on allocation concealment)
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report

Navaee 2015 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (VBAC) objective
Baseline characteristics similar?	Low risk	There were no differences in baseline characteristics between study groups at baseline
Baseline outcome measurements similar?	Low risk	There were no differences in outcome measures at baseline (Table 1 in the article)
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided in the report
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Unclear risk	Insufficient information provided to enable assessment of likelihood of group contamination
Other bias	Low risk	No evidence of other bias

Poma 1998

Methods	Interrupted time series study
Participants	USA Community hospital obstetric unit; women delivering over 6-year period 1991 to 1996
Interventions	Peer review and feedback regarding use of practice guidelines 24-hour in-house physician coverage
Outcomes	Total, primary and repeat caesarean section rate, perinatal morbidity and mortality
Notes	Baseline (control group) CS rate: 20.7% Date of study: January 1991 to December 1996 Funding: not stated Conflict of interest: not stated

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Unclear risk	Insufficient information provided in the report
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention

Poma 1998 (*Continued*)

Intervention unlikely to affect data collection?	Unclear risk	No distinction between intervention and records collected
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No description of missing data
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Rosenstein 2015

Methods	Interrupted time series study
Participants	USA Study period: 2005 and 2014: In 2011, privately insured women changed from a private practice model to one that included 24-hour midwifery and labourist coverage. Primary caesarean delivery rates among nulliparous, term, singleton, vertex women and VBAC rates among women with prior caesarean delivery were compared before and after the change
Interventions	Expanded access to collaborative 24-hour midwifery-labourist care model
Outcomes	Primary caesarean delivery and VBAC
Notes	Baseline (control group) CS rate: 31.7% Date of study: 2005 to 2014 Funding: National Institute of Child Health and Human Development (Grant # HD01262); National Center for Advancing Translational Sciences (Grant # UCSF-CTSI UL1 TR000004); and the non-profit Prima Medical Foundation Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Intervention independent of other changes?	Low risk	"We cannot be certain whether other factors could have led to the decrease in rates, although there were no other official hospital policies that took effect during this time. "
Shape of the intervention effect pre-specified?	Low risk	"In our study, we graphically demonstrated the converse: primary caesarean rates were increasing slightly before the expansion and decreased afterward."

Rosenstein 2015 (*Continued*)

Intervention unlikely to affect data collection?	Low risk	Sources and methods of data collection were the same before and after the intervention
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not specified in the report
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Rouhe 2013

Methods	Randomised trial
Participants	Finland Inclusion criteria: nulliparous women with severe fear of birth according to the Wijma Delivery Expectancy Questionnaire A (prenatal version) (W-DEQ A) (REF 21)
Interventions	Intervention: psychoeducative group sessions led by a psychologist Women in the control group received a letter in which they were advised to discuss their fear of childbirth in their primary maternity healthcare unit. When needed, primary health care referred fearful women to a special maternity care unit
Outcomes	Mode of delivery, life satisfaction and general well-being, costs, duration of labour and delivery, postpartum haemorrhage, usage of epidural or spinal analgesia, birthweight and umbilical arterial pH of the new born, Apgar scores, and interventions during the third stage of labour (suturing or surgical evacuation of placenta or membranes postpartum)
Notes	Baseline (control group) CS rate: 32.5% Date of study: October 2007 to August 2009 Funding: Emil Aaltonen Foundation and the Signe and Ane Gyllenberg Foundation Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Method of allocation sequence generation not reported (Women were randomised, by one of the researchers, to the intervention or control group in the proportion of 1:2 in balanced blocks of 18)
Allocation concealment (selection bias)	Low risk	Sealed opaque envelopes used

Rouhe 2013 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcomes (mode of delivery) objective
Baseline characteristics similar?	Low risk	Table 3 in the article: There were no significant differences between study groups in age, social status, education, previous pregnancies or marital status
Baseline outcome measurements similar?	Unclear risk	No information provided
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Protected against contamination?	Unclear risk	Insufficient information available to assess likelihood of contamination
Other bias	Low risk	No evidence of other bias

Runmei 2012

Methods	Retrospective before-after study Reanalysed as an interrupted time series study
Participants	China 25,280 pregnant women at a Regional referral centre, Yunnan, China from January 2005 to December 2011
Interventions	Stage 1 (Jan 2005 to Dec 2006): educational programme for hospital staff Stage 2 (Jan to June 2007): monitoring of risk-adjusted caesarean section rates Stage 3 (Jan 2005 to Dec 2011): monitoring of neonatal outcomes
Outcomes	Caesarean section rate, neonatal outcomes
Notes	Only first two stages targeting caesarean sections were considered for analysis Baseline (control group) CS rate: 54.8% Date of study: 2001-2011 Funding: Yunnan Science and Technology Committee, Yunnan Province Government (research grant 2009CA006) Conflict of interest: the authors declare that they have no known conflict of interests
Risk of bias	

Runmei 2012 (*Continued*)

Bias	Authors' judgement	Support for judgement
Intervention independent of other changes?	Unclear risk	Insufficient information provided in the report
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention
Intervention unlikely to affect data collection?	Low risk	Retrospective cohort study of all deliveries
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided in the report
Selective reporting (reporting bias)	Low risk	Data on all prespecified outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Saisto 2001

Methods	Randomised trial
Participants	Finland Physically healthy pregnant women with low obstetric risk and a diagnosis of fear of childbirth Exclusion criteria: contraindication to vaginal delivery (2 previous caesareans or vertical incision in previous caesarean)
Interventions	Intensive group therapy with trained obstetrician in cognitive behavioural therapy and childbirth psychology
Outcomes	Requests for caesarean delivery at 38 weeks pregnancy Mode of delivery, duration of labour and pain relief Reporting level of anxiety, depression and concerns using multiple scales at 24 and 36 weeks
Notes	Baseline (control group) CS rate: 15% Date of study: August 1996 to July 1999 Funding: Signe and Ane Gyllenberg Foundation, the Emil Aaltonen Foundation, Helsinki University Central Hospital, and the Academy of Finland Conflict of interest: not stated

Risk of bias

Bias	Authors' judgement	Support for judgement

Saisto 2001 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	No information provided in the report
Allocation concealment (selection bias)	Low risk	"...randomly assigned to groups in balanced blocks of 20 by sealed opaque envelopes"
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information provided in the report
Baseline characteristics similar?	Low risk	Measured and no significant differences between groups found
Baseline outcome measurements similar?	Low risk	Measured and no significant differences between groups found
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportion of missing data similar in study groups
Selective reporting (reporting bias)	Low risk	No evidence of selective reporting
Protected against contamination?	Low risk	No evidence of group contamination
Other bias	Low risk	No evidence of other bias

Scarella 2011

Methods	Interrupted time series study
Participants	Chile 4813 pregnant women at a regional health centre, admitted for spontaneous labour or pregnancy interruption Excluded deliveries with newborns < 500g, deliveries by private physicians
Interventions	Audit and feedback
Outcomes	Caesarean section rate, neonatal outcomes
Notes	Baseline (control group) CS rate: 36.8% Date of study: March 2007 to November 2008 Funding: not stated Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Scarella 2011 (*Continued*)

Intervention independent of other changes?	Unclear risk	Insufficient information provided in the report
Shape of the intervention effect pre-specified?	Low risk	Point of analysis is point of intervention
Intervention unlikely to affect data collection?	Low risk	Insufficient information provided in the report
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided in the report
Selective reporting (reporting bias)	Low risk	Data on all relevant outcomes reported
Knowledge of the allocated interventions adequately prevented during the study?	Low risk	Main outcome of interest (mode of delivery) objective
Other bias	Low risk	No evidence of other bias

Sharifirad 2013

Methods	Randomised trial
Participants	Iran Inclusion criteria: primiparous pregnant women in 28-32 pregnancy weeks who referred to private clinics and were willing to use caesarean section; lack of obvious barriers and medical diagnosis for vaginal delivery during sampling such as detectable medical causes; full consent and collaboration of pregnant women and their husbands in order to participate in the intervention
Interventions	Prenatal education for husbands of pregnant women
Outcomes	Elective caesarian section rate; knowledge and attitudes
Notes	Baseline (control group) CS rate: 50% Date of study: not stated Funding: none Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomised, but method of randomisation not mentioned
Allocation concealment (selection bias)	Unclear risk	No information provided in the report

Sharifirad 2013 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Objective outcome measure (caesarean delivery)
Baseline characteristics similar?	Low risk	No significant difference between study groups
Baseline outcome measurements similar?	Low risk	No significant difference between study groups
Incomplete outcome data (attrition bias) All outcomes	Low risk	No evidence of attrition bias
Selective reporting (reporting bias)	Low risk	All prespecified outcome data reported
Protected against contamination?	Unclear risk	No clear steps to prevent contamination (could have been possible if there was communication between participants)
Other bias	Low risk	No evidence of other bias

Shorten 2005

Methods	Randomised trial
Participants	Australia Inclusion criteria: pregnant women with 1 previous caesarean section and medically eligible for a trial of vaginal birth Exclusion criteria: more than 1 previous caesarean section; classical or unknown uterine scar; history of uterine rupture or upper segment perforation; multiple pregnancy; and obstetric or medical contraindications to vaginal birth, or trial of vaginal birth or both in the current pregnancy
Interventions	Decision-aid booklet describing risks and benefits of elective repeat caesarean section and trial of labour provided at 28 weeks gestation
Outcomes	Mode of delivery, level of knowledge, decisional conflict score, preference for mode of delivery at 36 weeks and postnatal satisfaction
Notes	Baseline (control group) CS rate: 30% Date of study: May 2001 to May 2003 Funding: MBF Research Grant, Sydney, The University of Wollongong New Researcher Grant Scheme, Wollongong, and NSW Midwives Association Research Scholarship, Sydney, New South Wales, Australia Conflict of interest: not stated
Risk of bias	

Shorten 2005 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	"Opaque envelopes containing a random allocation for each participant code number were prepared by computer-based randomized generation"
Allocation concealment (selection bias)	Low risk	"Opaque envelopes containing a random allocation for each participant code number were prepared by computer-based randomized generation"
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Insufficient information in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	"Socioeconomic and clinical baseline characteristics...were similar, except more intervention women reported experiencing problems after their previous caesarean section (infection, pain, breastfeeding problems) compared with the control group"
Baseline outcome measurements similar?	Low risk	Baseline outcome measures (pre-scores) comparable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportion of missing data is similar in both groups
Selective reporting (reporting bias)	Low risk	No evidence of selective outcome reporting
Protected against contamination?	Low risk	Decision-aid was provided only to those in the intervention arm
Other bias	Low risk	No evidence of other bias

Srinivas 2016

Methods	Controlled before-after study
Participants	USA Hospitals, matched 2:1 non-labourist to labourist using the following variables • Annual volume of deliveries categorised as <= 1000 or > 1000 • Geography based on USA census bureau designated areas: Northeast, Midwest, South, West • Teaching hospital status (presence of obstetric residents) • Level of Neonatal Intensive Unit Care
Interventions	Intervention: labourist model of obstetric care Control: standard care provided by the regular staff attending deliveries

Srinivas 2016 (*Continued*)

Outcomes	Caesarean delivery, chorioamnionitis, induction of labour, preterm birth, maternal prolonged length of stay (> 2 days postpartum for vaginal delivery; > 4 days postpartum for caesarean delivery), Apgar at 5 minutes of < 7, birth asphyxia, injury, trauma, and neonatal death
Notes	Baseline (control group) CS rate: 28.5% Date of study: 1998 to 2011 Funding: Maternal and Child Health Bureau R40 Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Controlled before-after design
Allocation concealment (selection bias)	High risk	Controlled before-after design
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Likelihood of performance bias considered minimal
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	"Hospital level characteristics were largely balanced post match with a few small non-significant differences related to delivery volume and geography (Table 2 in the article)"
Baseline outcome measurements similar?	Low risk	Baseline outcomes between study groups comparable
Incomplete outcome data (attrition bias) All outcomes	Low risk	No evidence of attrition bias
Selective reporting (reporting bias)	Low risk	No evidence of selective outcome reporting
Protected against contamination?	Low risk	Likelihood of contamination considered minimal
Other bias	Low risk	No evidence of other bias

Valiani 2014

Methods	Randomised trial
Participants	Iran Inclusion criteria • Mothers (alone) and couples (mothers and their respective partners) attending health centres in Iran • Primiparous in 26-32 weeks of gestational age • Spouses' literacy • Having adequate physical and physiological health to actively attend the workshop • Absence of: ○ severe midwifery problems related to pregnancy ○ any baseline specific diseases ○ any diagnosable contraindication for CS during pregnancy ○ any psychological diseases ○ an unexpected pregnancy
Interventions	Intervention: childbirth training workshop Control: conventional and routine education during maternal care by the midwives in healthcare centres, gynaecologists, and relatives
Outcomes	Knowledge, attitude, and delivery mode
Notes	Baseline (control group) CS rate: 73.3% Date of study: not reported Funding: Isfahan University of Medical Sciences Conflict of interest: the authors declare that they have no known conflict of interests

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"For random allocation of the subjects, the sequence of subjects' allocation to either of the above mentioned groups was made by draw as mothers, couples, and control."
Allocation concealment (selection bias)	Unclear risk	Not specified in the report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not specified in the report
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	No important difference were present
Baseline outcome measurements similar?	Low risk	No important difference were present

Valiani 2014 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided in the report
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Protected against contamination?	Unclear risk	Allocation was by individual patients (cannot rule out contamination)
Other bias	Low risk	No evidence of other bias

Wang 2014

Methods	Randomised trial
Participants	China Inclusion criteria: 16-32 weeks of gestation, normal cognitive function; no history of childbirth or abortion; diagnosis of singleton pregnancy by B-ultrasound; no obvious risk factors according to prenatal and B-ultrasound examination findings; and no history of urinary incontinence, pelvic surgery, pelvic organ prolapse, or vaginal wall prolapse
Interventions	Intervention: pelvic floor muscle training exercises with telephone follow-up Control: pelvic floor muscle training without telephone follow-up
Outcomes	Delivery mode, timing of each labour stage (first through third stages) (details of other outcomes available in paper)
Notes	Baseline (control group) CS rate: 49.1% Date of study: December 2010 to March 2011 Funding: 2010 Youth Fund Project of Guangzhou Medical University (Project number: 2010A03) Conflict of interest: not reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No information provided in the report
Allocation concealment (selection bias)	Unclear risk	No information provided in the report
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	No information provided in the report

Wang 2014 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Main outcome of interest (mode of delivery) objective
Baseline characteristics similar?	Low risk	No important difference present
Baseline outcome measurements similar?	Low risk	No important difference present
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Insufficient information provided in the report
Selective reporting (reporting bias)	Low risk	All relevant outcomes in the methods section are reported in the results section
Protected against contamination?	Low risk	Allocation was by practice and it is unlikely that the control group received the intervention
Other bias	Low risk	No evidence of other bias

CS: caesarean section; VBAC: vaginal birth after caesarian

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

Study	Reason for exclusion
Afshar 2015	Ineligible design (prospective cohort study)
Arrieta 2011	Intervention not aimed at reducing caesarean birth
Bailey 2010	Intervention not aimed at reducing caesarean birth
Barber 2010	Intervention not aimed at reducing caesarean birth
Bernitz 2011	Intervention assessed addressed in a related Cochrane Review (Sandall 2016)
Bonfrer 2016	National Health Insurance Scheme designed to increase access to maternal and infant healthcare services (including caesarean sections)
Calvo 2009	Uncontrolled before-after study
Chambliss 1992	Intervention assessed addressed in a related Cochrane Review (Sandall 2016)
Chen 2014	Uncontrolled before-after study

(*Continued*)

Chittithavorn 2006	ITS study with insufficient data points (only one data point before and after intervention)
Costa 2009	Uncontrolled before-after study
David 2001	Not an intervention study
Dunn 2013	Uncontrolled before-after study
Fournier 2014	Study assessed effect of fee exemption intended to increase access to caesarean deliveries
Ganji 2006	Uncontrolled before-after study
Gilbert 2012	No control group
Gregory 1999	ITS study with insufficient data points (fewer than 3 data points before intervention)
Gruber 1999	The study was not an intervention study
Hemminki 2013	Interventions in study were not specifically aimed at reducing caesarean section rate
Ho 2011	Uncontrolled before-after study
Howell 2004	ITS study with insufficient data points (fewer than 3 data points before intervention)
Hutcheon 2015	Not specifically designed to assess effect on primary outcome measures (primary outcome was a composite of adverse neonatal outcomes)
Iglesias 1991	ITS study with insufficient data points (fewer than 3 data points before intervention)
Jenabi 2012	Does not measure primary outcome of interest
Jiang 2015	Major methodological flaws
Kasawara 2013	Interventions in study were not aimed at reducing caesarean section rate
Kazandjian 1998	Retrospective cohort, observation study
Kim 2005	ITS study with insufficient data points (2 data points after the intervention)
Kiwankura 1993	ITS study with insufficient data points (only 1 data point before and after intervention)
Kongnyuy 2008	ITS study with insufficient data points
Koroukian 2001	Not an intervention study
Kunthonkitidej 2001	Insufficient number of sites to determine trend

(*Continued*)

Lagrew 1996	ITS study with insufficient data points (fewer than 3 data points before intervention)
Law 1999	Intervention assessed addressed in a related Cochrane Review (Sandall 2016)
Lee 2007	Controlled ITS with insufficient data points after the intervention to determine trend
Leone 2016	Study evaluates impact of user fee reform intended to increase access to maternal and child health services (including caesarean sections)
Main 1999	CBA (data compared were not the same time and inappropriate control group)
Misra 2008	ITS study with insufficient data points before and after the intervention
Morhason-Bello 2009	Intervention addressed in a related Cochrane Review (Bohren 2017)
Myers 1993	ITS study with insufficient data points (only 1 data point before intervention)
Oleske 1992	ITS study with insufficient data points (fewer than 3 data points before intervention)
Robson 1996	ITS study with insufficient data points (fewer than 3 data points before intervention)
Saint 2003	Caesarean section rate not measured
Sanavi 2014	The study does not measure mode of delivery (reports behavioural intention change in women intending to have a caesarean section)
Santerre 1996	Not an intervention study
Socol 1993	ITS study with no defined intervention time point
Tussey 2015	Clinical intervention
van Dillen 2008	Uncontrolled before-after study
Walker 2016	Intervention not specifically designed to reduce caesarean section rate
Werner 2013	Intervention not aimed at reducing caesarean section rate
Zanetta 1999	ITS study with insufficient data points (only 1 data point before intervention)
Zhang 2016	Intervention addressed in a related Cochrane Review (Sandall 2016)

CBA: controlled before-after; ITS: interrupted time series

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

Jang 2011

Methods	Interrupted time series study Setting: South Korea Time-series autoregressive integrated moving average (ARIMA) analysis was used to assess the effect of four repeated public releases (RPR) on caesarean section rates
Participants	Data sources: monthly data about institutional caesarean section rates and total deliveries from the Health Insurance Review & Assessment Service (HIRA) National Quality Improvement project database from 2003 through 2007
Interventions	Repeated public releases on caesarean section rates
Outcomes	Caesarean section rates
Notes	Study will be considered for inclusion in the next update of the review

Vankan 2015

Methods	Study design: not stated "Women pregnant after one previous CS without a contra-indication for an intended VB were enrolled in six matched pairs of hospitals." "The vaginal birth (VB) rate in the period before the study started was 48%. A difference of > 10 % was considered 'inferior' care. The sample size needed was 400 per study arm"
Participants	Women pregnant after one previous caesarean section without a contraindication for an intended vaginal birth
Interventions	Intervention (n = 479 women) Women in the intervention hospitals received a decision analysis, including both information on benefits and risks of intended vaginal birth or elective repeat caesarean delivery and a prediction model to calculate the individual vaginal birth probability Control (n = 441 women) Counselling in the control hospitals was performed according to usual care
Outcomes	Patient involvement, vaginal birth rate, elective and emergency caesarean section rate
Notes	Study will be considered for inclusion in the next update of the review

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

ACTRN12611000878976

Trial name or title	For pregnant women in the first half of their pregnancy with history of previous caesarean and eligible for vaginal birth after caesarean (VBAC), will using a decision aid increase their rate of VBAC compared to using a pamphlet?

ACTRN12611000878976 (*Continued*)

Methods	**Country:** New Zealand **Study design:** randomised trial
Participants	History of one previous caesarean less than 25 weeks gestation in current pregnancy
Interventions	**Intervention:** the decision aid is a comprehensive 25 page booklet that first explains the risks and benefits of elective repeat caesarean and of VBAC, and then asks the woman to write down her own values and preferences about the two birth options. It will be administered at the time of the consultation in the Positive Birth After Caesarean Clinic **Control:** the patient pamphlet is 6 pages and briefly lists risks and benefits of elective repeat caesarean and of VBAC. It is administered at the time of the consultation in Positive Birth After Caesarean Clinic
Outcomes	**Primary outcome:** the rate of VBAC is determined using the perinatal database at the hospital **Secondary outcomes** • Mean decisional conflict score about birth choice • Mean knowledge score about birth choices
Starting date	September 2014
Contact information	Michelle Wise: m.wise@auckland.ac.nz
Notes	Trial registry number: ACTRN12611000878976

ACTRN12611001214921

Trial name or title	Does continuity of care impact decision making in the next birth after a caesarean section (VBAC)? A randomised controlled trial
Methods	Randomised trial
Participants	Pregnant women whose most recent birth was by caesarean section
Interventions	Midwifery continuity of care to women through pregnancy, labour, birth and early postnatal care Control: standard hospital care from different midwives through pregnancy, labour, birth and early postnatal care
Outcomes	**Primary outcome:** proportion of women who attempt vaginal birth in their current pregnancy **Secondary outcomes:** proportion of vaginal births; neonatal health assessed at birth and at 28 days (Apgar scores, admission to special care nursery, length of stay in hospital, readmission to hospital); women's social and emotional outcomes examined using a survey at 36 weeks of pregnancy and at 6 weeks postpartum
Starting date	Not yet recruiting (anticipated 30/06/2012; as per trial registry record)
Contact information	caroline.homer@uts.edu.au
Notes	Trial registry number: ACTRN12611001214921; DOI: 10.1186/1471-2393-13-140

ACTRN12613000161729

Trial name or title	Enhanced care and support in early labour (ECSEL): a randomised controlled trial to reduce caesarean sections for first-time mothers
Methods	**Country:** Australia **Study design:** randomised trial
Participants	**Inclusion criteria:** women at normal risk of complication having their first baby booked at a participating hospital; live within 30 minutes drive of the hospital; English-speaking **Exclusion criteria:** complications of pregnancy that would indicate early admission to hospital in labour (e.g. foetal growth restriction, antepartum haemorrhage, planned caesarean section)
Interventions	**Intervention:** standard care in early labour is to telephone the midwife in the hospital birthsuite and seek advice on whether or not to come to hospital. The intervention here is that a known midwife will provide enhanced support (via telephone and/or home visiting) to assist women in the early or latent phases of labour to remain at home until labour is well established unless there is a reason to be admitted earlier. The support will include listening to the woman, taking a detailed history, assessing her current stage of labour and coping ability, advising whether or not to come to hospital, suggesting pain relief strategies and providing reassurance. This will be the midwife's main role, whereas midwives usually providing such guidance are concurrently providing care to women already admitted to hospital in labour. The study midwife will also visit the woman at home if this would be helpful (to be decided on an individual basis by the woman and the midwife). The duration of this additional support will vary according to individual needs between around 15 minutes and 3 hours **Control:** women telephone midwives working in birthsuite/emergency department when they want advice readmission to hospital for the birth (standard care)
Outcomes	**Primary outcome:** caesarean section for any indication **Secondary outcomes** • Instrumental vaginal birth • Length of time from hospital admission to birth • Admission to hospital with cervical • Use of oxytocin infusion to induce or augment labour • Cost of maternity care • Use of epidural analgesia for relief of pain in labour • Postpartum haemorrhage • Apgar score < 7 (5 minutes after birth) • Maternal satisfaction with intrapartum care • Breastfeeding • Neonatal admission to special care or neonatal intensive care • Maternal admission to high-dependency care • Neonatal resuscitation more intensive than oxygen and/or suction • Score > 12 on Edinburgh Postnatal Depression
Starting date	Anticipated: September 2014
Contact information	Mary-Ann Davey: m.davey@latrobe.edu.au
Notes	Trial registry number: ACTRN12613000161729

IRCT2013111010777N3

Trial name or title	The impact of a computerised decision aid on the mode of delivery, compared with conventional care
Methods	**Country:** Iran **Study design**: randomised, parallel group trial
Participants	**Inclusion criteria:** positive pregnancy test, being in good health, pregnancy above 28 weeks, and singleton pregnancy **Exclusion criteria:** unwanted pregnancy, inability to read and write and working with computer, experience of previous caesarean section
Interventions	**Intervention group**: they will receive a computer-based decision aid on mode of delivery **Control group**: they will receive the conventional care
Outcomes	**Primary outcome:** decisional conflict, knowledge **Secondary outcome:** mode of delivery
Starting date	December 2013
Contact information	Saeid Eslami: eslams@mums.ac.ir
Notes	IRCT registration number: IRCT2013111010777N3

ISRCTN10612254

Trial name or title	Improving the organisation of maternal health service delivery, and optimising childbirth, by increasing vaginal birth after caesarean section (VBAC) through enhanced women-centred care
Methods	**Countries:** Germany, Ireland and Italy **Study design:** multicentre cluster-randomised trial
Participants	**Participant inclusion criteria** • Pregnant women aged over 18 years • Pregnant women who have had one previous caesarean section • Pregnant women who speak a language for which translation is available • Pregnant women who give their consent
Interventions	**Intervention:** evidence-based education of women and clinicians, introduction of communities of practice (women and clinicians sharing knowledge), opinion leaders, audit and peer review of caesarean sections in each hospital, and joint decision-making by women and clinicians. The content and details of the intervention will be determined through systematic reviews and qualitative research **Control:** usual care
Outcomes	**Primary outcomes:** change from baseline in each hospital in the proportion of women who have had one previous caesarean section who have a vaginal birth during the study **Secondary outcomes** • Gestational age at birth • Length of labour • Emotional well-being, feelings of anxiety, control, satisfaction with care and perception of involvement

ISRCTN10612254 (*Continued*)

	in care, during pregnancy and the postnatal period • Intrapartum interventions (induction or augmentation of labour, use of epidural and foetal monitoring, mode of birth) • Maternal morbidities during pregnancy and the postnatal period (for example, pain, postpartum haemorrhage, wound infection, abdominal pain, depression) • Neonatal morbidities (resuscitation, Apgar scores, admission to intensive care) • Breastfeeding • Length of hospital stay (mother and infant). • Readmission Health economic analyses will be done using data on clinical outcomes, direct costs (such as length of stay and antibiotic use) and indirect costs (such as productivity loss) during pregnancy and postnatal period. The study will also seek to assess adherence to guidelines and practice protocols, adherence to intervention quantity and quality, and midwife-centred variables; to compare and contrast findings across the different hospitals
Starting date	December 2013
Contact information	Cecily Begley: cbegley@tcd.ie
Notes	Trial registry number: SRCTN10612254; DOI: 10.1186/ISRCTN10612254

ISRCTN48510263

Trial name or title	Appropriate decision for caesarean section in Burkina Faso
Methods	**Country:** Burkina Faso **Study design:** cluster-randomised trial
Participants	**Participant inclusion criteria** For the hospitals: • A minimum of 1000 deliveries per year • A minimum of 200 caesarean sections per year • The permanent availability of emergency caesarean section • The absence of current or recent experience in clinical audits for caesarean • Willingness to participate in the study is materialised by a written and signed ward agreement by the hospital director and the head of the maternity unit • District or regional hospital **For the patients:** all women who deliver by caesarean section in selected hospitals during the study period **For the health professionals:** all health professionals involved in the decision-making process for a caesarean section: obstetricians, general practitioners, nurses and midwives
Interventions	**Interventions** The evidence-based intervention will consist of three strategies to improve the competencies of maternity teams • Clinical audits based on objective criteria • Training of personnel • Decision-support reminders of indications for caesareans via text messages To analyse the intervention process, a longitudinal qualitative study consisting of deliberative workshops and individual in-depth interviews will be conducted

ISRCTN48510263 (*Continued*)

	Control group: no external intervention is planned for this group
Outcomes	**Primary outcomes** Change in the rate of non-medically justified caesarean sections among all caesarean sections **Secondary outcomes** • Knowledge score of health care professionals using specific vignettes • Quality scores for the practice of caesareans based on objective criteria (specific tasks) • Score of resource availability using the complexity index proposed by WHO • Fatality rate of caesarean sections (mother and child)
Starting date	March 2014
Contact information	Charles Kabore: kaborewendyam@yahoo.fr
Notes	Trial registry number: ISRCTN48510263; DOI 10.1186/ISRCTN48510263 Protocol: http://www.ncbi.nlm.nih.gov/pubmed/27769190

ISRCTN50041378

Trial name or title	Reducing caesarean section rates in Ireland: a feasibility study and pilot randomised trial of an evidence-based intervention designed to reduce unnecessary caesarean section
Methods	**Country:** Ireland **Study design:** feasibility study and pilot cluster randomised trial **Setting:** hospitals Target number of participants: 2 clusters (400 participants in each cluster)
Participants	**Participant inclusion criteria** • Pregnant woman • Aged over 18 • Speak either English or a language for which translation is available • Give informed consent **Participant exclusion criteria** • Vaginal birth contraindicated at time of booking
Interventions	**Intervention** Intervention will likely consist of an appointment of an obstetric and midwife opinion leader who will facilitate women-centred, evidence-based antenatal classes (2 classes) and information session for clinicians, providing accurate information on the risks and benefits of both VBAC and repeat caesarean sections, second opinions for all caesarean sections (other than category 1), peer-review of each caesarean section and feedback, reducing induction of labour rates, support of clinicians and women to choose normal options over medical intervention (e.g. mobility instead of oxytocin, water-bath instead of pharmacological pain relief, reducing use of electronic foetal monitoring in low-risk women) **Control** Usual care as per current hospital practice

ISRCTN50041378 (*Continued*)

Outcomes	**Primary outcome measures** • Caesarean section rate (overall per site) **Secondary outcome measures** • Labour interventions (e.g. induction and acceleration of labour, pain relief used, electronic foetal monitoring) • Maternal/neonatal morbidities (e.g. postpartum haemorrhage, perineal trauma, wound infection, need for neonatal resuscitation, neonatal admission to intensive care, readmission to hospital) • Mother and baby health problems assessed using self-completion surveys (health and well-being questionnaires that include the SF-36 instrument) during pregnancy and at 3 and 6 months postnatal • Clinician attitudes to caesarean section measured by a self-completion questionnaire adapted from the UK National Sentinel Caesarean Section Audit • Feasibility and pilot outcomes (% eligible and participating, time to recruit, etc.) assessed using trial screening and eligibility forms, numbers participating (consent forms) and time to recruit full sample size
Starting date	September 2017
Contact information	Cecily Begley: cbegley@tcd.ie
Notes	ISRCTN50041378 https://doi.org/10.1186/ISRCTN50041378

NCT02874443

Trial name or title	The REDUCED Trial: REDucing the Utilization of CEsarean Sections for Dystocia (REDUCED)
Methods	**Country:** Canada **Study design:** cluster-randomised trial
Participants	**Inclusion criteria:** centres in Alberta that provide intrapartum care, have facilities to perform caesarean section and deliver at least 70 primiparous women annually
Interventions	**Intervention:** application of a knowledge translation strategy, of new clinical practice guidelines on labour management, to physicians and nurses caring for women in labour **Control:** no intervention
Outcomes	**Primary outcome:** rate of caesarean section in primiparous women in labour **Secondary outcomes** • Perinatal death • NICU admission with arterial blood gasses pH < 7 and base excess >= 12 or NICU admission with Apgar at 5 minutes < 7 • Moderate or severe asphyxia or meets criteria for therapeutic cooling • Neonatal sepsis or suspected sepsis • Postpartum haemorrhage/blood transfusion
Starting date	October 2016
Contact information	Stephen Wood: slwood@ucalgary.ca

NCT02874443 (*Continued*)

Notes	NCT Number: NCT02874443

NICU: Neonatal intensive care unit; VBAC: vaginal birth after caesarean

ADDITIONAL TABLES

Table 1. Classification of non-clinical interventions

Intervention	Examples of interventions
Interventions targeted at women, the community, or the general public	
• Non-clinical educational interventions (e.g. educational games, materials, meetings) • Different modes or formats of communication (e.g. information and communication technology, written, radio, television)	• Booklets on vaginal birth after caesarean (VBAC) • Educational sessions on VBAC • Computer decision aids on VBAC • Special childbirth classes to explain active management of labour (AML) protocol • Birth preparation classes • Antenatal classes to reduce anxiety in nulliparous women • Special classes for women with fear of birth
• Opinion leaders	Dissemination of information or advocacy with support or campaigns from local or international opinion leaders • Role models • Leadership persons • Public celebrities
• Public dissemination of CS rates	• Informing the public about CS rates by releasing performance data in written or electronic form
Interventions targeted at healthcare professionals	
• Educational interventions targeted at healthcare professionals aiming to improve adherence to evidence-based clinical practice	• Education of nurses to focus on childbirth in group sessions during antenatal care (ANC) (this is a type of 'training the teacher': educational intervention) • Mailed educational material on trial of labour after caesarean (TOLAC) for physicians • Education of staff on management of labour using evidence-based practice guidelines • Education of nurses, physicians and community about labour support • Community education strategy (presentations on VBAC, foetal distress, breech and other common indications for CS) for healthcare professionals and lay people • Workshops for physicians on strategies to reduce CS, with

Table 1. Classification of non-clinical interventions (*Continued*)

	calls in-between to share experiences
• Policy of second opinion for CS indication	• Requirement of second opinion by an obstetrician on caesarean decisions
• Audit and feedback and peer review	• Summary of health workers' performance over a specified period of time, given to them in a written electronic or verbal format. Summary may include recommendations for clinical action
Interventions targeted at healthcare organisations or facilities	
• Staffing models	Different types of nurse/midwife staffing models • Midwife-led delivery units Different types of physician staffing models • 24-hour in-house physician
• Changing the physical or sensory environment of labour and delivery	• Changes to the physical or sensory healthcare environment, by adding or altering equipment or layout, providing music, art
• Targeted financial strategies for healthcare professionals or healthcare organisations	• Pay for performance (target payments) • Incentives for career • Equalise the payment for CS and VD or higher payment for VD than CS • Payment for 24-hour shifts, not for number of procedures • Financial penalties for exceeding certain CS rate • Additional payment if CS rate during shifts is maintained below a predefined threshold • Episode-based payment • Blended case rate payment
• Goal-setting for CS rates	• Setting specific predetermined goal for CS rate
• Policies that limit financial/legal liability in case of litigation of healthcare professionals or organisations	• Policies limiting financial/legal liability in case of litigation
• Strategies to change the organisational culture	• Strategies include various components of organisational culture (e.g. shared values, behaviours, norms, traditions, sense-making) which may shape, or contribute, or both, to the overall environment of an organisation

AML: active management of labour; ANC: antenatal care; CS: caesarean section; VBAC: vaginal birth after caesarean; VD: vaginal delivery; TOLAC: trial of labour after caesarean

Table 2. Examples of determinants of caesarean section births and interventions targeted at the determinants

Level	Determinants	Interventions
Healthcare recipients (women, families)	• Fear of childbirth • Anxiety about childbirth	• Birth preparation classes • Special classes for women with fear of childbirth • Psychoeducation
	• Lack of awareness of the potential harms of CS	• Antenatal education • Educational brochures • Decision aids
Healthcare professionals	• Non-adherence to evidence-based clinical practice guidelines	• Targeted in-service training • Academic detailing • Mandatory second opinion on CS decisions • Local opinion leaders
	• Physicians unaware of individual CS practices	• Audit and feedback
Healthcare organisations or facilities	• Staffing models	• Midwife-led delivery care • Laborist model of obstetric care
	• Payment methods for healthcare workers	• Equalising payment for CS and VD or higher payment for VD • Payment for 24-hour shifts (not for number of procedures)
	• Lack of awareness of facility CS practices	• Public dissemination of facility CS rates

CS: caesarean section; VD: vaginal delivery

Table 3. Primary and secondary outcome measures

Maternal mortality and morbidity

1. Maternal death
2. Maternal morbidity

Perineal or vaginal trauma

- 2nd, 3rd, or 4th degree perineal tears
- Obstetric anal sphincter injury
- Vaginal tears
- Episiotomy
- Perineal suturing
- Postpartum perineal pain

Maternal morbidity

- Febrile morbidity
- Peripartum infection
- Wound complication
- Postpartum haemorrhage

Serious maternal morbidity

- Severe obstetric haemorrhage
- Uterine rupture
- Sepsis
- Obstetric hysterectomy
- Organ failure

Long-term maternal outcomes

- Urinary or faecal incontinence
- Obstetric fistula
- Utero-vaginal prolapse

Neonatal mortality and morbidity

1. Neonatal death
2. Neonatal morbidity

Birth trauma

- Fractured skull, haematoma, cerebral haemorrhage
- Fractured clavicle, facial paralysis, brachial plexus injury
- Scalp injury, facial skin lesions
- Retinal haemorrhage

Perinatal asphyxia

- Low Apgar score (less than 7) at five minutes
- Cord blood acidosis
- Need for major resuscitation (respiratory support, intubation at birth)
- Hypoxic ischaemic encephalopathy

Long-term infant outcomes

- Breastfeeding
- Childhood disability
- Mother-infant bonding or separation

Table 4. Interventions targeted at women or families

Study	Intervention	Details
Bastani 2006	Nurse-led applied relaxation training programme	• Applied relaxation education based on Ost's description of applied relaxation, including progressive muscle relaxation and breathing (see Öst 1988 for details). • Seven 90-minute group education sessions over seven weeks led by a nurse, under the supervision of a clinical psychologist - session 1: introductory group discussion of anxiety and stress-related issues in pregnancy and purpose of applied relaxation; session 2: teaching subjects to relax with a shortened version of progressive relaxation; session 3: includes 'release-only' relaxation; session 4: deep breathing techniques; session 5: 'cue-controlled' relaxation; session 6: 'differential relaxation'; session 7: 'rapid relaxation'. • Participants are advised to practise the applied relaxation regularly and keep daily home relaxation practice records during the study
Bergstrom 2009	Antenatal education on natural childbirth preparation with training in breathing and relaxation techniques	• Education model included four, two-hour sessions during pregnancy and one follow-up session within 10 weeks after delivery. Classes started in the third trimester with groups of 12 people (6 couples). • Focus was on preparation for natural childbirth. Information was given about non-pharmacological methods for pain relief and the partner's role as a coach during labour. In each session, 30 minutes were spent on practical training in breathing, relaxation and massage techniques. Psychoprophylactic training between sessions was encouraged and a booklet to facilitate homework was distributed. The attitude of the educator was encouraged to be in favour of natural birth. Information about breastfeeding was provided but no other postnatal issues were addressed. If possible, one of the sessions could include a visit to the delivery ward. • The sessions were led by one midwife.
Eden 2014	Computerised decision aid versus educational brochures	**Computerised decision aid** • The decision aid was designed for women with low literacy and used multiple media (text, graphics, voice-over narration for all text). The reading level was sixth to eighth grade, depending on the screen. This decision aid provided brief summaries of the medical evidence for the two options in plain language. • The decision aid intervention also provided an

Table 4. Interventions targeted at women or families (*Continued*)

		explicit values clarification activity so that the women could set priorities around avoiding risk to herself, her baby, and to future pregnancies while also considering cost and her desired birth and recovery experience. Value clarification helps the women combine beliefs with their own values and helps them recognise they may have competing values. **Educational brochures** • The most current ACOG brochures on VBAC published in August 1999 and caesarean birth published in January 2005. The women could choose from the English or Spanish versions. The evidence-based brochures were developed by the Committee on Patient Education of ACOG. • The VBAC brochure provided a description of the delivery, vaginal delivery rate range, benefits and reasons for a VBAC, explanation of type of caesarean incision, and potential risks to mother and infant. Similarly, the caesarean brochure described the delivery and recovery, benefits and reasons for a repeat caesarean, and potential risks of caesarean to the mother.
Feinberg 2015	Psychosocial couple-based prevention programme	• The psychosocial programme consisted of nine classes, with four weekly classes conducted during the second or third trimester of pregnancy and four weekly classes conducted within the first six months postpartum. • Classes focused on emotional self-management, conflict management, problem solving, communication and mutual support strategies that foster positive joint parenting of an infant. • A male-female facilitator team led each class; the female was a childbirth educator in all cases, and males came from various backgrounds but were experienced working with families and leading groups.
Fenwick 2015	Psychoeducation by telephone	• Two sessions of psychoeducation provided at 24 and 34 weeks' gestation by telephone at a scheduled time convenient to participants. The sessions were around one hour duration (first session range: 22 to 125 minutes; second session range: 10 to 104 minutes). • The midwife-led counselling intervention aims to support the expression of feelings and provide a framework for women to identify and work through distressing elements of childbirth. • The intervention develops women's individual

Table 4. Interventions targeted at women or families (*Continued*)

		situational supports for the present and near future, affirming that negative events during childbirth can be managed, and developing a simple plan for achieving this. This combination of strategies diminishes emotional distress, builds constructive coping mechanisms and facilitates recovery.
Fraser 1997	Individualised prenatal education and support programme versus written information in pamphlet	**Prenatal education and support programme** • Prenatal education and support programme provided by two individuals: a research nurse with experience in prenatal instruction and a resource person selected on the basis of communication skills and personal experience of a vaginal birth after caesarean section. • Two individualised contacts: the research nurse on the day of randomisation and four to six weeks later by the research nurse and resource person. First contact, duration (minutes ± SD): stratum 1 (low motivation), 57 ± 20; stratum 2 (high motivation): 54 ± 20; second contact, duration (minutes ± SD): stratum 1: 54 ± 22, stratum 2: 54 ± 20 **Pamphlet group** • Women in the written information group received information on the benefits of vaginal birth over elective repeat caesarean section.
Masoumi 2016	Antenatal education programme for physiologic childbirth (birth preparation training)	• Training preparation for childbirth was formed in eight sessions of two hours. These classes were held every two weeks from 20 to 34 weeks of pregnancy in the study hospital. • The content of these classes included the mother's physical and mental changes, common problems and complications of pregnancy and ways to solve them, warning signs in pregnancy, nutrition and exercise during pregnancy and lactation, education about labour and the delivery process, and ways of coping with them, non-pharmacological methods for pain relief and the partner's role as a coach during labour. • 10 to 15 people were in one group. In each session, 40 minutes were spent on practical training in breathing, relaxation, massage techniques and special exercise.
Montgomery 2007	Computer decision aids versus usual care	**Two computer-based interventions** delivered using a laptop computer, usually in the women's own home • Information programme and website providing information and descriptions on outcomes for

Table 4. Interventions targeted at women or families (*Continued*)

		mother and baby associated with planned vaginal delivery, planned caesarean section and emergency caesarean section. Probabilities of having or not having the event are given and presented in numerical and pictorial format. • Decision analysis comprising of four steps: draw-up a decision tree that maps the likely outcomes of the strategies in question. Outcomes are assigned utilities that represent how an individual values a particular outcome. Probability information is included in the tree to represent the chance of each outcome occurring. Strategies are compared by calculating the weighted sum of the utilities of all possible outcomes. Recommended strategy is that with the highest expected utility value (the one that gives an individual the best chance of achieving an outcome that is valued). **Usual care:** this comprised the usual level of care given by the obstetric and midwifery team. Women in the two intervention groups also received usual care
Navaee 2015	Role play education versus standard education using lectures	**Role-playing group** • The role-playing group was divided into two subgroups of 10 subjects each and another two subgroups of nine subjects each (38 subjects). Each group was instructed in a 90-minute session about the advantages and disadvantages of normal delivery and CS. • In the warm-up stage, the researcher narrated two true stories about the individuals who were wondering about the selection of the mode of delivery due to fear of childbirth and asked the participants to voluntarily accept to play the role of pregnant woman with the researcher and two co-researchers. Then the participants helped the researcher to prepare and process the scene (scene preparation was conducted with the needed equipment for role play in two scenarios), and the observers were asked to pay close attention to the scenarios, taking important notes, and discussing them at the end of the scenario. In the scenarios, the reasons for mothers' fear of natural delivery and CS were discussed. In the first scenario, one of the participants (a pregnant woman) played the role of a woman who was referred to a midwife's office to select the mode of delivery and witnessed the events occurring in the office. Then, she was referred to the midwife and consulted with her about her concerns.

Table 4. Interventions targeted at women or families (*Continued*)

		• The second scenario was about a woman with a normal delivery and the benefits and complications experienced by her. The next step was similar to the first scenario. • In the third scenario, one of the co-researchers defended CS and another defended normal delivery. After these three scenarios, participants were asked to talk about their friends'/relatives' experiences of the two types of delivery. **Standard education (lecture group)** • Two subgroups of 10 subjects each and two subgroups of 9 subjects each was instructed using a PowerPoint presentation, marker, and whiteboard in a 90-minute session. At the end of the session, participants' questions were answered.
Rouhe 2013	Psychoeducation	• The psychoeducative group therapy was led by four different psychologists with special group therapeutic skills in pregnancy-related issues. Each group consisted of a maximum of six nulliparous women. Each group was led by the same psychologist from the beginning to the end. The starting point of group therapy was planned to be at approximately the 26th week of pregnancy. Six group sessions were held during pregnancy and one session with the newborns six to eight weeks after delivery. • Each two-hour session had a certain structure: a focused topic and a 30-minute guided relaxation exercise using a compact audio disk developed for this purpose. This relaxation exercise guided the participants through stages of imaginary delivery in a relaxed state of mind with positive, calming and supportive suggestions. • The topics covered included: information about fear and anxiety, group therapy and effects of relaxation; information about fear of childbirth, normalisation of individual reactions and information about stages of labour; hospital routines, birth process and pain relief (led by therapist and midwife); becoming a family, changes in relationship, parenthood and enhancing mutual understanding between becoming parents; becoming a mother, recognising the signs of postnatal depression and bonding with the foetus; completing preparation for delivery and birth plan. • Meeting two to three months after delivery with newborns, discussion of delivery experiences, detection of trauma and depression symptoms, discussion of mother-infant relationship.

Table 4. Interventions targeted at women or families (*Continued*)

Saisto 2001	Intensive group therapy (cognitive behavioural therapy and childbirth psychotherapy)	• Intensive group therapy by obstetrician who had attended a 185-hour course of cognitive therapy, 40 hours in childbirth psychology and was qualified as a therapist in addition to several years' experience in treating women suffering from fear of childbirth. • Therapy comprised of provision of information and conversation regarding previous obstetric experiences, feelings and misconceptions. Appointments for the group therapy were based on routine obstetric check-ups to assure the normal course of pregnancy. All women allowed to phone for advice between sessions. Written information on the pros and cons of vaginal delivery and modes of pain relief was provided.
Sharifirad 2013	Prenatal education for husbands	• Husbands were divided into three 13- to 15-member groups; and each group participated in an educational session for 90 minutes. • Educational content was about mechanism of natural vaginal and caesarean deliveries as well as their advantages and disadvantages. • Various educational methods (lecture with picture slides, question, and answer) and educational tools (overhead, pamphlet, and white board) were used. No educational session was held for pregnant women. • The training was done by a 'MSc expert' in health education.
Shorten 2005	Decision-aid booklet	• Decision-aid booklet constructed using the Ottawa Decision Framework (O'Connor 1999) as a format, incorporating evidence-based information, explicit probability illustrations and values clarification exercises. • Presents risks and benefits in a format that encourages the user to make individual judgments about the information, according to personal values, needs and priorities. • Decision booklet given at 28 weeks gestation.
Valiani 2014	Childbirth training workshop	• The educational workshop was held in three, four-hour sequential weekly sessions in groups of 30 members separately. • Lecture method, questions and answers, role play, problem solving, and educational pamphlets were used to promote subjects' knowledge and group dynamicity, as well as to attain the highest participation of the subjects. • Educational content included issues on couples'

Table 4. Interventions targeted at women or families (*Continued*)

		communication, parental role, the role of the spouse in mother's selection of delivery mode, attendance of the spouse or a relative at delivery stages, childbirth fear, delivery pain, delivery mechanism, medicational pain relief techniques and their effects, non-medicational pain relief methods, advantages and disadvantages of CS and vaginal delivery, indications and contraindications of CS, haemorrhage and infection after every mode of delivery, postpartum sorrow and depression, mother-infant attachment, breast feeding, and infants' intelligence, growth, and development.
Wang 2014	PFMT with telephone follow-up	• PFMT course topics included the female pelvic anatomy, the function of the female pelvic floor muscles, causes of pelvic floor muscle dysfunction, and possible symptoms. Using a discussion teaching method, the nurse explained the influence of pregnancy and delivery on the function of the pelvic floor muscles, the benefits of controlling maternal and foetal body weight, and how to perform PFMT. Women were given guidance in the correct muscle contraction method by a pelvic floor physiotherapist while performing pelvic floor muscle strength measurements during the first antenatal examination. • Programme details: training could be conducted at any time of day in a standing, supine, or sitting position. The women were asked to empty the bladder and then contract the anal and vaginal muscles for no less than three seconds. The muscles were then relaxed. This contraction-relaxation sequence was repeated twice and followed by five rapid contractions of the perineal muscles. Women were instructed to repeat the exercises for 10 to 15 minutes, two to three times a day; alternatively, contraction of the perineal muscles could be conducted 150 to 200 times per day at any time. The women were told to gradually prolong the duration of each contraction and the total training time. If the women felt unwell during the training, they were instructed to immediately stop the contraction movements. • The test group was followed up by telephone every two weeks until six weeks postpartum; they were given a one-on-one consultation regarding any problems or questions that may have arisen during their home practice, and they were encouraged to persistently practice PFMT at home.

Table 4. Interventions targeted at women or families (*Continued*)

		• The PFMT course was delivered in one session instructed by one full-time health education nurse.

ACOG: American College of Obstetricians and Gynecologists; CS: caesarean section; PFMT: pelvic floor muscle training; SD: standard deviation; VBAC: vaginal birth after caesarean

Table 5. Effects of interventions targeted at women or families

Study	Quality assessment						Outcome	Intervention	Control	Effect (95% CI) or P value	Certainty (GRADE) *
	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations					
Bastani 2006	RT	Serious[a]	Single study	Not serious	Serious[b]	None	CS	8/52 (15.4%)	21/52 (40.4%)	RR 0.22 (0.11 to 0.43)	⨁⨁◯◯ **LOW**[a,b]
							Instrumental delivery (forceps and vacuum extraction)	11/52 (21.2%)	25/52 (48.1%)	RR 0.44 (0.24 to 0.80)	
Bergstrom 2009	RT	Not serious	Single study	Not serious	Serious[c]	None	Elective CS	29/484 (6.0%)	31/493 (6.3%)	RR 0.95 (0.58 to 1.56)	⨁⨁⨁◯ **MODERATE**[c]
							Emergency CS	67/484 (13.8%)	75/493 (15.2%)	RR 0.91 (0.67 to 1.23)	
							SVD	321/484 (66.3%)	327/493 (66.3%)	RR 1.00 (0.91 to 1.09)	
							Instrumental delivery	67/484 (13.8%)	60/493 (12.2%)	RR 1.14 (0.82 to 1.57)	
							Experience of child-	49.6 ± 26 (number	50.1 ± 25 (number	MD -0.5 (-3.2 to 4.1)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

							birth (W-DEQ B): mean (SD)	of participants unclear)	of participants unclear)		
Eden 2014	RT	Serious[a]	Single study	Not serious	Serious[b]	None	Decisional conflict (overall, women in third trimester)	Mean score: Baseline: 19.4 (12.7 to 26.1) Follow-up: 10.7 (5.6 to 15.9) n = 35	Mean score: Baseline: 16.5 (9.5 to 23.5) Follow-up: 14.1 (8.7 to 19.4) n = 32	MD: -0.32, P = 0.003	⊕⊖⊖⊖ **LOW**[a,b]
							VBAC	41% (number of events/ participants unclear)	37% (number of events/ participants unclear)	P = 0.72	
Feinberg 2015	RT	Serious[a]	Single study	Not serious	Serious[b]	None	CS	21% (n = 76) (number of events unclear)	40% (n = 71) (number of events unclear)	OR 0.36 (0.15 to 0.86)	⊕⊖⊖⊖ **LOW**[a,b]
							Maternity length of stay (days) (mean, SD)	3.11 ± 2.09 (n = 76)	3.36 ± 2.50 (n = 71)	MD -0.25 (-1.00 to 0.50)	
							Newborn length of stay (days) (mean, SD)	2.67 ± 1.04 (n = 76)	2.89 ± 1.17 (n = 71)	MD -0.22 (-0.58 to 0.14)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

Fenwick 2015	RT	Serious[a]	Single study	Serious[d]	Serious[b]	None	Overall CS	31/91 (34.1%)	39/93 (41.9%)	RR 0.81 (0.56 to 1.18)	⊕⊖⊖⊖ **VERY LOW** *a,b,c*
							Emergency CS	16/91 (17.6%)	23/91 (24.7%)	RR 0.70 (0.39 to 1.23)	
							SVD	44/91 (48.4%)	39/93 (41.9%)	RR 1.15 (0.84 to 1.59)	
							Forceps and vacuum delivery	16/91 (17.6%)	15/93 (16.1%)	RR 1.09 (0.57 to 2.07)	
							Nursery admission	16/91 (17.6%)	18/91 (19.4%)	RR 0.89 (0.48 to 1.63)	
							Maternal readmission	3/91 (3.3%)	5/91 (5.4%)	RR 0.60 (0.15 to 2.44)	
							Baby readmission	8/91 (8.8%)	6/91 (6.5%)	RR 1.33 (0.48 to 3.69)	
							Breastfeeding at 6 months	76/91 (83.5%)	73/91 (78.5%)	RR 1.04 (0.91 to 1.19)	
							Satisfaction with mode of birth	53/91 (58.2%)	61/91 (65.6%)	RR 0.87 (0.69 to 1.09)	
Fraser 1997	RT	Not serious	Single study	Not serious	Serious[b]	None	Overall CS	302/641 (47.1%)	324/634 (51.1%)	RR 0.92 (0.82 to 1.03)	⊕⊕⊖⊖ **MODERATE** *b*
							Scheduled CS	137/641 (21.4%)	150/634 (23.7%)	RR 0.90 (0.74 to 1.11)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

							Urgent CS	39/641 (6.1%)	44/634 (6.9%)	RR 0.88 (0.58 to 1.33)	
							VBAC	339/641 (53%)	310/634 (49%)	RR 1.08 (0.97 to 1.21)	
							Birth experience	Mean score, SD: 75.2 ± 20.7	Mean score, SD: 74.2 ± 21.8	P = 0.59	
							Maternal morbidity and neonatal outcomes	Rates of maternal morbidity and neonatal outcomes were similar in the study groups (maternal-uterine rupture or dehiscence, hysterectomy, blood transfusion; neonatal-perinatal deaths, Apgar score less than 7 at 5 minutes, admission to NICU)			
Masoumi 2016	RT	Not serious	Single study	Not serious	Serious[b]	None	CS	33/75 (44%)	32/75 (43.7%)	RR 1.03 (0.72 to 1.49)	⊕⊕⊖⊖ **MODERATE** [b]
							Physiologic birth	6/75 (8%)	0/75 (0%)	Not estimable	
							Normal vaginal birth	36/75 (48%)	43/75 (57%)	RR 0.84 (0.62 to 1.14)	
Montgomery 2007	RT	Not serious	Single study	Not serious	Serious[c]	None	Information group versus usual care group: elective CS	117/240 (48.8%)	118/238 (49.6%)	RR 0.98 (0.82 to 1.18)	⊕⊕⊖⊖ **MODERATE** [c]
							Decision analysis group ver-	97/235 (41.3%)	118/238 (49.6%)	RR 0.83 (0.68 to 1.02)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

							sus usual care group: elective CS				
							Information group versus usual care group: emergency CS	53/240 (22.1%)	48/238 (20.2%)	RR 1.09 (0.77 to 1.55)	
							Decision analysis group versus usual care group: emergency CS	50/235 (21.3%)	48/238 (20.2%)	RR 1.05 (0.74 to 1.50)	
							Decision analysis versus usual care group: vaginal birth	88/235 (37.5%)	72/238 (30.3%)	RR 1.24 (0.96 to 1.60)	
							Information group versus usual care group: vaginal birth	70/240 (29.2%)	72/238 (30.3%)	RR 0.96 (0.73 to 1.27)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

Navaee 2015	RT	Serious[a]	Single study	Not serious	Serious[b]	None	CS	13/35 (37.1%)	18/32 (56.2%)	RR 0.66 (0.39 to 1.12)	⊕⊕⊖⊖ **LOW**[a,b]
Rouhe 2013	RT	Serious[a]	Single study	Not serious	Serious[b]	None	Overall CS	30/131 (22.9%)	78/240 (32.5%)	RR 0.70 (0.49 to 1.01)	⊕⊕⊖⊖ **LOW**[a,b]
							Elective CS	14/131 (10.1%)	31/240 (12.9%)	RR 0.83 (0.46 to 1.50)	
							Emergency CS	16/131 (12.2%)	47/240 (19.6%)	RR 0.62 (0.37 to 1.06)	
							SVD	83/131 (63.4%)	114/240 (47.5%)	RR 1.33 (1.11 to 1.61)	
							Positive delivery experience, >75th percentile of the DSS	30/77 (36.1%)	31/124 (22.8%)	RR 1.56 (1.03 to 2.36)	
Saisto 2001	RT	Serious[a]	Single study	Not serious	Serious[b]	None	CS	37/85 (43.5%)	44/91 (48.4%)	RR 0.90 (0.65 to 1.24)	⊕⊕⊖⊖ **LOW**[a,b]
							CS for psychosocial reasons	20/85 (23.5%)	26/91 (28.6%)	RR 0.82 (0.50 to 1.36)	
							Satisfaction with childbirth (scale: from 1 to 5)	Mean score, SD: 3.7 ± 1.4	Mean score, SD: 4.0 ± 1.3	NS	

Table 5. Effects of interventions targeted at women or families (*Continued*)

Sharifirad 2013	RT	Serious[a]	Single study	Serious[d]	Serious[b]	None	CS	29.5% (n = 44) (number of events unclear)	50.0% (n = 44) (number of events unclear)	P < 0.05	⊕⊖⊖⊖ **VERY LOW** *a,b,c*
Shorten 2005	RT	Not serious	Single study	Not serious	Serious[b]	None	Elective repeat CS	Baseline: 29.6% Follow-up: 52.2% (n = 115)	Baseline: 23.2% Follow-up: 49.4% (n = 112)	Absolute change from baseline: 26.2% versus 22.6% Difference in absolute change from baseline: -3.6% (NS)	⊕⊕⊕⊖ **MODERATE** *b*
							Decisional conflict scores	Baseline: 2.34 Follow-up: 1.94 Change in score: -0.40 (-0.51 to -0.29); n = 99	Baseline: 2.26 Follow-up: 2.18 Change in score: -0.08 (-0.22 to 0.06); n = 88	P < 0.05	
							Satisfaction with birth experience (scale: 1 to 10)	Mean satisfaction rating: 7.70	Mean satisfaction rating: 7.90	NS	
Valiani 2014	RT	Serious[a]	Single study	Not serious	Serious[b]	None	Mothers alone versus control: CS	12/30 (40%)	22/30 (73.3%)	RR 0.55 (0.33 to 0.89)	⊕⊕⊖⊖ **LOW**[a,b]

Table 5. Effects of interventions targeted at women or families (*Continued*)

							Couple versus control: CS	13/30 (43.3%)	22/30 (73.3%)	RR 0.59 (0.37 to 0.94)	
							Mothers alone versus control: vaginal delivery	18/30 (60%)	8/30 (26.7%)	RR 2.25 (1.16 to 4.36)	
							Couple versus control: vaginal delivery	17/30 (56.7%)	8/30 (26.7%)	RR 2.13 (1.09 to 4.16)	
Wang 2014	RT	Serious[a]	Single study	Not serious	Serious[b]	None	Overall CS	16/35 (31.4%)	27/55 (49.1%)	RR 0.87 (0.37 to 2.04)	⊕⊕⊖⊖ **LOW**[a,b]
							Episiotomy	47.1% (number of events/ participants unclear)	47.3% (number of events/ participants unclear)	P = 0.35	
							Perineal laceration	7.8% (number of events/ participants unclear)	3.6% (number of events/ participants unclear)	P = 0.98	
							Couple versus control: CS	13/30 (43.3%)	22/30 (73.3%)	RR 0.59 (0.37 to 0.94)	
							Mothers alone versus control:	18/30 (60%)	8/30 (26.7%)	RR 2.25 (1.16 to 4.36)	

Table 5. Effects of interventions targeted at women or families (*Continued*)

							vaginal delivery				
							Couple versus control: vaginal delivery	17/30 (56.7%)	8/30 (26.7%)	RR 2.13 (1.09 to 4.16)	

About the certainty of the evidence (GRADE)*
High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.
Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.
Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.
Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.
*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'
†Substantially different = a large enough difference that it might affect a decision

DSS: delivery satisfaction scale; MD: mean difference; NICU: neonatal intensive care unit; NS: not significant; OR: odds ratio; RR: risk ratio; RT: randomised trial; SD: standard deviation; SVD: spontaneous vaginal delivery; VBAC: vaginal birth after cesarean; W-DEQ B Wijma Delivery Expectancy/Experience Questionnaire-Version B
[a] Downgraded one level for serious risk of bias (due to flaws in randomisation procedures)
[b] Downgraded one level for serious imprecision (due to small sample size and few events)
[c] Downgraded one level due to serious imprecision (95% CI includes appreciable benefit and harm)
[d] Downgraded one level for serious indirectness (follow-up analyses, not described in the trial report, indicated that the impact on caesarean sections was due to reduced birth complications arising from fetal position (e.g. breech birth) and labor progression)

Table 6. Interventions targeted at healthcare professionals

Study	Intervention	Details
Althabe 2004	Evidence-based guidelines plus mandatory second opinion	• Mandatory second opinion by attending physician before caesarean section. Physician providing second opinion had to be a person with clinical qualifications equal to or higher than the attending physician, working at the same hospital, selected by the obstetrics department for the trial and who agreed to follow the clinical guidelines. Guidelines were prepared as decision flowcharts for six primary indications for caesarean section.
Chaillet 2015	Evidence-based guidelines plus audit and feedback	• Implementation of evidence-based guidelines (onsite training in evidence-based clinical practice, facilitation by local opinion leader, supervision), audits of indications for caesarean delivery and

Table 6. Interventions targeted at healthcare professionals (*Continued*)

		provision of feedback to health professionals.
Hemminki 2008	Education of public health nurses on childbirth classes	• Further training of public health nurses to pay more attention to mode of delivery in childbirth classes and informational material given to pregnant women. • Intervention consisted of: a) joint educational session (1.5 to 2 hours) to all public health nurses in the maternal health clinic by experienced midwifery teacher using instructional conversation in small groups; b) leaflet on childbirth and preparation to give to pregnant women including discussion of content during childbirth classes and other visits from week 32 onwards; c) file of evidence-based research material on the same topics for each maternal health clinic; and d) a questionnaire to public health nurses on their opinions and knowledge of childbirth before each educational session.
Liang 2004	Peer review plus mandatory second opinion	• Peer review included pre-caesarean consultation and post-caesarean surveillance. Two physicians appointed as consultants for the pre-caesarean surveillance. Second opinion by a consultant required for all caesarean sections. Every caesarean case presented at weekly meetings by chief resident.
Lomas 1991	Audit and feedback plus local opinion leader education	• Audit and feedback group: a) agreed on criteria for use of caesarean section on women with previous caesarean sections based on guidelines; b) medical audits of the charts of all women with a previous caesarean section and comparison of actual practice with agreed criteria; and c) meetings of whole department every three months for feedback and discussion of the audit. • Local opinion leader group: a) four physicians identified as opinion leaders through a survey of 300 physicians attended a one and a half-day workshop on evidence for practice guidelines and principles of behaviour change; b) two mailings to colleagues with information on the practice guidelines, with a letter of support from the local opinion leader; opinion leader hosted a meeting with an expert speaker with knowledge and credibility in the area of vaginal birth after caesarean section and maintained formal and informal educational contacts, recording these in a log book. • Control group: mailed copy of practice guideline with exhortatory letter highlighting section on caesarean section portion of guideline, that the

Table 6. Interventions targeted at healthcare professionals (*Continued*)

		guideline was endorsed by the national obstetrical speciality society and a request to implement the recommendations.
Mohammadi 2012	Audit and feedback plus financial incentive	• Clinical audit and feedback; review of random sample of caesarean section patients for indication with financial incentive to practitioners who meet the criteria.
Poma 1998	Audit and feedback plus 24-hour in-house coverage by dedicated physician	• Implementation of labour management and caesarean delivery guidelines, with review of every caesarean delivery that did not meet guidelines and confidential individual feedback; 24-hour in-house coverage established (attending physician on premises to manage labour and complications); and attempts made to achieve the goal of an annual caesarean delivery rate of less than 15%.
Scarella 2011	Audit and feedback using the Robson classification (Robson 2001)	• Initial audit and feedback to the maternity and midwifery staff on main contributors to overall caesarean section rate using the Robson classification (examples of caesarean sections performed without clinical justification shown and discussed, emphasising the need to safely reduce the number of caesarean sections in the groups of interest). • Caesarean section rate audited monthly following initial meeting; feedback on change in caesarean section rates, by individual letters provided to all staff. • Medical-midwifery staff meetings held every three months; changes in caesarean section rate according to the Robson classification and rate of 5-minute Apgar scores below 7 presented, as aggregate data and also divided according to the different duty-day shift that rotates through the week, ranking them from worst to best according to their caesarean section rates in the groups of interest. A report of the caesarean section data also provided by letter to every maternity staff member.

Table 7. Effects of interventions targeted at healthcare professionals

Study	Quality assessment						Out-come	Intervention		Control		Effect	Cer-tainty (GRADE)
	De-sign	Risk of bias	Incon-sis-	Indi-rect-	Im-preci-	Other con-						Rela-	

Table 7. Effects of interventions targeted at healthcare professionals (*Continued*)

			tency	**ness**	**sion**	**sidera-tions**					**tive (95% CI [a]) or P value**	
Al-thabe 2004	RT	Not se-rious	Single study	Not se-rious	Not se-rious	None	All CS	Mean base-line rate (34,735 women): 26.3 Mean follow-up rate (35,675) : 24.7 Mean rate change: -1.6	Mean base-line rate (39,175 women): 24.6 Mean follow-up rate (39,638) : 24.9 Mean rate change: 0.3	Mean differ-ence in rate change: -1.9 (-3.8 to -0.1)	⊕⊕⊕⊕ **HIGH**
							Elec-tive CS	Mean base-line rate (34,735 women): 8.9 Mean follow-up rate (35,675): 9.1 Mean rate change: 0.1	Mean base-line rate (39,175 women): 9.1 Mean follow-up rate (39,638): 9.0 Mean rate change: -0.1	Mean differ-ence in rate change: 0.2 (-1.4 to 1.8)	
							Intra-partum CS	Mean base-line rate (34,735 women): 17.4 Mean follow-up rate (35,675) : 15.6 Mean rate change: -1.8	Mean base-line rate (39,175 women): 15.4 Mean follow-up rate (39,638) : 15.9 Mean rate change: 0.4	Mean differ-ence in rate change: -2.2 (-4.3 to -0.1)	
							Mater-nal mor-tality	Mean baseline rate per 10,000 livebirths (34,735 women) : 3.2 Mean follow-up rate per 10,000 livebirths (35,675 women) : 4.3	Mean baseline rate per 10,000 livebirths (39,175 women) : 5.9 Mean follow-up rate per 10,000 livebirths (39,638 women) : 7.5	Mean differ-ence in rate change: 0.66 (-0.4 to 5.3) (re-anal-ysed)	
							Neona-tal mor-	Mean base-line rate (34,735 women): 1.1 Mean follow-up	Mean base-line rate (39,175 women): 1.1 Mean fol-	Mean differ-ence in	

Table 7. Effects of interventions targeted at healthcare professionals (*Continued*)

							tality	rate per 10,000 livebirths (35 675 women) : 0.9	low-up rate (39, 638 women): 1.0	rate change (95% CI): -0.1 (-0.4 to 0.3)	
							Neonatal morbidity	NR	-	-	-
Chaillet 2015	Cluster-RT	Not serious	Single study	Not serious	Not serious	None	Overall CS	Baseline: 5484/24,388 (22.5%) Post-intervention: 5128/23,484 (21.8%)	Baseline: 6671/28,698 (23.2%) Post-intervention: 6767/28,781 (23.5%)	OR 0.90 (0.80 to 0.99)[b] RD -1.8% (-3.8 to -0.2)[b]	⊕⊕⊕⊕ **HIGH**
							Elective repeat caesarean section	Baseline: 1995/24,388 (8.2%) Post-intervention: 1931/23,484 (8.2%)	Baseline: 2404/28,698 (8.4%) Post-intervention: 2598/28,781 (9.0%)	RD -0.6%	
							Low risk group: CS	Baseline: 971/11478 (8.5%) Post-intervention: 763/10067 (7.6%)	Baseline: 1256/14717 (8.5%) Post-intervention: 1172/13019 (9.0%)	RD -1.7% (-3.0 to -0.3)	
Hemminki 2008	Cluster-RT	Serious[c]	Single study	Not serious	Serious[d]	None	CS	166/845 (19%)	116/723 (16%)	OR 1.29 (0.99 to 1.67)	⊕⊕⊖⊖ **LOW**[c,d]
Liang 2004	ITS	Serious[e]	Single study	Not serious	Not serious	None	CS	Change in level of total caesarean deliveries at 12 months[f]: -2.4% (-11.4% to 6.7%) Change in slope[f]: 1.34% (-2.5% to 5.2%)			⊕⊖⊖⊖ **VERY LOW**[e]
Lomas 1991	Cluster-RT	Not serious	Single study	Not serious	Not serious	None		Audit and feedback	Opinion leader education	Control	⊕⊕⊕⊕ **HIGH**

Table 7. Effects of interventions targeted at healthcare professionals (*Continued*)

							Elective CS	69.7% (62.4 to 77.0%)	53.7% (46.5 to 61.0%)	66.8% (61.7 to 72.0%)	
							Unscheduled CS	18.6% (13.9 to 23.2%	21.4% (16.8 to 26.1%)	18.7% (15.4 to 22.1%)	
							Trial of labour rates (%)	21.4% (13.9 to 29.0%)	38.2% (30.6 to 45.7%)	28.3% (23.0 to 33.7%)	
							Vaginal births (%)	11.8% (5.8 to 17.7%)	25.3% (19.3 to 31.2%)	14.5% (10.3 to 18.7%)	
							Low Apgar score < 7 at 5 mins (%)	5.9 (4.2 to 7.6)	0.9 (0.0 to 2.6)	1.2 (0.0 to 2.4)	
							Duration of hospital stay (%)	< 6 days: 27.9 6 days: 29.9 > 6 days: 42.2	< 6 days: 46.6 6 days: 31.4 > 6 days: 22.0	< 6 days: 32.2 6 days: 31.1 > 6 days: 36.7	
Mohammadi 2012	CBA (re-analysed as ITS)	Serious [e]	Single study	Not serious	Not serious	None	CS	Change in level of caesarean deliveries during the intervention: -14.6% (-24.4% to -4.8%), P = 0.02 Change in slope -0.07% (-1.5% to 1.3%), NS			⊕⊖⊖⊖ **VERY LOW**[e]
Poma 1998	ITS	Serious [e]	Single study	Not serious	Not serious	None	CS	Change in level of total caesarean deliveries (primary and repeat caesarean sections) at 24 months: -6.6% (-10.1 to -3.2); change in slope: -0.11% (-0.25 to 0.02) (data reanalysed)			⊕⊖⊖⊖ **VERY LOW**[e]

Table 7. Effects of interventions targeted at healthcare professionals (*Continued*)

Scarella 2011	ITS	Serious [e]	Single study	Not serious	Not serious	None	CS	Change in level of caesarean deliveries during intervention: -11% (-23.2 to 1.2%), NS Change in slope: -1.1% (-6.4 to 4.2%), NS Change in level of caesarean deliveries in the immediate post-intervention period compared with the intervention period: 8.6% (2.1 to 15.2%), P = 0.022 Change in slope: -0.3% (-1.6 to 0.9%), NS	⊕⊖⊖⊖ **VERY LOW**[e]

About the certainty of the evidence (GRADE)*
High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different[†] is low.
Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different[†] is moderate.
Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different[†] is high.
Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different[†] is very high.
*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'
[†]Substantially different = a large enough difference that it might affect a decision

CBA: controlled before-after study; CS: caesarean section; ITS: interrupted time series; NR: not reported; NS: not significant; OR: odds ratio; RD: risk difference; RR: risk ratio; RT: randomised trial
[a]Numbers in parentheses are 95% confidence limits.
[b]Downgraded one level for serious imprecision (confidence interval includes null effects)
[c]Adjusted in between-group comparison of the change from the preintervention period to the post-intervention period (adjusted for hospital and patient characteristics)
[d]Downgraded one level for serious risk of bias (pilot study with no sample size calculation; unit of analysis error)
[e]Downgraded one level for possible confounding (unclear whether the intervention occurred independently of other changes over time)
[f]Two standardised effect sizes are obtained from ITS analysis: change in level (also called 'step change') and change in trend (also called 'change in slope') before and after the intervention. Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in caesarean section rate

Table 8. Interventions targeted at healthcare organisations or facilities

Study	Intervention	Details
Financial interventions targeted at healthcare professionals		
Keeler 1996	Equalising physician fees for vaginal and caesarean section delivery	Revision to fee schedule for obstetric and other procedures including equalising the fees for vaginal and caesarean sections
Lo 2008	• Increase physician fees for VBAC fee to the same level as caesarean section • Increase in vaginal birth physician fees to that of	National Health Insurance Taiwan equalised the fee for VBAC to that of a caesarean in April 2003. In May 2005, the fee for vaginal birth was raised to the equivalent of

Table 8. Interventions targeted at healthcare organisations or facilities (*Continued*)

	caesarean section	that of a caesarean section
Staffing model interventions		
Rosenstein 2015	Expanded access to collaborative 24-hour midwifery-labourist care model	Expansion of a labourist model that includes 24-hour in-hospital midwifery coverage to privately insured patients ('labourist', generally designates an obstetrician who provides in-house labour and delivery coverage without competing clinical duties) One midwife and one labourist present in-house, 24 hours a day, working collaboratively to provide primary labour management for all private and public patients
Srinivas 2016	Labourist model of obstetric care	Labourist model of obstetric care: presence of a labour and delivery provider for a set period of time, whose sole focus is on the labour and delivery unit without other competing clinical duties. The labourist model was based on the internal medicine hospitalist model where physicians spend > 25% of their time caring for inpatients

VBAC: vaginal birth after caesarean

Table 9. Effects of interventions targeted at healthcare organisations or facilities

Study	Quality assessment						Outcome	Intervention	Control	Relative effect (95% CI)	Certainty (GRADE)
	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations					
Effects of financial strategies targeted at healthcare professionals											
Keeler 1996	ITS	Serious[a]	Single study	Not serious	Not serious	None	CS	CS rates for non-breech deliveries decreased by 1.2% (22.5% before reform versus 21.3% after reform)			⊕⊖⊖⊖ **VERY LOW**[a]
Lo 2008	ITS	Serious[a]	Single study	Not serious	Not serious	None	CS	The change in the level of total CS rates following the rise in VBAC fees was -1.68 (95% CI -2.3 to -1.07); the change in slope was -0.004 (95% CI -0.05 to 0.04)[b] The change in the level of total			⊕⊖⊖⊖ **VERY LOW**[a]

Table 9. Effects of interventions targeted at healthcare organisations or facilities (*Continued*)

								CS rates (for all indications and order of birth) following the rise in vaginal birth fees was 1.19 (95% CI -0.01 to 2.40) and the change in slope was -0.43 (95% CI -0.78 to -0.09)[b]			
Effects of different staffing models of care											
Rosenstein 2015	Cohort (with ITS analysis)	Not serious	Single study	Not serious	Not serious	None	Primary CS	Before expansion: 381/1201 (31.7%)	After expansion: 130/521 (25.0%)	OR 0.56 (0.39 to 0.81)	⊕⊕◯◯ **LOW**[c]
							VBAC	Before expansion: 60/452 (13.3%)	After expansion: 52/232 (22.4%)	OR 2.03 (1.08 to 3.80)	
Srinivas 2016	CBA	Not serious	Single study	Not serious	Not serious	None	CS	Labourist before, % (N): 32.6 (47,206) Labourist after, % (N): 33.6 (35,210)	Non-labourist before, % (N): 28.5 (46,486) Non-labourist after, % (N): 31.8 (42,348)	OR 1.02 (0.97 to 1.1)	◯◯◯◯ **LOW**[c]
								Labourist before, % (N): 3.8 (5549) Labourist after, % (N): 3.5 (3814)	Non-labourist before, % (N): 6.2 (10,018) Non-labourist before, % (N): 4.8 (6339)	OR 1.07 (0.88 to 1.30)	

Table 9. Effects of interventions targeted at healthcare organisations or facilities (*Continued*)

							Low Apgar (less than 7) at 5 minutes	Labourist before, % (N): 0.2 (216) Labourist after, % (N): 0.2 (223)	Non-labourist before, % (N): 0.4 (557) Non-labourist after, % (N): 0.4 (476)	OR 1.09 (0.69 to 1.72)
							Birth asphyxia	Labourist before, % (N): 0.2 (310) Labourist after, % (N): 0.2 (171)	Non-labourist before, % (N): 0.3 (398) Non-labourist after, % (N): 0.2 (247)	OR 0.75 (0.48 to 1.18)
							Maternal prolonged length of stay	Labourist before, % (N): 21.4 (31,002) Labourist after, % (N): 21.5 (22,512)	Non-labourist before, % (N): 24.2 (39,354) Non-labourist after, % (N): 26.2 (34,876)	OR 0.99 (0.87 to 1.14)

About the certainty of the evidence (GRADE)*

High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.

Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.

Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.

Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.

*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'

†Substantially different = a large enough difference that it might affect a decision

Table 9. Effects of interventions targeted at healthcare organisations or facilities (*Continued*)

CBA: controlled before-after; CS: caesarean section; CI: confidence interval; ITS: interrupted time series; OR: odds ratio; VBAC: vaginal birth after caesarean

[a] Downgraded one level for serious risk of bias (due to possible confounding of outcome, unclear whether the intervention occurred independently of other changes over time)

[b] Two standardised effect sizes are obtained from ITS analysis: a change in level (also called 'step change') and a change in trend (also called 'change in slope') before and after the intervention. Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in CS rate

[c] Observational study which start at low certainty evidence according to GRADE (we did not downgrade or upgrade the certainty of evidence)

Table 10. 'Cross-cutting' interventions

Study	Intervention	Details
Ayres-De-Campos 2015	Transmission of information and training of healthcare professionals, together with the inclusion of CS rates as a criterion for hospital funding	Concerted action to reduce CS • Regional CS committee visited all state-owned hospitals with CS rates above 35% and held meetings with the obstetric and midwifery staff to present data on international CS rates, individual hospital comparisons, risks associated with CS, financial aspects related with CS, and to share proposed measures to decrease CS rates. Some of these measures required local implementation, such as avoidance of labour inductions without a health indication before 41 weeks of gestation; promotion of vaginal birth after caesarean; implementation of external cephalic version; and conduction of regular CS audits. • Courses on intrapartum foetal monitoring and simulation-based training of obstetric emergencies were organised in 2010 and 2011, and made available free of charge to healthcare professionals in state-owned hospitals. • From 2010 onwards, an important percentage of hospital funding was indexed to the annual CS rate, and individual targets were negotiated with each state-owned hospital.
Runmei 2012	Continuous quality improvement programme (educational programme for hospital staff and women, auditing surgeon practices, public health education, monitoring caesarean section rates and neonatal outcomes)	Continuous quality improvement programme Stage 1: January 2005 to December 2006 • Educational programme for hospital staff • Discouragement of unnecessary caesarean deliveries by: ○ depriving surgeons of potential financial incentives for cesarean deliveries ○ reviewing indications for caesarean

Table 10. 'Cross-cutting' interventions (*Continued*)

		deliveries performed every day ○ implementing international guidelines on caesarean delivery (e.g. those of the American or the Royal College of Obstetricians and Gynaecologists) ○ improving labour monitoring and assessment • Active promotion of public health education on the advantages of natural delivery and the risks associated with caesarean deliveries among pregnant women, both through antenatal school and the public media Stage 2 (January to June 2007) • Monitoring of risk-adjusted cesarean section rates Stage 3 (Jan 2005-Dec 2011) • Monitoring of neonatal outcomes

CS: caesarean section

Table 11. Effects of 'cross-cutting' interventions

Study	Quality assessment						Outcome	No of participants		Relative effect (95% CI) or P value	Certainty (GRADE)
	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other Considerations		Intervention	Control		
Ayres-De-Campos 2015	ITS	Serious[a]	Single study	Not serious	Not serious	None	In the period between 2009 and 2014, representing the possible influence of the concerted action: the CS rate in the study region decreased by 20.0% (from 36.0 to 28.8%, time trend P < 0.001)[b]; rates of instrumental vaginal delivery increased by 33.1% (from 13.7 to 18.2%, time trend P < 0.001), VBAC increased by 99.8% (from 16.4 to 32.8%, time trend P < 0.001), while perineal lacerations increased by 45.2% (from 0.42 to 0.61%, time trend P < 0.001)[b]; the incidence of hypoxia-related complications decreased by 14.1% (from 0.71 to 0.61%, time trend P < 0.001)[b]				⊕⊖⊖⊖ **VERY LOW**[a]
Runmei 2012	CBA (reanalysed as	Serious[a]	Single study	Not serious	Not serious	None	CS	Change in level of caesarean deliveries during intervention: -			⊕⊖⊖⊖ **VERY**

Table 11. Effects of 'cross-cutting' interventions (*Continued*)

	ITS)							13.4% (95% CI -19.6% to -7.1%)[b]; change in slope of caesarean deliveries: -0.72% (95% CI -3% to 1.5%)[b]	**LOW**[a]
							Maternal morbidity	"We found a significant increase in the incidence of all obstetric complications, with the exception of placental abruption, after 2004..."	
							Neonatal morbidity	"The incidence of birth asphyxia did not increase after 2004 (P = 0.303)"	

About the certainty of the evidence (GRADE)*
High: this research provides a very good indication of the likely effect; the likelihood that the effect will be substantially different† is low.
Moderate: this research provides a good indication of the likely effect; the likelihood that the effect will be substantially different† is moderate.
Low: this research provides some indication of the likely effect; however, the likelihood that it will be substantially different† is high.
Very low: this research does not provide a reliable indication of the likely effect; the likelihood that the effect will be substantially different† is very high.
*This is sometimes referred to as 'quality of evidence' or 'confidence in the estimate'
†Substantially different = a large enough difference that it might affect a decision

CBA: controlled before-after; CI: confidence interval; CS: caesarean section; ITS: interrupted time series; VBAC: vaginal birth after caesarean
[a] Downgraded one level for serious risk of bias (due to possible confounding of outcome, unclear whether the intervention occurred independently of other changes over time)
[b] Two standardised effect sizes are obtained from interrupted time series analysis: a change in level (also called 'step change') and a change in trend (also called 'change in slope') before and after the intervention
Change in level = difference between the observed level at the first intervention time point and that predicted by the pre-intervention time trend; change in trend = difference between post- and pre-intervention slopes. A negative change in level and slope indicates a reduction in caesarean section rate

Table 12. Related systematic reviews

Boatin 2018 assessed the effect of audit and feedback using the Robson classification to reduce caesarean section rates. Studies (any design) that used the Robson classification within clinical audit cycles (including but not limited to strategies using audit and feedback) either alone or in multifaceted interventions to reduce caesarean section rate were eligible for inclusion. Six studies were included. All the studies used prospective uncontrolled before-after designs and none accounted for confounding, blinding or intervention integrity (i.e. the degree to which the participants received the intervention, and consistency of the intervention). All six studies reported reductions in caesarean section rates. The authors noted that the results should be interpreted with caution because of limited methodological quality of the included studies
Catling-Paull 2011a assessed the effect of non-clinical interventions intended to increase the uptake or the success rates of VBAC, or both. Twenty-seven studies were included in the review (five randomised trials, one prospective cohort study, nine retrospective cohort studies, one case-control study and 11 before-after studies). The findings showed that national guidelines influence VBAC rates, but a greater effect is seen when institutions develop local guidelines, adopt a conservative approach to caesarean section, use opinion leaders, give individualised information to women, and give feedback to obstetricians about mode of birth rates
Chaillet 2007 assessed the effectiveness of interventions intended to reduce cesarean section rate. Ten studies were included in the review (three randomised trials, two cluster-randomised trials and five interrupted time series studies). Audit and feedback, quality improvement, and multifaceted strategies were found to be effective for reducing the cesarean section rate
Long 2016 assessed the effect of OMBUs embedded within hospitals which provide comprehensive emergency obstetric and newborn care. Three randomised trials, one controlled before-after study and six cohort studies were included in the review. Three cohort studies (one each from UK, China and Nepal) found more spontaneous vaginal deliveries, fewer caesarean sections and fewer episiotomies performed in OMBUs compared to standard obstetric units. There were no differences in these outcomes in randomised trials and the remaining cohorts. There were no or very few maternal and perinatal deaths in either OMBUs or standard obstetric units. One study reported higher satisfaction with midwife-led birth care among women and midwives in the OMBUs
Lundgren 2015 assessed the effect of clinician-centred interventions designed to increase the rate of VBAC. Three randomised trials were included in the review. The use of external peer review, audit and feedback had no effect on VBAC rates. An educational strategy delivered by an opinion leader increased VBAC rates
Nilsson 2015 assessed the effectiveness of women-centred interventions during pregnancy and birth to increase rates of VBAC. Randomised trials or cluster randomised trials were eligible for inclusion. Three trials were included in the review. Two studies evaluated the effectiveness of decision aids for mode of birth and one evaluated the effectiveness of an antenatal education programme. The findings show that neither the use of decision aids nor information/education of women have a significant effect on VBAC rates

OMBU: onsite midwife-led birth units; VBAC: vaginal birth after caesarean.

Table 13. Recommendations for future research

Further research should focus on the following areas	
Population	Pregnant women who may be at risk of delivering by caesarean section without a medical indication or need • Low-risk group of women (Robson Groups 1 to 4; Robson 2001) • Women with a previous caesarean section (Robson Group 5)
Settings	• All areas with high or increasing caesarean section rates • All settings where women receive maternity or delivery care (community, home, clinics, hospitals, birth centres)
Study designs	• Pragmatic randomised trials or cluster-randomised trials (involving clusters of practices, hospitals, birth centres, labour units). Where these are not feasible, interrupted time series designs should be used

Table 13. Recommendations for future research (*Continued*)

	• Studies should be sufficiently powered (include adequate sample sizes) for primary and secondary outcomes • Include sufficient sample sizes to allow assessment of intervention effect by factors such as parity, socioeconomic status, staffing patterns, practice setting (private versus public), geographical region (urban versus rural), among others. • Multisite studies are encouraged to increase sample size and generalisability • Studies should be preceded with formative research to define main determinants of caesarean births
Interventions	Multifaceted (rather than single-component) interventions tailored to local determinants (facilitators) of caesarean section practices are recommended **The certainty of evidence for caesarean section rate was low to very low for the following interventions. Further studies are needed to address the uncertainty in the effect of these interventions** Educational interventions targeted at women or families • Education, birth preparation classes and support programmes • Psychoeducation by telephone • Prenatal education for husbands of pregnant women • Different formats of educational interventions (decision support tools) Interventions targeted at healthcare professionals • Audit and feedback using the Robson classification (Robson 2001) • Education of public health nurses on childbirth classes (Hemminki 2008). Interventions targeted at healthcare organisations or facilities • Insurance reforms equalising physician fees for vaginal and caesarean deliveries • Collaborative midwifery-labourist model of care **Although not specifically designed to reduce caesarean births, the following interventions examined in related reviews showed benefits in reducing caesarean births and improving other birth outcomes (further studies are required to confirm observed benefits in areas with high caesarean section rates)** • Continuous one-to-one intrapartum support (by nurse-midwives, lay companion and doulas) • Midwifery care versus other care models (such as obstetric care) **We did not identify any eligible studies on the following prespecified interventions (outlined in Table 1); studies evaluating the effects of these interventions are needed.** Use of opinion leaders • Dissemination of information or advocacy with support or campaigns from local or international opinion leaders (role models, leadership persons, public celebrities) Public dissemination of caesarean section rates • Informing the public about caesarean section rates by releasing performance data (e.g. for individual physicians or hospitals) in written or electronic form

Table 13. Recommendations for future research (*Continued*)

	Financial strategies for healthcare professionals or organisations • Pay for performance (target payments) • Payment for 24-hour shifts (not for number of procedures) • Additional payment if caesarean section rate during shifts is maintained below a predefined threshold Goal setting for caesarean section rates • Setting specific predetermined goal for caesarean rate Policies that limit financial/legal liability in case of litigation of healthcare professionals or organisations (tort reforms) Changing the physical or sensory environment of labour and delivery • Adding or altering equipment or layout • Place of birth (planned home versus hospital births) Strategies to change the organisational culture • Strategies include various components of organisational culture, e.g. shared values, behaviours, norms, traditions, sense-making, which may shape or contribute, or both, to the overall environment of an organisation
Outcomes	• Limited data were available from the included studies on maternal mortality and morbidity, neonatal mortality and morbidity, resource use and costs. Future studies should address these outcomes to aid assessment of the desirable and undesirable effects of unnecessary caesarean sections. • Studies should address both short-term and long-term maternal and neonatal outcomes.
Methodological considerations	Classification of caesarean section • The included studies measured and reported caesarean sections in different ways (overall, elective, emergency, intrapartum). This made synthesis and interpretation of findings across studies difficult. A unified system for classifying and reporting caesarean sections would be useful. Taxonomy of caesarean section interventions • Given the broad range of interventions intended to reduce caesarean sections (targeting women, community, public, healthcare professionals, healthcare organisations, facilities and systems), there is a need to develop a comprehensive typology of these interventions. This would aid identification, categorisation, comparison and synthesis in systematic reviews and related research. Reporting interventions • Studies should fully describe components of interventions (including standard care) to help implementation and replication. Use of the Template for Intervention Description and Replication (TIDieR) checklist is recommended (Hoffmann 2014).

APPENDICES

Appendix 1. Search strategies (March 2018)

MEDLINE (OVID)

Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily, Ovid MEDLINE and Versions(R) <1946 to 7 March 2018>

No.	Search terms	Results
1	exp cesarean section/	40707
2	((caesarean or cesarean) adj2 (section? or birth? or deliver* or surgery)).ti,ab,kf	51101
3	c-section?.ti,ab,kf.	1033
4	natural childbirth/	2330
5	(natural adj (birth or childbirth)).ti,ab,kf.	599
6	((operative or surgical) adj (birth* or deliver*)).ti,ab,kf.	1790
7	(unnecessary cesarean* or unnecessary caesarean*).ti,ab,kf.	136
8	or/1-7	67346
9	patient education as topic/	78996
10	decision making/	82374
11	exp clinical audit/	21032
12	exp education, professional/	273591
13	((caesarean or cesarean) adj5 rate?).ti,ab,kf.	6689
14	CS rate?.ti,ab,kf.	405
15	(decision adj2 (aid? or tool?)).ti,ab,kf.	7433
16	(audit? or feedback or fed back).ti,ab,kf.	145940
17	opinion leader?.ti,ab,kf.	1182
18	second opinion?.ti,ab,kf.	1782
19	((midwife* or midwive*) adj2 (led or lead* or intervention* or manag*)).ti,ab,kf	848

(*Continued*)

20	((educat* or teach* or learn*) adj5 (pregnan* or women or woman or mother* or father* or husband* or parent* or physician* or midwife* or midwive* or nurs* or obstetric* or program* or intervention* or workshop*)).ti,ab,kf	175663
21	((antenatal or birth* or childbirth) adj (program* or lesson* or class* or educat*)).ti,ab,kf	1380
22	psychoeducation.ti,ab,kf.	2188
23	or/9-22	704026
24	8 and 23	8934
25	randomized controlled trial.pt.	455307
26	controlled clinical trial.pt.	92216
27	multicenter study.pt.	229741
28	pragmatic clinical trial.pt.	690
29	(randomis* or randomiz* or randomly).ti,ab.	758637
30	groups.ab.	1769815
31	(trial or multicenter or multi center or multicentre or multi centre).ti	211228
32	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab	8329902
33	non-randomized controlled trials as topic/	293
34	interrupted time series analysis/	388
35	controlled before-after studies/	305
36	or/25-35	9300000
37	exp animals/	21359264
38	humans/	16926842

(*Continued*)

39	37 not (37 and 38)	4432422
40	review.pt.	2351394
41	meta analysis.pt.	85606
42	news.pt.	186291
43	comment.pt.	707682
44	editorial.pt.	452023
45	cochrane database of systematic reviews.jn.	13470
46	comment on.cm.	707679
47	(systematic review or literature review).ti.	107442
48	or/39-47	7827358
49	36 not 48	6500762
50	24 and 49	4681
51	(2010* or 2011* or 2012* or 2013* or 2014* or 2015* or 2016* or 2017* or 2018*).dt,dp,ed,ep,yr	9397266
52	50 and 51	2247

Embase (OVID)

Embase <1974 to 2018 March 7>

No.	Search terms	Results
1	exp *cesarean section/	27445
2	((caesarean or cesarean) adj2 (section? or birth? or deliver* or surgery)).ti,ab,kw	69574
3	c-section?.ti,ab,kw.	2676
4	*natural childbirth/	1481
5	(natural adj (birth or childbirth)).ti,ab,kw.	585

(*Continued*)

6	(unnecessary cesarean* or unnecessary caesarean*).ti,ab,kw.	171
7	((operative or surgical) adj (birth* or deliver*)).ti,ab,kw.	2589
8	or/1-7	78200
9	*patient education/	27239
10	*shared decision making/	783
11	*patient decision making/	1805
12	exp *decision support system/	9529
13	*clinical audit/	516
14	*vocational education/	4615
15	*continuing education/	8940
16	*education program/	9465
17	*in service training/	6606
18	*medical education/	104893
19	*childbirth education/	118
20	((caesarean or cesarean) adj5 rate?).ti,ab,kw.	9705
21	CS rate?.ti,ab,kw.	806
22	(decision adj2 (aid? or tool?)).ti,ab,kw.	10568
23	(audit? or feedback or fed back).ti,ab,kw.	206003
24	opinion leader?.ti,ab,kw.	1605
25	second opinion?.ti,ab,kw.	2822
26	((midwife* or midwive*) adj2 (led or lead* or intervention* or manag*)).ti,ab,kw	1036
27	((educat* or teach* or learn*) adj5 (pregnan* or women or woman or mother* or father* or husband* or parent* or physician* or midwife* or midwive* or nurs* or obstetric* or program* or intervention* or workshop*)).ti,ab,kw	215925

(*Continued*)

28	((antenatal or birth* or childbirth) adj (program* or lesson* or class* or educat*)).ti,ab,kw	1334
29	psychoeducation.ti,ab,kw.	3573
30	or/9-29	580458
31	8 and 30	12104
32	randomized controlled trial/	490387
33	controlled clinical trial/	455867
34	quasi experimental study/	4309
35	pretest posttest control group design/	330
36	time series analysis/	20321
37	experimental design/	15194
38	multicenter study/	177380
39	(randomis* or randomiz* or randomly).ti,ab.	1044802
40	groups.ab.	2397974
41	(trial or multicentre or multicenter or multi centre or multi center).ti	293432
42	(intervention? or effect? or impact? or controlled or control group? or (before adj5 after) or (pre adj5 post) or ((pretest or pre test) and (posttest or post test)) or quasiexperiment* or quasi experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or time series or time point? or repeated measur*).ti,ab	10604676
43	or/32-42	11829255
44	(systematic review or literature review).ti.	126655
45	"cochrane database of systematic reviews".jn.	11656
46	exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/	25647687
47	human/ or normal human/ or human cell/	19376788

(*Continued*)

48	46 not (46 and 47)	6318930
49	44 or 45 or 48	6456024
50	43 not 49	9017948
51	31 and 50	7507
52	limit 51 to yr="2014 -Current"	2630

The Cochrane Library (Wiley)

No.	Search terms	Results
#1	[mh "cesarean section"]	2950
#2	((caesarean or cesarean) near/2 (section? or birth? or deliver* or surgery)):ti,ab	3174
#3	c-section?:ti,ab	12
#4	[mh "natural childbirth"]	34
#5	(natural next (birth or childbirth)):ti,ab	23
#6	((operative or surgical) next (birth* or deliver*)):ti,ab	249
#7	(unnecessary next cesarean* or unnecessary next caesarean*):ti,ab	12
#8	{or #1-#7}	5068
#9	[mh "patient education as topic"]	8530
#10	[mh "decision making"]	3940
#11	[mh "clinical audit"]	356
#12	[mh "education, professional"]	4356
#13	((caesarean or cesarean) near/5 rate?):ti,ab	397
#14	(CS next rate?):ti,ab	19

(*Continued*)

#15	(decision near/2 (aid? or tool?)):ti,ab	455
#16	(audit? or feedback or fed back):ti,ab	8865
#17	(opinion next leader?):ti,ab	125
#18	(second next opinion?):ti,ab	11
#19	((midwife* or midwive*) near/2 (led or lead* or intervention* or manag*)):ti,ab	131
#20	((educat* or teach* or learn*) near/5 (pregnan* or women or woman or mother* or father* or husband* or parent* or physician* or midwife* or midwive* or nurs* or obstetric* or program* or intervention* or workshop*)):ti,ab	19774
#21	((antenatal or birth* or childbirth) next (program* or lesson* or class* or educat*)):ti,ab	133
#22	psychoeducation:ti,ab	906
#23	{or #9-#22}	40779
#24	#8 and #23	420
#25	#8 and #23 Publication Year from 2014 to 2018	154

Cinahl (EBSCO)

No.	Search terms	Results
S1	(MH "Cesarean Section+")	9,860
S2	((caesarean or cesarean) N2 (section? or birth? or deliver* or surgery))	5,413
S3	c-section	334
S4	(natural N0 (birth or childbirth))	212
S5	((operative or surgical) N0 (birth* or deliver*))	378
S6	(unnecessary cesarean* or unnecessary caesarean*)	53

(*Continued*)

S7	(MH "Prepared Childbirth")	631
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	12,977
S9	(MH "Patient Education")	44,761
S10	(MH "Childbirth Education")	1,934
S11	(MH "Childbirth Educators")	420
S12	(MH "Decision Making")	24,928
S13	(MH "Decision Making, Patient")	11,466
S14	(MH "Decision Support Techniques")	2,550
S15	(MH "Audit")	10,726
S16	(MH "Psychoeducation")	1,990
S17	(MH "Education, Clinical")	9,012
S18	MH "Education, Continuing")	7,685
S19	((caesarean or cesarean) N5 rate?)	1,090
S20	CS rate?	97
S21	(decision N2 (aid? or tool?))	1,043
S22	(audit? or feedback or fed back)	21,596
S23	(opinion leader?)	343
S24	(second opinion?)	141
S25	((midwife* or midwive*) N2 (led or lead* or intervention* or manag*))	1,170
S26	((educat* or teach* or learn*) N5 (pregnan* or women or woman or mother* or father* or husband* or parent* or physician* or midwife* or midwive* or nurs* or obstetric* or program* or intervention* or workshop*))	159,310
S27	((antenatal or birth* or childbirth) N0 (program* or lesson* or class* or educat*))	2,897

(*Continued*)

S28	psychoeducation	2,356
S29	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28	274,020
S30	S8 AND S29	2,191
S31	PT randomized controlled trial	42,986
S32	PT clinical trial	55,844
S33	PT research	1,186,187
S34	(MH "Randomized Controlled Trials")	40,140
S35	(MH "Clinical Trials")	92,783
S36	(MH "Intervention Trials")	6,880
S37	(MH "Nonrandomized Trials")	253
S38	(MH "Experimental Studies")	17,663
S39	(MH "Pretest-Posttest Design+")	30,750
S40	(MH "Quasi-Experimental Studies+")	10,272
S41	(MH "Multicenter Studies")	34,631
S42	(MH "Health Services Research")	8,010
S43	TI (randomis* or randomiz* or randomly) OR AB (randomis* or randomiz* or randomly)	140,270
S44	TI (trial or effect* or impact* or intervention* or before N5 after or pre N5 post or ((pretest or "pre test") and (posttest or "post test")) or quasiexperiment* or quasi W0 experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or "time series" or time W0 point* or repeated W0 measur*) OR AB (trial or effect* or impact* or intervention* or before N5 after or pre N5 post or ((pretest or "pre test") and (posttest or "post test")) or quasiexperiment* or quasi W0 experiment* or pseudo experiment* or pseudoexperiment* or evaluat* or "time series" or time W0 point* or repeated W0 measur*)	961,623
S45	S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44	1,568,152

(*Continued*)

S46	S30 AND S45	1,426
S47	S46 Limiters - Exclude MEDLINE records	418
S48	S47 Limiters - Published Date: 20140101-20181231	239

ClinicalTrials.gov

Search terms	Results
"caesarean section" OR "caesarean birth" OR "caesarean delivery" OR "cesarean section" OR "cesarean birth" OR "cesarean delivery" Interventional Studies	229

WHO International Clinical Trials Registry Platform (ICTRP)

Search terms	Results
caesarean or cesarean	1972

Appendix 2. Search strategies (August 2014)

MEDLINE (OVID) (In-Process & Other Non-Indexed Citations) (search date: 6 August 2014)

1 exp Cesarean Section/ (0)
2 ((caesarean or cesarean) adj2 (section? or birth? or deliver$)).ti,ab. (3115)
3 c-section?.ti,ab. (60)
4 or/1-3 (3151)
5 exp *education, continuing/ or *pamphlets/ or *advance directives/ or *reminder systems/ or *feedback/ (0)
6 (education$ adj2 (program$ or intervention? or meeting? or session? or strateg$ or workshop? or visit?)).tw. (3881)
7 (leaflet? or booklet? or poster?).tw. (2015)
8 ((written or printed or oral) adj information).tw. (103)
9 (information$ adj2 campaign).tw. (16)
10 (education$ adj1 (method? or material?)).tw. (406)
11 (outreach or facilitator? or "academic detailing" or "consensus conference?" or algorithm? feedback or marketing).tw. (3426)
12 ((opinion or education$ or influential) adj1 leader?).tw. (98)
13 ((reminder? or recall) adj2 system?).ti,ab. (61)
14 (prompter? or prompting).tw. (485)
15 (chart adj2 review$).ti,ab. (2255)
16 ((effect? or impact or record? or chart?) adj2 audit).tw. (79)

17 or/5-16 (12411)
18 exp *reimbursement mechanisms/ or *capitation fee/ or *"deductibles and coinsurance"/ or *hospital charges/ or *Medicaid/ or *medicare/ (0)
19 fee for service.tw. (195)
20 cost shar$.tw. (88)
21 (copayment? or co payment?).tw. (104)
22 (prepay$ or prepaid or prospective payment?).tw. (91)
23 (formular? or fundhold? or "blue cross").tw. (305)
24 or/18-23 (740)
25 *nurse clinicians/ or *nurse midwives/ or *nurse practitioners/ or *pharmacists/ or *patient care team/ or exp* patient care planning/ or exp *ambulatory care facilities/ or *ambulatory care/ (1)
26 (nurse adj (rehabilitator? or clinician? or practitioner? or midwi$)).tw. (671)
27 clinical pharmacist?.tw. (179)
28 paramedic?.tw. (226)
29 (team? adj2 (care or treatment or assessment or consultation)).tw. (905)
30 (care adj2 (coordinat$ or program$ or continuity)).tw. (1542)
31 (case adj management).tw. (453)
32 or/25-31 (3802)
33 *home care services/ or *hospices/ or *nursing homes/ or *office visits/ or *house calls/ or *day care/ or *aftercare/ or *community health nursing/ or *medical records/ or *medical records systems, computerized/ or *peer review/ or *utilization review/ or exp *health services misuse/ (0)
34 (chang$ adj1 location?).tw. (45)
35 domiciliary.tw. (87)
36 (home adj1 treat$).tw. (86)
37 day surgery.tw. (97)
38 (information adj2 (management or system?)).tw. (2370)
39 or/33-38 (2682)
40 *physician's practice patterns/ or *process assessment/ or *program evaluation/ or *length of stay/ or exp *"Referral and Consultation"/ or "consultation"/ or *drug therapy, computer assisted/ or *medical history taking/ or *telephone/ or *health maintenance organizations/ (0)
41 quality assurance.tw. (1140)
42 (early adj1 discharg$).tw. (140)
43 discharge planning.tw. (94)
44 offset.tw. (2484)
45 triage.tw. (831)
46 near patient testing.tw. (7)
47 (physician patient adj (interaction? or relationship?)).tw. (103)
48 managed care.tw. (325)
49 (hospital? adj1 merg$).tw. (7)
50 or/40-49 (5108)
51 ((standard or usual or routine or regular or traditional or conventional or pattern) adj2 care).tw. (4458)
52 (program$ adj2 (reduc$ or increas$ or decreas$ or chang$ or improv$ or modify$ or monitor$ or care)).tw. (3703)
53 (computer$ adj2 (dosage or dosing or diagnosis or therapy or decision?)).tw. (266)
54 ((introduc$ or impact or effect? or implement$ or computer$) adj2 protocol?).tw. (428)
55 ((effect or impact or introduc$) adj2 (legislation or regulations or policy)).tw. (133)
56 or/51-55 (8846)
57 17 or 24 or 32 or 39 or 50 (23890)
58 (intervention? or multiintervention? or multi-intervention? or postintervention? or post-intervention? or preintervention? or pre-intervention?).ti,ab. (49536)
59 (change or changing or evaluation or IMPROVE or IMPROVES or improvement? or improving).ti. (42422)
60 ((chang$ or improv$ or quality or evaluat$) adj3 (care or healthcare or organi?ation$ or practitioner? or practice)).ab. (9504)
61 implement$.ti. (3663)

62 (multi-facet$ or multifacet$).ti,ab. (1402)
63 ((guideline? or pathway? or protocol?) adj3 (adhere$ or concord$ or uptake or up-take)).ti,ab. (702)
64 ((physician? or provider? or practitioner?) adj2 behavio$).ti,ab. (211)
65 (collaborat$ or teambased or team-based or interdisciplinar$ or inter-disciplinar$ or cross-disciplin$).ti,ab. or team?.ti. (10943)
66 effectiveness.ti. or (effective adj2 practice).ti,ab. (4620)
67 Guideline adherence.hw. (2)
68 (financial or payment?).ti. (838)
69 evidence-based.ti,hw. (2041)
70 or/58-69 [INTERVENTION terms] (112958)
71 intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailor$ or target$ or team$ or usual care)).ab. (16931)
72 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (1427)
73 (hospital$ or patient?).hw. and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (2)
74 demonstration project?.ti,ab. (88)
75 (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab. (7453)
76 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (78)
77 trial.ti. or ((study adj3 aim?) or "our study").ab. (66512)
78 (before adj10 (after or during)).ti,ab. (22446)
79 ("quasi-experiment$" or quasiexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab,hw. (11324)
80 ("time series" adj2 interrupt$).ti,ab,hw. (121)
81 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab. (894)
82 pilot.ti. (4001)
83 Pilot projects/ (0)
84 (clinical trial or controlled clinical trial or multicenter study).pt. (489)
85 (multicentre or multicenter or multi-centre or multi-center).ti. (2155)
86 random$.ti,ab. or controlled.ti. (74207)
87 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. (38069)
88 (control year? or experimental year? or (control period? or experimental period?)).ti,ab. [Added May 30-2013] (718)
89 evaluation studies as topic/ or prospective studies/ or retrospective studies/ [Added Jan 2013] (4)
90 (utili?ation or programme or programmes).ti. [Added Jan 2013] (3980)
91 (during adj5 period).ti,ab. [Added Jan 2013] (19076)
92 ((strategy or strategies) adj2 (improv$ or education$)).ti,ab. [Added Jan 2013] (2141)
93 (purpose adj3 study).ab. (19505)
94 "comment on".cm. or review.pt. or (review not "peer review$").ti. or randomized controlled trial.pt. [Changed Jan 2013] (83817)
95 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti,hw. or veterinar$.ti,ab,hw. [Edited May 2013] (51956)
96 exp animals/ not humans.sh. (5)
97 (or/71-93) not (or/94-96) [EPOC Methods Filter 2.6-added Evaluation Studies line forward--Jan 20130 Medline] (204923)
98 (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti. (49946)
99 exp animals/ not humans.sh. (5)

100 98 not 99 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing] (49946)
101 4 and (57 or 70) and 97 [EPOC Results before date limits] (195)
102 4 and (57 or 70) and 100 [RCT Results before date limits] (68)
103 (201008$ or 2011$ or 2012$ or 2013$ or 2014$).em,dp,yr. (1269997)
104 101 and 103 [EPOC 2010-2014] (178)
105 102 and 103 [RCT 2010-2014] (61)

Embase (OVID) (search date: 6 August 2014)

1 exp Cesarean Section/ (67446)
2 ((caesarean or cesarean) adj2 (section? or birth? or deliver$)).ti,ab. (56175)
3 c-section?.ti,ab. (1525)
4 or/1-3 (78835)
5 continuing education/ or professional development/ or reminder system/ or clinical education/ or in service training/ [EM] (56167)
6 (education$ adj2 (program$ or intervention? or meeting? or session? or strateg$ or workshop? or visit?)).tw. (58016)
7 (leaflet? or booklet? or poster?).tw. (36092)
8 ((written or printed or oral) adj information).tw. (2293)
9 (information$ adj2 campaign).tw. (484)
10 (education$ adj1 (method? or material?)).tw. (7609)
11 outreach.tw. (10141)
12 ((opinion or education$ or influential) adj1 leader?).tw. (1247)
13 facilitator?.tw. (15931)
14 academic detailing.tw. (443)
15 consensus conference?.tw. (5452)
16 ((reminder? or recall) adj2 system?).ti,ab. (1079)
17 (prompter? or prompting).tw. (6695)
18 algorithm?.tw. (155893)
19 feedback.tw. (101865)
20 (chart adj2 review$).ti,ab. (38759)
21 ((effect? or impact or record? or chart?) adj2 audit).tw. (1336)
22 marketing.tw. (22911)
23 or/5-22 (501449)
24 *reimbursement/ or capitation fee/ or hospital charge/ or *"cost"/ or medicare/ or medicaid/ [EM] (95147)
25 fee for service.tw. (4223)
26 cost shar$.tw. (1425)
27 (copayment? or co payment?).tw. (1772)
28 (prepay$ or prepaid or prospective payment?).tw. (4843)
29 formular?.tw. (4781)
30 fundhold?.tw. (1)
31 blue cross.tw. (1403)
32 or/24-31 (107608)
33 advanced practice nurse/ or clinical nurse specialist/ or nurse midwife/ or nurse practitioner/ or pharmacist/ or *patient care planning/ or *ambulatory care/ or *ambulatory monitoring/ [EM] (95763)
34 (nurse adj (rehabilitator? or clinician? or practitioner? or midwi$)).tw. (12691)
35 clinical pharmacist?.tw. (2904)
36 paramedic?.tw. (4518)
37 (team? adj2 (care or treatment or assessment or consultation)).tw. (14467)
38 (care adj2 (coordinat$ or program$ or continuity)).tw. (24786)
39 (case adj management).tw. (8860)
40 or/33-39 (148821)
41 exp *home care/ or hospice/ or hospice care/ or *nursing home/ or aftercare/ or *community health nursing/ or medical record/ or *health care utilization/ or *"utilization review"/ [EM] (217481)

42 (chang$ adj1 location?).tw. (455)
43 domiciliary.tw. (3296)
44 (home adj1 treat$).tw. (2100)
45 day surgery.tw. (2940)
46 (information adj2 (management or system?)).tw. (32814)
47 or/41-46 (254076)
48 *program development/ or *health care quality/ or *"length of stay"/ or patient referral/ or anamnesis/ or computer assisted drug therapy/ or health maintenance organization/ or *telemedicine/ or teleconsultation/ or telemonitoring/ [EM] (275665)
49 quality assurance.tw. (24832)
50 (early adj1 discharg$).tw. (3027)
51 discharge planning.tw. (2691)
52 offset.tw. (21988)
53 triage.tw. (13606)
54 near patient testing.tw. (253)
55 (physician patient adj (interaction? or relationship?)).tw. (2236)
56 managed care.tw. (18676)
57 (hospital? adj1 merg$).tw. (416)
58 or/48-57 (352044)
59 ((standard or usual or routine or regular or traditional or conventional or pattern) adj2 care).tw. (56059)
60 (program$ adj2 (reduc$ or increas$ or decreas$ or chang$ or improv$ or modify$ or monitor$ or care)).tw. (52493)
61 (computer$ adj2 (dosage or dosing or diagnosis or therapy or decision?)).tw. (4815)
62 ((introduc$ or impact or effect? or implement$ or computer$) adj2 protocol?).tw. (3946)
63 ((effect or impact or introduc$) adj2 (legislation or regulations or policy)).tw. (2021)
64 or/59-63 (117274)
65 23 or 32 or 40 or 47 or 58 or 64 (1328796)
66 4 and 65 (5198)
67 controlled clinical trial/ or controlled study/ or randomized controlled trial/ [EM] (4454983)
68 randomi?ed.ti. or ((random$ or control) adj3 (group? or cohort? or patient? or hospital$ or department?)).ab. or (controlled adj2 (study or trial)).ti. (727293)
69 (multicenter and (study or trial)).ti. (22099)
70 (random sampl$ or random digit$ or random effect$ or random survey or random regression).ti,ab. not randomized controlled trial/ [Per BMJ Clinical Evidence filter] (58004)
71 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) and (human/ or normal human/ or human cell/) (15174084)
72 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) not 71 (5874509)
73 (or/67-69) not (or/70,72) [RCT Filter for EMBASE] (3041624)
74 intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailor$ or target$ or team$ or usual care)).ab. (215196)
75 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4] (14286)
76 (hospital$ or patient?).hw. and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (1771656)
77 demonstration project?.ti,ab. (2410)
78 (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab. (103001)
79 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (910)
80 trial.ti. or ((study adj3 aim?) or "our study").ab. (905869)
81 (before adj10 (after or during)).ti,ab. (485407)

82 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab. (12888)
83 pilot.ti. or (pilot adj (project? or study or trial)).ab. (93525)
84 (multicentre or multicenter or multi-centre or multi-center).ti. (41370)
85 random$.ti,ab. or controlled.ti. (969384)
86 (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. (643628)
87 ((evaluation or prospective or retrospective) adj study).ti,ab. [Added Jan 2013] (244113)
88 (utili?ation or programme or programmes).ti. [Added Jan 2013] (73041)
89 (during adj5 period).ti,ab. [Added Jan 2013] (416162)
90 ((strategy or strategies) adj2 (improv$ or education$)).ti,ab. [Added Jan 2013] (23681)
91 *experimental design/ or *pilot study/ or quasi experimental study/ (8891)
92 ("quasi-experiment$" or quasiexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab. (129669)
93 ("time series" adj2 interrupt$).ti,ab. (1214)
94 or/74-93 (4719795)
95 (rat or rats or cow or cows or chicken? or horse or horses or mice or mouse or bovine or animal?).ti. (1629462)
96 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) and (human/ or normal human/ or human cell/) (15174084)
97 (exp animals/ or exp invertebrate/ or animal experiment/ or animal model/ or animal tissue/ or animal cell/ or nonhuman/) not 96 (5874509)
98 94 not (or/95,97) [EPOC Filter 2.5--Added Lines Jan. 2013] (4071232)
99 66 and 73 [RCT] (1058)
100 66 and 98 [EPOC] (2773)
101 99 or 100 [ALL] (3024)
102 remove duplicates from 101 (2997)
103 limit 102 to yr="2010 -Current" (1343)

Cochrane Central Register of Controlled Trials (OVID) (search date: 6 August 2014)

1 (cesarean? or caeserean? or c-section? or "abdominal birth$" or "abdominal deliver$").ti,hw,sh. (3610)
2 (reduc$ or decreas$ or lower$ or intervention?).ti. (49575)
3 (reduc$ or decreas$ or lower$ or intervention?).ab. (293801)
4 ((reduc$ or decreas$ or prevent$ or lower$ or intervention?) adj4 (cesarean$ or caesarean$ or c-section$ or "abdominal deliver$")).ab. (595)
5 ((increas$ or escalat$ or growing or rising) adj4 (cesarean$ or caesarean$ or c-section$ or "abdominal deliver$")).ab. (199)
6 1 and (or/2-3) (1686)
7 or/4-5 (753)
8 7 or 6 (1939)
9 limit 8 to yr="2010 -Current" (517)
10 8 and new.uf. (86)
11 limit 1 to yr="2010-2014" (751)
12 1 and NEW.uf. (127)
13 or/9-12 (771)

Cochrane Library; CDSR, DARE, (WILEY) (search date: 6 August 2014)

1. MeSH descriptor Cesarean Section explode all trees
2. (cesarean* or caeserean* or c-section* or "abdominal birth*" or "abdominal deliver*"):ti,ab,kw.
3. (reduc* or decreas* or lower* or intervention*):ti OR (reduc* or decreas* or lower* or intervention*):ab
4. reduc* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab
5. decreas* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab
6. prevent* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab

7. lower* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
8. intervention* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
9. increas* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
10. escalat* near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
11. growing near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
12. rising near/4 (cesarean* or caesarean* or c-section* or "abdominal deliver*"):ab.
13. ((#1 or #2) and #3)
14. (#4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12)
15. #13 or #14
16. #15, from 2010 to 2014

CINAHL (Ebsco) (search date: 6 August 2014)

Limits: 2010-2014
(((((MW (cesarean)) or (TI (c section* OR cesarean OR caesarean OR "abdominal deliver*")) or (AB (c section* OR cesarean OR caesarean OR "abdominal deliver*"))) AND (((TI (reduc* OR lower OR rising OR decreas*) OR AB (reduc* OR lower OR rising OR decreas*)))))) AND ((((TI (interrupt* N2 series)) or (TI (interrupt* N2 series)) or (AB (interrupt* N2 series))) OR ((TI (randomized OR randomised OR control* OR trial*))) OR ((MW (clinical trials)) or (MW (random assignment OR Chi square test OR pretest posttest design))) OR ((MW (quasi experiment* OR quasiexperiment*)) or (TI (quasi experiment* OR quasiexperiment*)) or (AB (quasi experiment* OR quasiexperiment*))) OR ((TI (intervention OR interventions)) or (AB (intervention OR interventions)) or (MW (intervention OR interventions))))))

Appendix 3. Search strategies (February 2017)

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to 17 February>

1 Health Facility Environment/ (4101)
2 environment?.ti,ab. (448054)
3 "Interior Design and Furnishings"/ (4251)
4 (Interior adj3 Design?).ti,ab. (194)
5 (furniture or furnishing$).ti,ab. (2830)
6 floor$.ti,ab. (35402)
7 Lighting/ (10904)
8 (light$ or lighting).ti,ab. (544050)
9 Music/ (12033)
10 Odorants/ (15526)
11 (scent or smell or odor).ti,ab. (19660)
12 Temperature/ (215850)
13 (room adj3 temperature).ti,ab. (56103)
14 ((hospital or unit or ward or clinic or department$ or organisat$ or organizat$) adj3 (goal$ or target$ or purpose or object$)).ti,ab. (8257)
15 Organizational culture/ (14966)
16 (organi?ation$ adj3 cultur$).ti,ab. (3222)
17 (corporate culture? or workplace culture? or work culture? or organ?ation$ ethos or organi?ation$ climate?).ti,ab. (1087)
18 or/1-17 (1313524)
19 Cesarean Section/ (39364)
20 ((caesarean or cesarean) adj2 (section? or birth? or deliver$)).ti,ab. (47343)
21 c-section?.ti,ab. (868)
22 or/19-21 (61302)
23 18 and 22 (1295)

Database: Embase <1974 to 2017 17 February>

1 *health care facility/ (23887)
2 environment?.ti,ab. (535512)
3 1 and 2 (1435)
4 exp furniture/ (28200)
5 (Interior adj3 Design?).ti,ab. (221)
6 (furniture or furnishing$).ti,ab. (3749)
7 floor$.ti,ab. (48549)
8 Lighting/ (24299)
9 (light$ or lighting).ti,ab. (595293)
10 Music/ (16527)
11 odor/ (29465)
12 (scent or smell or odor).ti,ab. (25163)
13 room temperature/ or air temperature/ or environmental temperature/ (65969)
14 (room adj3 temperature).ti,ab. (59353)
15 ((hospital or unit or ward or clinic or department$ or organisat$ or organizat$) adj3 (goal$ or target$ or purpose or object$)).ti,ab. (15597)
16 (organi?ation$ adj3 cultur$).ti,ab. (3576)
17 (corporate culture? or workplace culture? or work culture? or organ?ation$ ethos or organi?ation$ climate?).ti,ab. (1242)
18 or/3-17 (844128)
19 *cesarean section/ (27961)
20 ((caesarean or cesarean) adj2 (section? or birth? or deliver$)).ti,ab. (64076)
21 c-section?.ti,ab. (2282)
22 or/19-21 (69962)
23 18 and 22 (1500)

WHO International Clinical Trials Registry Platform (ICTRP) (searched April 2017)

Search terms: "caesarean section OR caesarean birth OR caesarean delivery"

ClinicalTrials.gov (searched April 2017)

Search terms: "caesarean section OR caesarean birth OR caesarean delivery"

WHAT'S NEW

Last assessed as up-to-date: 8 March 2018.

Date	Event	Description
8 March 2018	New citation required and conclusions have changed	We amended the conclusions to highlight the limitation of the evidence examined
8 March 2018	New search has been performed	We updated the searches in August 2014, February 2017 and March 2018. We expanded the scope of the review and added 17 new studies in this update. We implemented GRADE and created 'Summary of findings' tables. We amended the author team. Two studies (Jang 2011; Vankan 2015) identified in the March 2018 searches are awaiting

(*Continued*)

		classification

HISTORY

Protocol first published: Issue 4, 2005

Review first published: Issue 6, 2011

Date	Event	Description
26 June 2009	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

Original review

- Protocol development (SK, PL, TL, RG)
- All the authors contributed to the conduct of the review and approved the final version

For this update

- Designing search strategies and undertaking searches (TR, IC, APB, NO)
- Study selection (IC, EM, SM, APB, NO, SY, JP, SA, MT)
- Data collection and study quality assessment (IC, ET, APB, NO, SM, JP, SA, MT)
- Synthesis and writing of review (IC, APB, NO)
- All authors commented on the draft review and approved the final version

DECLARATIONS OF INTEREST

Innie Chen: no known conflicts of interest

Newton Opiyo is an editor with Cochrane EPOC and member of the WHO CS Guideline Technical Working Group

Emma Tavender: no known conflicts of interest

Sameh Mortazhejri: no known conflicts of interest

Tamara Rader: no known conflicts of interest

Jennifer Petkovic: no known conflicts of interest

Sharlini Yogasingam: no known conflicts of interest

Monica Taljaard: no known conflicts of interest

Sugandha Agarwal: no known conflicts of interest

Malinee Laopaiboon: no known conflicts of interest

Jason Wasiak: no known conflicts of interest

Suthit Khunpradit: no known conflicts of interest

Pisake Lumbiganon: Member of the WHO CS Guideline Development Group (Co-chair)

Russell Gruen: no known conflicts of interest

Ana Pilar Betran: Member of the WHO Steering Group who managed the CS guideline development process

SOURCES OF SUPPORT

Internal sources

- Australian Satellite of the Cochrane EPOC Group, Monash University, Australia.

Tavender Emma

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Monica Taljaard, Sameh Mortazhejri, Sugandha Agarwal

- Nanyang Technological University, Singapore.

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- University of Melbourne, Australia.

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- University of Ottawa, Canada.

Innie Chen

External sources

- UNDP-UNFPA-UNICEF-WHO-World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), Department of Reproductive Health and Research (RHR), World Health Organization, Switzerland.

Ana Pilar Betran (WHO employee, salary support)

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

- We updated the eligible study designs to align with current Cochrane EPOC criteria.
- We amended study eligibility criteria as follows.

  ○ To avoid duplication and substantial overlap with related reviews, we excluded studies of other related interventions assessed in related reviews: midwife-led continuity of care (Sandall 2016); continuous labour support (Bohren 2017); physical activity-based interventions (i-WIP 2017); alternative institutional birth environment (Hodnett 2012); and planned hospital birth versus planned home birth (Olsen 2012).

  ○ We only included non-clinical interventions specifically designed to reduce caesarean section rates (interventions not specifically designed to reduce caesarean section rates are not included, even if they may incidentally reduce caesarean section rates; these interventions have been proposed for further research in areas with high caesarean section rates).

- We expanded the scope of the review to include the following additional interventions.

  ○ Opinion leaders: dissemination of information or advocacy with support or campaigns from local or international opinion leader (role models, leadership persons, public celebrities).

  ○ Staffing models (e.g. different types of physician staffing models).

  ○ Goal-setting for caesarean section rates (setting a specific predetermined goal for caesarean section rate).

  ○ Policies that limit financial/legal liability in case of litigation of healthcare professionals or organisations.

  ○ Strategies to change the organisational culture: strategies include various components of organisational culture (e.g. shared values, behaviours, norms, traditions, sense-making) which may shape and/or contribute to the overall environment of an organisation).

- We adopted a new system for classifying identified interventions drawing on updated EPOC taxonomy (Table 1; EPOC 2015). The new system also drew on the taxonomy drafted by the World Health Organization (WHO) expert panel on caesarean section guidelines.
- Types of outcome measures (primary outcomes amended to include only modes of delivery: caesarean section, spontaneous vaginal birth, instrumental vaginal birth).
- We implemented GRADE and created 'Summary of findings' tables.
- New authors: Innie Chen, Newton Opiyo, Ana Pilar Betran, Sameh Mortazhejri, Jennifer Petkovic, Tamara Rader, Sugandha Agarwal, Monica Taljaard, Sharlini Yogasingam.

INDEX TERMS

Medical Subject Headings (MeSH)

Anxiety [therapy]; Cesarean Section [*utilization]; Guideline Adherence; Parturition [psychology]; Randomized Controlled Trials as Topic; Referral and Consultation [statistics & numerical data]; Unnecessary Procedures [*utilization]; Vaginal Birth after Cesarean [statistics & numerical data]

MeSH check words

Female; Humans; Pregnancy