National Institute for Health and Care Excellence

Draft for consultation

Caesarean birth

[E] Monitoring after intrathecal or epidural opioids for caesarean birth

NICE guideline CG132 (update)

Evidence review

October 2020

Draft for Consultation

This evidence review was developed by the National Guideline Alliance which is a part of the Royal College of Obstetricians and Gynaecologists

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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ISBN:

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Monitoring after intrathecal or epidural opioids

Review question

What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

Introduction

The current NICE guideline on caesarean birth recommends that women who have received intrathecal opioids should have their respiratory rate, sedation and pain scores monitored at a minimum of hourly intervals for at least 12 hours for diamorphine and 24 hours for morphine. However, morphine is now rarely used in the UK, and intrathecal diamorphine appears to be safer, with less impact on respiratory drive, meaning that this level of monitoring may not be necessary for all women. In addition, the workload implications of this intensive monitoring regimen are significant.

The aim of this review is to identify the optimal monitoring strategy for women who have received intrathecal or epidural opioids at the time of caesarean birth to ensure safety and allow appropriate early identification of adverse events.

Summary of the protocol

Please see Table 1 for a summary of the Population, Intervention, Comparison and Outcome (PICO) characteristics of this review.

Table 1: Summary of the protocol (PICO table)

Population	All women having a caesarean birth who have received intrathecal or epidural opioids. • include any type of caesarean birth (emergency or planned) • include general or regional (spinal/epidural) anaesthetic
Intervention	Specific observations to be recorded: • respiratory depression (as oxygen saturation, CO_2 levels, respiratory rate) • sedation scores • pain scores • cardiovascular (blood pressure, heart rate) • modified early warning score charts • nausea and vomiting • Glasgow coma score • urine output/catheter function Monitoring schedule: • frequency (for example, hourly, 2-hourly) • duration of monitoring
Comparison	• Each of the monitoring interventions/schedules outlined above, compared to a different monitoring schedule • No monitoring/usual care

Outcomes	**Critical outcomes:**
	• Maternal death or serious morbidity (defined as requiring ITU admission)
	• Clinically significant respiratory depression (pooled outcome) defined as one or more of the following:
	  ○ need for airway intervention
	  ○ need for pharmacological therapy (centrally acting respiratory stimulants or opioid antagonists)
	  ○ need for oxygen therapy due to a low respiratory rate or hypoxia
	  ○ need for other intervention due to excessive sedation
	Important outcomes
	• Pain scores
	• Time to discharge
	• Women's satisfaction/HRQoL
	• Need for re-catheterisation
	• Breastfeeding

HRQoL: health-related quality of life; ITU: intensive therapy unit;

For further details see the review protocol in appendix A.

Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual (2014). Please see the methods chapter for further details. Methods specific to this review question are described in the review protocol in appendix A.

Declarations of interest were recorded according to NICE's 2014 conflicts of interest policy until 31 March 2018. From 1 April 2018, declarations of interest were recorded according to NICE's 2018 conflicts of interest policy. Those interests declared until April 2018 were reclassified according to NICE's 2018 conflicts of interest policy (see Register of Interests).

Clinical evidence

Included studies

A systematic review of the clinical literature was conducted but no studies were identified which were applicable to this review question.

See the literature search strategy in appendix B and study selection flow chart in appendix C.

Excluded studies

Studies not included in this review with reasons for their exclusions are provided in appendix K.

Summary of clinical studies included in the evidence review

No studies were identified which were applicable to this review question (and so there are no evidence tables in appendix D). No meta-analysis was undertaken for this review (and so there are no forest plots in appendix E).

Quality assessment of clinical outcomes included in the evidence review

No studies were identified which were applicable to this review question and so there are no evidence profiles in appendix F.

Economic evidence

Included studies

A systematic review of the economic literature was conducted but no economic studies were identified which were applicable to this review question.

See the literature search strategy in appendix B.

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation.

Evidence statements

No clinical evidence was identified which was applicable to this review question.

Economic evidence statements

No economic evidence was identified which was applicable to this review question.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Maternal mortality or serious morbidity were prioritised by the committee as a critical outcome because insufficient monitoring could result in maternal death if adverse effects from intrathecal or epidural opioids (for example, respiratory depression) were left undetected. For the same reason, clinically significant respiratory distress (CSRD) was also considered as a critical outcome as this may result if monitoring is inadequate.

Pain, time to discharge, satisfaction/health-related quality of life (HRQoL) and breastfeeding were deemed important but not critical outcomes, as they would influence the woman's birth experience and her and her baby's wellbeing, but were unlikely to have a serious effect on her overall clinical outcomes. The need for re-catheterisation was included as an important outcome as bladder control and emptying may be affected by the intrathecal or spinal anaesthesia.

The quality of the evidence

No studies or evidence were identified that fulfilled the protocol for this question, and the recommendations were therefore based on committee consensus, utilising their experience and expertise on the topic.

Benefits and harms

The committee discussed the lack of specific evidence identified for this review, the wider literature on monitoring in women who have had a caesarean birth compared to a general surgical population, and the type of analgesia used in the UK compared to studies conducted in North America and Europe.

The committee also discussed that the monitoring section of the guideline needed to be applicable to women who had had a caesarean birth using either general anaesthesia or spinal anaesthesia. However, the post-operative monitoring requirements for these 2 groups would be different so the committee agreed to split the monitoring recommendations into 2 sections.

The recommendations for monitoring after general anaesthesia were based on the committee's knowledge and experience, and included monitoring women on a one-to-one basis until they were haemodynamically stable, had regained airway control and were able to communicate, and then monitoring them regularly depending on their clinical status. The committee discussed how frequently this monitoring should occur and agreed that standard practice would be every half an hour for 2 hours, but that if these observations were not stable or there were other risk factors, then the woman should be medically reviewed and it may be necessary to increase the frequency and duration of monitoring.

The committee then considered their recommendations for women following spinal anaesthesia. Intrathecal opioids only became accepted as a standard technique for caesarean birth in 2000 to 2001 after publication of studies to show intra-operative and post-operative improvements in pain control. There was concern about introducing opioid-associated side effects into a technique that had previously relied upon local anaesthetic alone, and the most likely adverse event was considered to be respiratory depression. The committee were aware of a review of the side-effects and safety of neuraxial opioids in pregnancy (Armstrong 2016) that had identified that pregnant women may be at a lower risk of respiratory depression due the physiological changes of pregnancy (for example, increased respiratory rate due to an effect of progesterone), and the fact that they are younger and have fewer comorbidities than the general surgical population. In addition, there is a lower risk of respiratory complications with diamorphine (compared to morphine) as it has higher lipid solubility than morphine and is less likely to cause delayed onset respiratory depression.

Although not a publication directly relevant to the protocol for this review, the committee discussed findings from a systematic review examining the incidence of CSRD after intrathecal morphine and diamorphine (Sharawi 2018) as it was pertinent to decision-making. This review found low rates of CSRD with morphine and no cases with diamorphine.

Based on this, their experience and the absence of definitive evidence to compare monitoring strategies, the committee agreed that, as with women who had received general anaesthesia, women who had received spinal anaesthesia still needed a period of one-to-one observation to ensure women that they were haemodynamically stable. Once women had been stabilised post-operatively, for the majority of healthy women, the risks of respiratory depression from spinal or epidural diamorphine were very small, and there was therefore no need for additional monitoring for women who had spinal or epidural diamorphine, above that which would normally be carried out on the postnatal ward.

However, the committee discussed that there may be certain women who are at a higher baseline risk of respiratory depression, for example those who are severely obese or who have a history of obstructive sleep apnoea. These women should be monitored more intensively to allow early identification of the development of respiratory depression, haemodynamic instability or excessive sedation. The committee therefore made a recommendation for continuous pulse oximetry to identify a decrease in oxygen saturation, and hourly monitoring of other vital signs. The committee agreed that the effects of the spinal or epidural anaesthesia wear off after surgery, and that the onset of respiratory depression was most likely in the first few hours after surgery, with even late onset respiratory depression likely to occur by 7.5 hours. Therefore monitoring hourly for 12 hours would be sufficient for most women, but monitoring could be continued for longer if there were any concerns, in which case the woman would still be under anaesthetic care.

The committee noted that there may also be reasons unrelated to the risk of respiratory depression why more intensive monitoring should be in place, for example a complicated birth or unstable observations in the first 2 hours after birth, and made a recommendation to ensure the increased monitoring requirements of these women were not overlooked.

Cost effectiveness and resource use

Previous guidance recommended that there should be minimum hourly observations of respiratory rate, sedation and pain scores for at least 12 hours for women who have had intrathecal opioids. However, the committee concluded this level of monitoring was unlikely to be necessary or cost effective for women who had spinal or epidural diamorphine. This was based on their own expertise and experience and evidence from a systematic review (Sharawi 2018), where there were no cases of CSRD in patients who had diamorphine. As a result, the new recommendations removed the stipulation for minimum hourly observations in women not at an increased risk of respiratory depression.

The recommendations will lead to a reduction in the frequency and duration of monitoring of most women who have received intrathecal or epidural opioids at the time of caesarean birth, but will require women to be assessed for risk factors to determine if they require a more intensive monitoring schedule. Carrying out the risk assessment may require additional training and time. However, as only women identified as high risk will require intensive monitoring, the overall monitoring workload is expected to decrease, with subsequent reduced use of staff time.

Other factors the committee took into account

The committee also discussed the widespread use of clinical early warning scoring systems (such as the Modified Early Warning Score [MEWS] or the Modified Early Obstetric Warning Score [MEOWS]) and lack of consistency between units in thresholds which require action or escalation. For example, the upper or lower limits of respiratory rate in one hospital that indicate increased monitoring or intervention is required, may differ from the upper or lower limits of respiratory rate in another hospital that require the same intervention. The committee agreed that in the future a standardised approach to monitoring and interpreting standard observations should be developed, but the variation at the moment meant that they were unable to make more detailed recommendations about the exact monitoring parameters as this would be based on local protocols.

Although there was no evidence available for this review, the committee agreed not to prioritise a research recommendation as they agreed that other topics were a higher priority for future research.

References

There were no studies identified for inclusion in this review

Armstrong 2016

Armstrong S., Fernando R. (2016) Side-effects and efficacy of neuraxial opioids in pregnant patients at delivery: a comprehensive review. Drug Safety 39: 381-99

Sharawi 2018

Sharawi, N., Carvalho, B., Habib, AS., Blake, L., Mhyre, JM., Sultan, P. (2018) A Systematic Review Evaluating Neuraxial Morphine and Diamorphine-Associated Respiratory Depression After Cesarean Delivery. Obstetric Anesthesiology 127 (6): 1385-1395

Appendices

Appendix A – Review protocols

Review protocol for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

Table 2: Review protocol for monitoring after caesarean birth

Field (based on PRISMA-P)	Content
Actual review question	What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?
Type of review question	Intervention
Objective of the review	To identify how women who have received intrathecal opioids should be monitored. This will include what observations are needed and what frequency of observations is required, and for how long. Background: The current guideline recommends 'For women who have had intrathecal opioids, there should be a minimum hourly observation of respiratory rate, sedation and pain scores for at least 12 hours for diamorphine and 24 hours for morphine.' However, morphine is now rarely used, and the pharmacokinetics of diamorphine mean that this may be too much monitoring, and the workload implications of this monitoring regimen are not insignificant.
Eligibility criteria – **population**/disease/condition/issue/domain	All women having a caesarean birth who have received intrathecal or epidural opioids. • include any type of caesarean birth (emergency or planned) • include general or regional (spinal/epidural) anaesthetic

Field (based on PRISMA-P)	Content
Eligibility criteria – **intervention**(s)/exposure(s)/prognostic factor(s)	• Specific observations to be recorded: ○ respiratory depression (as oxygen saturation, CO_2 levels, respiratory rate) ○ sedation scores ○ pain scores ○ cardiovascular (blood pressure, heart rate) ○ modified early warning score charts ○ nausea and vomiting ○ Glasgow coma score ○ urine output/catheter function • Monitoring schedule: ○ frequency (for example, hourly, 2-hourly) ○ duration of monitoring
Eligibility criteria – **comparator(s)/**control or reference (gold) standard	• Each of the monitoring interventions/schedules outlined above, compared to a different monitoring schedule • No monitoring/usual care
Outcomes and prioritisation	**Critical outcomes:** • Maternal death or serious morbidity (defined as requiring ITU admission) • Clinically significant respiratory depression (CSRD) (pooled outcome) defined as one or more of the following: - need for airway intervention - need for pharmacological therapy (centrally acting respiratory stimulants or opioid antagonists) - need for oxygen therapy due to a low respiratory rate or hypoxia - need for other intervention due to excessive sedation **Important outcomes** • Pain scores • Time to discharge • Women's satisfaction/HRQoL • Need for re-catheterisation

Field (based on PRISMA-P)	Content
	• Breast-feeding
Eligibility criteria – **study design**	Only published full text papers • Systematic reviews/meta-analyses of RCTs • RCTs • Comparative cohort studies (if no RCT evidence is identified)
Other inclusion **exclusion criteria**	Exclude conference abstracts Exclude studies from non-OECD countries Exclude studies where all women have additional morbidities such as pre-eclampsia or post-operative morbidities such as sepsis, PPH, APH
Proposed stratified, sensitivity/**sub-group analysis**, or meta-regression	**Subgroup analyses (to be conducted only if heterogeneity is identified):** • Different route of administration of opioid (intrathecal versus epidural) • Different opioids (with different solubility in water or lipid e.g. diamorphine/ morphine; morphine is mostly water-soluble, diamorphine is soluble in both water and lipids and is much easier to dissolve in both)
Selection process – duplicate screening/selection/analysis	Duplicate screening/selection/analysis will not be undertaken for this review as this question was not prioritised for it. Included and excluded studies will be cross checked with the committee and with published systematic reviews when available.
Data management (software)	If pairwise meta-analyses are undertaken, they will be performed using Cochrane Review Manager (RevMan5). 'GRADE' will be used to assess the quality of evidence for each outcome. STAR will be used for bibliographies/citations and study sifting. Microsoft Word will be used for data extraction and quality assessment/critical appraisal
Information sources – databases and dates	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase.

Field (based on PRISMA-P)	Content
	Limits (e.g. date, study design): Study design limited to Systematic Reviews and RCTs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques will be used.
Identify if an update	Yes, this is an update of a question reviewed for the 2004 Caesarean birth guideline (and not updated as part of the previous update in 2011). However, no specific review question and protocol were identified in the existing (2004) review.
Author contacts	Developer: National Guideline Alliance NGA-enquiries@RCOG.ORG.UK
Highlight if amendment to previous protocol	For details please see section 4.5 of Developing NICE guidelines: the manual
Search strategy – for one database	For details please see appendix B
Data collection process – forms/duplicate	A standardised evidence table format will be used, and published as appendix D (clinical evidence tables) or H (economic evidence tables).
Data items – define all variables to be collected	For details please see evidence tables in appendix D (clinical evidence tables) or H (economic evidence tables).
Methods for assessing bias at outcome/study level	Appraisal of methodological quality: The methodological quality of each study will be assessed using an appropriate checklist: • ROBIS for systematic reviews • Cochrane risk of bias tool for randomised studies • Newcastle Ottowa scale for comparative cohort studies For details please see section 6.2 of Developing NICE guidelines: the manual The risk of bias across all available evidence will evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/

Field (based on PRISMA-P)	Content
Criteria for quantitative synthesis	For details please see section 6.4 of Developing NICE guidelines: the manual
Methods for quantitative analysis – combining studies and exploring (in)consistency	Synthesis of data: Meta-analysis will be conducted where appropriate using Review Manager. Minimum important differences For maternal death/serious morbidity, any statistically significant result will be viewed as a clinically important difference. For other outcomes, default values will be used of: A relative risk of 0.8 and 1.25 for dichotomous outcomes; 0.5 times SD of the control group at baseline for continuous outcomes, unless more appropriate values are identified by the guideline committee or in the literature.
Meta-bias assessment – publication bias, selective reporting bias	For details please see section 6.2 of Developing NICE guidelines: the manual.
Confidence in cumulative evidence	For details please see sections 6.4 and 9.1 of Developing NICE guidelines: the manual
Rationale/context – what is known	For details please see the introduction to the evidence review in the full guideline.
Describe contributions of authors and guarantor	A multidisciplinary committee developed the guideline. The committee was convened by the NGA and chaired by Sarah Fishburn in line with section 3 of Developing NICE guidelines: the manual. Staff from the NGA undertook systematic literature searches, appraised the evidence, conducted meta-analysis and cost-effectiveness analysis where appropriate, and drafted the guideline in collaboration with the committee. For details please see the methods chapter of the full guideline.
Sources of funding/support	The NGA is funded by NICE and hosted by the Royal College of Obstetricians and Gynaecologists
Name of sponsor	The NGA is funded by NICE and hosted by the Royal College of Obstetricians and Gynaecologists
Roles of sponsor	NICE funds the NGA to develop guidelines for the NHS in England.
PROSPERO registration number	Not registered with PROSPERO

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CDSR: Cochrane Database of Systematic Reviews; CENTRAL: Cochrane Central Register of Controlled Trials; DARE: Database of Abstracts of Reviews of Effects; GRADE: Grading of Recommendations Assessment, Development and Evaluation; HTA: Health Technology Assessment; NGA: National Guideline Alliance; NHS: National health service; NICE: National Institute for Health and Care Excellence; RCT: randomised controlled trial; RoB: risk of bias; SD: standard deviation

Appendix B – Literature search strategies

Literature search strategies for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

Review question search strategies

Databases: Medline; Medline EPub Ahead of Print; and Medline In-Process & Other Non-Indexed Citations

Date last searched: 25/11/2019

#	Searches
1	exp CESAREAN SECTION/
2	(c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$)).ti,ab.
3	or/1-2
4	exp "ANESTHESIA AND ANALGESIA"/
5	INJECTIONS, SPINAL/
6	INJECTIONS, EPIDURAL/
7	(an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$).ti,ab.
8	or/4-7
9	exp NARCOTICS/
10	(opiod? or opiate? or morphine or diamorphine).ti,ab.
11	or/9-10
12	exp MONITORING, PHYSIOLOGIC/
13	monitor$.ti,ab.
14	(observe or observed or observing or observation?).ti,ab.
15	VITAL SIGNS/
16	RESPIRATORY INSUFFICIENCY/
17	exp BLOOD GAS ANALYSIS/
18	RESPIRATORY RATE/
19	((respirat$ or ventilator$) adj3 (depress$ or insufficien$ or fail$)).ti,ab.
20	CSRD.ti,ab.
21	((oxygen or carbon dioxide or CO2) adj3 (saturat$ or desaturat$ or level? or analy$ or monitor$ or measur$)).ti,ab.
22	(blood adj3 gas$ adj3 (analy$ or monitor$ or measur$)).ti,ab.
23	oximetr$.ti,ab.
24	(respirat$ adj3 rate?).ti,ab.
25	((cardiovascular$ or cardio-vascular$ or circulat$) adj3 (collaps$ or fail$)).ti,ab.
26	(sedat$ adj3 scor$).ti,ab.
27	PAIN MEASUREMENT/
28	(pain adj3 (scor$ or scale? or test? or assess$ or questionnaire? or measur$)).ti,ab.
29	BLOOD PRESSURE/
30	HEART RATE/
31	((blood or diastolic$ or systolic$ or pulse) adj3 pressure).ti,ab.
32	((heart or pulse) adj3 rate).ti,ab.
33	(early adj3 warning adj3 (scor$ or system? or tool?)).ti,ab.
34	EWS.ti,ab.
35	MEWS.ti,ab.
36	MEOWS.ti,ab.
37	SEWS.ti,ab.
38	MEWS.ti,ab.
39	NAUSEA/
40	VOMITING/
41	"POSTOPERATIVE NAUSEA AND VOMITING"/
42	(nausea or nauseous or vomit$).ti,ab.
43	GLASGOW COMA SCALE/
44	(glasgow coma adj3 (scor$ or scale?)).ti,ab.
45	URINATION/
46	(urin$ adj3 (output? or volume?)).ti,ab.
47	URINARY CATHETERS/
48	URINARY CATHETERIZATION/
49	((urin$ or ureth$) adj3 catheter$).ti,ab.
50	or/12-49
51	POSTOPERATIVE PERIOD/

#	Searches
52	POSTOPERATIVE CARE/
53	(postoperat$ or post-operat$).ti,ab.
54	or/51-53
55	((post or follow$ or after$) adj3 (c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$))).ti,ab.
56	((post or follow$ or after$) adj3 (an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$)).ti,ab.
57	TIME FACTORS/ and exp MONITORING, PHYSIOLOGIC/
58	((modalit$ or intensit$ or frequenc$ or duration or no or limit$ or routine$ or additional$ or contin$ or interval? or hour$ or regular$ or intermittent$ or schedul$ or requir$ or amount? or optimal$ or optimis$ or suffic$ or regimen? or rate? or repetition or repeat$ or often or length) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
59	((1h$ or 2h$ or 3h$ or 4h$ or 5h$ or 6h$ or 7h$ or 8h$ or 9h$ or 10h$ or 11h$ or 12h$ or 13h$ or 14h$ or 15h$ or 16h$ or 17h$ or 18h$ or 19h$ or 20h$ or 21h$ or 22h$ or 23h$ or 24h$ or 30h$ or 36h$ or 48h$ or 1 h$ or 2 h$ or 3 h$ or 4 h$ or 5 h$ or 6 h$ or 7 h$ or 8 h$ or 9 h$ or 10 h$ or 11 h$ or 12 h$ or 13 h$ or 14 h$ or 15 h$ or 16 h$ or 17 h$ or 18 h$ or 19 h$ or 20 h$ or 21 h$ or 22 h$ or 23 h$ or 24 h$ or 30 h$ or 36 h$ or 48 h$) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
60	or/57-59
61	high dependency unit?.ti,ab.
62	HDU?.ti,ab.
63	RECOVERY ROOM/
64	recovery room?.ti,ab.
65	((postnatal or post-natal) adj3 ward?).ti,ab.
66	or/61-65
67	3 and 8 and 11 and 50 and 54
68	8 and 11 and 50 and 55
69	3 and 11 and 50 and 56
70	3 and 8 and 11 and 60
71	3 and 8 and 11 and 66
72	or/67-71
73	limit 72 to english language
74	LETTER/
75	EDITORIAL/
76	NEWS/
77	exp HISTORICAL ARTICLE/
78	ANECDOTES AS TOPIC/
79	COMMENT/
80	CASE REPORT/
81	(letter or comment*).ti.
82	or/74-81
83	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
84	82 not 83
85	ANIMALS/ not HUMANS/
86	exp ANIMALS, LABORATORY/
87	exp ANIMAL EXPERIMENTATION/
88	exp MODELS, ANIMAL/
89	exp RODENTIA/
90	(rat or rats or mouse or mice).ti.
91	or/84-90
92	73 not 91

Databases: Embase; and Embase Classic

Date last searched: 25/11/2019

#	Searches
1	exp CESAREAN SECTION/
2	(c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$)).ti,ab.
3	or/1-2
4	ANESTHESIOLOGICAL PROCEDURE/
5	exp ANESTHESIA/
6	exp ANALGESIA/
7	INTRASPINAL DRUG ADMINISTRATION/
8	EPIDURAL DRUG ADMINISTRATION/
9	(an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$).ti,ab.
10	or/4-9
11	exp NARCOTIC AGENT/
12	exp NARCOTIC ANALGESIC AGENT/
13	(opiod? or opiate? or morphine or diamorphine).ti,ab.
14	or/11-13
15	MONITORING/
16	DRUG MONITORING/
17	PATIENT MONITORING/
18	PERIOPERATIVE MONITORING/

#	Searches
19	PERSONAL MONITORING/
20	PHYSIOLOGIC MONITORING/
21	monitor$.ti,ab.
22	(observe or observed or observing or observation?).ti,ab.
23	VITAL SIGN/
24	exp RESPIRATORY FAILURE/
25	exp BLOOD GAS ANALYSIS/
26	BREATHING RATE/
27	((respirat$ or ventilator$) adj3 (depress$ or insufficien$ or fail$)).ti,ab.
28	CSRD.ti,ab.
29	((oxygen or carbon dioxide or CO2) adj3 (saturat$ or desaturat$ or level? or analy$ or monitor$ or measur$)).ti,ab.
30	(blood adj3 gas$ adj3 (analy$ or monitor$ or measur$)).ti,ab.
31	oximetr$.ti,ab.
32	(respirat$ adj3 rate?).ti,ab.
33	((cardiovascular$ or cardio-vascular$ or circulat$) adj3 (collaps$ or fail$)).ti,ab.
34	(sedat$ adj3 scor$).ti,ab.
35	PAIN MEASUREMENT/
36	*PAIN ASSESSMENT/
37	(pain adj3 (test? or questionnaire? or measur$)).ti,ab.
38	(pain adj3 (scor$ or scale? or assess$) adj10 (monitor$ or observ$ or surveillan$)).ti,ab.
39	BLOOD PRESSURE/
40	BLOOD PRESSURE MONITORING/
41	HEART RATE/
42	((blood or diastolic$ or systolic$ or pulse) adj3 pressure).ti,ab.
43	((heart or pulse) adj3 rate).ti,ab.
44	(early adj3 warning adj3 (scor$ or system? or tool?)).ti,ab.
45	EWS.ti,ab.
46	MEWS.ti,ab.
47	MEOWS.ti,ab.
48	SEWS.ti,ab.
49	MEWS.ti,ab.
50	*"NAUSEA AND VOMITING"/
51	*NAUSEA/
52	*VOMITING/
53	exp "POSTOPERATIVE NAUSEA AND VOMITING"/
54	((nausea or nauseous or vomit$) adj10 (monitor$ or observ$ or surveillan$ or scor$ or scale? or test? or assess$ or questionnaire? or measur$)).ti,ab.
55	GLASGOW COMA SCALE/
56	(glasgow coma adj3 (scor$ or scale?)).ti,ab.
57	URINE VOLUME/
58	(urin$ adj3 (output? or volume?)).ti,ab.
59	exp URINARY CATHETER/
60	exp BLADDER CATHETERIZATION/
61	((urin$ or ureth$) adj3 catheter$).ti,ab.
62	or/15-61
63	POSTOPERATIVE PERIOD/
64	POSTOPERATIVE CARE/
65	(postoperat$ or post-operat$).ti,ab.
66	or/63-65
67	((post or follow$ or after$) adj3 (c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$))).ti,ab.
68	POSTANESTHESIA CARE/
69	POSTOPERATIVE ANALGESIA/
70	((post or follow$ or after$) adj3 (an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$)).ti,ab.
71	TIME FACTOR/ and exp MONITORING/
72	((modalit$ or intensit$ or frequenc$ or duration or no or limit$ or routine$ or additional$ or contin$ or interval? or hour$ or regular$ or intermittent$ or schedul$ or requir$ or amount? or optimal$ or optimis$ or suffic$ or regimen? or rate? or repetition or repeat$ or often or length) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
73	((1h$ or 2h$ or 3h$ or 4h$ or 5h$ or 6h$ or 7h$ or 8h$ or 9h$ or 10h$ or 11h$ or 12h$ or 13h$ or 14h$ or 15h$ or 16h$ or 17h$ or 18h$ or 19h$ or 20h$ or 21h$ or 22h$ or 23h$ or 24h$ or 30h$ or 36h$ or 48h$ or 1 h$ or 2 h$ or 3 h$ or 4 h$ or 5 h$ or 6 h$ or 7 h$ or 8 h$ or 9 h$ or 10 h$ or 11 h$ or 12 h$ or 13 h$ or 14 h$ or 15 h$ or 16 h$ or 17 h$ or 18 h$ or 19 h$ or 20 h$ or 21 h$ or 22 h$ or 23 h$ or 24 h$ or 30 h$ or 36 h$ or 48 h$) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
74	or/71-73
75	HIGH DEPENDENCY UNIT/
76	high dependency unit?.ti,ab.
77	HDU?.ti,ab.
78	RECOVERY ROOM/
79	recovery room?.ti,ab.
80	((postnatal or post-natal) adj3 ward?).ti,ab.
81	or/75-80
82	3 and 10 and 14 and 62 and 66

#	Searches
83	10 and 14 and 62 and 67
84	3 and 14 and 68
85	3 and 14 and 62 and 69
86	3 and 14 and 62 and 70
87	3 and 10 and 14 and 74
88	3 and 10 and 14 and 81
89	or/82-88
90	limit 89 to english language
91	letter.pt. or LETTER/
92	note.pt.
93	editorial.pt.
94	CASE REPORT/ or CASE STUDY/
95	(letter or comment*).ti.
96	or/91-95
97	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
98	96 not 97
99	ANIMAL/ not HUMAN/
100	NONHUMAN/
101	exp ANIMAL EXPERIMENT/
102	exp EXPERIMENTAL ANIMAL/
103	ANIMAL MODEL/
104	exp RODENT/
105	(rat or rats or mouse or mice).ti.
106	or/98-105
107	90 not 106

Databases: Cochrane Central Register of Controlled Trials; and Cochrane Database of Systematic Reviews

Date last searched: 25/11/2019

#	Searches
#1	[mh "CESAREAN SECTION"]
#2	(cesar#an* or caesar#an* or "c section*" or csection* or (deliver* near/3 abdom*)):ti,ab
#3	#1 or #2
#4	[mh "ANESTHESIA AND ANALGESIA"]
#5	[mh ^"INJECTIONS, SPINAL"]
#6	[mh ^"INJECTIONS, EPIDURAL"]
#7	(anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*):ti,ab
#8	#4 or #5 or #6 or #7
#9	[mh NARCOTICS]
#10	(opiod* or opiate* or morphine or diamorphine):ti,ab
#11	#9 or #10
#12	[mh "MONITORING, PHYSIOLOGIC"]
#13	monitor*:ti,ab
#14	(observe or observed or observing or observation*):ti,ab
#15	[mh ^"VITAL SIGNS"]
#16	[mh ^"RESPIRATORY INSUFFICIENCY"]
#17	[mh "BLOOD GAS ANALYSIS"]
#18	[mh ^"RESPIRATORY RATE"]
#19	((respirat* or ventilator*) near/3 (depress* or insufficien* or fail*)):ti,ab
#20	CSRD:ti,ab
#21	((oxygen or "carbon dioxide" or CO2) near/3 (saturat* or desaturat* or level* or analy* or monitor* or measur*)):ti,ab
#22	(blood near/3 gas* near/3 (analy* or monitor* or measur*)):ti,ab
#23	oximetr*:ti,ab
#24	(respirat* near/3 rate*):ti,ab
#25	((cardiovascular* or cardio-vascular* or circulat*) near/3 (collaps* or fail*)):ti,ab
#26	(sedat* near/3 scor*):ti,ab
#27	[mh ^"PAIN MEASUREMENT"]
#28	(pain near/3 (scor* or scale* or test* or assess* or questionnaire* or measur*)):ti,ab
#29	[mh ^"BLOOD PRESSURE"]
#30	[mh ^"HEART RATE"]
#31	((blood or diastolic* or systolic* or pulse) near/3 pressure):ti,ab
#32	((heart or pulse) near/3 rate):ti,ab
#33	(early near/3 warning near/3 (scor* or system* or tool*)):ti,ab
#34	EWS:ti,ab
#35	MEWS:ti,ab
#36	MEOWS:ti,ab
#37	SEWS:ti,ab
#38	MEWS:ti,ab

#	Searches
#39	[mh ^NAUSEA]
#40	[mh ^VOMITING]
#41	[mh ^"POSTOPERATIVE NAUSEA AND VOMITING"]
#42	(nausea or nauseous or vomit*):ti,ab
#43	[mh ^"GLASGOW COMA SCALE"]
#44	("glasgow coma" near/3 (scor* or scale*)):ti,ab
#45	[mh ^URINATION]
#46	(urin* near/3 (output* or volume*)):ti,ab
#47	[mh ^"URINARY CATHETERS"]
#48	[mh ^"URINARY CATHETERIZATION"]
#49	((urin* or ureth*) near/3 catheter*):ti,ab
#50	#12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49
#51	[mh ^"POSTOPERATIVE PERIOD"]
#52	[mh ^"POSTOPERATIVE CARE"]
#53	(postoperat* or post-operat*):ti,ab
#54	#51 or #52 or #53
#55	((post or follow* or after*) near/3 (cesar#an* or caesar#an* or "c section*" or csection* or (deliver* near/3 abdom*))):ti,ab
#56	((post or follow* or after*) near/3 (anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*)):ti,ab
#57	[mh ^"TIME FACTORS"] and [mh "MONITORING, PHYSIOLOGIC"]
#58	((modalit* or intensit* or frequenc* or duration or no or limit* or routine* or additional* or contin* or interval* or hour* or regular* or intermittent* or schedul* or requir* or amount* or optimal* or optimis* or suffic* or regimen* or rate* or repetition or repeat* or often or length) near/5 (monitor* or observ* or surveillan*)):ti,ab
#59	((1h* or 2h* or 3h* or 4h* or 5h* or 6h* or 7h* or 8h* or 9h* or 10h* or 11h* or 12h* or 13h* or 14h* or 15h* or 16h* or 17h* or 18h* or 19h* or 20h* or 21h* or 22h* or 23h* or 24h* or 30h* or 36h* or 48h* or "1 h*" or "2 h*" or "3 h*" or "4 h*" or "5 h*" or "6 h*" or "7 h*" or "8 h*" or "9 h*" or "10 h*" or "11 h*" or "12 h*" or "13 h*" or "14 h*" or "15 h*" or "16 h*" or "17 h*" or "18 h*" or "19 h*" or "20 h*" or "21 h*" or "22 h*" or "23 h*" or "24 h*" or "30 h*" or "36 h*" or "48 h*") near/5 (monitor* or observ* or surveillan*)):ti,ab
#60	#57 or #58 or #59
#61	"high dependency unit*":ti,ab
#62	HDU*:ti,ab
#63	[mh ^"RECOVERY ROOM"]
#64	"recovery room*":ti,ab
#65	((postnatal or post-natal) near/3 ward*):ti,ab
#66	#61 or #62 or #63 or #64 or #65
#67	#3 and #8 and #11 and #50 and #54
#68	#8 and #11 and #50 and #55
#69	#3 and #11 and #50 and #56
#70	#3 and #8 and #11 and #60
#71	#3 and #8 and #11 and #66
#72	#67 or #68 or #69 or #70 or #71

Database: Health Technology Assessment

Date last searched: 25/11/2019

#	Searches
1	MeSH DESCRIPTOR CESAREAN SECTION EXPLODE ALL TREES IN HTA
2	(cesarean* OR caesarean* OR "c section*" OR csection*) IN HTA
3	(deliver* NEAR3 abdom*) IN HTA
4	#1 OR #2 OR #3
5	MeSH DESCRIPTOR ANESTHESIA AND ANALGESIA EXPLODE ALL TREES IN HTA
6	MeSH DESCRIPTOR INJECTIONS, SPINAL IN HTA
7	MeSH DESCRIPTOR INJECTIONS, EPIDURAL IN HTA
8	(anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*) IN HTA
9	#5 OR #6 OR #7 OR #8
10	MeSH DESCRIPTOR NARCOTICS EXPLODE ALL TREES IN HTA
11	(opiod* or opiate* or morphine or diamorphine) IN HTA
12	#10 OR #11
12	#4 AND #9 AND #12

Database: Database of Abstracts of Reviews of Effect

Date last searched: 25/11/2019

#	Searches
1	MeSH DESCRIPTOR CESAREAN SECTION EXPLODE ALL TREES IN DARE

#	Searches
2	((cesarean* OR caesarean* OR "c section*" OR csection*)) and ((Systematic review:ZDT and Bibliographic:ZPS) OR (Systematic review:ZDT and Abstract:ZPS)) IN DARE
3	((deliver* NEAR3 abdom*)) and ((Systematic review:ZDT and Bibliographic:ZPS) OR (Systematic review:ZDT and Abstract:ZPS)) IN DARE
4	#1 OR #2 OR #3
5	MeSH DESCRIPTOR ANESTHESIA AND ANALGESIA EXPLODE ALL TREES IN DARE
6	MeSH DESCRIPTOR INJECTIONS, SPINAL IN DARE
7	MeSH DESCRIPTOR INJECTIONS, EPIDURAL IN DARE
8	((anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*)) and ((Systematic review:ZDT and Bibliographic:ZPS) OR (Systematic review:ZDT and Abstract:ZPS)) IN DARE
9	#5 OR #6 OR #7 OR #8
10	MeSH DESCRIPTOR NARCOTICS EXPLODE ALL TREES IN DARE
11	((opiod* or opiate* or morphine or diamorphine)) and ((Systematic review:ZDT and Bibliographic:ZPS) OR (Systematic review:ZDT and Abstract:ZPS)) IN DARE
12	#10 OR #11
13	#4 AND #9 AND #12

Health economics search strategies

Databases: Medline; Medline EPub Ahead of Print; and Medline In-Process & Other Non-Indexed Citations

Date last searched: 29/11/2019

#	Searches
1	ECONOMICS/
2	VALUE OF LIFE/
3	exp "COSTS AND COST ANALYSIS"/
4	exp ECONOMICS, HOSPITAL/
5	exp ECONOMICS, MEDICAL/
6	exp RESOURCE ALLOCATION/
7	ECONOMICS, NURSING/
8	ECONOMICS, PHARMACEUTICAL/
9	exp "FEES AND CHARGES"/
10	exp BUDGETS/
11	budget*.ti,ab.
12	cost*.ti,ab.
13	(economic* or pharmaco?economic*).ti,ab.
14	(price* or pricing*).ti,ab.
15	(financ* or fee or fees or expenditure* or saving*).ti,ab.
16	(value adj2 (money or monetary)).ti,ab.
17	resourc* allocat*.ti,ab.
18	(fund or funds or funding* or funded).ti,ab.
19	(ration or rations or rationing* or rationed).ti,ab.
20	ec.fs.
21	or/1-20
22	exp CESAREAN SECTION/
23	(c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$)).ti,ab.
24	or/22-23
25	exp "ANESTHESIA AND ANALGESIA"/
26	INJECTIONS, SPINAL/
27	INJECTIONS, EPIDURAL/
28	(an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$).ti,ab.
29	or/25-28
30	exp NARCOTICS/
31	(opiod? or opiate? or morphine or diamorphine).ti,ab.
32	or/30-31
33	exp MONITORING, PHYSIOLOGIC/
34	monitor$.ti,ab.
35	(observe or observed or observing or observation?).ti,ab.
36	VITAL SIGNS/
37	RESPIRATORY INSUFFICIENCY/
38	exp BLOOD GAS ANALYSIS/
39	RESPIRATORY RATE/
40	((respirat$ or ventilator$) adj3 (depress$ or insufficien$ or fail$)).ti,ab.
41	CSRD.ti,ab.
42	((oxygen or carbon dioxide or CO2) adj3 (saturat$ or desaturat$ or level? or analy$ or monitor$ or measur$)).ti,ab.

#	Searches
43	(blood adj3 gas$ adj3 (analy$ or monitor$ or measur$)).ti,ab.
44	oximetr$.ti,ab.
45	(respirat$ adj3 rate?).ti,ab.
46	((cardiovascular$ or cardio-vascular$ or circulat$) adj3 (collaps$ or fail$)).ti,ab.
47	(sedat$ adj3 scor$).ti,ab.
48	PAIN MEASUREMENT/
49	(pain adj3 (scor$ or scale? or test? or assess$ or questionnaire? or measur$)).ti,ab.
50	BLOOD PRESSURE/
51	HEART RATE/
52	((blood or diastolic$ or systolic$ or pulse) adj3 pressure).ti,ab.
53	((heart or pulse) adj3 rate).ti,ab.
54	(early adj3 warning adj3 (scor$ or system? or tool?)).ti,ab.
55	EWS.ti,ab.
56	MEWS.ti,ab.
57	MEOWS.ti,ab.
58	SEWS.ti,ab.
59	MEWS.ti,ab.
60	NAUSEA/
61	VOMITING/
62	"POSTOPERATIVE NAUSEA AND VOMITING"/
63	(nausea or nauseous or vomit$).ti,ab.
64	GLASGOW COMA SCALE/
65	(glasgow coma adj3 (scor$ or scale?)).ti,ab.
66	URINATION/
67	(urin$ adj3 (output? or volume?)).ti,ab.
68	URINARY CATHETERS/
69	URINARY CATHETERIZATION/
70	((urin$ or ureth$) adj3 catheter$).ti,ab.
71	or/33-70
72	POSTOPERATIVE PERIOD/
73	POSTOPERATIVE CARE/
74	(postoperat$ or post-operat$).ti,ab.
75	or/72-74
76	((post or follow$ or after$) adj3 (c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$))).ti,ab.
77	((post or follow$ or after$) adj3 (an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$)).ti,ab.
78	TIME FACTORS/ and exp MONITORING, PHYSIOLOGIC/
79	((modalit$ or intensit$ or frequenc$ or duration or no or limit$ or routine$ or additional$ or contin$ or interval? or hour$ or regular$ or intermittent$ or schedul$ or requir$ or amount? or optimal$ or optimis$ or suffic$ or regimen? or rate? or repetition or repeat$ or often or length) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
80	((1h$ or 2h$ or 3h$ or 4h$ or 5h$ or 6h$ or 7h$ or 8h$ or 9h$ or 10h$ or 11h$ or 12h$ or 13h$ or 14h$ or 15h$ or 16h$ or 17h$ or 18h$ or 19h$ or 20h$ or 21h$ or 22h$ or 23h$ or 24h$ or 30h$ or 36h$ or 48h$ or 1 h$ or 2 h$ or 3 h$ or 4 h$ or 5 h$ or 6 h$ or 7 h$ or 8 h$ or 9 h$ or 10 h$ or 11 h$ or 12 h$ or 13 h$ or 14 h$ or 15 h$ or 16 h$ or 17 h$ or 18 h$ or 19 h$ or 20 h$ or 21 h$ or 22 h$ or 23 h$ or 24 h$ or 30 h$ or 36 h$ or 48 h$) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
81	or/78-80
82	high dependency unit?.ti,ab.
83	HDU?.ti,ab.
84	RECOVERY ROOM/
85	recovery room?.ti,ab.
86	((postnatal or post-natal) adj3 ward?).ti,ab.
87	or/82-86
88	24 and 29 and 32 and 71 and 75
89	29 and 32 and 71 and 76
90	24 and 32 and 71 and 77
91	24 and 29 and 32 and 81
92	24 and 29 and 32 and 87
93	or/88-92
94	limit 93 to english language
95	LETTER/
96	EDITORIAL/
97	NEWS/
98	exp HISTORICAL ARTICLE/
99	ANECDOTES AS TOPIC/
100	COMMENT/
101	CASE REPORT/
102	(letter or comment*).ti.
103	or/95-102
104	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
105	103 not 104
106	ANIMALS/ not HUMANS/
107	exp ANIMALS, LABORATORY/

#	Searches
108	exp ANIMAL EXPERIMENTATION/
109	exp MODELS, ANIMAL/
110	exp RODENTIA/
111	(rat or rats or mouse or mice).ti.
112	or/105-111
113	94 not 112
114	21 and 113

Databases: Embase; and Embase Classic

Date last searched: 29/11/2019

#	Searches
1	HEALTH ECONOMICS/
2	exp ECONOMIC EVALUATION/
3	exp HEALTH CARE COST/
4	exp FEE/
5	BUDGET/
6	FUNDING/
7	RESOURCE ALLOCATION/
8	budget*.ti,ab.
9	cost*.ti,ab.
10	(economic* or pharmaco?economic*).ti,ab.
11	(price* or pricing*).ti,ab.
12	(financ* or fee or fees or expenditure* or saving*).ti,ab.
13	(value adj2 (money or monetary)).ti,ab.
14	resourc* allocat*.ti,ab.
15	(fund or funds or funding* or funded).ti,ab.
16	(ration or rations or rationing* or rationed).ti,ab.
17	or/1-16
18	exp CESAREAN SECTION/
19	(c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$)).ti,ab.
20	or/18-19
21	ANESTHESIOLOGICAL PROCEDURE/
22	exp ANESTHESIA/
23	exp ANALGESIA/
24	INTRASPINAL DRUG ADMINISTRATION/
25	EPIDURAL DRUG ADMINISTRATION/
26	(an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$).ti,ab.
27	or/21-26
28	exp NARCOTIC AGENT/
29	exp NARCOTIC ANALGESIC AGENT/
30	(opiod? or opiate? or morphine or diamorphine).ti,ab.
31	or/28-30
32	MONITORING/
33	DRUG MONITORING/
34	PATIENT MONITORING/
35	PERIOPERATIVE MONITORING/
36	PERSONAL MONITORING/
37	PHYSIOLOGIC MONITORING/
38	monitor$.ti,ab.
39	(observe or observed or observing or observation?).ti,ab.
40	VITAL SIGN/
41	exp RESPIRATORY FAILURE/
42	exp BLOOD GAS ANALYSIS/
43	BREATHING RATE/
44	((respirat$ or ventilator$) adj3 (depress$ or insufficien$ or fail$)).ti,ab.
45	CSRD.ti,ab.
46	((oxygen or carbon dioxide or CO2) adj3 (saturat$ or desaturat$ or level? or analy$ or monitor$ or measur$)).ti,ab.
47	(blood adj3 gas$ adj3 (analy$ or monitor$ or measur$)).ti,ab.
48	oximetr$.ti,ab.
49	(respirat$ adj3 rate?).ti,ab.
50	((cardiovascular$ or cardio-vascular$ or circulat$) adj3 (collaps$ or fail$)).ti,ab.
51	(sedat$ adj3 scor$).ti,ab.
52	PAIN MEASUREMENT/
53	*PAIN ASSESSMENT/
54	(pain adj3 (test? or questionnaire? or measur$)).ti,ab.
55	(pain adj3 (scor$ or scale? or assess$) adj10 (monitor$ or observ$ or surveillan$)).ti,ab.
56	BLOOD PRESSURE/
57	BLOOD PRESSURE MONITORING/

#	Searches
58	HEART RATE/
59	((blood or diastolic$ or systolic$ or pulse) adj3 pressure).ti,ab.
60	((heart or pulse) adj3 rate).ti,ab.
61	(early adj3 warning adj3 (scor$ or system? or tool?)).ti,ab.
62	EWS.ti,ab.
63	MEWS.ti,ab.
64	MEOWS.ti,ab.
65	SEWS.ti,ab.
66	MEWS.ti,ab.
67	*"NAUSEA AND VOMITING"/
68	*NAUSEA/
69	*VOMITING/
70	exp "POSTOPERATIVE NAUSEA AND VOMITING"/
71	((nausea or nauseous or vomit$) adj10 (monitor$ or observ$ or surveillan$ or scor$ or scale? or test? or assess$ or questionnaire? or measur$)).ti,ab.
72	GLASGOW COMA SCALE/
73	(glasgow coma adj3 (scor$ or scale?)).ti,ab.
74	URINE VOLUME/
75	(urin$ adj3 (output? or volume?)).ti,ab.
76	exp URINARY CATHETER/
77	exp BLADDER CATHETERIZATION/
78	((urin$ or ureth$) adj3 catheter$).ti,ab.
79	or/32-78
80	POSTOPERATIVE PERIOD/
81	POSTOPERATIVE CARE/
82	(postoperat$ or post-operat$).ti,ab.
83	or/80-82
84	((post or follow$ or after$) adj3 (c?esar#an$ or c section$ or csection$ or (deliver$ adj3 abdom$))).ti,ab.
85	POSTANESTHESIA CARE/
86	POSTOPERATIVE ANALGESIA/
87	((post or follow$ or after$) adj3 (an?esthesia or analgesia or epidural$ or intrathecal$ or neuraxial$)).ti,ab.
88	TIME FACTOR/ and exp MONITORING/
89	((modalit$ or intensit$ or frequenc$ or duration or no or limit$ or routine$ or additional$ or contin$ or interval? or hour$ or regular$ or intermittent$ or schedul$ or requir$ or amount? or optimal$ or optimis$ or suffic$ or regimen? or rate? or repetition or repeat$ or often or length) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
90	((1h$ or 2h$ or 3h$ or 4h$ or 5h$ or 6h$ or 7h$ or 8h$ or 9h$ or 10h$ or 11h$ or 12h$ or 13h$ or 14h$ or 15h$ or 16h$ or 17h$ or 18h$ or 19h$ or 20h$ or 21h$ or 22h$ or 23h$ or 24h$ or 30h$ or 36h$ or 48h$ or 1 h$ or 2 h$ or 3 h$ or 4 h$ or 5 h$ or 6 h$ or 7 h$ or 8 h$ or 9 h$ or 10 h$ or 11 h$ or 12 h$ or 13 h$ or 14 h$ or 15 h$ or 16 h$ or 17 h$ or 18 h$ or 19 h$ or 20 h$ or 21 h$ or 22 h$ or 23 h$ or 24 h$ or 30 h$ or 36 h$ or 48 h$) adj5 (monitor$ or observ$ or surveillan$)).ti,ab.
91	or/88-90
92	HIGH DEPENDENCY UNIT/
93	high dependency unit?.ti,ab.
94	HDU?.ti,ab.
95	RECOVERY ROOM/
96	recovery room?.ti,ab.
97	((postnatal or post-natal) adj3 ward?).ti,ab.
98	or/92-97
99	20 and 27 and 31 and 79 and 83
100	27 and 31 and 79 and 84
101	20 and 31 and 85
102	20 and 31 and 79 and 86
103	20 and 31 and 79 and 87
104	20 and 27 and 31 and 91
105	20 and 27 and 31 and 98
106	or/99-105
107	limit 106 to english language
108	letter.pt. or LETTER/
109	note.pt.
110	editorial.pt.
111	CASE REPORT/ or CASE STUDY/
112	(letter or comment*).ti.
113	or/108-112
114	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
115	113 not 114
116	ANIMAL/ not HUMAN/
117	NONHUMAN/
118	exp ANIMAL EXPERIMENT/
119	exp EXPERIMENTAL ANIMAL/
120	ANIMAL MODEL/
121	exp RODENT/

#	Searches
122	(rat or rats or mouse or mice).ti.
123	or/115-122
124	107 not 123
125	17 and 124

Database: Cochrane Central Register of Controlled Trials

Date last searched: 29/11/2019

#	Searches
#1	MeSH descriptor: [Economics] this term only
#2	MeSH descriptor: [Value of Life] this term only
#3	MeSH descriptor: [Costs and Cost Analysis] explode all trees
#4	MeSH descriptor: [Economics, Hospital] explode all trees
#5	MeSH descriptor: [Economics, Medical] explode all trees
#6	MeSH descriptor: [Resource Allocation] explode all trees
#7	MeSH descriptor: [Economics, Nursing] this term only
#8	MeSH descriptor: [Economics, Pharmaceutical] this term only
#9	MeSH descriptor: [Fees and Charges] explode all trees
#10	MeSH descriptor: [Budgets] explode all trees
#11	budget*:ti,ab
#12	cost*:ti,ab
#13	(economic* or pharmaco?economic*):ti,ab
#14	(price* or pricing*):ti,ab
#15	(financ* or fee or fees or expenditure* or saving*):ti,ab
#16	(value near/2 (money or monetary)):ti,ab
#17	resourc* allocat*:ti,ab
#18	(fund or funds or funding* or funded):ti,ab
#19	(ration or rations or rationing* or rationed) .ti,ab.
#20	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19
#21	[mh "CESAREAN SECTION"]
#22	(cesar#an* or caesar#an* or "c section*" or csection* or (deliver* near/3 abdom*)):ti,ab
#23	#21 or #22
#24	[mh "ANESTHESIA AND ANALGESIA"]
#25	[mh ^"INJECTIONS, SPINAL"]
#26	[mh ^"INJECTIONS, EPIDURAL"]
#27	(anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*):ti,ab
#28	#24 or #25 or #26 or #27
#29	[mh NARCOTICS]
#30	(opiod* or opiate* or morphine or diamorphine):ti,ab
#31	#29 or #30
#32	[mh "MONITORING, PHYSIOLOGIC"]
#33	monitor*:ti,ab
#34	(observe or observed or observing or observation*):ti,ab
#35	[mh ^"VITAL SIGNS"]
#36	[mh ^"RESPIRATORY INSUFFICIENCY"]
#37	[mh "BLOOD GAS ANALYSIS"]
#38	[mh ^"RESPIRATORY RATE"]
#39	((respirat* or ventilator*) near/3 (depress* or insufficien* or fail*)):ti,ab
#40	CSRD:ti,ab
#41	((oxygen or "carbon dioxide" or CO2) near/3 (saturat* or desaturat* or level* or analy* or monitor* or measur*)):ti,ab
#42	(blood near/3 gas* near/3 (analy* or monitor* or measur*)):ti,ab
#43	oximetr*:ti,ab
#44	(respirat* near/3 rate*):ti,ab
#45	((cardiovascular* or cardio-vascular* or circulat*) near/3 (collaps* or fail*)):ti,ab
#46	(sedat* near/3 scor*):ti,ab
#47	[mh ^"PAIN MEASUREMENT"]
#48	(pain near/3 (scor* or scale* or test* or assess* or questionnaire* or measur*)):ti,ab
#49	[mh ^"BLOOD PRESSURE"]
#50	[mh ^"HEART RATE"]
#51	((blood or diastolic* or systolic* or pulse) near/3 pressure):ti,ab
#52	((heart or pulse) near/3 rate):ti,ab
#53	(early near/3 warning near/3 (scor* or system* or tool*)):ti,ab
#54	EWS:ti,ab
#55	MEWS:ti,ab
#56	MEOWS:ti,ab
#57	SEWS:ti,ab
#58	MEWS:ti,ab
#59	[mh ^NAUSEA]

#	Searches
#60	[mh ^VOMITING]
#61	[mh ^"POSTOPERATIVE NAUSEA AND VOMITING"]
#62	(nausea or nauseous or vomit*):ti,ab
#63	[mh ^"GLASGOW COMA SCALE"]
#64	("glasgow coma" near/3 (scor* or scale*)):ti,ab
#65	[mh ^URINATION]
#66	(urin* near/3 (output* or volume*)):ti,ab
#67	[mh ^"URINARY CATHETERS"]
#68	[mh ^"URINARY CATHETERIZATION"]
#69	((urin* or ureth*) near/3 catheter*):ti,ab
#70	#32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67 or #68 or #69
#71	[mh ^"POSTOPERATIVE PERIOD"]
#72	[mh ^"POSTOPERATIVE CARE"]
#73	(postoperat* or post-operat*):ti,ab
#74	#71 or #72 or #73
#75	((post or follow* or after*) near/3 (cesar#an* or caesar#an* or "c section*" or csection* or (deliver* near/3 abdom*))):ti,ab
#76	((post or follow* or after*) near/3 (anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*)):ti,ab
#77	[mh ^"TIME FACTORS"] and [mh "MONITORING, PHYSIOLOGIC"]
#78	((modalit* or intensit* or frequenc* or duration or no or limit* or routine* or additional* or contin* or interval* or hour* or regular* or intermittent* or schedul* or requir* or amount* or optimal* or optimis* or suffic* or regimen* or rate* or repetition or repeat* or often or length) near/5 (monitor* or observ* or surveillan*)):ti,ab
#79	((1h* or 2h* or 3h* or 4h* or 5h* or 6h* or 7h* or 8h* or 9h* or 10h* or 11h* or 12h* or 13h* or 14h* or 15h* or 16h* or 17h* or 18h* or 19h* or 20h* or 21h* or 22h* or 23h* or 24h* or 30h* or 36h* or 48h* or "1 h*" or "2 h*" or "3 h*" or "4 h*" or "5 h*" or "6 h*" or "7 h*" or "8 h*" or "9 h*" or "10 h*" or "11 h*" or "12 h*" or "13 h*" or "14 h*" or "15 h*" or "16 h*" or "17 h*" or "18 h*" or "19 h*" or "20 h*" or "21 h*" or "22 h*" or "23 h*" or "24 h*" or "30 h*" or "36 h*" or "48 h*") near/5 (monitor* or observ* or surveillan*)):ti,ab
#80	#77 or #78 or #79
#81	"high dependency unit*":ti,ab
#82	HDU*:ti,ab
#83	[mh ^"RECOVERY ROOM"]
#84	"recovery room*":ti,ab
#85	((postnatal or post-natal) near/3 ward*):ti,ab
#86	#81 or #82 or #83 or #84 or #85
#87	#23 and #28 and #31 and #70 and #74
#88	#28 and #31 and #70 and #75
#89	#23 and #31 and #70 and #76
#90	#23 and #28 and #31 and #80
#91	#23 and #28 and #31 and #86
#92	#87 or #88 or #89 or #90 or #91
#93	#20 and #92

Database: Health Technology Assessment

Date last searched: 29/11/2019

#	Searches
1	MeSH DESCRIPTOR CESAREAN SECTION EXPLODE ALL TREES IN HTA
2	(cesarean* OR caesarean* OR "c section*" OR csection*) IN HTA
3	(deliver* NEAR3 abdom*) IN HTA
4	#1 OR #2 OR #3
5	MeSH DESCRIPTOR ANESTHESIA AND ANALGESIA EXPLODE ALL TREES IN HTA
6	MeSH DESCRIPTOR INJECTIONS, SPINAL IN HTA
7	MeSH DESCRIPTOR INJECTIONS, EPIDURAL IN HTA
8	(anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*) IN HTA
9	#5 OR #6 OR #7 OR #8
10	MeSH DESCRIPTOR NARCOTICS EXPLODE ALL TREES IN HTA
11	(opiod* or opiate* or morphine or diamorphine) IN HTA
12	#10 OR #11
12	#4 AND #9 AND #12

Database: NHS Economic Evaluation Database

Date last searched: 29/11/2019

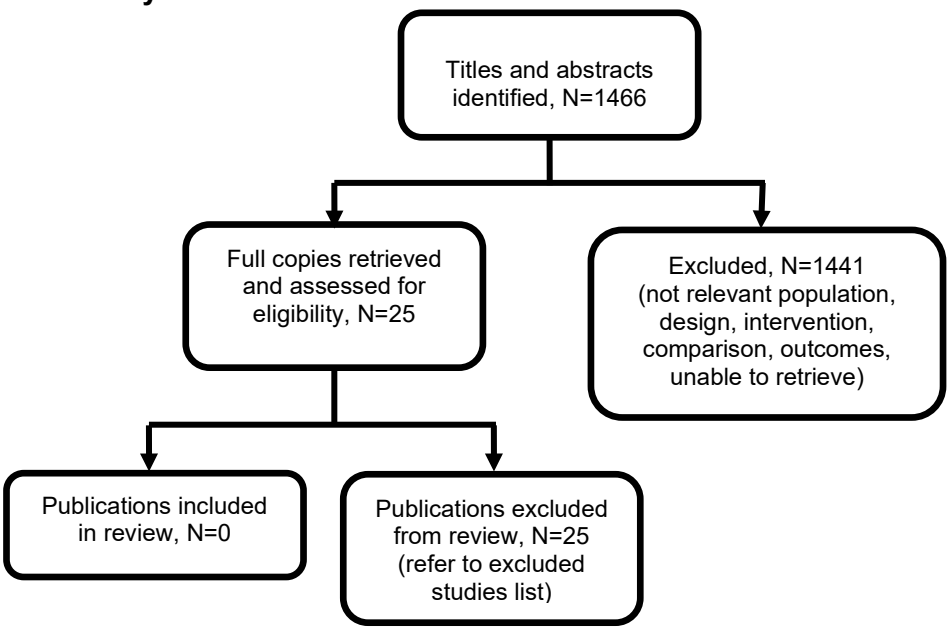
#	Searches
1	MeSH DESCRIPTOR CESAREAN SECTION EXPLODE ALL TREES IN NHSEED
2	(cesarean* OR caesarean* OR "c section*" OR csection*) IN NHSEED

#	Searches
3	(deliver* NEAR3 abdom*) IN NHSEED
4	#1 OR #2 OR #3
5	MeSH DESCRIPTOR ANESTHESIA AND ANALGESIA EXPLODE ALL TREES IN NHSEED
6	MeSH DESCRIPTOR INJECTIONS, SPINAL IN NHSEED
7	MeSH DESCRIPTOR INJECTIONS, EPIDURAL IN NHSEED
8	(anesthesia or anaesthesia or analgesia or epidural* or intrathecal* or neuraxial*) IN NHSEED
9	#5 OR #6 OR #7 OR #8
10	MeSH DESCRIPTOR NARCOTICS EXPLODE ALL TREES IN NHSEED
11	(opiod* or opiate* or morphine or diamorphine) IN NHSEED
12	#10 OR #11
13	#4 AND #9 AND #12

Appendix C – Clinical evidence study selection

Clinical study selection for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

Figure 1: Study selection flow chart



Appendix D – Clinical evidence tables

Clinical evidence tables for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No evidence was identified which was applicable to this review question.

Appendix E – Forest plots

Forest plots for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No meta-analysis was conducted for this review question and so there are no forest plots.

Appendix F – GRADE tables

GRADE tables for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

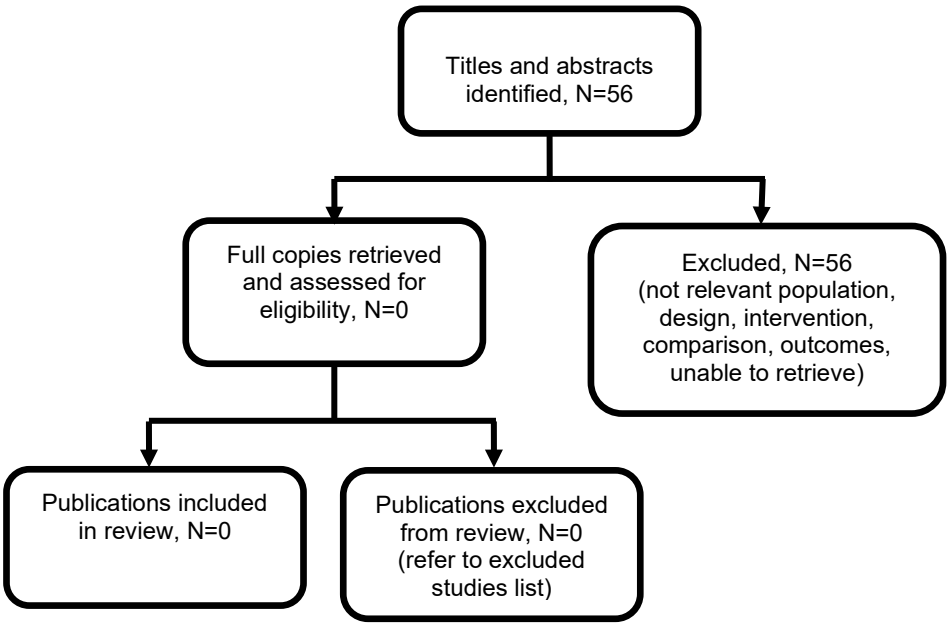
No evidence was identified which was applicable to this review question.

Appendix G – Economic evidence study selection

Economic evidence study selection for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No evidence was identified which was applicable to this review question.

Figure 2: Study selection flow chart



Appendix H – Economic evidence tables

Economic evidence tables for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No evidence was identified which was applicable to this review question.

Appendix I – Economic evidence profiles

Economic evidence profiles for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No evidence was identified which was applicable to this review question.

Appendix J – Economic analysis

Economic evidence analysis for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No economic analysis was conducted for this review question.

Appendix K – Excluded studies

Excluded studies for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

Clinical studies

Table 3: Excluded studies and reasons for their exclusion

Study	Reason for Exclusion
Abdallah, F. W., Halpern, S. H., Margarido, C. B., Transversus abdominis plane block for postoperative analgesia after Caesarean delivery performed under spinal anaesthesia? A systematic review and meta-analysis, British Journal of Anaesthesia, 109, 679-687, 2012	Not relevant intervention - examines efficacy of TAP block in caesarean
Albright, G., Epidural morphine, hydromorphone, and meperidine for post C-section pain relief utilizing a respiratory apnea monitor, Anesthesiology, 59, A416, 1983	Unavailable
Aluri, S., Wrench, I. J., Enhanced recovery from obstetric surgery: A UK survey of practice, International Journal of Obstetric Anesthesia, 23, 157-160, 2014	Survey only, not intervention trial
Angle, P., Walsh, V., Pain relief after cesarean section, Techniques in Regional Anesthesia and Pain Management, 5, 36-40, 2001	Narrative overview of current post caesarean pain relief options
Argoff, C. E., Recent Management Advances in Acute Postoperative Pain, Pain Practice, 14, 477-487, 2014	Narrative overview of current post-operative pain relief options
Armand, S., Langlade, A., Boutros, A., Lobjoit, K., Monrigal, C., Ramboatiana, R., Rauss, A., Bonnet, F., Meta-analysis of the efficacy of extradural clonidine to relieve postoperative pain: an impossible task, British Journal of Anaesthesia, 81, 126-134, 1998	Systematic review of efficacy of particular drug for pain relief. Not relevant intervention
Bauchat, Jeanette R., Weiniger, Carolyn F., Sultan, Pervez, Habib, Ashraf S., Ando, Kazuo, Kowalczyk, John J., Kato, Rie, George, Ronald B., Palmer, Craig M., Carvalho, Brendan, Society for Obstetric Anesthesia and Perinatology Consensus Statement: Monitoring Recommendations for Prevention and Detection of Respiratory Depression Associated With Administration of Neuraxial Morphine for Cesarean Delivery Analgesia, Anesthesia and Analgesia, 129, 458-474, 2019	Consensus statement only (not an intervention or comparative study)
Brown, E. N., Pavone, K. J., Naranjo, M., Multimodal general anesthesia: Theory and practice, Anesthesia and Analgesia, 127, 1246-1258, 2018	Narrative overview of the mechanisms of pain relief and anaesthesia
Campbell, J. P., Sabharwal, A., Harrop-Griffiths, W., Malhotra, S., Monitoring after neuraxial opioids for caesarean section: A survey of UK practice, Anaesthesia, 65, 102-103, 2010	Conference abstract/ abstract only
Clark, R. B., Miller, F. C., Recovery room and postoperative complications of cesarean section, Anesthesiology Clinics of North America, 8, 173-187, 1990	Narrative overview

Study	Reason for Exclusion
Das, B., Vickers, R., Machineni, V., Enhanced recovery in obstetrics, International Journal of Obstetric Anesthesia, 22, S13, 2013	Conference poster presentation
Harrison, D. M., Sinatra, R., Morgese, L., Chung, J. H., Epidural narcotic and patient-controlled analgesia for post-cesarean section pain relief, Anesthesiology, 68, 454â□□457, 1988	Not relevant intervention - assesses different postoperative analgesia, uses same monitoring protocol in all 3 groups
Juri, Takashi, Suehiro, Koichi, Kimura, Aya, Mukai, Akira, Tanaka, Katsuaki, Yamada, Tokuhiro, Mori, Takashi, Nishikawa, Kiyonobu, Impact of non-invasive continuous blood pressure monitoring on maternal hypotension during cesarean delivery: a randomized-controlled study, Journal of Anesthesia, 32, 822-830, 2018	Not relevant intervention. Study assesses correlation (with usual methods) and accuracy of a new blood pressure monitoring device during caesarean
Kaneyama, A., Sato, M., Yamashita, Y., Suzuki, Y., Continuous respiratory monitoring after caesarean section with intrathecal morphine analgesia-a prospective observational study of 100 cases, Regional Anesthesia and Pain Medicine, 42, e72, 2017	Conference poster presentation
Kotelko, D. M., Dailey, P. A., Shnider, S. M., Rosen, M. A., Hughes, S. C., Brizgys, R. V., Epidural morphine analgesia after cesarean delivery, Obstetrics and Gynecology, 63, 409-13, 1984	Not relevant intervention - uses same monitoring technique in both groups
Kuczkowski, K. M., Postoperative pain control in the parturient: New challenges in the new millennium, Journal of Maternal-Fetal and Neonatal Medicine, 24, 301-304, 2011	Narrative overview of post-operative pain management
Liu, Y., Pian-Smith, M. C. M., Leffert, L. R., Minehart, R. D., Torri, A., Cote, C., Kacmarek, R. M., Jiang, Y., Continuous measurement of cardiac output with the electrical velocimetry method in patients under spinal anesthesia for cesarean delivery, Journal of Clinical Monitoring and Computing, 29, 627-634, 2015	Study from non-OECD country
Meniolle, F., Dadure, C., Morau, E., Update on C-section under general anaesthesia, Praticien en Anesthesie Reanimation, 22, 342-345, 2018	Full text only available in French
Nct,, Determining the Effect of an "Alternate Recovery Protocol" Versus Current Standard of Care After Cesarean Section, Https://clinicaltrials.gov/show/nct03330119, 2017	Trial abandoned (Aug 2018) due to lack of funds and limited recruitment
O'Shea,E., Jee,R., Wee,M., A 10 year retrospective audit of monitoring following intrathecal and epidural opioids, International Journal of Obstetric Anesthesia, 19, 345-, 2010	Non comparative study (audit only)
Palmer, C. M., Post Cesarean Analgesia, Techniques in Regional Anesthesia and Pain Management, 7, 213-221, 2003	Narrative overview of pain management drugs, mechanisms and side-effects
Simpson, Kathleen Rice, Postoperative pain relief measures, MCN. The American journal of maternal child nursing, 34, 136, 2009	Short overview of post-operative pain relief measures
Wai, C., Okonkwo, I., Jones, A., Multimodal analgesic regime post Caesarean section - What are we missing?, Anaesthesia, 67, 73, 2012	Poster presentation (abstract)
Wee,M.Y.K., Brown,H., Reynolds,F., The National Institute of Clinical Excellence (NICE) guidelines for caesarean sections: Implications for the anaesthetist,	Commentary in response to 2004 NICE recommendations

Study	Reason for Exclusion
International Journal of Obstetric Anesthesia, 14, 147-158, 2005	
Yurashevich, M., Habib, A. S., Monitoring, prevention and treatment of side effects of long-acting neuraxial opioids for post-cesarean analgesia, International Journal of Obstetric Anesthesia, 39, 117-128, 2019	Narrative overview of side effects from analgesia

Economic studies

No economic evidence was identified for this review.

Appendix L – Research recommendations

Research recommendations for review question: What post-operative monitoring is required for women who have received intrathecal or epidural opioids at the time of caesarean birth, to identify or prevent potential complications (including the duration, frequency and features to be monitored)?

No research recommendations were made for this review question