National Institute for Health and Care Excellence

Final

Intrapartum care for women with existing medical conditions or obstetric complications and their babies

[I] Evidence reviews for obesity

NICE guideline NG121

Evidence reviews for women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions

March 2019

Final

Developed by the National Guideline Alliance hosted by the Royal College of Obstetricians and Gynaecologists

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ISBN: 978-1-4731-3296-2

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Intrapartum care for women with obesity

This evidence report contains information on 5 reviews relating to intrapartum care for women with obesity.

- What is the value of assessing fetal presentation early in labour for women with obesity?
- Does an ultrasound scan of woman's back improve needle siting for central neuraxial blockade anaesthesia and analgesia for women with obesity in the peripartum period?
- What is the effectiveness of intermittent auscultation compared with electronic fetal monitoring during labour in women with obesity?
- What is the optimal position in the second stage of labour for women with obesity?
- What additional equipment is needed to ensure optimal care of women with obesity in the peripartum period?

Intrapartum care for women with obesity – fetal presentation

Review question

What is the value of assessing fetal presentation early in labour for women with obesity?

Introduction

The aim of this review is to determine whether early assessment of fetal presentation (during the first stage of labour) by ultrasound scan (with or without palpation) is more clinically and cost effective than assessment of fetal presentation by palpation alone. This is important because palpation to assess fetal presentation in women with obesity can be difficult to perform and as a consequence malpresentation (breech) may be missed.

Summary of the protocol

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	Women in labour who are obese (BMI≥30 kg/m^2) at the booking appointment
Intervention	Ultrasound (with or without palpation)
Comparison	Palpation only
Outcomes	For the woman: • major morbidity (such as genital tract trauma, blood loss, or infection) • mode of birth • women's satisfaction with labour and birth (including psychological wellbeing) • admission to a high dependency unit (HDU) or intensive treatment unit (ITU) For the baby: • mortality • major neonatal morbidity (such as hypoxic ischaemic encephalopathy, birth injuries and respiratory complications) • admission to a neonatal unit • undiagnosed breech presentation

BMI: body mass index

For further details see the full review protocol in appendix A. The search strategies are presented in appendix B.

Clinical evidence

Included studies

No clinical evidence was identified for this review.

See the study selection flow chart in Appendix C.

Excluded studies

Studies not included in this review with reasons for their exclusion are listed in Appendix D.

Summary of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so there are no evidence tables in Appendix E). No meta-analysis was undertaken for this review (and so there are no forest plots in Appendix F).

Quality assessment of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so no quality assessment was undertaken and there are no GRADE tables in Appendix G).

Economic evidence

Included studies

No economic evidence was identified for this review.

See the study selection flow chart in Supplement 2 (Health economics).

Excluded studies

No full-text copies of articles were requested for this review and so there is no excluded studies list (see Supplement 2 (Health economics)).

Summary of studies included in the economic evidence review

No economic evidence was identified for this review (and so there are no economic evidence tables in Supplement 2 (Health economics)).

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation (see Supplement 2 (Health economics)).

Evidence statements

No clinical evidence was identified for this review.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Outcomes for the woman and the baby were prioritised for review.

The incidence of major morbidity (such as genital tract trauma, blood loss or infection) was considered to be of critical importance for the woman because these are complications of

labour associated with malpresentation and because they constitute a major harm. The incidence of mortality and of major neonatal morbidity (such as hypoxic ischaemic encephalopathy, birth injuries and respiratory complications) were regarded as critical outcomes for the baby.

Mode of birth and women's satisfaction with labour and birth (including psychological wellbeing) were considered as important rather than critical outcomes. This is because they are unlikely to be life threatening. Admission to a neonatal unit and undiagnosed breech presentation were considered as important outcomes for the baby.

The quality of the evidence

No studies were identified that examined ultrasound scanning (with or without palpation) in comparison to palpation alone in women with obesity.

Benefits and harms

The benefit of detecting a breech presentation early is significant as it can be fatal for the baby and cause serious morbidity for the woman. The committee considered, based on their experience, that use of ultrasound was more effective than palpation alone in determining presentation during pregnancy.

However, the committee also recognised that use of ultrasound could be associated with some harms. For example, following no finding or a positive finding from palpation, a negative finding on a scan might provide false reassurance of a normal presentation.

The committee considered women's experience of labour and birth. It was recognised that a woman may have to wait some time to receive sonography, that even abdominal scanning can be uncomfortable and that it is intrusive if performed transvaginally or transperineally. However, the benefit of using ultrasound is that healthcare professionals can identify the baby's position and thereby an informed decision can be made on mode of birth. It was also recognised that ultrasound scanning is not available in all birthing units.

The committee noted that abdominal palpation was part of usual clinical examination during initial assessment and that the benefits of its performance were not solely for the assessment of fetal presentation. Consequently the recommendation should be interpreted as meaning that an ultrasound should only be performed if there was clinical uncertainty following a vaginal examination and palpation.

Additionally the committee noted that an ultrasound scan is technically more difficult to perform in a woman with a BMI over 30 kg/m^2.

The committee considered whether any further distinction could be made regarding degree of obesity. They noted that a high waist circumference even in a lower category of BMI-determined obesity might prevent successful palpation and therefore agreed that the recommendation should extend to all women who are obese.

The committee recommended to consider ultrasound scanning at the start of established labour in women who are obese and for whom the presentation of the baby is uncertain to provide information to help minimise intervention during labour. The committee discussed that on occasion where transabdominal ultrasound scanning is not able to determine presentation (for example, in those with very high BMI or high waist circumference) that transvaginal or transperineal ultrasound scanning could be used if the woman consents. The choice of scanning method should be based on the clinical judgement of benefits and risks to the individual woman.

The committee considered whether any further recommendations should be made for women whose weight is poorly controlled, women with cognitive or physical disability, women

who in preterm labour or women who have received no antenatal care, but did not believe separate recommendations needed to be made for any of these groups.

Cost effectiveness and resource use

The committee made a qualitative assessment of cost effectiveness.

The committee recognised that identifying the fetal position by palpation can be difficult for women with a BMI over 30 kg/m^2 and that the confidence in palpation tends to decrease with increasing bodyweight. The committee recognised that performing an early assessment of fetal presentation (that is, in the first stage of labour) by ultrasound scan in addition to palpation increases the cost of assessment. However, they thought that these additional costs would produce a net health benefit especially as the consequences of malpresentation are more serious in women with a BMI over 30 kg/m^2.

The committee considered that the recommendation reflects current practice and, therefore, they did not anticipate a significant resource impact to the NHS.

Other factors the committee took into account

Due to the uncertainty of the evidence, the committee chose to make a research recommendation to explore whether a routine ultrasound scan at 36 weeks should be provided to pregnant women with a BMI over 30 kg/m^2. See appendix L for further details.

The committee noted that the accuracy of BMI as an assessment of obesity and risk might be limited without adjustment for ethnicity, for example adjusting in line with the NICE guideline on BMI: preventing ill health and premature death in black, Asian and other minority ethnic groups (PH46). The committee was aware that a lower BMI threshold of 27.5 kg/m^2 for obesity has been recommended for black African, African-Caribbean and Asian (South Asian and Chinese) populations to indicate high risk of conditions such as type 2 diabetes and to trigger action to reduce the risk of these conditions. However, as the recommendations in this guideline in relation to obesity relate to problems that may arise due to body mass instead of the higher risk of comorbidities this was not considered particularly relevant for the recommendations in this guideline. Waist circumference was also noted to be an important consideration with BMI in both the healthcare professional's assessment of risk to the woman and in their ability to perform abdominal palpation successfully.

Intrapartum care for women with obesity – anaesthesia and analgesia

Review question

Does an ultrasound scan of woman's back improve needle siting for central neuraxial blockade anaesthesia and analgesia for women with obesity in the peripartum period?

Introduction

The aim of this review is to examine whether ultrasound-guided anaesthesia helps to improve effective placement of needles or catheters in regional techniques for women with obesity in the peripartum period. This is important because, although regional anaesthesia can offer advantages over general anaesthesia, the increased amount of subcutaneous tissue in women with obesity can pose a significant challenge to successful needle and catheter placement, which are essential for effective regional anaesthesia/analgesia.

Summary of the protocol

See Table 2 for a summary of the population, intervention, comparison and outcome (PICO) characteristics of this review.

Table 2: Summary of the protocol (PICO) table

Population	Women in labour who are obese (BMI≥30 kg/m^2) at the booking appointment
Intervention	Ultrasound-guided needle and catheter siting
Comparison	Landmark technique
Outcomes	For the woman: • women's reporting of effective analgesia (assessed through different methods such as pain scores, block to cold, block to touch, motor block) • failed analgesia • women's satisfaction with labour and birth (including psychological wellbeing) • major morbidity (such as blood loss, infection at needle site, catheter placement and postdural puncture headache) • admission to intensive treatment unit (ITU) • mode of birth For the baby: • major neonatal morbidity (such as hypoxic ischaemic encephalopathy, birth injuries and respiratory complications)

BMI: body mass index

For further details see the full review protocol in appendix A. The search strategies are presented in appendix B.

Clinical evidence

Included studies

Three randomised controlled trials (RCTs) were included in this review (see 'Summary of clinical studies included in the evidence review').

All 3 studies compared ultrasound-guided (USG) needle siting and palpation only needle siting (Sahin 2014, Urfalioglu 2017, Wang 2012).

Evidence from the studies included in the review is summarised below (see 'Quality assessment of clinical studies included in the evidence review').

Data was reported on the critical outcomes for the woman, failed analgesia and the important outcome, major morbidity (blood loss, postdural puncture headache and backache). There was no evidence identified for the following outcomes for the woman: women's reporting of effective analgesia (critical outcome), women's satisfaction with labour and birth (critical outcome), major morbidity (infection at needle site, catheter placement) (important outcome), admission to intensive treatment unit (important outcome), and mode of birth (outcome of limited importance). There was no evidence identified for the following outcome for the baby: major neonatal morbidity (critical outcome).

See also the study selection flow chart in appendix C.

Excluded studies

Studies not included in this review with reasons for their exclusion are listed in appendix D.

Summary of clinical studies included in the evidence review

Table 3 provides a brief summary of the included studies.

Table 3: Summary of included studies

Study	Population	Intervention/Comparison	Outcomes
Sahin 2014 RCT Turkey	N=100 obese (BMI ≥30) women, term pregnancy for an elective caesarean section under subarachnoid block. Data for these participants were reported separately (n=50) and were included in this review	Ultrasound guidance (USG) (n=25) Palpation only for needle siting with parturients by an anaesthetist of 4 years' experience (n=25)	For the woman: • Failed subarachnoid block • Bloody CSF • Post-dural puncture headache • Backache
Urfalioglu 2017 RCT Turkey	N=97 obese (BMI >30) women at ≥37 weeks gestation for an elective caesarean section under spinal anaesthesia	USG (n=48) Palpation only by an anaesthetist of 5 years' experience (n=49)	For the woman: • Headache • Backache

Study	Population	Intervention/Comparison	Outcomes
Wang 2012 RCT China	N=60 obese (BMI ≥30) women scheduled for a caesarean section under combined spinal-epidural procedure	USG (n=30) Palpation only for needle siting with parturients by an anaesthetist of 10 years' experience (n=30)	For the woman: • Puncture site haemorrhage* • Post-procedural headache • Back pain

N: number of participants; BMI: body mass index; CSF: cerebrospinal fluid; RCT: randomised controlled trial; USG: ultrasound guidance
**Haemorrhage due to the epidural or spinal needle*

See also the study evidence tables in Appendix E and forest plots in Appendix F.

Quality assessment of clinical studies included in the evidence review

The clinical evidence profile for this review question is presented in Appendix G.

Economic evidence

Included studies

No economic evidence was identified for this review.

See the study selection flow chart in Supplement 2 (Health economics).

Excluded studies

No full-text copies of articles were requested for this review and so there is no excluded studies list (see Supplement 2 (Health economics)).

Summary of studies included in the economic evidence review

No economic evidence was identified for this review (and so there are no economic evidence tables in Supplement 2 (Health economics)).

Economic model

An original health economic cost utility analysis was developed to evaluate the cost effectiveness of ultrasound scanning (plus palpation) compared to palpation alone, to improve needle siting in obese women for regional anaesthesia and analgesia. A summary of the model is presented below, with full details provided in Supplement 2 (Health economics).

The model setting was the NHS and the population was obese women who require regional anaesthesia or analgesia. The clinical outcomes were based on the outcomes reported in 3 studies (Wang 2012, Sahin 2014, Urfalioglu 2017) that were included in the clinical evidence review undertaken for this guideline. The baseline risks and treatment effect sizes were based on the control arms of these 2 included studies. Probabilistic and deterministic sensitivity analysis was undertaken to assess the impact of parameter uncertainty on the model results.

In order to estimate the QALY loss from adverse outcomes, a health state utility associated with these conditions was derived from published studies. The decrement was then estimated by subtracting this value from EQ5D population norms for women aged 25 to 34 years. This was then multiplied by the expected duration of these outcomes, which was also estimated from the published literature, to derive a total QALY loss from these outcomes. No

discounting was needed as the duration of these adverse outcomes is generally less than 1 month.

The analysis adopted a NHS and Personal Social Services perspective for costs and was based on a 2016/17 price year. In addition to the incremental costs of ultrasound scanning the model also included the 'downstream' costs arising from adverse outcomes. Costs were not discounted as any 'downstream' costs were assumed to occur within 1 year.

The probabilistic and deterministic sensitivity analyses both suggested that ultrasound scanning (plus palpation) to improve needle siting in obese women for regional anaesthesia and analgesia was not cost effective when compared to palpation alone, which dominated ultrasound scanning plus palpation. In the probabilistic sensitivity analysis (PSA) the mean incremental net monetary benefit (iNMB) of ultrasound scanning was -£91 and palpation alone had a 99% chance of being cost effective at a cost effectiveness threshold of either £20,000 per QALY and a 95% probability of being cost effective at a threshold of £30,000 per QALY. In the deterministic analysis the iNMB of ultrasound scanning (plus palpation) was -£53 when compared to palpation alone. One-way sensitivity analysis generally suggested that the model conclusion was not sensitive to relatively large changes in input values.

The results of this analysis need to be interpreted with caution given the limitations of the clinical evidence which underpins it. Potentially, improved needle siting could reduce the need for general anaesthesia in obese women which has a greater risk then in the non-obese population, but this outcome was not reported in the studies. Furthermore, the studies were exploratory and generally underpowered to detect differences in outcomes. As a result the estimate of treatment effect was very imprecise.

The model results suggested that there was no economic benefit in undertaking ultrasound scanning plus palpation to improve needle siting in obese women for regional anaesthesia and analgesia. However, the committee did not think that the analysis provided conclusive evidence that ultrasound plus palpation should not be undertaken for needle siting. Therefore, they refrained from making any recommendation on this topic but did make a recommendation for further research (see below).

Evidence statements

Ultrasound-guided versus palpation only needle siting

Outcomes for the woman

Failed analgesia: failed subarachnoid block

Low quality evidence from 1 RCT (N=50) reported that there was no clinically important difference in the risk of failed subarachnoid block between the group of women who had ultrasound-guided and those who had palpation only needle siting.

Major morbidity (blood loss): puncture site haemorrhage or bloody cerebral spinal fluid

Very low quality evidence from 2 RCTs (N=110) reported that there was no clinically important difference in the risk of blood loss between the group of women who had ultrasound-guided and those who had palpation only needle siting.

Major morbidity (post-dural puncture headache)

Very low quality evidence from 3 RCTs (N=207) reported that there was no clinically important difference in the risk of headache between the group of women who had ultrasound-guided and those who had palpation only needle siting.

Major morbidity: backache

Low quality evidence from 3 RCTs (N=207) reported that there was a clinically significant beneficial effect in the group of women who had ultrasound-guided needle siting in comparison with palpation only needle siting for the risk of backache.

Economic evidence

Evidence from the guideline economic analysis did not suggest that ultrasound scanning (plus palpation) is cost effective compared to palpation alone for improving needle siting for regional anaesthesia and analgesia in obese women. The economic analysis is directly applicable to the NICE decision-making context although it is characterised by major limitations.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Outcomes for the woman and the baby were prioritised for this review.

Women's reporting of effective analgesia, failed analgesia and satisfaction with labour and birth were considered to be of critical importance to the woman because they identify how effective pain relief has been. Major morbidity was considered to be of critical importance to the baby as it was a lifelong and severe outcome.

Admission to ITU and major morbidity were considered as important rather than critical outcomes for the woman. This was because these outcomes are extremely important to women, but the committee concluded there was limited reason to believe that they would be affected by needle siting technique.

The quality of the evidence

There were 3 trials that provided evidence for this review. These trials involved women who were undergoing an elective caesarean section and there was no evidence available for women who were in labour. Only 1 out of 3 critical outcomes specified in the review protocol, that is failed analgesia, was reported in 1 trial. The trials reported incidence of some major maternal morbidities (haemorrhage at the puncture site, headache and backache) although the quality of these findings was very low to low. The quality of the evidence was downgraded because of the risk of bias (unclear randomisation, allocation concealment and blinding) and imprecision. The committee discussed how these studies were exploratory and therefore underpowered.

Benefits and harms

The benefit of correctly siting the needle is effective pain relief and lack of complications. Failing to site the needle correctly means no analgesia, and potentially serious complications.

The benefit of improved siting is that it may reduce the risk of inadvertent dural puncture. Additionally, there is a theoretical risk of infection increasing with multiple injection sites, therefore improved siting has a potentially protective effect in terms of infection in the woman.

The potential harms of ultrasound are that it is more expensive, requires training to use effectively and may take longer to perform, which might be an important consideration in an emergency.

The committee discussed a theoretical concern that over-reliance on ultrasound techniques might lead to a lack of expertise among healthcare professionals which could necessitate the use of ultrasound even in low-risk populations. This risk was not judged likely to have an immediate impact, although it might require review if the prevalence of obesity in the maternal population increases.

However, the committee did not make any recommendation as the evidence was inconclusive.

Cost effectiveness and resource use

The committee noted that the economic evaluation (see Supplement 2 (Health economics)) did not provide evidence that ultrasound scanning to improve needle siting in women with a BMI over 30 kg/m^2 for regional anaesthesia or analgesia was cost effective. Therefore, they did not make a recommendation for ultrasound scanning to be used. However, they did not think the evidence was sufficiently robust to make a 'do not use' recommendation.

Other factors the committee took into account

The committee discussed the lack of the evidence and they highlighted that despite the phrasing of the review question, ultrasound and other techniques were not intended to be mutually exclusive options; healthcare professionals might be able to use existing training and techniques in combination to improve accuracy of needle siting.

Due to the uncertainty of the evidence, the committee chose to make a research recommendation to explore whether the use of ultrasound of the lumbar spine can improve siting of regional anaesthetic needles in pregnant women with a BMI over 30 kg/m^2. See appendix L for further details.

The committee also discussed that if a woman with a BMI over 40 kg/m^2 is admitted for birth it would be advisable to inform the anaesthetist. No evidence on this was reviewed, therefore, no recommendation was made.

Intrapartum care for women with obesity – fetal monitoring

Review question

What is the effectiveness of intermittent auscultation compared with electronic fetal monitoring during labour in women with obesity?

Introduction

The aim of this review is to determine which method of intrapartum fetal monitoring (continuous electronic fetal monitoring or intermittent auscultation) is associated with better outcomes for the woman and baby in women with obesity and if relevant, to determine the most clinically effective method of continuous fetal monitoring (fetal scalp electrode or external electronic method). This is important because obesity is associated with adverse outcomes for the baby and external monitoring can be difficult to achieve.

Summary of the protocol

See Table 4 for a summary of the population, intervention, comparison and outcome (PICO) characteristics of this review.

Table 4: Summary of the protocol (PICO) table

Population	Women in labour who are obese (BMI ≥ 30 kg/m2) at the booking appointment
Intervention	Intervention 1 • Electronic fetal monitoring (EFM) using an external ultrasound transducer and displayed as a cardiotocograph trace Intervention 2 • Electronic fetal monitoring (EFM) using a fetal scalp electrode and displayed as cardiotocograph trace Intervention 3 • Intermittent auscultation (IA)
Comparison	• Any of the above interventions compared with each other
Outcomes	For the woman: • major morbidity (such as genital tract trauma, blood loss, or infection) • admission to intensive treatment unit • mode of birth • women's satisfaction with labour and birth (including psychological wellbeing) For the baby: • neonatal, perinatal and infant mortality • major neonatal morbidity (such as hypoxic ischaemic encephalopathy, brain injuries and respiratory complications) • admission to a neonatal unit • cord gases

BMI: body mass index

For further details see the full review protocol in appendix A. The search strategies are presented in appendix B.

Clinical evidence

Included studies

No clinical evidence was identified for this review.

See the study selection flow chart in Appendix C.

Excluded studies

Studies not included in this review with reasons for their exclusion are listed in Appendix D.

Summary of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so there are no evidence tables in Appendix E). No meta-analysis was undertaken for this review (and so there are no forest plots in Appendix F).

Quality assessment of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so no quality assessment was undertaken and there are no GRADE tables in Appendix G).

Economic evidence

Included studies

No economic evidence was identified for this review.

See the study selection flow chart in Supplement 2 (Health economics).

Excluded studies

No full-text copies of articles were requested for this review and so there is no excluded studies list (see Supplement 2 (Health economics)).

Summary of studies included in the economic evidence review

No economic evidence was identified for this review (and so there are no economic evidence tables in Supplement 2 (Health economics)).

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation (see Supplement 2 (Health economics)).

Evidence statements

No clinical evidence was identified for this review.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Outcomes for the woman and the baby were prioritised for this review.

The committee identified 1 outcome of critical importance for the woman, which was major morbidity (such as genital tract trauma, blood loss or infection) because these morbidities can constitute a major harm. The committee identified 2 further outcomes of critical importance for the baby, which were neonatal, perinatal and infant mortality and major neonatal morbidity (such as hypoxic ischaemic encephalopathy, brain injuries and respiratory complications). These outcomes were prioritised because they had the potential for lifelong and serious impacts on the woman or the baby.

The committee identified 3 important outcomes for the woman, which were admission to ITU, mode of birth and women's satisfaction with labour and birth (including psychological wellbeing). They identified 1 important outcome for the baby, which was admission to a neonatal unit. These were considered to be important as they either served as proxy outcomes for serious morbidities not captured in the critical outcomes, or because they were direct measures of women's experience.

The quality of the evidence

No clinical evidence was identified for this review.

Although there was no evidence meeting the protocol inclusion criteria, the committee was aware of epidemiological studies on the issue of whether obesity was a risk factor for complications in labour by itself, or whether it was only associated with risk by the fact that it typically presented with comorbidities of known risk during the intrapartum period, such as hypertension. The committee's view was that there was no definitive evidence, but that women with a BMI >35 kg/m^2 have similar maternal and neonatal outcomes as low-risk primipara women when care follows the NICE guideline on intrapartum care for healthy women and babies (CG190).

Benefits and harms

The committee made the recommendations based on their experience as there was no evidence identified. They agreed that continuous cardiotocography (electronic fetal monitoring) is used as a step up from intermittent auscultation where concerns about the fetal heart are present or where other risk factors are identified. They discussed that evidence on the effectiveness of continuous cardiotocography in the general population is mixed, however, in their experience when the fetal heart cannot be monitored effectively by intermittent auscultation because of the woman's BMI then continuous cardiotocography can be helpful. They also agreed that where intermittent auscultation and continuous cardiotocography fails to detect the fetal heart adequately then use of a fetal scalp electrode would be the next step. Although obesity is not a medical complication, the committee highlighted that it can present challenges as it is technically difficult to monitor the baby's wellbeing when the women has a BMI over 30 kg/m^2. However, the committee emphasised that in a woman with a BMI over 30 kg/m^2 without additional medical complexities, it was probably safe for her care to be managed in line with the NICE guideline on intrapartum care for healthy women and babies (CG190) as far as fetal monitoring is concerned. They cautioned that as it may be difficult to auscultate the fetal heart a low threshold for use of continuous cardiotocography is required.

Intermittent auscultation is non-invasive and simple to perform. However there may be difficulties anticipated in detecting the fetal heart rate with a thick pannus, and where this occurs continuous cardiotocography would be the next step. The committee discussed the harms associated with using continuous monitoring, which include risk of detecting the maternal pulse and the invasiveness of using fetal scalp electrodes. There is also a higher risk of intervention including instrumental birth in women at low risk and with decreased mobility. Women with a BMI over 30 kg/m^2 have a higher risk of operative intervention. Continuous cardiotocography for women with a BMI over 30 kg/m^2 is expected to be associated with a higher rate of operative birth, however in the absence of effective fetal heart rate monitoring from intermittent auscultation continuous cardiotocography is warranted and the harms of using such monitoring are likely to be acceptable to the woman given the anticipated benefits in detecting fetal heart rate abnormalities where intermittent auscultation is difficult to perform because of the woman's BMI.

The committee discussed whether continuous cardiotocography would reduce or improve maternal satisfaction with birth. They concluded that women's experiences would vary depending on individual perspectives. Continuous cardiotocography could reduce anxiety and, therefore, increase satisfaction, but it could be considered uncomfortable or restrict movement and therefore decrease satisfaction. As the evidence about the effectiveness of continuous cardiotocography is conflicted it was agreed that fetal monitoring should be based on the woman's preference as well as the individual obstetric indications and that information should be provided to the woman to help support her involvement in decision making.

Cost effectiveness and resource use

No clinical evidence was identified for this review and the committee made a qualitative assessment of cost effectiveness.

The committee noted that there was no evidence that continuous cardiotocography improves outcomes compared with intermittent auscultation, although it is widely seen as a step-up in monitoring when there are concerns about the fetal heart and other risk factors. The committee did not consider that there was sufficient evidence to determine the most cost effective fetal monitoring technique in women who are obese and have no medical complications. Therefore, they considered it would be reasonable to base fetal monitoring on the woman's preference and obstetric indications (including no antenatal care), in line with the NICE guideline on intrapartum care for healthy women and babies (CG190).

The committee considered that there is a wide variation in practice with regard to the use of continuous cardiotocography and intermittent auscultation for women with a BMI over 30 kg/m^2. However, the recommendation is not prescriptive with respect to how fetal monitoring is carried out. Therefore, the committee did not think the recommendation would lead to a large change in practice or have a significant resource impact for the NHS.

Other factors the committee took into account

The committee emphasised that, in line with the NICE guideline on intrapartum care for healthy women and babies (CG190), women with a BMI >35 kg/m^2 should be offered birth in an obstetric unit where access to continuous cardiotocography and other facilities are readily available.

Due to the lack of evidence in this area, the committee made 2 research recommendations. The first research recommendation looks at whether continuous cardiotocography is preferred over intermittent auscultation for fetal monitoring in labour in women with a BMI over 30 kg/m^2. The second focuses on whether obesity is an independent risk factor for perinatal morbidity and mortality. See appendix L for further details.

Intrapartum care for women with obesity – optimal position

Review question

What is the optimal position in the second stage of labour for women with obesity?

Introduction

The aim of this review is to determine the optimal position for women with obesity who are in the second stage of labour.

Summary of the protocol

See Table 5 for a summary of the population, intervention, comparison and outcome (PICO) characteristics of this review.

Table 5: Summary of the protocol (PICO) table

Population	Women in the second stage of labour who are obese (BMI ≥ 30 kg/m^2) at the booking appointment
Intervention	Intention to give birth in the following positions Intervention 1 • standing Intervention 2 • squatting Intervention 3 • kneeling Intervention 4 • semi-recumbent Intervention 5 • lying on back Intervention 6 • left lateral Intervention 7 • with birth stool Intervention 8 • on all fours Intervention 9 • lithotomy/Lloyd-Davies Intervention 10 • McRoberts Intervention 11 • in a birthing pool
Comparison	Comparisons • any of the above birth positions
Outcomes	For the woman: ○ mortality ○ major morbidity (genital tract trauma, blood loss, or infection) ○ mode of birth

	○ admission to a high dependency unit (HDU) or intensive treatment unit (ITU) ○ women's satisfaction with labour and birth (including psychological wellbeing) ○ duration of hospital stay For the baby: ○ mortality ○ major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries, respiratory complications) ○ admission to a neonatal unit

BMI: body mass index

For further details see the full review protocol in appendix A. The search strategies are presented in appendix B.

Clinical evidence

Included studies

No clinical evidence was identified for this review.

See the study selection flow chart in Appendix C.

Excluded studies

Studies not included in this review with reasons for their exclusion are listed in Appendix D.

Summary of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so there are no evidence tables in Appendix E). No meta-analysis was undertaken for this review (and so there are no forest plots in Appendix F).

Quality assessment of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so no quality assessment was undertaken and there are no GRADE tables in Appendix G).

Economic evidence

Included studies

No economic evidence was identified for this review.

See the study selection flow chart in Supplement 2 (Health economics).

Excluded studies

No full-text copies of articles were requested for this review and so there is no excluded studies list (see Supplement 2 (Health economics)).

Summary of studies included in the economic evidence review

No economic evidence was identified for this review (and so there are no economic evidence tables in Supplement 2 (Health economics)).

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation (see Supplement 2 (Health economics)).

Evidence statements

No clinical evidence was identified for this review.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Outcomes for the woman and the baby were prioritised for this review.

The committee identified 3 factors of critical importance for the woman: mortality, major morbidity (genital tract trauma, blood loss and infection) because these morbidities can constitute a major harm and be influenced by mode of birth, which was also identified as a critical outcome. They identified 2 factors of critical importance for the baby: mortality and major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries and respiratory complications). The committee argued that almost nothing was more important in this setting than preserving the life and health of the woman and baby. They added that mode of birth was a critical outcome in this population as the risk of an emergency caesarean section was high for obese women.

The committee identified 2 important outcomes for the woman: admission to HDU or ITU, and women's satisfaction with labour and birth (including psychological wellbeing). They identified 1 important outcome for the baby, which was admission to a neonatal unit. The committee described how admission to HDU or ITU of the woman and admission to a neonatal unit were good indications for complications during birth, while women's satisfaction with labour was an important outcome in its own right, but not as critical as preserving the life of the woman and baby.

The quality of the evidence

No clinical evidence was identified for this review.

Benefits and harms

The clinical issue for this review question is balancing the need for the woman to feel as comfortable as possible and the need for healthcare professionals to be able to care for the woman promptly if a complication arises during birth. For most women most of the time there is no clinical tension between these issues, as if an obstetric emergency occurs the woman can move into whatever position the healthcare professionals require to best address the issue. However in some groups of women, including women with a BMI over 30 kg/m^2, this may not always be possible due to reduced mobility. Therefore the benefit of maximally comfortable positions is that the woman will have a superior birth experience, but the harm is that in the rare event of an obstetric emergency, clinical access could be restricted leading to

mortality or morbidity in either the woman or the baby (or both). The benefits and harms of a position of maximal access are the opposite; the woman is better protected against high-risk, low-probability events but will generally be less comfortable during the birth (although it is possible that the most comfortable position for the woman might also give healthcare professionals adequate access, in which case there would be no tension to resolve). Based on their experience, the committee discussed how the birth plan for a woman with a BMI over 30 kg/m^2 should asses these risks and take into account any reduction in mobility which could be caused by her condition. Healthcare professionals should be sensitive to the woman's preference, but aware of how the obesity might impact on labour and birth. For example, if an emergency caesarean section is a possibility, healthcare professionals should ensure that appropriate equipment and expertise is on hand for the procedure to take place.

Based on their experience, the committee discussed how a left-lateral position was sometimes helpful for women with reduced mobility. They discussed how this position was usually comfortable for the woman, but at the same time allowed healthcare professionals to have access to the woman, for example, to provide peritoneal support. The committee agreed that in the event of an obstetric emergency such access would be potentially life-saving, but the left-lateral position was not the only position which would allow access in this way; however, it was likely that healthcare professionals (and especially midwives) would be most familiar with the position.

Based on their experience, the committee determined that management only needed to change from recommendations in the NICE guideline on intrapartum care for healthy women and babies (CG190) if the woman's mobility was affected by her obesity. Consequently the committee determined that in women with a BMI over 30 kg/m^2 and adequate mobility there was no reason to manage labour and birth differently from the recommendations in the existing guideline. The committee believed that this was not widely appreciated in the clinical community, and so determined that a recommendation explicitly alerting healthcare professionals to this fact would be helpful.

The committee was aware of recommendations in the NICE guideline on intrapartum care for healthy women and babies (CG190) implying that women with a BMI greater than 35 kg/m^2 were at higher risk during birth, and discussed how some women with a BMI greater than 35 kg/m^2 might have adequate mobility, whereas some women with a BMI less than 35 kg/m^2 might not, either for reasons specific to the obesity or because of an interaction between the obesity and another condition).

Consequently the committee emphasised that healthcare professionals should look at the level of mobility as well as BMI when determining whether the woman should be advised to try positions that allow clinical access rather than maximising comfort.

Cost effectiveness and resource use

No clinical evidence was found for this review and the committee made a qualitative assessment of cost effectiveness.

The committee noted that for many positions in the second stage of labour there would be no additional costs compared with some of the alternative positions and, in those cases, the preference for one position over another would not involve an opportunity cost, unless the different positions were associated with different rates of adverse outcomes. The committee noted that the 2 key principles were comfort for the woman and maximal access for healthcare professionals in the event that there are complications in labour. The committee noted that the left-lateral position is often considered helpful to women with reduced mobility as it is usually comfortable for the woman while allowing adequate access. However, the committee accepted that this was not the only position which would achieve the objectives of comfort and access. They considered that the left lateral position would be cost effective for

obese women with reduced mobility and made a weak recommendation to reflect that. For obese women with adequate mobility, the committee considered it would be cost effective to manage the second stage of labour in line with the NICE guideline on intrapartum care for healthy women and babies (CG190).

The committee considered that their recommendations reflected current practice. Furthermore, they considered the costs associated with their recommendations would be minimal and therefore the committee was confident that there would be no significant resource impact to the NHS.

Other factors the committee took into account

Despite the lack of evidence, the committee decided to prioritise other areas addressed by the guideline for future research and therefore made no research recommendations regarding the optimal position in the second stage of labour for women with a BMI over 30 kg/m^2.

Intrapartum care for women with obesity – equipment needs

Review question

What additional equipment is needed to ensure optimal care of women with obesity in the peripartum period?

Introduction

The aim of this review is to examine what additional equipment is needed to ensure optimal care of women with obesity in the peripartum period. This is important because maternal obesity is associated with an increased risk of adverse outcomes for the woman and the baby, and approximately half of all women of childbearing age in England are either overweight or obese. Access to appropriate equipment has been identified as a common problem in the UK. For example, equipment such as weighing scales, which are essential to ensure correct doses of medication, are typically available in outpatient areas which may not be readily accessible during the peripartum period.

Summary of the protocol

See Table 6 for a summary of the population, intervention, comparison and outcome (PICO) characteristics of this review.

Table 6: Summary of the protocol (PICO) table

Population	Women in the peripartum period who are obese (BMI ≥ 30 kg/m^2) at the booking appointment
Intervention	• Use of specially manufactured or adapted equipment: o equipment or flooring with a safe working load of up to 250kg o theatre gowns appropriate to be worn by women with obesity o large blood pressure cuffs o sit-on weighing scales o large chairs without arms o large wheelchairs o beds used in wards and the birthing suite o theatre trolleys o stirrups o operating theatre tables o lifting and lateral transfer equipment o long epidural and spinal needles o operating instruments, for example, deeper retractors o vaginal speculum o air-assisted lateral patient transfer device o birthing stools o thromboembolic deterrent stockings
Comparison	No specialist equipment
Outcomes	For the woman: o injury to the woman or weight-related medical errors

	○ mortality ○ women's satisfaction with labour and birth (including psychological wellbeing) For the staff: ○ injuries to staff For the baby: ○ major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries, or respiratory complications) ○ admission to a neonatal unit ○ mortality

BMI: body mass index

For further details see the full review protocol in appendix A. The search strategies are presented in appendix B.

Clinical evidence

Included studies

No clinical evidence was identified for this review.

See the study selection flow chart in Appendix C.

Excluded studies

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

Summary of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so there are no evidence tables in Appendix E). No meta-analysis was undertaken for this review (and so there are no forest plots in Appendix F).

Quality assessment of clinical studies included in the evidence review

No clinical evidence was identified for this review (and so no quality assessment was undertaken and there are no GRADE tables in Appendix G).

Economic evidence

Included studies

No economic evidence was identified for this review.

See the study selection flow chart in Supplement 2 (Health economics).

Excluded studies

No full-text copies of articles were requested for this review and so there is no excluded studies list (see Supplement 2 (Health economics)).

Summary of studies included in the economic evidence review

No economic evidence was identified for this review (and so there are no economic evidence tables in Supplement 2 (Health economics).

Economic model

No economic modelling was undertaken for this review because the committee agreed that other topics were higher priorities for economic evaluation (see Supplement 2 (Health economics)).

Evidence statements

No clinical evidence was identified for this review.

The committee's discussion of the evidence

Interpreting the evidence

The outcomes that matter most

Maternal, neonatal and staff related outcomes were prioritised for this review.

The committee identified a number of critical outcomes, related to the different individuals that might be harmed when using an inadequate equipment. For the woman, injury or weight-related medical errors were identified as being of critical importance. For healthcare professionals, injuries were identified as being critical outcomes. For the baby, major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries, or respiratory complications) and admission to a neonatal unit were identified as critical outcomes. Although in a clinical sense, mortality or major morbidity for either the woman or the baby is likely to be more serious than injuries to healthcare professionals, the committee identified that the NHS has a specific duty of care to its staff, and therefore it would be unacceptable to trade risk to healthcare professionals against risk to the woman or the baby.

The committee identified 2 important outcomes related to the woman, namely mortality and the woman's satisfaction with labour and birth. The committee reasoned that equipment that malfunctioned seriously enough that the woman would die as a result should be recalled immediately and therefore it was unlikely that a recommendation would improve quality of care.

The quality of the evidence

No clinical evidence was identified for this review.

Benefits and harms

There is no clinical trade-off in these recommendations – it is always clinically beneficial to have access to the correct equipment to perform relevant procedures. However there is potentially a high economic impact of having highly specialised equipment available if it will be used rarely, as the resources used to purchase and use the equipment (including training and maintenance resources) could have been used to support other aspects of care. This harm is discussed in more detail below (see 'Cost effectiveness and resource use').

A substantial benefit to providing the correct equipment is to reduce injury to healthcare professionals, for example, back injury caused by the strain of lifting heavy women.

The committee discussed how it was extremely unlikely that any unit would ever require a bed rated for 250 kg (which would imply a BMI of approximately 100 kg/m^2). They considered recommending a lower tolerance than this, despite CMACE and RCOG guidance that 250 kg is the minimum safe working load (CMACE and RCOG joint guideline 2010). After some discussion, the committee used health economic analysis to identify that the saving from beds with a lower safe working load was not substantial (Table 7), and 250 kg allowed a precautionary principle to be adopted in case equipment was inadvertently misused – for example, if the woman's birth companions(s) were to sit on the bed. Therefore the committee reiterated the 250 kg limit, to emphasise that the issue had been considered and – despite the prima facie case for lowering the safe working limit – lowering the limit would be unlikely to be of net value to the NHS.

The committee used their clinical experience and judgement to identify major items of equipment that needed to be different (usually larger) when caring for women who are obese, and which might sometimes be overlooked. The committee emphasised that the list was not exhaustive, and they intended to focus the considerations of healthcare professionals on whether the equipment at hand was adequate for the degree of obesity in an individual woman. The committee also emphasised that the items in the list were not presented in order of priority; all centres that care for very obese women should consider the availability and suitability of each item of equipment used in the intrapartum period.

The committee wished to offer guidance about when to begin stocking highly specialised equipment. They suggested that centres caring for very obese women would require such equipment at any time. Based on their experience and judgement, the committee recommended a model in which hospitals decide early in care whether or not they have the equipment needed for an individual woman and refer onward if this is not available. This might lead to the development of regional 'centres of excellence' (as exist in Wales), which the committee believed would be a positive change for the NHS.

The committee discussed how, in most cases, the fact that equipment was designed to be suitable for larger women would not preclude smaller women using it. For example, beds and wheelchairs could be used by any woman if not in use by women with a BMI over 30 kg/m^2. This would lower the cost of purchasing more equipment, since only the marginal difference between general and specialised equipment would need to be considered.

Cost effectiveness and resource use

No evidence was identified for this review and the committee made a qualitative assessment of cost effectiveness.

In order to assist the committee in making recommendations, data relating to obesity in pregnancy from the CMACE Maternal obesity in the UK: findings from a national project 2010 was presented. Figure 1 shows the prevalence of maternal obesity in the UK, with BMI over 50 kg/m^2 affecting about 1 in 300 maternities. Figure 2 shows the distribution of pregnancies by maternity unit and indicates that with rising BMI the proportion of births that take place in an obstetric-led unit rises.

Figure 1: UK Prevalence of obesity in pregnancy by BMI category

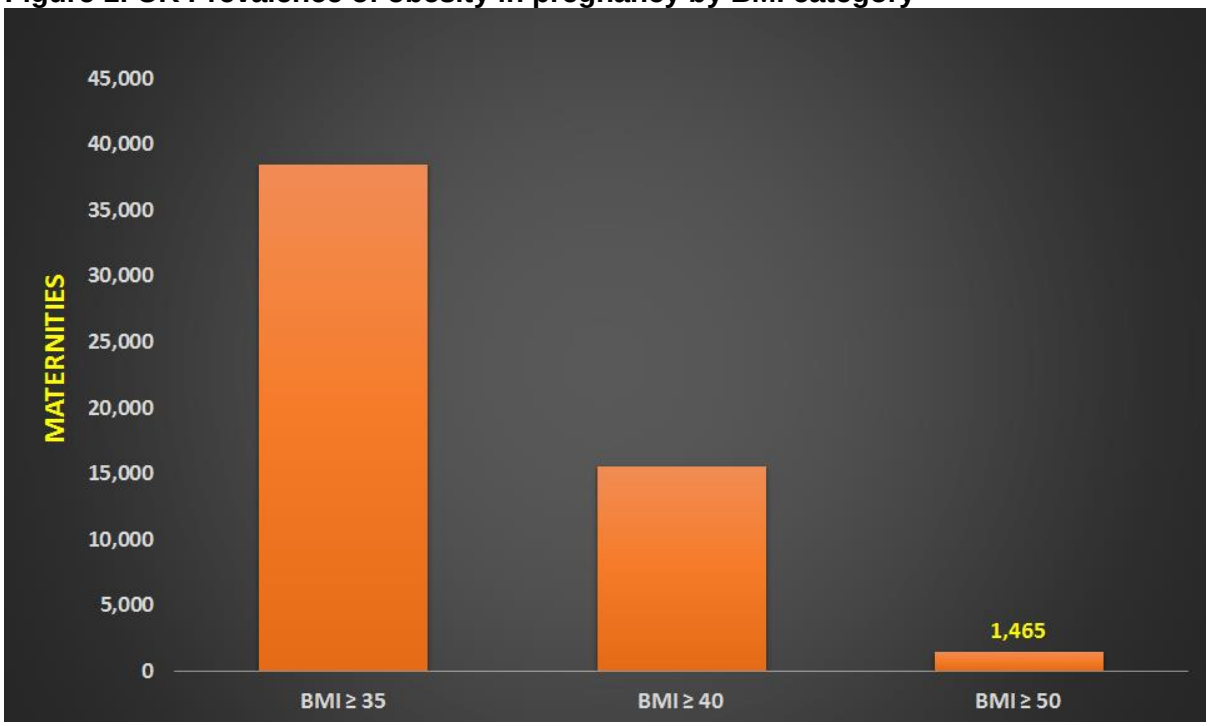

Figure 2: Prevalence of maternal obesity by type of maternity unit (March to April 2009)

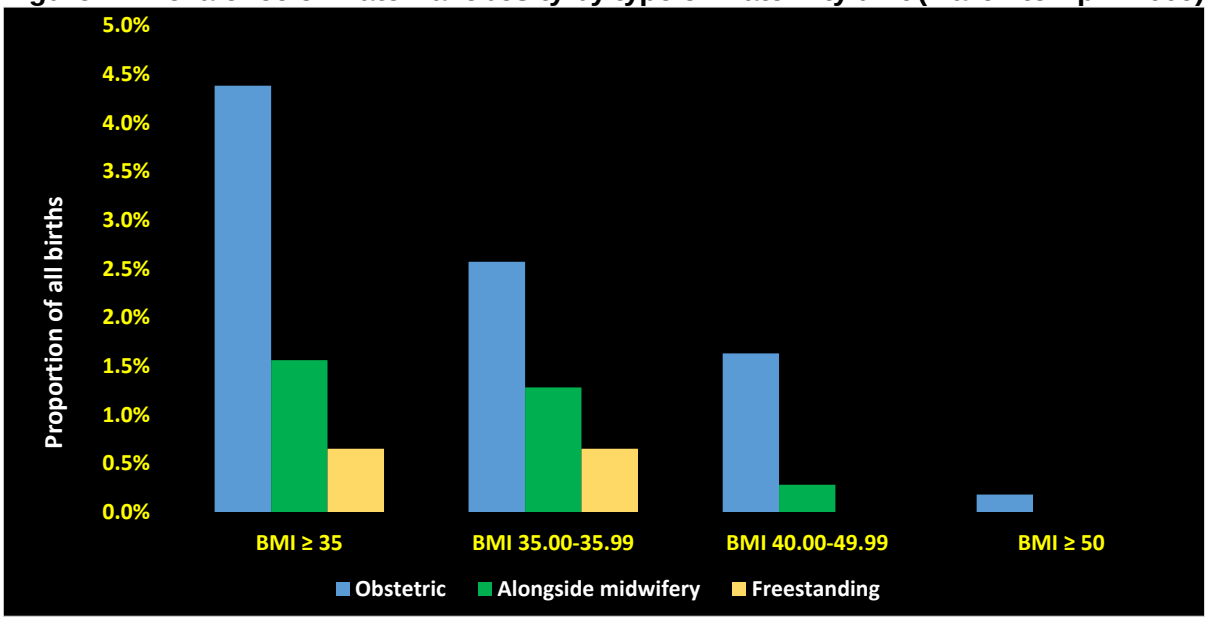

Table 7 presents examples of bariatric equipment costs to indicate the resource implications for the NHS of providing such equipment. The data in the table are taken from Betsi Cadwaladr University Health Board bariatric equipment costs

Table 7: Example bariatric equipment costs

Description	Cost
Bariatric armchair	£648
Bariatric hoist	£7,080
Bariatric operating table	£31,057
Trolleys-obstetrics	£9,333
Bariatric profiling bed	£8,139
Air moving lift, 50 stone	£1,646
Bariatric toilet converted	£464
Weighing Scales Seca 685 C Class III approved SWL47stone	£2,202
Bed Weighing System BW SWL -100 stone	£2,303
Bariatric Shower Stool, SWL 47stone	£294
Transfer chair	£337
Bariatric folding wheelchair	£3,938

The committee agreed that specialist equipment for obese women was essential in order to achieve a safe birth. However, given the low prevalence of women with BMI over 50 kg/m^2 they reasoned that it might not be cost effective for all units to care for such women. They noted that the women would often have complex comorbidities that need to be managed in specialist centres anyway.

Although major gaps in the provision of hospital equipment for pregnant women who are obese have been identified previously, the committee believed that the situation has improved significantly in recent years, and therefore they did not think the recommendations would greatly affect current practice or entail a significant resource impact to the NHS.

Other factors the committee took into account

The committee considered how equipment could be most usefully deployed. For example, it might be that instead of one bariatric wheelchair being available for the maternity ward, 10 such wheelchairs could be available across an entire hospital and that these could be booked out by the ward that needed them at a particular moment. This might not be possible with all equipment, and it might not be the most efficient way of organising access to the equipment all the time, but based on their clinical experience the committee described that it was likely that efficiency and cost savings could be made in some settings using this approach. However, it was agreed that such arrangements were a matter for local implementation.

Despite the lack of evidence, the committee decided to prioritise other areas addressed by the guideline for future research and therefore made no research recommendations regarding the equipment needs for women with obesity in the peripartum period.

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Appendices

Appendix A – Review protocols

Intrapartum care for women with obesity – fetal presentation

Item	Details	Working notes
Area in the scope	Women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions – intrapartum care for women with obesity – fetal presentation	
Review question in the scope	What is the value of assessing fetal presentation early in labour for women with obesity?	
Review question for the guideline	What is the value of assessing fetal presentation early in labour for women with obesity?	
Objective	The aim of this review is to determine whether early assessment of fetal presentation (during the first stage of labour) by ultrasound scan (with or without palpation) is more clinically and cost effective than assessment of fetal presentation by palpation alone. This is important because palpation to assess fetal presentation in women with obesity can be difficult to perform and as a consequence malpresentation (breech) may be missed	
Population and directness	Women in labour who are obese (BMI ≥ 30 kg/m^2) at the booking appointment Definitions from the NICE guideline on obesity (CG189): • healthy weight, BMI 18.5–24.9 kg/m2 • overweight, BMI 25–29.9 kg/m2 • obesity I, BMI 30 – 34.9 kg/m2 • obesity 2, BMI 35 – 39.9 kg/m2 • obesity 3, 40 or greater kg/m^2	
Intervention	Ultrasound (with or without palpation)	
Comparison	Palpation only	

Outcomes	Critical outcomes:
	• for the woman:
	  ○ major morbidity (such as genital tract trauma, blood loss, or infection)
	• for the baby:
	  ○ mortality
	  ○ major neonatal morbidity (such as hypoxic ischaemic encephalopathy, brain injuries and respiratory complications)
	
	Important outcomes:
	• for the woman:
	  ○ mode of birth	

Item	Details	Working notes
	○ woman's satisfaction with labour and birth (including psychological wellbeing) ○ for the baby: ○ admission to a neonatal unit ○ undiagnosed breech presentation Outcomes of limited importance: • for the woman: ○ admission to a high dependency unit (HDU) or intensive treatment unit (ITU)	
Importance of outcomes	Preliminary classification of the outcomes for decision making: • critical (up to 3 outcomes) • important but not critical (up to 3 outcomes) • of limited importance (1 outcome)	Given the small volume of evidence available for inclusion overall, the committee agreed to consider more than the nominal maximum of 7 outcomes for this question
Setting	All settings	
Stratified, subgroup and adjusted analyses	Stratification by: • weight in early pregnancy • weight at admission for labour • amount of gestational weight gain In the presence of heterogeneity, the following subgroups will be considered for sensitivity analysis: • BMI category • maternal age • preterm birth • other comorbidities such as hypertension and gestational diabetes • large- and small-for-gestational-age babies • presence of meconium • complications in previous pregnancies These subgroup factors will be used as confounding factors when data from observational studies are analysed	
Language	English	
Study design	• Published full-text papers only • Systematic reviews • RCTs • Only if RCTs unavailable or there is limited data to inform decision making: ○ prospective or retrospective comparative cohort studies ○ case series studies	

Item	Details	Working notes
	• Prospective study designs will be prioritised over retrospective study designs • Conference abstracts will not be considered	
Search strategy	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase. Limits (e.g. date, study design): All study designs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques were used. See Appendix B for full strategies	
Review strategy	Appraisal of methodological quality: • the methodological quality of each study will be assessed using checklists recommended in the NICE guidelines manual 2014 (for example, AMSTAR or ROBIS for systematic reviews, and Cochrane RoB tool for RCTs) and the quality of the evidence for each outcome (that is, across studies) will be assessed using GRADE • if studies report only p-values, this information will be recorded in GRADE tables without an assessment of imprecision Synthesis of data: • meta-analysis will be conducted where appropriate • default MIDs will be used; 0.8 and 1.25 for dichotomous outcomes; 0.5 times the SD of the measurement in the control arm (or median score across control arms if multiple studies are included) for continuous outcomes for continuous data, change scores will be used in preference to final scores for data from non-RCT studies; final and change scores will not be pooled; if any study reports both, the method used in the majority of studies will be adopted	Review questions selected as high priorities for health economic analysis (and those selected as medium priorities and where health economic analysis could influence recommendations) will be subject to dual weeding and study selection; any discrepancies will be resolved through discussion between the first and second reviewers or by reference to a third person. This review question was not prioritised for health economic analysis and so no formal dual weeding, study selection (inclusion/exclusion) or data extraction into evidence tables will be undertaken. However, internal (NGA) quality assurance processes will include consideration of the outcomes of weeding, study selection and data extraction and the committee will review the results of study

Item	Details	Working notes
		selection and data extraction
Equalities	Equalities considerations will be considered systematically in relation to the available evidence and draft recommendations. The guideline scope includes women with cognitive or physical disability as populations for whom there may be equalities issues. Women who have received no antenatal care will be considered as a subgroup for all systematic reviews performed within the medical conditions work stream and a specific question has been included in the obstetric complications work stream for this population	
Notes/additional information	None	
Key papers	Sonography in obese and overweight pregnant women: clinical, medicolegal and technical issues. Paladini 2009	

AMSTAR: Assessing the Methodological Quality of Systematic Reviews; 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; MID: minimally important difference; NGA: National Guideline Alliance; NICE: National Institute for Health and Care Excellence; RCT: randomised controlled trial; RoB: risk of bias; SD: standard deviation; ROBIS: Risk of Bias in Systematic Reviews

Intrapartum care for women with obesity – anaesthesia and analgesia

Item	Details	Working notes
Area in the scope	Women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions – intrapartum care for women with obesity – anaesthesia and analgesia	
Review question in the scope	Does an ultrasound scan of the woman's back improve needle siting for central neuraxial blockade (spinal, epidural or combined spinal–epidural) anaesthesia and analgesia for women with obesity in the peripartum period?	
Review question for the guideline	Does an ultrasound scan of the woman's back improve needle siting for central neuraxial blockade anaesthesia and analgesia for women with obesity in the peripartum period?	
Objective	The aim of this review is to examine whether ultrasound-guided anaesthesia helps to improve effective placement of needles or catheters in regional techniques for women with obesity in the peripartum period. This is important because, although regional anaesthesia can offer advantages over general anaesthesia, the increased amount of subcutaneous tissue in women with obesity can pose a significant challenge to successful needle and catheter placement, which are essential for effective regional anaesthesia/analgesia	

Item	Details	Working notes
Population and directness	Women in labour who are obese (BMI ≥ 30 kg/m^2) at the booking appointment Definitions from the NICE guideline on obesity: identification, assessment and management (CG189): • healthy weight, BMI 18.5–24.9 kg/m2 • overweight, BMI 25–29.9 kg/m2 • obesity I, BMI 30 – 34.9 kg/m2 • obesity 2, BMI 35 – 39.9 kg/m2 • obesity 3, 40 or greater kg/m2	
Intervention	Ultrasound-guided needle and catheter siting	
Comparison	Landmark technique	
Outcomes	Critical outcomes: • for the woman: ○ women's reporting of effective analgesia (assessed through different methods such as pain scores, block to cold, block to touch, motor block) ○ failed analgesia ○ women's satisfaction with labour and birth (including psychological wellbeing) • for the baby: ○ major neonatal morbidity (such as hypoxic ischaemic encephalopathy, birth injuries and respiratory complications) Important outcomes: • for the woman: ○ major morbidity (such as blood loss, infection at needle site, catheter placement and postdural puncture headache) ○ admission to intensive treatment unit (ITU) Outcomes of limited importance: • for the woman: ○ mode of birth	
Importance of outcomes	Preliminary classification of the outcomes for decision making: • critical (up to 3 outcomes) • important but not critical (up to 3 outcomes) • of limited importance (1 outcome)	Given the small volume of evidence available for inclusion overall, the committee agreed to consider more than the nominal maximum of 7 outcomes for this question
Setting	All settings	

Item	Details	Working notes
Stratified, subgroup and adjusted analyses	In the presence of heterogeneity, the following subgroups will be considered for sensitivity analysis: • emergency versus elective regional anaesthesia and/or analgesia • BMI category • bleeding disorders These subgroup factors will be used as confounding factors when data from observational studies are analysed	
Language	English	

Study design	• Published full-text papers only
	• Systematic reviews
	• RCTs
	• Only if RCTs unavailable or there is limited data to inform decision making with a minimum sample size of 15 women in each group:
	  ○ prospective or retrospective comparative cohort studies
	  ○ case series studies
	• Prospective study designs will be prioritised over retrospective study designs
	• Conference abstracts will not be considered	

Search strategy	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase. Limits (e.g. date, study design): All study designs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques were used. See Appendix B for full strategies	
Review strategy	Appraisal of methodological quality: • the methodological quality of each study will be assessed using checklists recommended in the NICE guidelines manual 2014 (for example, AMSTAR or ROBIS for systematic reviews, and Cochrane RoB tool for RCTs) and the quality of the evidence for each outcome (that is, across studies) will be assessed using GRADE • if studies report only p-values, this information will be recorded in GRADE tables without an assessment of imprecision Synthesis of data: • meta-analysis will be conducted where appropriate • default MIDs will be used; 0.8 and 1.25 for dichotomous outcomes; 0.5 times the SD of the measurement in the control arm (or median score across control arms if multiple studies are included) for continuous outcomes	Review questions selected as high priorities for health economic analysis (and those selected as medium priorities and where health economic analysis could influence recommendations) will be subject to dual weeding and study selection; any discrepancies will be resolved through discussion between the first and second

Item	Details	Working notes
	• for continuous data, change scores will be used in preference to final scores for data from non-RCT studies; final and change scores will not be pooled; if any study reports both, the method used in the majority of studies will be adopted	reviewers or by reference to a third person. This review question was prioritised for health economic analysis and so formal dual weeding will be undertaken. Additionally, internal (NGA) quality assurance processes will include consideration of the outcomes of weeding, study selection and data extraction and the committee will review the results of study selection and data extraction
Equalities	Equalities considerations will be considered systematically in relation to the available evidence and draft recommendations. The guideline scope includes women with cognitive or physical disability as populations for whom there may be equalities issues. Women who have received no antenatal care will be considered as a subgroup for all systematic reviews performed within the medical conditions work stream and a specific question has been included in the obstetric complications work stream for this population	
Notes/additional information	None	
Key papers	Singh S, Wirth KM, Phelps AL, Badve MH, Shah TH, Sah N, Vallejo MC. Epidural Catheter Placement in Morbidly Obese Parturients with the Use of an Epidural Depth Equation prior to Ultrasound Visualization. Scientific World Journal, 2013:695209	

AMSTAR: Assessing the Methodological Quality of Systematic Reviews; BMI: body mass index; 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; ITU: intensive therapy unit; MID: minimally important difference; NGA: National Guideline Alliance; NICE: National Institute for Health and Care Excellence; RCT: randomised controlled trial; RoB: risk of bias; SD: standard deviation; ROBIS: Risk of Bias in Systematic Reviews

Intrapartum care for women with obesity - fetal monitoring

Item	Details	Working notes
Area in the scope	Women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions – intrapartum care for women with obesity – fetal monitoring	
Review question in the scope	How should fetal monitoring be managed during labour in women with obesity?	
Review question for the guideline	What is the effectiveness of intermittent auscultation compared with electronic fetal monitoring during labour in women with obesity?	
Objective	The aim of this review is to determine which method of intrapartum fetal monitoring (continuous electronic fetal monitoring or intermittent auscultation) is associated with better outcomes for the woman and baby in women with obesity and if relevant, to determine the most clinically effective method of continuous fetal monitoring (fetal scalp electrode or external electronic method). This is important because obesity is associated with adverse outcomes for the baby and external monitoring can be difficult to achieve	
Population and directness	Women in labour who are obese (BMI ≥ 30 kg/m^2) at the booking appointment Definitions from the NICE guideline on obesity: identification, assessment and management (CG189): • healthy weight, BMI 18.5–24.9 kg/m2 • overweight, BMI 25–29.9 kg/m2 • obesity I, BMI 30 – 34.9 kg/m2 • obesity 2, BMI 35 – 39.9 kg/m2 • obesity 3, 40 or greater kg/m^2	
Intervention	Intervention 1 • Electronic fetal monitoring (EFM) using an external ultrasound transducer and displayed as a cardiotocograph trace Intervention 2 • Electronic fetal monitoring (EFM) using a fetal scalp electrode and displayed as cardiotocograph trace Intervention 3 • Intermittent auscultation (IA)	
Comparison	Any of the above interventions compared with each other	
Outcomes	Critical outcomes: • for the woman: ○ major morbidity (such as genital tract trauma, blood loss, or infection) • for the baby:	

Item	Details	Working notes
	○ neonatal, perinatal and infant mortality ○ major neonatal morbidity (such as hypoxic ischaemic encephalopathy, brain injuries and respiratory complications) Important outcomes: • for the woman: ○ admission to intensive treatment unit ○ mode of birth ○ woman's satisfaction with labour and birth (including psychological wellbeing) • for the baby: ○ admission to a neonatal unit Outcomes of limited importance: • for the baby: ○ cord gases	
Importance of outcomes	Preliminary classification of the outcomes for decision making: • critical (up to 3 outcomes) • important but not critical (up to 3 outcomes) • of limited importance (1 outcome)	Given the small volume of evidence available for inclusion overall, the committee agreed to consider more than the nominal maximum of 7 outcomes for this question
Setting	All settings	
Stratified, subgroup and adjusted analyses	In the presence of heterogeneity, the following subgroups will be considered for sensitivity analysis: • BMI category • maternal age • preterm birth • other comorbidities such as hypertension, gestational diabetes • large- and small-for-gestational-age babies • presence of meconium • complications in previous pregnancies • induced versus spontaneous labour (only for continuous part of the question) These subgroup factors will be used as confounding factors when data from observational studies are analysed	

Item	Details	Working notes
Language	English	
Study design	• Published full-text papers only • Systematic reviews • RCTs • Only if RCTs unavailable or there is limited data to inform decision making with a minimum sample size of 15 women in each group: ○ prospective or retrospective comparative cohort studies • Prospective study designs will be prioritised over retrospective study designs • Conference abstracts will not be considered	
Search strategy	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase. Limits (e.g. date, study design): All study designs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques were used. See Appendix B for full strategies	
Review strategy	Appraisal of methodological quality: • the methodological quality of each study will be assessed using checklists recommended in the NICE guidelines manual 2014 (for example, AMSTAR or ROBIS for systematic reviews, and Cochrane RoB tool for RCTs) and the quality of the evidence for each outcome (that is, across studies) will be assessed using GRADE • if studies report only p-values, this information will be recorded in GRADE tables without an assessment of imprecision Synthesis of data: • meta-analysis will be conducted where appropriate • default MIDs will be used; 0.8 and 1.25 for dichotomous outcomes; 0.5 times the SD of the measurement in the control arm (or median score across control arms if multiple studies are included) for continuous outcomes • for continuous data, change scores will be used in preference to final scores for data from non-RCT studies; final and change scores will not be pooled; if any study reports both, the method used in the majority of studies will be adopted	Review questions selected as high priorities for health economic analysis (and those selected as medium priorities and where health economic analysis could influence recommendations) will be subject to dual weeding and study selection; any discrepancies will be resolved through discussion between the first and second reviewers or by reference to a third person. This review question was not prioritised for health economic analysis and so no formal dual weeding, study selection (inclusion/exclusion) or data extraction into evidence tables will be undertaken.

Item	Details	Working notes
		However, internal (NGA) quality assurance processes will include consideration of the outcomes of weeding, study selection and data extraction and the committee will review the results of study selection and data extraction
Equalities	Equalities considerations will be considered systematically in relation to the available evidence and draft recommendations. The guideline scope includes women with cognitive or physical disability as populations for whom there may be equalities issues. Women who have received no antenatal care will be considered as a subgroup for all systematic reviews performed within the medical conditions work stream and a specific question has been included in the obstetric complications work stream for this population	
Notes/additional information	None	
Key papers	None identified by the committee	

AMSTAR: Assessing the Methodological Quality of Systematic Reviews; BMI: Body Mass Index; 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; MID: minimally important difference; NGA: National Guideline Alliance; NICE: National Institute for Health and Care Excellence; RCT: randomised controlled trial; RoB: risk of bias; SD: standard deviation; ROBIS: Risk of Bias in Systematic Reviews

Intrapartum care for women with obesity – optimal position

Item	Details	Working notes
Area in the scope	Women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions – intrapartum care for women with obesity – labour position	
Review question in the scope	What is the optimal labour position for women with obesity in the second stage of labour?	
Review question for the guideline	What is the optimal position in the second stage of labour for women with obesity?	
Objective	The aim of this review is to determine the optimal position for women with obesity who are in the second stage of labour	
Population and directness	Women in the second stage of labour who are obese (BMI ≥ 30 kg/m^2) at the booking appointment	

Item	Details	Working notes
	Definitions from the NICE guideline on obesity: identification, assessment and management (CG189): • healthy weight, BMI 18.5–24.9 kg/m2 • overweight, BMI 25–29.9 kg/m2 • obesity I, BMI 30 – 34.9 kg/m2 • obesity 2, BMI 35 – 39.9 kg/m2 • obesity 3, 40 or greater kg/m^2	
Intervention	Intention to give birth in any of the following positions: • standing • squatting • kneeling • semi-recumbent • lying on back • left lateral • with birth stool • on all fours • lithotomy/Lloyd-Davies • McRoberts • in a birthing pool	Giving birth in water is not strictly a 'position' but was viewed as relevant to the question overall
Comparison	Any of the above birth positions	
Outcomes	Critical outcomes: • for the woman: ○ mortality ○ major morbidity (genital tract trauma, blood loss, or infection) ○ mode of birth • for the baby: ○ mortality ○ major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries, respiratory complications) Important outcomes: • for the woman: ○ admission to a high dependency unit (HDU) or intensive treatment unit (ITU) ○ woman's satisfaction with labour and birth (including psychological wellbeing) • for the baby: ○ admission to a neonatal unit Outcomes of limited importance: • for the woman: ○ duration of hospital stay	

Item	Details	Working notes
Importance of outcomes	Preliminary classification of the outcomes for decision making: • critical (up to 3 outcomes) • important but not critical (up to 3 outcomes) • of limited importance (1 outcome)	Given the small volume of evidence available for inclusion overall, the committee agreed to consider more than the nominal maximum of 7 outcomes for this question
Setting	All settings	
Stratified, subgroup and adjusted analyses	In the presence of heterogeneity, the following subgroups will be considered for sensitivity analysis: • complications in previous pregnancies	
Language	English	
Study design	• Published full-text papers only • Systematic reviews • RCTs • Only if RCTs unavailable or there is limited data to inform decision making: ○ prospective or retrospective comparative observational studies (including cohort and case-control studies) • Prospective study designs will be prioritised over retrospective study designs • Conference abstracts will not be considered	
Search strategy	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase. Limits (e.g. date, study design): All study designs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques were used. See Appendix B for full strategies	
Review strategy	Appraisal of methodological quality: • the methodological quality of each study will be assessed using checklists recommended in the NICE guidelines manual 2014 (for example, AMSTAR or ROBIS for systematic reviews, and Cochrane RoB tool for RCTs) and the quality of the evidence for each outcome (that is, across studies) will be assessed using GRADE • if studies report only p-values, this information will be recorded in GRADE tables without an assessment of imprecision Synthesis of data: • meta-analysis will be conducted where appropriate • default MIDs will be used; 0.8 and 1.25 for dichotomous outcomes; 0.5 times the SD of the measurement in the	Review questions selected as high priorities for health economic analysis (and those selected as medium priorities and where health economic analysis could influence recommendations) will be subject to dual weeding and study selection; any discrepancies will be resolved through discussion between the first and second

Item	Details	Working notes
	control arm (or median score across control arms if multiple studies are included) for continuous outcomes for continuous data, change scores will be used in preference to final scores for data from non-RCT studies; final and change scores will not be pooled; if any study reports both, the method used in the majority of studies will be adopted	reviewers or by reference to a third person. This review question was not prioritised for health economic analysis and so no formal dual weeding, study selection (inclusion/exclusion) or data extraction into evidence tables will be undertaken. However, internal (NGA) quality assurance processes will include consideration of the outcomes of weeding, study selection and data extraction and the committee will review the results of study selection and data extraction
Equalities	Equalities considerations will be considered systematically in relation to the available evidence and draft recommendations. The guideline scope includes women with cognitive or physical disability as populations for whom there may be equalities issues. Women who have received no antenatal care will be considered as a subgroup for all systematic reviews performed within the medical conditions work stream and a specific question has been included in the obstetric complications work stream for this population	
Notes/additional information	NICE guideline on intrapartum care for healthy women and babies (CG190) “The woman's position and pushing in the second stage: 1.13.9 Discourage the woman from lying supine or semi‑supine in the second stage of labour and encourage her to adopt any other position that she finds most comfortable. [2007] 1.13.10 Inform the woman that in the second stage she should be guided by her own urge to push. [2007] 1.13.11 If pushing is ineffective or if requested by the woman, offer strategies to assist birth, such as support, change of position, emptying of the bladder and encouragement. [2007]”	
Key papers	None identified by the committee	

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Intrapartum care for women with obesity – equipment needs

Item	Details	Working notes
Area in the scope	Women at high risk of adverse outcomes for themselves and/or their baby because of existing maternal medical conditions – intrapartum care for women with obesity – equipment needs	
Review question in the scope	What additional equipment is needed to ensure optimal care of women with obesity in the peripartum period?	
Review question for the guideline	What additional equipment is needed to ensure optimal care of women with obesity in the peripartum period?	
Objective	The aim of this review is to examine what additional equipment is needed to ensure optimal care of women with obesity in the peripartum period. This is important because maternal obesity is associated with an increased risk of adverse outcomes for the woman and the baby, and approximately half of all women of childbearing age in England are either overweight or obese. Access to appropriate equipment has been identified as a common problem in the UK. For example, equipment such as weighing scales, which are essential to ensure correct doses of medication, are typically available in outpatient areas which may not be readily accessible during the peripartum period	
Population and directness	Women in the peripartum period who are obese (BMI ≥ 30 kg/m^2) at the booking appointment Definitions from the NICE guideline on obesity (CG189): • healthy weight, BMI 18.5–24.9 kg/m^2 • overweight, BMI 25–29.9 kg/m^2 • obesity I, BMI 30 – 34.9 kg/m^2 • obesity 2, BMI 35 – 39.9 kg/m^2 • obesity 3, 40 or greater kg/m^2 Note: for some aspects of this review question, absolute weight will be of greater importance than BMI or obesity; for example, a woman with obesity who is of short stature may not require a different bed	
Intervention	Use of specially manufactured or adapted equipment: • equipment or flooring with a safe working load of up to 250kg • theatre gowns appropriate to be worn by women with obesity • large blood pressure cuffs • sit-on weighing scales • large chairs without arms	

Item	Details	Working notes
	• large wheelchairs • beds used in wards and the birthing suite • theatre trolleys • stirrups • operating theatre tables • lifting and lateral transfer equipment • long epidural and spinal needles • operating instruments, for example, deeper retractors • vaginal speculum • air-assisted lateral patient transfer device • birthing stools • thromboembolic deterrent stockings	
Comparison	No specialist equipment	
Outcomes	Critical outcomes: • for the woman: o injury to the woman or weight-related medical errors • for staff: o injuries to staff • for the baby: o major neonatal morbidity (shoulder dystocia, hypoxic ischaemic encephalopathy and other brain injuries, birth injuries, or respiratory complications) o admission to a neonatal unit Important outcomes: • for the woman: o mortality o women's satisfaction with labour and birth (including psychological wellbeing) Outcomes of limited importance: • for the baby: o mortality	
Importance of outcomes	Preliminary classification of the outcomes for decision making: • critical (up to 3 outcomes) • important but not critical (up to 3 outcomes) • of limited importance (1 outcome)	
Setting	All settings	
Stratified, subgroup and adjusted analyses	In the presence of heterogeneity, the following subgroups will be considered for sensitivity analysis: • BMI category Potential confounders: • none specified	

Item	Details	Working notes
Language	English	
Study design	• Published full-text papers only • Systematic reviews • RCTs • Only if RCTs unavailable or there is limited data to inform decision making with a minimum sample size of 15 women in each group: ○ prospective or retrospective comparative cohort studies ○ case series studies • Prospective study designs will be prioritised over retrospective study designs • Conference abstracts will not be considered	
Search strategy	Sources to be searched: Medline, Medline In-Process, CCTR, CDSR, DARE, HTA and Embase. Limits (e.g. date, study design): All study designs. Apply standard animal/non-English language filters. No date limit. Supplementary search techniques: No supplementary search techniques were used. See Appendix F for full strategies	
Review strategy	Appraisal of methodological quality: • the methodological quality of each study will be assessed using checklists recommended in the NICE guidelines manual 2014 (for example, AMSTAR or ROBIS for systematic reviews, and Cochrane RoB tool for RCTs) and the quality of the evidence for each outcome (that is, across studies) will be assessed using GRADE • if studies report only p-values, this information will be recorded in GRADE tables without an assessment of imprecision Synthesis of data: • meta-analysis will be conducted where appropriate • default MIDs will be used; 0.8 and 1.25 for dichotomous outcomes; 0.5 times the SD of the measurement in the control arm (or median score across control arms if multiple studies are included) for continuous outcomes • for continuous data, change scores will be used in preference to final scores for data from non-RCT studies; final and change scores will not be pooled; if any study reports both, the method used in the majority of studies will be adopted	Review questions selected as high priorities for health economic analysis (and those selected as medium priorities and where health economic analysis could influence recommendations) will be subject to dual weeding and study selection; any discrepancies will be resolved through discussion between the first and second reviewers or by reference to a third person. This review question was prioritised for health economic analysis and so formal dual weeding will be undertaken. Additionally, internal (NGA) quality assurance processes will

Item	Details	Working notes
		include consideration of the outcomes of weeding, study selection and data extraction and the committee will review the results of study selection and data extraction
Equalities	Equalities considerations will be considered systematically in relation to the available evidence and draft recommendations. The guideline scope includes women with cognitive or physical disability as populations for whom there may be equalities issues. Women who have received no antenatal care will be considered as a subgroup for all systematic reviews performed within the medical conditions work stream and a specific question has been included in the obstetric complications work stream for this population	
Notes/additional information	• Age-adjusted BMI cut-offs equivalent to conventional • obesity thresholds by ethnic group (BMI (kg/m2)): • White: 30 • South Asian (Pakistani): 21.6 • South Asian (Indian): 22.3 • Chinese: 24 • Black: 26 • (from “New BMI thresholds suggested for ethnic minorities to reduce obesity and diabetes risk”, University of Glasgow, 2014, http://www.gla.ac.uk/news/archiveofnews/2014/july/headline_343682_en.html) International guidance on BMI thresholds for Asian populations (risk of obesity-related comorbidities): • increasing but acceptable risk: 18.5-23 BMI kg/m2 • increased risk: 23-27.5 BMI kg/m2 • high risk: 27.5 BMI kg/m2 • (from NICE guideline [PH46], 2013; “BMI: preventing ill • health and premature death in black, Asian and other • minority ethnic groups”, • https://www.nice.org.uk/guidance/ph46/chapter/1-recommendations)	
Key papers	• Public Health England: Maternal obesity, http://www.noo.org.uk/NOO_about_obesity/maternal_obesity_2015) • http://www.publichealth.hscni.net/sites/default/files/Maternal%20Obesity%20in%20the%20UK%20executive%20summary.pdf • Section 1.9. Appropriate facilities and equipment in maternity units	

Item	Details	Working notes
	• The availability of appropriate equipment in the event of an unplanned admission to a maternity unit of a woman with super-morbid obesity was generally inadequate. Approximately two thirds of units in the UK reported not having immediate access to appropriate extra-wide wheelchairs, examination couches, trolleys or ward beds. Furthermore, the majority of facilities and equipment in maternity units did not have the minimum safe working load of 250kg recommended by the CMACE/RCOG guideline for the management of women with obesity in pregnancy. Facilities such as weighing scales, which are essential to ensure correct doses of medication such as thromboprophylaxis, were mainly concentrated in outpatient areas which may not be easily accessible out-of-hours • https://www.rcog.org.uk/globalassets/documents/guidelines/cmacercogjointguidelinemanagementwomenobesitypregnancya.pdf	

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Appendix B – Literature search strategies

Intrapartum care for women with obesity – fetal presentation

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

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	PATIENT ADMISSION/
10	(admission or admitt$).ti,ab.
11	((birth? or deliver?) adj3 (admission or admitt$)).ti,ab.
12	((first or initial$ or early) adj3 (contact or assess$)).ti,ab.
13	"on arrival".ab,ti.
14	or/9-13
15	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
16	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/

#	Searches
17	body mass index.ti.
18	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
19	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
20	or/15-19
21	LABOR PRESENTATION/
22	BREECH PRESENTATION/
23	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).ab,ti.
24	((complete$ or incomplete$ or frank or present$) adj5 breech$).ab,ti.
25	((occipito or occiput) adj3 (posterior or transverse)).ab,ti.
26	OP.ab,ti.
27	or/21-26
28	exp ULTRASONOGRAPHY/
29	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
30	PALPATION/
31	palpat$.ab,ti.
32	or/28-31
33	8 and 20 and 27
34	14 and 20 and 27
35	20 and 27 and 32
36	or/33-35
37	limit 36 to english language
38	LETTER/
39	EDITORIAL/
40	NEWS/
41	exp HISTORICAL ARTICLE/
42	ANECDOTES AS TOPIC/
43	COMMENT/
44	CASE REPORT/
45	(letter or comment*).ti.
46	or/38-45
47	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
48	46 not 47
49	ANIMALS/ not HUMANS/
50	exp ANIMALS, LABORATORY/
51	exp ANIMAL EXPERIMENTATION/
52	exp MODELS, ANIMAL/
53	exp RODENTIA/
54	(rat or rats or mouse or mice).ti.
55	or/48-54
56	37 not 55

Database: Cochrane Central Register of Controlled Trials

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti,kw.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	PATIENT ADMISSION/
10	(admission or admitt$).ti,ab,kw.
11	((birth? or deliver?) adj3 (admission or admitt$)).ti,ab.
12	((first or initial$ or early) adj3 (contact or assess$)).ti,ab.
13	"on arrival".ab,ti.
14	or/9-13
15	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
16	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
17	body mass index.ti.
18	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
19	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
20	or/15-19
21	LABOR PRESENTATION/
22	BREECH PRESENTATION/
23	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).ab,ti.
24	((complete$ or incomplete$ or frank or present$) adj5 breech$).ab,ti.
25	((occipito or occiput) adj3 (posterior or transverse)).ab,ti.
26	OP.ab,ti.
27	or/21-26
28	exp ULTRASONOGRAPHY/
29	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
30	PALPATION/
31	palpat$.ab,ti,kw.
32	or/28-31
33	8 and 20 and 27
34	14 and 20 and 27
35	20 and 27 and 32
36	or/33-35

Database: Cochrane Database of Systematic Reviews

#	Searches
1	PERIPARTUM PERIOD.kw.
2	PARTURITION.kw.

#	Searches
3	LABOR, OBSTETRIC.kw.
4	DELIVERY, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	PATIENT ADMISSION.kw.
10	(admission or admitt$).ti,ab.
11	((birth? or deliver?) adj3 (admission or admitt$)).ti,ab.
12	((first or initial$ or early) adj3 (contact or assess$)).ti,ab.
13	"on arrival".ab,ti.
14	or/9-13
15	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
16	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
17	body mass index.ab,ti.
18	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ab,ti.
19	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
20	or/15-19
21	LABOR PRESENTATION.kw.
22	BREECH PRESENTATION.kw.
23	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).ab,ti.
24	((complete$ or incomplete$ or frank or present$) adj5 breech$).ab,ti.
25	((occipito or occiput) adj3 (posterior or transverse)).ab,ti.
26	OP.ab,ti.
27	or/21-26
28	ULTRASONOGRAPHY.kw.
29	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
30	PALPATION.kw.
31	palpat$.ab,ti.
32	or/28-31
33	8 and 20 and 27
34	14 and 20 and 27
35	20 and 27 and 32
36	or/33-35

Database: Database of Abstracts of Reviews of Effects

#	Searches
1	PERIPARTUM PERIOD.kw.
2	PARTURITION.kw.
3	LABOR, OBSTETRIC.kw.
4	DELIVERY, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.

#	Searches
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).tw,tx.
7	((during or giving or give) adj5 (birth$ or deliver$)).tw,tx.
8	or/1-7
9	PATIENT ADMISSION.kw.
10	(admission or admitt$).tw,tx.
11	((birth? or deliver?) adj3 (admission or admitt$)).tw,tx.
12	((first or initial$ or early) adj3 (contact or assess$)).tw,tx.
13	"on arrival".tw,tx.
14	or/9-13
15	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
16	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
17	body mass index.tw,tx.
18	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw,tx.
19	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
20	or/15-19
21	LABOR PRESENTATION.kw.
22	BREECH PRESENTATION.kw.
23	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).tw,tx.
24	((complete$ or incomplete$ or frank or present$) adj5 breech$).tw,tx.
25	((occipito or occiput) adj3 (posterior or transverse)).tw,tx.
26	OP.tw,tx.
27	or/21-26
28	ULTRASONOGRAPHY.kw.
29	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).tw,tx.
30	PALPATION.kw.
31	palpat$.tw,tx.
32	or/28-31
33	8 and 20 and 27
34	14 and 20 and 27
35	20 and 27 and 32
36	or/33-35

Database: Health Technology Assessment

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).tw.
7	((during or giving or give) adj5 (birth$ or deliver$)).tw.
8	or/1-7

#	Searches
9	PATIENT ADMISSION/
10	(admission or admitt$).tw.
11	((birth? or deliver?) adj3 (admission or admitt$)).tw.
12	((first or initial$ or early) adj3 (contact or assess$)).tw.
13	"on arrival".tw.
14	or/9-13
15	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
16	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
17	body mass index.tw.
18	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw.
19	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
20	or/15-19
21	LABOR PRESENTATION/
22	BREECH PRESENTATION/
23	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).tw.
24	((complete$ or incomplete$ or frank or present$) adj5 breech$).tw.
25	((occipito or occiput) adj3 (posterior or transverse)).tw.
26	OP.tw.
27	or/21-26
28	exp ULTRASONOGRAPHY/
29	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).tw.
30	PALPATION/
31	palpat$.tw.
32	or/28-31
33	8 and 20 and 27
34	14 and 20 and 27
35	20 and 27 and 32
36	or/33-35

Database: Embase

#	Searches
1	INTRAPARTUM CARE/
2	PERINATAL PERIOD/
3	BIRTH/
4	exp LABOR/
5	exp DELIVERY/
6	PREMATURE LABOR/
7	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
8	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
9	or/1-8
10	*HOSPITAL ADMISSION/
11	(admission or admitt$).ti,ab.

#	Searches
12	((birth? or deliver?) adj3 (admission or admitt$)).ti,ab.
13	((first or initial$ or early) adj3 (contact or assess$)).ti,ab.
14	"on arrival".ab,ti.
15	or/10-14
16	*OBESITY/ or *ABDOMINAL OBESITY/ or *MORBID OBESITY/
17	*BODY MASS/ or *BODY SIZE/ or *WAIST CIRCUMFERENCE/ or *WAIST-HIP RATIO/
18	body mass index.ti.
19	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
20	*ADIPOSE TISSUE/ or *WHITE ADIPOSE TISSUE/
21	or/16-20
22	*MALPRESENTATION/
23	*BREECH PRESENTATION/
24	((Present$ or malpresent$ or malposition$) adj5 (labo?r or fetal or fetus?)).ab,ti.
25	((complete$ or incomplete$ or frank or present$) adj5 breech$).ab,ti.
26	((occipito or occiput) adj3 (posterior or transverse)).ab,ti.
27	OP.ab,ti.
28	or/22-27
29	exp *ECHOGRAPHY/
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
31	*PALPATION/
32	palpat$.ab,ti.
33	or/29-32
34	9 and 21 and 28
35	15 and 21 and 28
36	21 and 28 and 33
37	or/34-36
38	limit 37 to english language
39	letter.pt. or LETTER/
40	note.pt.
41	editorial.pt.
42	CASE REPORT/ or CASE STUDY/
43	(letter or comment*).ti.
44	or/39-43
45	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
46	44 not 45
47	ANIMAL/ not HUMAN/
48	NONHUMAN/
49	exp ANIMAL EXPERIMENT/
50	exp EXPERIMENTAL ANIMAL/
51	ANIMAL MODEL/
52	exp RODENT/
53	(rat or rats or mouse or mice).ti.

#	Searches
54	or/46-53
55	38 not 54

Intrapartum care for women with obesity – anaesthesia and analgesia

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

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.ti,ab.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	exp ULTRASONOGRAPHY/
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).ti,ab.
9	or/7-8
10	ANESTHESIA, OBSTETRICAL/
11	ANESTHESIA, SPINAL/
12	ANESTHESIA, EPIDURAL/
13	ANALGESIA, OBSTETRICAL/
14	ANALGESIA, EPIDURAL/
15	INJECTIONS, EPIDURAL/
16	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).ti,ab.
17	epidural$.ti,ab.
18	CSE.ti,ab.
19	central neuraxial block$.ti,ab.
20	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).ti,ab.
21	or/10-20
22	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).ti,ab.
23	6 and 9 and 21
24	6 and 9 and 22
25	SPINE/us [Ultrasonography]
26	6 and 25
27	EPIDURAL SPACE/us [Ultrasonography]
28	6 and 27
29	23 or 24 or 26 or 28
30	limit 29 to english language
31	LETTER/
32	EDITORIAL/
33	NEWS/

#	Searches
34	exp HISTORICAL ARTICLE/
35	ANECDOTES AS TOPIC/
36	COMMENT/
37	CASE REPORT/
38	(letter or comment*).ti.
39	or/31-38
40	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
41	39 not 40
42	ANIMALS/ not HUMANS/
43	exp ANIMALS, LABORATORY/
44	exp ANIMAL EXPERIMENTATION/
45	exp MODELS, ANIMAL/
46	exp RODENTIA/
47	(rat or rats or mouse or mice).ti.
48	or/41-47
49	30 not 48

Database: Cochrane Central Register of Controlled Trials

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.ti,ab,kw.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab,kw.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	exp ULTRASONOGRAPHY/
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).ti,ab,kw.
9	or/7-8
10	ANESTHESIA, OBSTETRICAL/
11	ANESTHESIA, SPINAL/
12	ANESTHESIA, EPIDURAL/
13	ANALGESIA, OBSTETRICAL/
14	ANALGESIA, EPIDURAL/
15	INJECTIONS, EPIDURAL/
16	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).ti,ab.
17	epidural$.ti,ab,kw.
18	CSE.ti,ab.
19	central neuraxial block$.ti,ab,kw.
20	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).ti,ab.
21	or/10-20
22	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).ti,ab.

#	Searches
23	6 and 9 and 21
24	6 and 9 and 22
25	SPINE/us [Ultrasonography]
26	6 and 25
27	EPIDURAL SPACE/us [Ultrasonography]
28	6 and 27
29	23 or 24 or 26 or 28

Database: Cochrane Database of Systematic Reviews

#	Searches
1	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
2	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
3	body mass index.ti,ab.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.
5	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
6	or/1-5
7	ULTRASONOGRAPHY.kw.
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).ti,ab.
9	or/7-8
10	ANESTHESIA, OBSTETRICAL.kw.
11	ANESTHESIA, SPINAL.kw.
12	ANESTHESIA, EPIDURAL.kw.
13	ANALGESIA, OBSTETRICAL.kw.
14	ANALGESIA, EPIDURAL.kw.
15	INJECTIONS, EPIDURAL.kw.
16	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).ti,ab.
17	epidural$.ti,ab.
18	CSE.ti,ab.
19	central neuraxial block$.ti,ab.
20	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).ti,ab.
21	or/10-20
22	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).ti,ab.
23	6 and 9 and 21
24	6 and 9 and 22
25	23 or 24

Database: Database of Abstracts of Reviews of Effects

#	Searches
1	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
2	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.

#	Searches
3	body mass index.tw,tx.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw,tx.
5	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
6	or/1-5
7	ULTRASONOGRAPHY.kw.
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).tw,tx.
9	or/7-8
10	ANESTHESIA, OBSTETRICAL.kw.
11	ANESTHESIA, SPINAL.kw.
12	ANESTHESIA, EPIDURAL.kw.
13	ANALGESIA, OBSTETRICAL.kw.
14	ANALGESIA, EPIDURAL.kw.
15	INJECTIONS, EPIDURAL.kw.
16	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).tw,tx.
17	epidural$.tw,tx.
18	CSE.tw,tx.
19	central neuraxial block$.tw,tx.
20	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).tw,tx.
21	or/10-20
22	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).tw,tx.
23	6 and 9 and 21
24	6 and 9 and 22
25	23 or 24

Database: Health Technology Assessment

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.tw.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	exp ULTRASONOGRAPHY/
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).tw.
9	or/7-8
10	ANESTHESIA, OBSTETRICAL/
11	ANESTHESIA, SPINAL/
12	ANESTHESIA, EPIDURAL/
13	ANALGESIA, OBSTETRICAL/
14	ANALGESIA, EPIDURAL/
15	INJECTIONS, EPIDURAL/

#	Searches
16	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).tw.
17	epidural$.tw.
18	CSE.tw.
19	central neuraxial block$.tw.
20	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).tw.
21	or/10-20
22	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).tw.
23	6 and 9 and 21
24	6 and 9 and 22
25	SPINE/us [Ultrasonography]
26	6 and 25
27	EPIDURAL SPACE/us [Ultrasonography]
28	6 and 27
29	23 or 24 or 26 or 28

Database: Embase

#	Searches
1	*OBESITY/ or *ABDOMINAL OBESITY/ or *MORBID OBESITY/
2	*BODY MASS/ or *BODY SIZE/ or *WAIST CIRCUMFERENCE/ or *WAIST-HIP RATIO/
3	(body mass index or obesity or obese).ti,ab.
4	(heavy or heavier or overweight or fat$ or BMI).ti.
5	*ADIPOSE TISSUE/ or *WHITE ADIPOSE TISSUE/
6	or/1-5
7	exp *ECHOGRAPHY/
8	(ultraso$ or echo$ or sono$ or doppler$ or flowmet$).ti,ab.
9	or/7-8
10	*OBSTETRIC ANESTHESIA/
11	*SPINAL ANESTHESIA/
12	*EPIDURAL ANESTHESIA/
13	*OBSTETRIC ANALGESIA/
14	*EPIDURAL DRUG ADMINISTRATION/
15	((Spinal$ or spinous or obstetric$) adj3 (analges$ or an?esth$)).ti,ab.
16	epidural$.ti,ab.
17	CSE.ti,ab.
18	central neuraxial block$.ti,ab.
19	(neuraxial adj3 (analges$ or an?esth$ or technique? or procedur$)).ti,ab.
20	or/10-19
21	((Needle? or catheter$) adj3 (site? or siting or place$ or placing or position$ or accura$ or success$ or effective$ or problem$ or difficult$ or challeng$)).ti,ab.
22	6 and 9 and 20
23	6 and 9 and 21
24	22 or 23

#	Searches
25	limit 24 to english language
26	letter.pt. or LETTER/
27	note.pt.
28	editorial.pt.
29	CASE REPORT/ or CASE STUDY/
30	(letter or comment*).ti.
31	or/26-30
32	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
33	31 not 32
34	ANIMAL/ not HUMAN/
35	NONHUMAN/
36	exp ANIMAL EXPERIMENT/
37	exp EXPERIMENTAL ANIMAL/
38	ANIMAL MODEL/
39	exp RODENT/
40	(rat or rats or mouse or mice).ti.
41	or/33-40
42	25 not 41

Intrapartum care for women with obesity – fetal monitoring

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

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
10	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
11	body mass index.ti.
12	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
13	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
14	or/9-13
15	FETAL MONITORING/
16	UTERINE MONITORING/
17	HEART RATE, FETAL/
18	FETAL HEART/

#	Searches
19	FETAL DISTRESS/
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).ti,ab.
21	FHR.ti,ab.
22	CARDIOTOCOGRAPHY/
23	(cardiotocogra$ or CTG or EFM).ti,ab.
24	MONITORING, PHYSIOLOGIC/
25	(monitor$ adj3 continu$).ti,ab.
26	ELECTROCARDIOGRAPHY/
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).ti,ab.
28	ULTRASONOGRAPHY, DOPPLER/
29	ECHOCARDIOGRAPHY, DOPPLER/
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
31	exp AUSCULTATION/
32	(auscultat$ or IA or pin?ard$ or fetoscop$).ti,ab.
33	((f?etal or f?etus$) adj3 stethoscop$).ti,ab.
34	"listening in".ti,ab.
35	(non stress test$ or non?stress test$ or NST).ti,ab.
36	sonicaid$.ti,ab.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).ti,ab.
38	SCALP/
39	ELECTRODES/
40	(scalp$ adj3 electrode?).ab,ti.
41	or/15-40
42	8 and 14 and 41
43	limit 42 to english language
44	LETTER/
45	EDITORIAL/
46	NEWS/
47	exp HISTORICAL ARTICLE/
48	ANECDOTES AS TOPIC/
49	COMMENT/
50	CASE REPORT/
51	(letter or comment*).ti.
52	or/44-51
53	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
54	52 not 53
55	ANIMALS/ not HUMANS/
56	exp ANIMALS, LABORATORY/
57	exp ANIMAL EXPERIMENTATION/
58	exp MODELS, ANIMAL/
59	exp RODENTIA/
60	(rat or rats or mouse or mice).ti.

#	Searches
61	or/54-60
62	43 not 61

Database: Cochrane Central Register of Controlled Trials

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti,kw.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
10	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
11	body mass index.ti.
12	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
13	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
14	or/9-13
15	FETAL MONITORING/
16	UTERINE MONITORING/
17	HEART RATE, FETAL/
18	FETAL HEART/
19	FETAL DISTRESS/
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).ti,ab.
21	FHR.ti,ab.
22	CARDIOTOCOGRAPHY/
23	(cardiotocogra$ or CTG or EFM).ti,ab,kw.
24	MONITORING, PHYSIOLOGIC/
25	(monitor$ adj3 continu$).ti,ab.
26	ELECTROCARDIOGRAPHY/
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).ti,ab.
28	ULTRASONOGRAPHY, DOPPLER/
29	ECHOCARDIOGRAPHY, DOPPLER/
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
31	exp AUSCULTATION/
32	(auscultat$ or IA or pin?ard$ or fetoscop$).ti,ab.
33	((f?etal or f?etus$) adj3 stethoscop$).ti,ab.
34	"listening in".ti,ab.
35	(non stress test$ or non?stress test$ or NST).ti,ab.
36	sonicaid$.ti,ab.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).ti,ab.

#	Searches
38	SCALP/
39	ELECTRODES/
40	(scalp$ adj3 electrode?).ab,ti.
41	or/15-40
42	8 and 14 and 41

Database: Cochrane Database of Systematic Reviews

#	Searches
1	PERIPARTUM PERIOD.kw.
2	PARTURITION.kw.
3	LABOR, OBSTETRIC.kw.
4	DELIVERY, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
7	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
8	or/1-7
9	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
10	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
11	body mass index.ab,ti.
12	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ab,ti.
13	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
14	or/9-13
15	FETAL MONITORING.kw.
16	UTERINE MONITORING.kw.
17	HEART RATE, FETAL.kw.
18	FETAL HEART.kw.
19	FETAL DISTRESS.kw.
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).ti,ab.
21	FHR.ti,ab.
22	CARDIOTOCOGRAPHY.kw.
23	(cardiotocogra$ or CTG or EFM).ti,ab.
24	MONITORING, PHYSIOLOGIC.kw.
25	(monitor$ adj3 continu$).ti,ab.
26	ELECTROCARDIOGRAPHY.kw.
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).ti,ab.
28	ULTRASONOGRAPHY, DOPPLER.kw.
29	ECHOCARDIOGRAPHY, DOPPLER.kw.
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
31	AUSCULTATION.kw.
32	(auscultat$ or IA or pin?ard$ or fetoscop$).ti,ab.
33	((f?etal or f?etus$) adj3 stethoscop$).ti,ab.
34	"listening in".ti,ab.

#	Searches
35	(non stress test$ or non?stress test$ or NST).ti,ab.
36	sonicaid$.ti,ab.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).ti,ab.
38	SCALP.kw.
39	ELECTRODES.kw.
40	(scalp$ adj3 electrode?).ab,ti.
41	or/15-40
42	8 and 14 and 41

Database: Database of Abstracts of Reviews of Effects

#	Searches
1	PERIPARTUM PERIOD.kw.
2	PARTURITION.kw.
3	LABOR, OBSTETRIC.kw.
4	DELIVERY, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).tw,tx.
7	((during or giving or give) adj5 (birth$ or deliver$)).tw,tx.
8	or/1-7
9	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
10	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
11	body mass index.tw,tx.
12	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw,tx.
13	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
14	or/9-13
15	FETAL MONITORING.kw.
16	UTERINE MONITORING.kw.
17	HEART RATE, FETAL.kw.
18	FETAL HEART.kw.
19	FETAL DISTRESS.kw.
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).tw,tx.
21	FHR.tw,tx.
22	CARDIOTOCOGRAPHY.kw.
23	(cardiotocogra$ or CTG or EFM).tw,tx.
24	MONITORING, PHYSIOLOGIC.kw.
25	(monitor$ adj3 continu$).tw,tx.
26	ELECTROCARDIOGRAPHY.kw.
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).tw,tx.
28	ULTRASONOGRAPHY, DOPPLER.kw.
29	ECHOCARDIOGRAPHY, DOPPLER.kw.
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).tw,tx.
31	AUSCULTATION.kw.

#	Searches
32	(auscultat$ or IA or pin?ard$ or fetoscop$).tw,tx.
33	((f?etal or f?etus$) adj3 stethoscop$).tw,tx.
34	"listening in".tw,tx.
35	(non stress test$ or non?stress test$ or NST).tw,tx.
36	sonicaid$.tw,tx.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).tw,tx.
38	SCALP.kw.
39	ELECTRODES.kw.
40	(scalp$ adj3 electrode?).tw,tx.
41	or/15-40
42	8 and 14 and 41

Database: Health Technology Assessment

#	Searches
1	PERIPARTUM PERIOD/
2	exp PARTURITION/
3	exp LABOR, OBSTETRIC/
4	exp DELIVERY, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).tw.
7	((during or giving or give) adj5 (birth$ or deliver$)).tw.
8	or/1-7
9	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
10	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
11	body mass index.tw.
12	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw.
13	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
14	or/9-13
15	FETAL MONITORING/
16	UTERINE MONITORING/
17	HEART RATE, FETAL/
18	FETAL HEART/
19	FETAL DISTRESS/
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).tw.
21	FHR.tw.
22	CARDIOTOCOGRAPHY/
23	(cardiotocogra$ or CTG or EFM).tw.
24	MONITORING, PHYSIOLOGIC/
25	(monitor$ adj3 continu$).tw.
26	ELECTROCARDIOGRAPHY/
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).tw.
28	ULTRASONOGRAPHY, DOPPLER/

#	Searches
29	ECHOCARDIOGRAPHY, DOPPLER/
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).tw.
31	exp AUSCULTATION/
32	(auscultat$ or IA or pin?ard$ or fetoscop$).tw.
33	((f?etal or f?etus$) adj3 stethoscop$).tw.
34	"listening in".tw.
35	(non stress test$ or non?stress test$ or NST).tw.
36	sonicaid$.tw.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).tw.
38	SCALP/
39	ELECTRODES/
40	(scalp$ adj3 electrode?).tw.
41	or/15-40
42	8 and 14 and 41

Database: Embase

#	Searches
1	INTRAPARTUM CARE/
2	PERINATAL PERIOD/
3	BIRTH/
4	exp LABOR/
5	exp DELIVERY/
6	PREMATURE LABOR/
7	(labo?r? or childbirth$ or partu$ or intra?part$ or peri?part$).ab,ti.
8	((during or giving or give) adj5 (birth$ or deliver$)).ti,ab.
9	or/1-8
10	*OBESITY/ or *ABDOMINAL OBESITY/ or *MORBID OBESITY/
11	*BODY MASS/ or *BODY SIZE/ or *WAIST CIRCUMFERENCE/ or *WAIST-HIP RATIO/
12	body mass index.ti.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti.
14	*ADIPOSE TISSUE/ or *WHITE ADIPOSE TISSUE/
15	or/10-14
16	*FETUS MONITORING/
17	*FETUS HEART RATE/
18	*FETUS HEART/
19	*FETUS DISTRESS/
20	((f?etal or f?etus$ or uter$) adj3 (monitor$ or observ$ or assess$ or heart$ or distress$)).ti,ab.
21	FHR.ti,ab.
22	*CARDIOTOCOGRAPHY/
23	(cardiotocogra$ or CTG or EFM).ti,ab.
24	*PHYSIOLOGIC MONITORING/
25	(monitor$ adj3 continu$).ti,ab.

#	Searches
26	*ELECTROCARDIOGRAPHY MONITORING/
27	((electrocardiogra$ or ECG or EKG) adj5 (f?etal or f?etus$)).ti,ab.
28	*DOPPLER FLOWMETRY/
29	*DOPPLER ECHOCARDIOGRAPHY/
30	((ultraso$ or echo$ or sono$ or doppler$ or flowmet$) adj5 (f?etal or f?etus$)).ti,ab.
31	exp *AUSCULTATION/
32	(auscultat$ or IA or pin?ard$ or fetoscop$).ti,ab.
33	((f?etal or f?etus$) adj3 stethoscop$).ti,ab.
34	"listening in".ti,ab.
35	(non stress test$ or non?stress test$ or NST).ti,ab.
36	sonicaid$.ti,ab.
37	(monitor$ adj3 (select$ or routine$ or intermittent$ or interval$)).ti,ab.
38	*SCALP/
39	*ELECTRODE/
40	(scalp$ adj3 electrode?).ab,ti.
41	or/16-40
42	9 and 15 and 41
43	limit 42 to english language
44	letter.pt. or LETTER/
45	note.pt.
46	editorial.pt.
47	CASE REPORT/ or CASE STUDY/
48	(letter or comment*).ti.
49	or/44-48
50	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
51	49 not 50
52	ANIMAL/ not HUMAN/
53	NONHUMAN/
54	exp ANIMAL EXPERIMENT/
55	exp EXPERIMENTAL ANIMAL/
56	ANIMAL MODEL/
57	exp RODENT/
58	(rat or rats or mouse or mice).ti.
59	or/51-58
60	43 not 59

Intrapartum care for women with obesity – optimal position

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

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/

#	Searches
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.ti,ab.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	LABOR STAGE, SECOND/
8	((second stage? or 2nd stage?) adj3 labo?r).ab,ti.
9	or/7-8
10	PATIENT POSITIONING/
11	exp POSTURE/
12	position$.ti,ab.
13	postur$.ti,ab.
14	(stand? or standing).ti,ab.
15	Squat$.ti,ab.
16	Kneel$.ti,ab.
17	(recumbent$ or semi-recumbent$).ti,ab.
18	((lie or lying or lay or laid) adj3 back?).ti,ab.
19	left lateral$.ti,ab.
20	birth$ stool?.ti,ab.
21	all fours.ti,ab.
22	Lithotomy$.ti,ab.
23	Lloyd-Davies.ti,ab.
24	McRoberts.ti,ab.
25	Birth$ pool?.ti,ab.
26	(supine$ or semi-supine$).ti,ab.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29
31	limit 30 to english language
32	LETTER/
33	EDITORIAL/
34	NEWS/
35	exp HISTORICAL ARTICLE/
36	ANECDOTES AS TOPIC/
37	COMMENT/
38	CASE REPORT/
39	(letter or comment*).ti.
40	or/32-39
41	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
42	40 not 41

#	Searches
43	ANIMALS/ not HUMANS/
44	exp ANIMALS, LABORATORY/
45	exp ANIMAL EXPERIMENTATION/
46	exp MODELS, ANIMAL/
47	exp RODENTIA/
48	(rat or rats or mouse or mice).ti.
49	or/42-48
50	31 not 49

Database: Cochrane Central Register of Controlled Trials

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.ti,ab,kw.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab,kw.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	LABOR STAGE, SECOND/
8	((second stage? or 2nd stage?) adj3 labo?r).ab,ti.
9	or/7-8
10	PATIENT POSITIONING/
11	exp POSTURE/
12	position$.ti,ab,kw.
13	postur$.ti,ab,kw.
14	(stand? or standing).ti,ab,kw.
15	Squat$.ti,ab,kw.
16	Kneel$.ti,ab,kw.
17	(recumbent$ or semi-recumbent$).ti,ab,kw.
18	((lie or lying or lay or laid) adj3 back?).ti,ab.
19	left lateral$.ti,ab,kw.
20	birth$ stool?.ti,ab,kw.
21	all fours.ti,ab,kw.
22	Lithotomy$.ti,ab,kw.
23	Lloyd-Davies.ti,ab.
24	McRoberts.ti,ab.
25	Birth$ pool?.ti,ab,kw.
26	(supine$ or semi-supine$).ti,ab,kw.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29

Database: Cochrane Database of Systematic Reviews

#	Searches
1	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
2	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
3	body mass index.ti,ab.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.
5	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
6	or/1-5
7	LABOR STAGE, SECOND.kw.
8	((second stage? or 2nd stage?) adj3 labo?r).ab,ti.
9	or/7-8
10	PATIENT POSITIONING.kw.
11	POSTURE.kw.
12	position$.ti,ab.
13	postur$.ti,ab.
14	(stand? or standing).ti,ab.
15	Squat$.ti,ab.
16	Kneel$.ti,ab.
17	(recumbent$ or semi-recumbent$).ti,ab.
18	((lie or lying or lay or laid) adj3 back?).ti,ab.
19	left lateral$.ti,ab.
20	birth$ stool?.ti,ab.
21	all fours.ti,ab.
22	Lithotomy$.ti,ab.
23	Lloyd-Davies.ti,ab.
24	McRoberts.ti,ab.
25	Birth$ pool?.ti,ab.
26	(supine$ or semi-supine$).ti,ab.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29

Database: Database of Abstracts of Reviews of Effects

#	Searches
1	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
2	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
3	body mass index.tw,tx.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw,tx.
5	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
6	or/1-5
7	LABOR STAGE, SECOND.kw.

#	Searches
8	((second stage? or 2nd stage?) adj3 labo?r).tw,tx.
9	or/7-8
10	PATIENT POSITIONING.kw.
11	POSTURE.kw.
12	position$.tw,tx.
13	postur$.tw,tx.
14	(stand? or standing).tw,tx.
15	Squat$.tw,tx.
16	Kneel$.tw,tx.
17	(recumbent$ or semi-recumbent$).tw,tx.
18	((lie or lying or lay or laid) adj3 back?).tw,tx.
19	left lateral$.tw,tx.
20	birth$ stool?.tw,tx.
21	all fours.tw,tx.
22	Lithotomy$.tw,tx.
23	Lloyd-Davies.tw,tx.
24	McRoberts.tw,tx.
25	Birth$ pool?.tw,tx.
26	(supine$ or semi-supine$).tw,tx.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29

Database: Health Technology Assessment

#	Searches
1	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
2	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
3	body mass index.tw.
4	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw.
5	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
6	or/1-5
7	LABOR STAGE, SECOND/
8	((second stage? or 2nd stage?) adj3 labo?r).tw.
9	or/7-8
10	PATIENT POSITIONING/
11	exp POSTURE/
12	position$.tw.
13	postur$.tw.
14	(stand? or standing).tw.
15	Squat$.tw.
16	Kneel$.tw.

#	Searches
17	(recumbent$ or semi-recumbent$).tw.
18	((lie or lying or lay or laid) adj3 back?).tw.
19	left lateral$.tw.
20	birth$ stool?.tw.
21	all fours.tw.
22	Lithotomy$.tw.
23	Lloyd-Davies.tw.
24	McRoberts.tw.
25	Birth$ pool?.tw.
26	(supine$ or semi-supine$).tw.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29

Database: Embase

#	Searches
1	*OBESITY/ or *ABDOMINAL OBESITY/ or *MORBID OBESITY/
2	*BODY MASS/ or *BODY SIZE/ or *WAIST CIRCUMFERENCE/ or *WAIST-HIP RATIO/
3	(body mass index or obesity or obese).ti,ab.
4	(heavy or heavier or overweight or fat$ or BMI).ti.
5	*ADIPOSE TISSUE/ or *WHITE ADIPOSE TISSUE/
6	or/1-5
7	LABOR STAGE 2/
8	((second stage? or 2nd stage?) adj3 labo?r).ab,ti.
9	or/7-8
10	PATIENT POSITIONING/
11	BODY POSTURE/
12	position$.ti,ab.
13	postur$.ti,ab.
14	(stand? or standing).ti,ab.
15	Squat$.ti,ab.
16	Kneel$.ti,ab.
17	(recumbent$ or semi-recumbent$).ti,ab.
18	((lie or lying or lay or laid) adj3 back?).ti,ab.
19	left lateral$.ti,ab.
20	birth$ stool?.ti,ab.
21	all fours.ti,ab.
22	Lithotomy$.ti,ab.
23	Lloyd-Davies.ti,ab.
24	McRoberts.ti,ab.
25	Birth$ pool?.ti,ab.

#	Searches
26	(supine$ or semi-supine$).ti,ab.
27	or/10-26
28	6 and 9
29	9 and 27
30	or/28-29
31	limit 30 to english language
32	letter.pt. or LETTER/
33	note.pt.
34	editorial.pt.
35	CASE REPORT/ or CASE STUDY/
36	(letter or comment*).ti.
37	or/32-36
38	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
39	37 not 38
40	ANIMAL/ not HUMAN/
41	NONHUMAN/
42	exp ANIMAL EXPERIMENT/
43	exp EXPERIMENTAL ANIMAL/
44	ANIMAL MODEL/
45	exp RODENT/
46	(rat or rats or mouse or mice).ti.
47	or/39-46
48	31 not 47

Intrapartum care for women with obesity – equipment needs

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

#	Searches
1	PREGNANCY/
2	PERIPARTUM PERIOD/
3	PARTURITION/
4	exp LABOR, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	pregnan$.ti,ab.
7	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).ti,ab.
8	((during or giving or give) adj3 birth?).ti,ab.
9	or/1-8
10	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
11	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
12	body mass index.ti,ab.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.

#	Searches
14	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
15	or/10-14
16	"EQUIPMENT AND SUPPLIES"/
17	"HOSPITAL DESIGN AND CONSTRUCTION"/
18	"FLOORS AND FLOORCOVERINGS"/
19	EQUIPMENT SAFETY/
20	(working adj2 load?).ti,ab.
21	((equipment or floor$) adj3 safe$).ti,ab.
22	CLOTHING/
23	gown?.ti,ab.
24	cuff?.ti,ab.
25	"WEIGHTS AND MEASURES"/
26	(weigh$ adj10 scales).ti,ab.
27	chair?.ti,ab.
28	WHEELCHAIRS/
29	wheelchair?.ti,ab.
30	BEDS/
31	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).ti,ab.
32	STRETCHERS/
33	(trolley? or stretcher? or gurney?).ti,ab.
34	stirrup?.ti,ab.
35	OPERATING TABLES/
36	(operat$ adj3 table?).ti,ab.
37	"MOVING AND LIFTING PATIENTS"/
38	TRANSPORTATION OF PATIENTS/
39	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).ti,ab.
40	NEEDLES/
41	(long$ adj10 needle?).ti,ab.
42	SURGICAL INSTRUMENTS/
43	((surgical$ or operati$) adj3 (instrument$ or equipment)).ti,ab.
44	(Retractor? or speculum? or scissor? or tantalum? or trocar?).ti,ab.
45	(birth$ adj3 stool?).ti,ab.
46	STOCKINGS, COMPRESSION/
47	PNEUMATIC COMPRESSION STOCKINGS/
48	stocking?.ti,ab.
49	or/16-48
50	((access$ or availab$) adj10 equipment).ti,ab.
51	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).ti,ab.
52	or/50-51
53	SAFETY MANAGEMENT/
54	((move or moving or lift$) adj5 (patient? or mother?)).ti,ab.
55	or/53-54

#	Searches
56	9 and 15 and 49
57	9 and 15 and 52
58	9 and 15 and 55
59	or/56-58
60	limit 59 to english language
61	LETTER/
62	EDITORIAL/
63	NEWS/
64	exp HISTORICAL ARTICLE/
65	ANECDOTES AS TOPIC/
66	COMMENT/
67	CASE REPORT/
68	(letter or comment*).ti.
69	or/61-68
70	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
71	69 not 70
72	ANIMALS/ not HUMANS/
73	exp ANIMALS, LABORATORY/
74	exp ANIMAL EXPERIMENTATION/
75	exp MODELS, ANIMAL/
76	exp RODENTIA/
77	(rat or rats or mouse or mice).ti.
78	or/71-77
79	60 not 78

Database: Cochrane Central Register of Controlled Trials

#	Searches
1	PREGNANCY/
2	PERIPARTUM PERIOD/
3	PARTURITION/
4	exp LABOR, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	pregnan$.ti,ab,kw.
7	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).ti,ab,kw.
8	((during or giving or give) adj3 birth?).ti,ab.
9	or/1-8
10	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
11	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
12	body mass index.ti,ab,kw.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab,kw.
14	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
15	or/10-14

#	Searches
16	"EQUIPMENT AND SUPPLIES"/
17	"HOSPITAL DESIGN AND CONSTRUCTION"/
18	"FLOORS AND FLOORCOVERINGS"/
19	EQUIPMENT SAFETY/
20	(working adj2 load?).ti,ab.
21	((equipment or floor$) adj3 safe$).ti,ab.
22	CLOTHING/
23	gown?.ti,ab.
24	cuff?.ti,ab.
25	"WEIGHTS AND MEASURES"/
26	(weigh$ adj10 scales).ti,ab.
27	chair?.ti,ab.
28	WHEELCHAIRS/
29	wheelchair?.ti,ab,kw.
30	BEDS/
31	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).ti,ab.
32	STRETCHERS/
33	(trolley? or stretcher? or gurney?).ti,ab,kw.
34	stirrup?.ti,ab.
35	OPERATING TABLES/
36	(operat$ adj3 table?).ti,ab.
37	"MOVING AND LIFTING PATIENTS"/
38	TRANSPORTATION OF PATIENTS/
39	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).ti,ab.
40	NEEDLES/
41	(long$ adj10 needle?).ti,ab.
42	SURGICAL INSTRUMENTS/
43	((surgical$ or operati$) adj3 (instrument$ or equipment)).ti,ab.
44	(Retractor? or speculum? or scissor? or tantalum? or trocar?).ti,ab.
45	(birth$ adj3 stool?).ti,ab.
46	STOCKINGS, COMPRESSION/
47	PNEUMATIC COMPRESSION STOCKINGS/
48	stocking?.ti,ab.
49	or/16-48
50	((access$ or availab$) adj10 equipment).ti,ab.
51	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).ti,ab.
52	or/50-51
53	SAFETY MANAGEMENT/
54	((move or moving or lift$) adj5 (patient? or mother?)).ti,ab.
55	or/53-54
56	9 and 15 and 49
57	9 and 15 and 52

#	Searches
58	9 and 15 and 55
59	or/56-58

Database: Cochrane Database of Systematic Reviews

#	Searches
1	PREGNANCY.kw.
2	PERIPARTUM PERIOD.kw.
3	PARTURITION.kw.
4	LABOR, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.
6	pregnan$.ti,ab.
7	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).ti,ab.
8	((during or giving or give) adj3 birth?).ti,ab.
9	or/1-8
10	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
11	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
12	body mass index.ti,ab.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).ti,ab.
14	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
15	or/10-14
16	"EQUIPMENT AND SUPPLIES".kw.
17	"HOSPITAL DESIGN AND CONSTRUCTION".kw.
18	"FLOORS AND FLOORCOVERINGS".kw.
19	EQUIPMENT SAFETY.kw.
20	(working adj2 load?).ti,ab.
21	((equipment or floor$) adj3 safe$).ti,ab.
22	CLOTHING.kw.
23	gown?.ti,ab.
24	cuff?.ti,ab.
25	"WEIGHTS AND MEASURES".kw.
26	(weigh$ adj10 scales).ti,ab.
27	chair?.ti,ab.
28	WHEELCHAIRS.kw.
29	wheelchair?.ti,ab.
30	BEDS.kw.
31	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).ti,ab.
32	STRETCHERS.kw.
33	(trolley? or stretcher? or gurney?).ti,ab.
34	stirrup?.ti,ab.
35	OPERATING TABLES.kw.
36	(operat$ adj3 table?).ti,ab.
37	"MOVING AND LIFTING PATIENTS".kw.

#	Searches
38	TRANSPORTATION OF PATIENTS.kw.
39	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).ti,ab.
40	NEEDLES.kw.
41	(long$ adj10 needle?).ti,ab.
42	SURGICAL INSTRUMENTS.kw.
43	((surgical$ or operati$) adj3 (instrument$ or equipment)).ti,ab.
44	(Retractor? or speculum? or scissor? or tantalum? or trocar?).ti,ab.
45	(birth$ adj3 stool?).ti,ab.
46	STOCKINGS, COMPRESSION.kw.
47	PNEUMATIC COMPRESSION STOCKINGS.kw.
48	stocking?.ti,ab.
49	or/16-48
50	((access$ or availab$) adj10 equipment).ti,ab.
51	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).ti,ab.
52	or/50-51
53	SAFETY MANAGEMENT.kw.
54	((move or moving or lift$) adj5 (patient? or mother?)).ti,ab.
55	or/53-54
56	9 and 15 and 49
57	9 and 15 and 52
58	9 and 15 and 55
59	or/56-58

Database: Database of Abstracts of Reviews of Effects

#	Searches
1	PREGNANCY.kw.
2	PERIPARTUM PERIOD.kw.
3	PARTURITION.kw.
4	LABOR, OBSTETRIC.kw.
5	OBSTETRIC LABOR, PREMATURE.kw.
6	pregnan$.tw,tx.
7	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).tw,tx.
8	((during or giving or give) adj3 birth?).tw,tx.
9	or/1-8
10	(OBESITY or OBESITY, ABDOMINAL or OBESITY, MORBID).kw.
11	(BODY MASS INDEX or BODY SIZE or OVERWEIGHT or WAIST CIRCUMFERENCE or WAIST-HIP RATIO).kw.
12	body mass index.tw,tx.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw,tx.
14	(ADIPOSE TISSUE or ADIPOSE TISSUE, WHITE).kw.
15	or/10-14
16	"EQUIPMENT AND SUPPLIES".kw.
17	"HOSPITAL DESIGN AND CONSTRUCTION".kw.

#	Searches
18	"FLOORS AND FLOORCOVERINGS".kw.
19	EQUIPMENT SAFETY.kw.
20	(working adj2 load?).tw,tx.
21	((equipment or floor$) adj3 safe$).tw,tx.
22	CLOTHING.kw.
23	gown?.tw,tx.
24	cuff?.tw,tx.
25	"WEIGHTS AND MEASURES".kw.
26	(weigh$ adj10 scales).tw,tx.
27	chair?.tw,tx.
28	WHEELCHAIRS.kw.
29	wheelchair?.tw,tx.
30	BEDS.kw.
31	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).tw,tx.
32	STRETCHERS.kw.
33	(trolley? or stretcher? or gurney?).tw,tx.
34	stirrup?.tw,tx.
35	OPERATING TABLES.kw.
36	(operat$ adj3 table?).tw,tx.
37	"MOVING AND LIFTING PATIENTS".kw.
38	TRANSPORTATION OF PATIENTS.kw.
39	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).tw,tx.
40	NEEDLES.kw.
41	(long$ adj10 needle?).tw,tx.
42	SURGICAL INSTRUMENTS.kw.
43	((surgical$ or operati$) adj3 (instrument$ or equipment)).tw,tx.
44	(Retractor? or speculum? or scissor? or tantalum? or trocar?).tw,tx.
45	(birth$ adj3 stool?).tw,tx.
46	STOCKINGS, COMPRESSION.kw.
47	PNEUMATIC COMPRESSION STOCKINGS.kw.
48	stocking?.tw,tx.
49	or/16-48
50	((access$ or availab$) adj10 equipment).tw,tx.
51	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).tw,tx.
52	or/50-51
53	SAFETY MANAGEMENT.kw.
54	((move or moving or lift$) adj5 (patient? or mother?)).tw,tx.
55	or/53-54
56	9 and 15 and 49
57	9 and 15 and 52
58	9 and 15 and 55
59	or/56-58

Database: Health Technology Assessment

#	Searches
1	PREGNANCY/
2	PERIPARTUM PERIOD/
3	PARTURITION/
4	exp LABOR, OBSTETRIC/
5	OBSTETRIC LABOR, PREMATURE/
6	pregnan$.tw.
7	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).tw.
8	((during or giving or give) adj3 birth?).tw.
9	or/1-8
10	OBESITY/ or OBESITY, ABDOMINAL/ or OBESITY, MORBID/
11	BODY MASS INDEX/ or BODY SIZE/ or OVERWEIGHT/ or WAIST CIRCUMFERENCE/ or WAIST-HIP RATIO/
12	body mass index.tw.
13	(obesity or obese or heavy or heavier or overweight or fat$ or BMI).tw.
14	ADIPOSE TISSUE/ or ADIPOSE TISSUE, WHITE/
15	or/10-14
16	"EQUIPMENT AND SUPPLIES"/
17	"HOSPITAL DESIGN AND CONSTRUCTION"/
18	"FLOORS AND FLOORCOVERINGS"/
19	EQUIPMENT SAFETY/
20	(working adj2 load?).tw.
21	((equipment or floor$) adj3 safe$).tw.
22	CLOTHING/
23	gown?.tw.
24	cuff?.tw.
25	"WEIGHTS AND MEASURES"/
26	(weigh$ adj10 scales).tw.
27	chair?.tw.
28	WHEELCHAIRS/
29	wheelchair?.tw.
30	BEDS/
31	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).tw.
32	STRETCHERS/
33	(trolley? or stretcher? or gurney?).tw.
34	stirrup?.tw.
35	OPERATING TABLES/
36	(operat$ adj3 table?).tw.
37	"MOVING AND LIFTING PATIENTS"/
38	TRANSPORTATION OF PATIENTS/
39	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).tw.
40	NEEDLES/
41	(long$ adj10 needle?).tw.

#	Searches
42	SURGICAL INSTRUMENTS/
43	((surgical$ or operati$) adj3 (instrument$ or equipment)).tw.
44	(Retractor? or speculum? or scissor? or tantalum? or trocar?).tw.
45	(birth$ adj3 stool?).tw.
46	STOCKINGS, COMPRESSION/
47	PNEUMATIC COMPRESSION STOCKINGS/
48	stocking?.tw.
49	or/16-48
50	((access$ or availab$) adj10 equipment).tw.
51	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).tw.
52	or/50-51
53	SAFETY MANAGEMENT/
54	((move or moving or lift$) adj5 (patient? or mother?)).tw.
55	or/53-54
56	9 and 15 and 49
57	9 and 15 and 52
58	9 and 15 and 55
59	or/56-58

Database: Embase

#	Searches
1	*PREGNANCY/
2	*PERINATAL PERIOD/
3	exp *BIRTH/
4	exp *LABOR/
5	*PREMATURE LABOR/
6	*INTRAPARTUM CARE/
7	pregnan$.ti,ab.
8	(labo?r or childbirth or partu$ or intra?part$ or peri?part$).ti,ab.
9	((during or giving or give) adj3 birth?).ti,ab.
10	or/1-9
11	*OBESITY/ or *ABDOMINAL OBESITY/ or *MORBID OBESITY/
12	*BODY MASS/ or *BODY SIZE/ or *WAIST CIRCUMFERENCE/ or *WAIST-HIP RATIO/
13	(body mass index or obesity or obese).ti,ab.
14	(heavy or heavier or overweight or fat$ or BMI).ti.
15	*ADIPOSE TISSUE/ or *WHITE ADIPOSE TISSUE/
16	or/11-15
17	*DEVICES/
18	HOSPITAL EQUIPMENT/
19	HOSPITAL DESIGN/
20	DEVICE SAFETY/
21	(working adj2 load?).ti,ab.

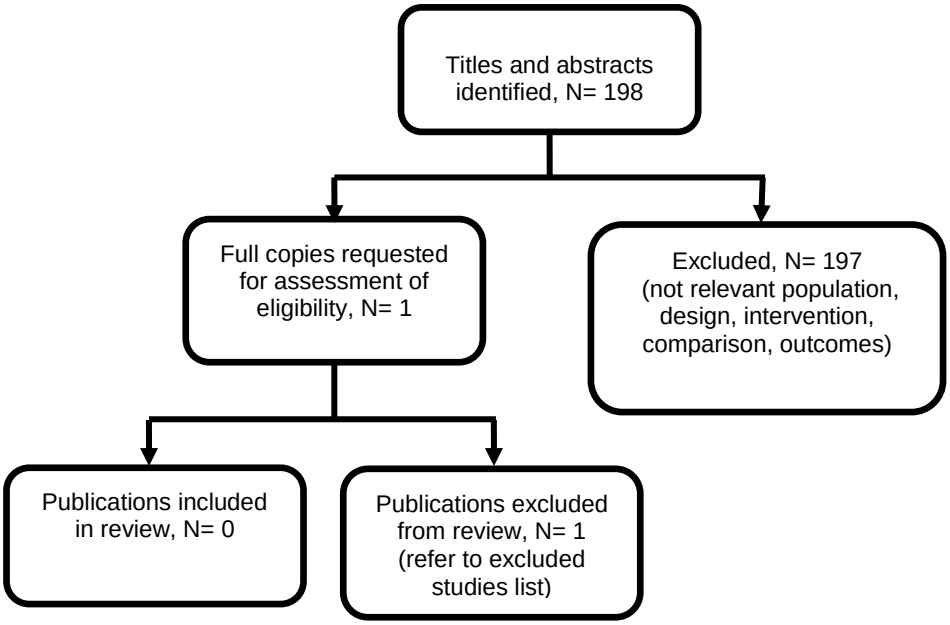
#	Searches
22	((equipment or floor$) adj3 safe$).ti,ab.
23	CLOTHING/
24	SURGICAL GOWN/
25	gown?.ti,ab.
26	BLOOD PRESSURE CUFF/
27	cuff?.ti,ab.
28	(weigh$ adj10 scales).ti,ab.
29	CHAIR/
30	chair?.ti,ab.
31	WHEELCHAIR/
32	wheelchair?.ti,ab.
33	exp BED/
34	((hospital? or ward? or suite? or deliver$ or department$) adj10 bed?).ti,ab.
35	STRETCHER/
36	(trolley? or stretcher? or gurney?).ti,ab.
37	stirrup?.ti,ab.
38	OPERATING TABLE/
39	(operat$ adj3 table?).ti,ab.
40	PATIENT LIFTING/
41	*PATIENT TRANSPORT/
42	((lift$ or (lateral$ adj2 transfer$)) adj10 (equip$ or device?)).ti,ab.
43	*NEEDLE/
44	(long$ adj10 needle?).ti,ab.
45	exp "GYNECOLOGICAL AND OBSTETRIC GENERAL EQUIPMENT"/
46	exp "GYNECOLOGICAL AND OBSTETRIC SURGICAL EQUIPMENT"/
47	((surgical$ or operati$) adj3 (instrument$ or equipment)).ti,ab.
48	(Retractor? or speculum? or scissor? or tantalum? or trocar?).ti,ab.
49	(birth$ adj3 stool?).ti,ab.
50	COMPRESSION STOCKING/
51	stocking?.ti,ab.
52	or/17-51
53	((access$ or availab$) adj10 equipment).ti,ab.
54	((emergenc$ or immediate$ or out-of-hours or after hours) adj10 equipment).ti,ab.
55	or/53-54
56	*SAFETY/
57	((move or moving or lift$) adj5 (patient? or mother?)).ti,ab.
58	or/56-57
59	10 and 16 and 52
60	10 and 16 and 55
61	10 and 16 and 58
62	or/59-61
63	limit 62 to english language

#	Searches
64	letter.pt. or LETTER/
65	note.pt.
66	editorial.pt.
67	CASE REPORT/ or CASE STUDY/
68	(letter or comment*).ti.
69	or/64-68
70	RANDOMIZED CONTROLLED TRIAL/ or random*.ti,ab.
71	69 not 70
72	ANIMAL/ not HUMAN/
73	NONHUMAN/
74	exp ANIMAL EXPERIMENT/
75	exp EXPERIMENTAL ANIMAL/
76	ANIMAL MODEL/
77	exp RODENT/
78	(rat or rats or mouse or mice).ti.
79	or/71-78
80	63 not 79

Appendix C – Clinical evidence study selection

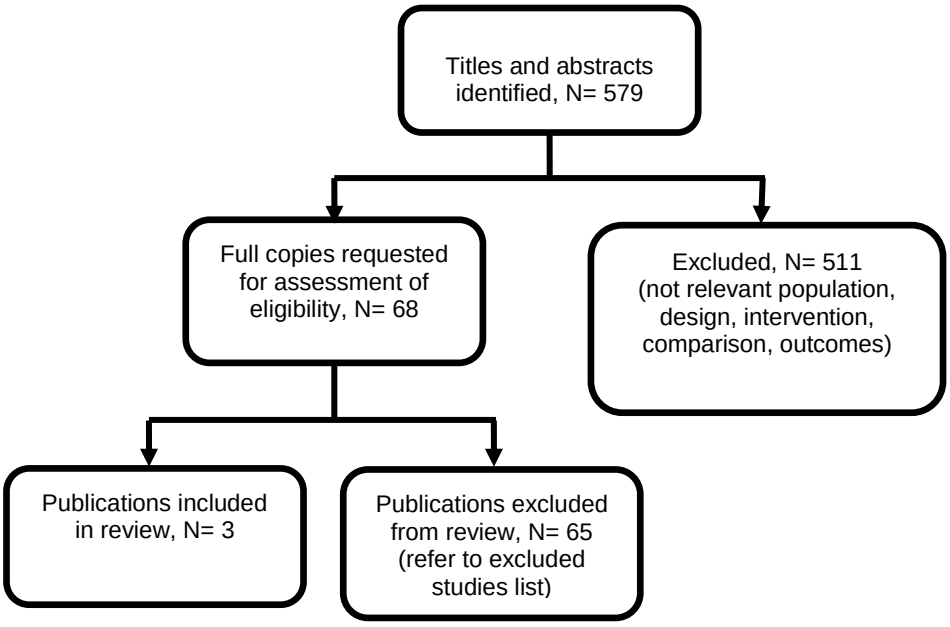
Intrapartum care for women with obesity – fetal presentation

Figure 3: Flow diagram of clinical article selection for intrapartum care for women with obesity - fetal presentation



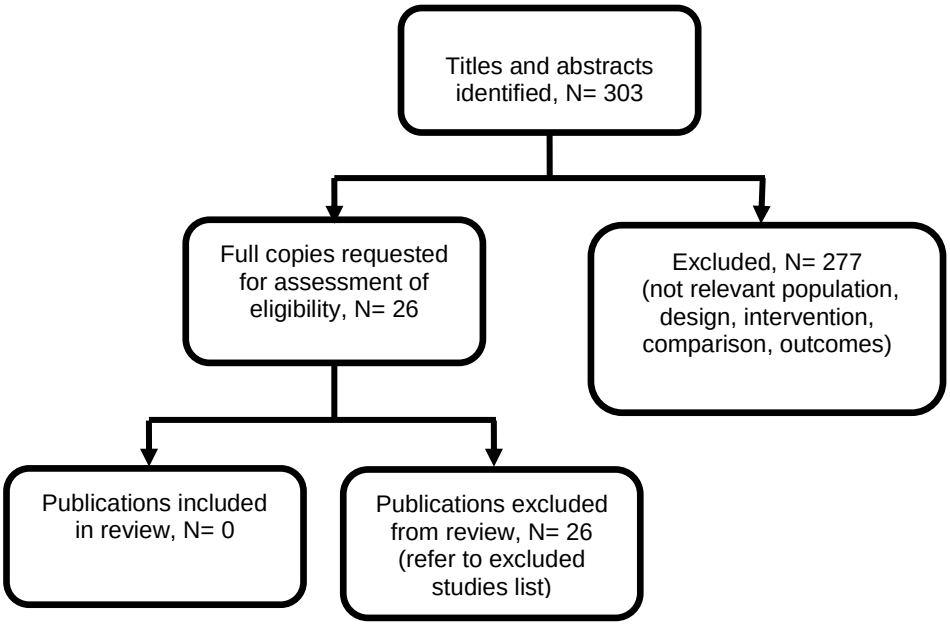
Intrapartum care for women with obesity – anaesthesia and analgesia

Figure 4: Flow diagram of clinical article selection for intrapartum care for women with obesity – anaesthesia and analgesia



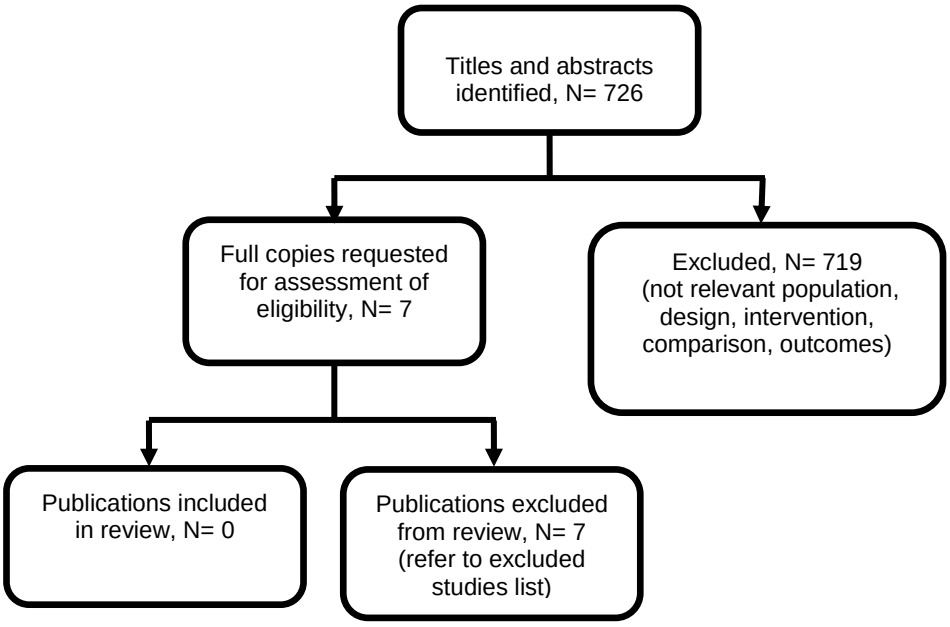
Intrapartum care for women with obesity - fetal monitoring

Figure 5: Flow diagram of clinical article selection for intrapartum care for women with obesity - fetal monitoring



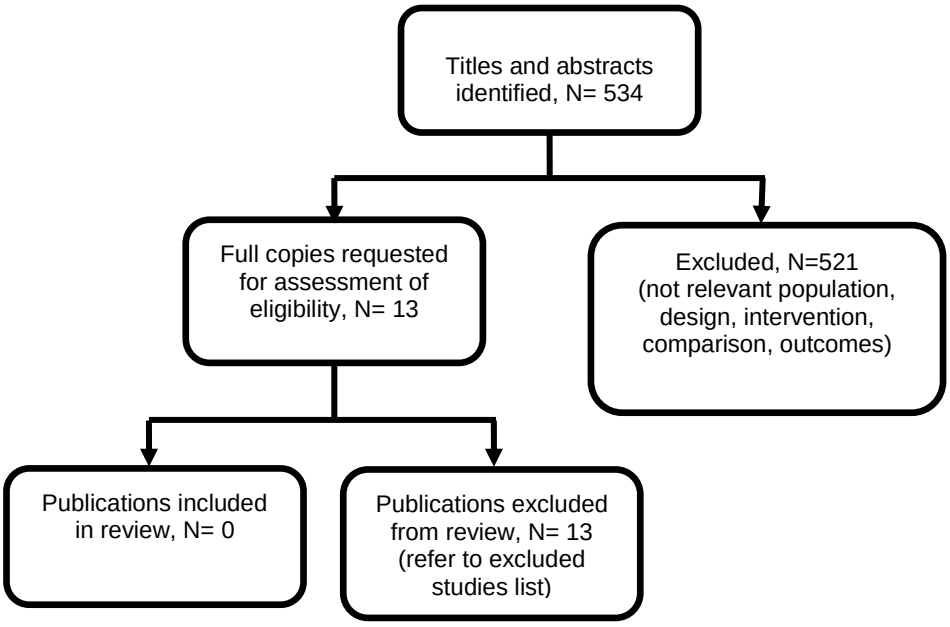
Intrapartum care for women with obesity – optimal position

Figure 6: Flow diagram of clinical article selection for intrapartum care for women with obesity – optimal position



Intrapartum care for women with obesity – equipment needs

Figure 7: Flow diagram of clinical article selection for intrapartum care for women with obesity – equipment needs



Appendix D – Excluded studies

Intrapartum care for women with obesity – fetal presentation

Clinical studies

Study	Reason for exclusion
Watson, W. J., Welter, S., Day, D., Antepartum identification of breech presentation, Journal of Reproductive Medicine, 49, 294-6, 2004	Antenatal assessment of fetal presentation (not intrapartum assessment)

Economic studies

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - anaesthesia and analgesia

Clinical studies

Study	Reason for exclusion
Ambulkar, R., Patil, V., Bhosale, S., Desai, M., Shetty, N., Agrawal, V., Accuracy of ultrasound imaging versus manual palpation for locating the inter-vertebral level, Regional Anesthesia and Pain Medicine, 1), E234, 2013	Population outside of scope; post-operative patients with a chest radiograph
Amir, A., Lash, V., Moore, A., Rao, P., Torres, C., Kaufman, I., Management of a Rare Complication of Epidural Analgesia in an Obese Laterally Positioned Parturient: Catheter Entrapment Next to the Inferior Vena Cava, Regional Anesthesia & Pain Medicine, 40, 726-8, 2015	Study design; case report
Ansari, T., Yousef, A., El Gamassy, A., Fayez, M., Ultrasound-guided spinal anaesthesia in obstetrics: is there an advantage over the landmark technique in patients with easily palpable spines?, International Journal of Obstetric Anesthesia, 23, 213-6, 2014	Population outside of scope; not women in labour who are obese
Arzola, C., Davies, S., Rofaeel, A., Carvalho, J. C., Ultrasound using the transverse approach to the lumbar spine provides reliable landmarks for labor epidurals, Anesthesia & Analgesia, 104, 1188-92, tables of contents, 2007	No comparison data
Arzola, C., Smith, R., Balki, M., Ye, X. Y., Carvalho, J. C. A., Sensory block levels during CSE in labor: Dose and dural sac influence, Canadian Journal of Anesthesia, 61, 2014	Population not obese (mean BMI mean 28.8(3.8) and not outcomes of relevance
Balki, M., Lee, Y., Halpern, S., Carvalho, J. C., Ultrasound imaging of the lumbar spine in the transverse plane: the correlation between estimated and actual depth to the epidural space in obese parturients, Anesthesia & Analgesia, 108, 1876-81, 2009	No comparison data
Benmiloud, K., Pitteloud, J. C., Amacker, M. H., Ravussin, P., Should ultrasonography be the gold standard for difficult epidural access in parturient?, Regional Anesthesia and Pain Medicine, 1), E306-E307, 2012	Conference proceeding; non-randomised study
Benmiloud, K., Pitteloud, J. C., Ravussin, P., Place of ultrasonography-assisted method for difficult epidural access in pregnant women, performed by resident in anesthesiology, Regional Anesthesia and Pain Medicine. Conference: 36th Annual Regional Anesthesia Meeting and Workshops, ASRA, 36, 2011	Conference proceeding; non-randomised study

Study	Reason for exclusion
Brown-Shreves, D., Chin, K., Vaishnav, V., Perlas, A., Chan, V., Pre-procedural ultrasound imaging improves ease of performance of spinal anesthesia in patients with difficult spinal anatomy, Anesthesia and Analgesia, 1), S473, 2010	Population outside of scope; not women in labour who are obese
Brozovic, G., Blagaic, V., Sakic, K., Preliminary study: Ultrasound in locating the epidural space in obstetric patients using ultrasound, Periodicum Biologorum, 113, 39-40, 2011	Conference proceeding; non-randomised study
Butcher, M., George, R. T., Ip, J., Campbell, J. P., Yentis, S. M., Identification of the midline by obese and non-obese women during late pregnancy, Anaesthesia, 69, 1351-4, 2014	Wrong intervention; ultrasound not used for needle siting
Clegg, I., Bhatia, K., Kochhar, P., Maguire, S., The availability and use of ultrasound in obstetric anaesthesia in the UK, International Journal of Obstetric Anesthesia, 23, S17, 2014	Irrelevant study design (online questionnaire) and no relevant data to be extracted
Clitheroe, E., Ssenoga, A., Chevannes, C., McNamara, H., Bhalla, A., Evaluation of ultrasound in parturients with a body mass index > 35 kg/m2, International Journal of Obstetric Anesthesia, 22, S49, 2013	Conference proceeding; non-randomised study
Corbacho, C., Reina, M. A., Rodriguez Del Rio, M., Martinez Roman, J. A., Palacio, F. J., Loopez, A., Galindo, S., Sonographic estimation of needle depth for lumbar epidural blocks in the transverse plane in parturients, Regional Anesthesia and Pain Medicine, 35 (5), E48-E49, 2010	Conference proceeding; non-randomised study
Creaney, M., Mullane, D., Casby, C., Tan, T., Ultrasound to identify the lumbar space in women with impalpable bony landmarks presenting for elective caesarean delivery under spinal anaesthesia: a randomised trial, International Journal of Obstetric Anesthesia, 28, 12-16, 2016	Population outside of scope; BMI/obesity was not considered as inclusion criterion
Darrieutort-Laffite, C., Bart, G., Planche, L., Glemarec, J., Maugars, Y., Le Goff, B., Usefulness of a pre-procedure ultrasound scanning of the lumbar spine before epidural injection in patients with a presumed difficult puncture: A randomized controlled trial, Joint, Bone, Spine: Revue du Rhumatisme, 82, 356-61, 2015	Population outside of scope; patients with sciatica
Davies, G. A., Maxwell, C., McLeod, L., Gagnon, R., Basso, M., Bos, H., Delisle, M. F., Farine, D., Hudon, L., Menticoglou, S., Mundle, W., Murphy-Kaulbeck, L., Ouellet, A., Pressey, T., Roggensack, A., Leduc, D., Ballerman, C., Biringer, A., Duperron, L., Jones, D., Lee, L. S., Shepherd, D., Wilson, K., Society of, Obstetricians, Gynaecologists of, Canada, Obesity in pregnancy, Journal of Obstetrics & Gynaecology Canada: JOGC, 32, 165-73, 2010	Systematic review: studies were hand-searched and included in this 3.2 needle siting review if relevant
Duniec, L., Nowakowski, P., Kosson, D., Lazowski, T., Anatomical landmarks based assessment of intravertebral space level for lumbar puncture is misleading in more than 30%, Anestezjologia Intensywna Terapia, 45, 1-6, 2013	Population outside of scope; patients with lower limb surgery
Farahmand, Shervin, Safavi, Somayeh, Shahriarian, Shahriar, Arbab, Mona, Basirghafoori, Hamed, Bagheri-Hariri, Shahram, Preferred view and transducer in lumbar ultrasound in overweight and obese patients, Ultrasound (Leeds, England), 25, 45-52, 2017	Outcomes outside of scope for this review
Galante, D., Pedrotti, D., Melai, E., Badii, F., The use of ultrasound can reduce complications of epidural analgesia in obstetric patients, Regional Anesthesia and Pain Medicine, 1), e183, 2014	Conference proceeding; non-randomised study
Gnaho, A., Boutonnet, M., Okoue, R., Chrisment, A., Chazalon, P., Lemarec, C., Gentili, M. E., Does ultrasonography facilitate epidural anesthesia in obese	Conference proceeding; RCT with insufficient methodological information

Study	Reason for exclusion
patients?, Regional Anesthesia and Pain Medicine, 2), E144-145, 2011	
Gnaho, A., Nau, A., Gentil, M. E., Real-time ultrasound-guided epidural catheter insertion in obese parturients.[Erratum appears in Can J Anaesth. 2015 Nov;62(11):1228; PMID: 26403529], Canadian Journal of Anaesthesia, 62, 1226-7, 2015	Study design; descriptive study with no comparison data
Grau, T., Bartusseck, E., Conradi, R., Martin, E., Motsch, J., Ultrasound imaging improves learning curves in obstetric epidural anesthesia: a preliminary study, Canadian Journal of Anaesthesia, 50, 1047-50, 2003	Population outside of scope; obesity was not an inclusion criterion
Grau, T., Leipold, R. W., Conradi, R., Martin, E., Ultrasound control for presumed difficult epidural puncture, Acta Anaesthesiologica Scandinavica, 45, 766-71, 2001	Population outside of scope; obesity was not an inclusion criterion
Grau, T., Leipold, R. W., Conradi, R., Martin, E., Motsch, J., Ultrasound imaging facilitates localization of the epidural space during combined spinal and epidural anesthesia, Regional Anesthesia & Pain Medicine, 26, 64-7, 2001	Population outside of scope; obesity was not an inclusion criterion
Grau, T., Leipold, R. W., Conradi, R., Martin, E., Motsch, J., Efficacy of ultrasound imaging in obstetric epidural anesthesia, Journal of Clinical Anesthesia, 14, 169-75, 2002	Population outside of scope; obesity was not an inclusion criterion
Grau, T., Leipold, R. W., Horter, J., Conradi, R., Martin, E., Motsch, J., The lumbar epidural space in pregnancy: visualization by ultrasonography, British Journal of Anaesthesia, 86, 798-804, 2001	Comparison outside of scope; pregnant versus non-pregnant on alterations of tissue on epidural space
Guglielminotti, J., Chaieri, A., Guezouli, L., Wachowska, B., Bedairia, K., Bedairia, E., Michel, D., Montravers, P., Predictive criteria of difficult Tuohy needle insertion during labour analgesia, International Journal of Obstetric Anesthesia, 18, S27, 2009	Conference proceeding; non-randomised study
Hartopp, A., Peerless, J., Begum, S., Nguyen-Lu, N., Comparing lumbar intervertebral distances using ultrasound in an obstetric population, Regional Anesthesia and Pain Medicine, 42, e71-e72, 2017	Conference proceeding
Hinkewich, C. S., George, R. B., Carvalho, J. C., McKeen, D., Opinion towards use of ultrasonography for labour epidurals, Canadian Journal of Anesthesia, 58, S83, 2011	Conference proceeding; non-randomised study
Hollister, N., Thorp-Jones, D., Coghill, J., Are depth to epidural space and the incidence of accidental dural tap related?, International Journal of Obstetric Anesthesia, 18, S15, 2009	Conference proceeding; non-randomised study
Ip, J., Campbell, J., Yentis, S. M., Sensory thresholds and mothers' self-identification of the midline in late pregnancy, International Journal of Obstetric Anesthesia, 21, S10, 2012	Conference proceeding; non-randomised study
Kenth, J., Ali, U., Sodhi, M., An audit to delineate the correlation of epidural level using ultrasound, compared to traditional landmark technique in obstetric patients, Anaesthesia, 68, 18, 2013	Conference proceeding; non-randomised study
Kumar, M. D., Land, G., Quality and safety of performance and patient experience with ultrasound guided central neuraxial block during caesarean section, Regional Anesthesia and Pain Medicine, 1), E258, 2012	Conference proceeding; non-randomised study
Locks Gde, F., Almeida, M. C., Pereira, A. A., Use of the ultrasound to determine the level of lumbar puncture in pregnant women, Revista Brasileira de Anestesiologia, 60, 13-9, 2010	Comparison outside of scope; obese versus non-obese by ultrasound siting
Mac Colgain, S., Memon, F., Tan, T., The ease of performing spinal anaesthesia with ultrasound guidance in obese women with poor quality back surface landmarks	Conference proceeding; non-randomised study

Study	Reason for exclusion
undergoing elective caesarean delivery, International Journal of Obstetric Anesthesia, 20, S34, 2011	
Margarido, C. B., Mikhael, R., Arzola, C., Balki, M., Carvalho, J. C., The intercristal line determined by palpation is not a reliable anatomical landmark for neuraxial anesthesia, Canadian Journal of Anaesthesia, 58, 262-6, 2011	Wrong intervention; ultrasound was not used for siting of the needle
Marri, S., Munishankar, B., McLeod, G. A., Corner, G. A., Cochran, S., Imaging of the lumbar spine before caesarean section, International Journal of Obstetric Anesthesia, 19, S9, 2010	Conference proceeding; no relevant data to be extracted
Mullane, D., Creaney, M., Casby, C., Tan, T., A comparison of the ease of performing spinal anaesthesia with ultrasound guidance versus landmark palpation in women with poor quality back surface landmarks undergoing elective caesarean section, International Journal of Obstetric Anesthesia, 23, 2014	Conference proceeding; RCT-insufficient methodological information
Muppuri, R., Gupta, D., Agarwal, S., Soskin, V., Predictive model for the inadequate labor epidural analgesia: an outcome of the prospective observational study at university women's hospital, Middle East Journal of Anesthesiology, 21, 719-24, 2012	No relevant data to be extracted
Ortiz-Gomez,J.R., Palacio-Abizanda,F., Fornet-Ruiz,I., Monge-Cid,E., All obese patients in labor should receive an epidural catheter? Pro-con discussion. The con point of view, Regional Anesthesia and Pain Medicine, 36, E52-E57, 2011	Conference proceeding; non-systematic review
Porter, J., Maynard, S., Rao, K., Lucas, N., Robinson, N., Vaughan, D., Audit of ultrasound-guided epidural anaesthesia in pregnancy: Is depth to ligamentum flavum and epidural space predicted accurately?, Regional Anesthesia and Pain Medicine, 35 (5), E53, 2010	Conference proceeding; non-randomised study
Rafii-Tari, H., Lessoway, V. A., Kamani, A. A., Abolmaesumi, P., Rohling, R., Panorama Ultrasound for Navigation and Guidance of Epidural Anesthesia, Ultrasound in Medicine & Biology, 41, 2220-31, 2015	No relevant data to be extracted
Rao, K. P., Russell, I. F., Purva, M., Validation of ultrasound to identify the lumbar intervertebral space in morbidly obese using MRI imaging as the gold standard-A pilot study, International Journal of Obstetric Anesthesia, 21, S11, 2012	Conference proceeding; non-randomised study
Rauch, S., Kasuya, Y., Turan, A., Neamtu, A., Vinayakan, A., Sessler, D. I., Ultrasound-guided lumbar medial branch block in obese patients: a fluoroscopically confirmed clinical feasibility study, Regional Anesthesia & Pain Medicine, 34, 340-2, 2009	Population outside of scope; non-pregnant population
Sahota, J. S., Carvalho, J. C., Balki, M., Fanning, N., Arzola, C., Ultrasound estimates for midline epidural punctures in the obese parturient: paramedian sagittal oblique is comparable to transverse median plane, Anesthesia & Analgesia, 116, 829-35, 2013	No comparison data
Sajayan, A., Nejdlova, M., Morbidly obese obstetric patient for LSCS-should regional always be the first option?, Anaesthesia, 69, 109, 2014	Conference proceeding; case study
Salman, A., Arzola, C., Tharmaratnam, U., Balki, M., Ultrasound imaging of the thoracic spine in paramedian sagittal oblique plane: the correlation between estimated and actual depth to the epidural space, Regional Anesthesia & Pain Medicine, 36, 542-7, 2011	Population outside of scope; epidural analgesia for upper abdominal surgery
Schlotterbeck,H., Schaeffer,R., Dow,W.A., Touret,Y., Bailey,S., Diemunsch,P., Ultrasonographic control of the	No relevant data to be extracted

Study	Reason for exclusion
puncture level for lumbar neuraxial block in obstetric anaesthesia, British Journal of Anaesthesia, 100, 230-234, 2008	
Seligman, K., Weiniger, C., Carvalho, B., Accuracy of a handheld ultrasound device and a traditional ultrasound for neuraxial depth and landmark assessment, Regional Anesthesia and Pain Medicine, 42, 2017	Conference proceeding
Shanmugam, M., Natesan, R., Kochhar, P., Anaesthesia for morbidly obese parturients: How big a problem is it?, International Journal of Obstetric Anesthesia, 20, S31, 2011	Conference proceedings; non-randomised study
Sharpe, P., A service evaluation of ultrasound assessment of the epidural space: A retrospective audit, International Journal of Ultrasound and Applied Technologies in Perioperative Care, 1, 87-88, 2010	No relevant data to be extracted
Singh, S., Wirth, K. M., Phelps, A. L., Badve, M. H., Shah, T. H., Sah, N., Vallejo, M. C., Epidural catheter placement in morbidly obese parturients with the use of an epidural depth equation prior to ultrasound visualization, Thescientificworldjournal, 2013, 695209, 2013	No comparison data
Smith, D. M., Cooke, A., Lavender, T., Maternal obesity is the new challenge; a qualitative study of health professionals' views towards suitable care for pregnant women with a Body Mass Index (BMI) > 30 kg/m2, BMC Pregnancy & Childbirth, 12, 157, 2012	No relevant data to be extracted
Smith, K. A., Ray, A. P., Epidural anesthesia for repeat cesarean delivery in a parturient with Klippel-Feil syndrome, Journal of Anaesthesiology Clinical Pharmacology, 27, 377-9, 2011	Case report
Spence, D., Nations, R., Rivera, O., Bowdoin, S., Hazen, B., Orgill, R., Maye, J., Evidence-based anesthesia: The use of preprocedural ultrasonography during labor to facilitate placement of an epidural catheter, AANA Journal, 80, 223-230, 2012	Systematic review: no primary data and included studies had been hand-searched
Tawfik, Mohamed Mohamed, Atallah, Magdy Mamdouh, Elkharboutly, Walaa Safaa, Allakkany, Nasser Sameh, Abdelkhalek, Mostafa, Does Preprocedural Ultrasound Increase the First-Pass Success Rate of Epidural Catheterization Before Cesarean Delivery? A Randomized Controlled Trial, Anesthesia and Analgesia, 124, 851-856, 2017	Excluded women with BMI of >/= 35 kg/m2
Tran,D., Kamani,A.A., Lessoway,V.A., Peterson,C., Hor,K.W., Rohling,R.N., Preinsertion paramedian ultrasound guidance for epidural anesthesia, Anesthesia and Analgesia, 109, 661-667, 2009	No relevant outcomes to be extracted; no pregnancy outcomes
Valentim, A., Unexpectedly high spinal block in obstetrics, Regional Anesthesia and Pain Medicine, 35 (5), E38-E40, 2010	Conference proceedings; non-systematic review
Vallejo,M.C., Phelps,A.L., Singh,S., Orebaugh,S.L., Sah,N., Ultrasound decreases the failed labor epidural rate in resident trainees, International Journal of Obstetric Anesthesia, 19, 373-378, 2010	Population outside of scope: the study did not consider obesity in the inclusion criteria
Wallace, D. H., Santos, R., Currie, J. M., Gilstrap, L. C., Indirect sonographic guidance for epidural anesthesia in obese pregnant patients, Regional Anesthesia, 17, 233-236, 1992	No relevant outcomes to be extracted: no pregnancy outcomes
Wang, C. S., Wen, D. X., Li, S. H., Li, Q., Sun, L. Y., Study on ultrasound locating interspinous space of combined spinal and epidural anesthesia in cesarean section. [Chinese], Journal of Shanghai Jiaotong University (Medical Science), 34, 1610-3, 2014	Article published in Chinese

Study	Reason for exclusion
Wee, M. Y. K., Isaacs, R., Parker, B., Vaughan, N., Dubey, V., Measurement of epidural insertion pressures in labouring women of varying body mass indices, International Journal of Obstetric Anesthesia, 23, S9, 2014	Conference proceedings; non-randomised study
Willers, J., 101 palpations: Remake of an audit ultrasonically verifying obstetric spinal needle insertion level against estimation by landmark to close the audit loop, Anaesthesia, 69, 88, 2014	Conference proceedings; non-randomised study
Yildiz, T. S., Balaban, O., Sahin, L., Solak, M., Toker, K., Preinsertion ultrasound guidance for spinal anesthesia in pregnancy: Outcomes among obese and lean parturients, Regional Anesthesia and Pain Medicine, 2), E146, 2011	Conference proceedings; non-randomised study

Economic studies

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - fetal monitoring

Clinical studies

Study	Reason for exclusion
Basraon, S., Jain, S., Fox, K., Mateus, J., Wen, T., Maner, W., Garfield, R., Comparing vaginal probe uterine electromyography to transabdominal & tocodynamometer in morbidly obese pregnant women, American Journal of Obstetrics and Gynecology, 1), S126, 2009	Conference abstract publication only: Uterine contractility monitoring (not on fetal monitoring)
Carlson, N. S., Corwin, E. J., Lowe, N. K., Labor Intervention and Outcomes in Women Who Are Nulliparous and Obese: Comparison of Nurse-Midwife to Obstetrician Intrapartum Care, Journal of Midwifery & Women's Health, 62, 29-39, 2017	The study did not compare different fetal monitoring techniques on clinical outcomes
Cedergren,M.I., Non-elective caesarean delivery due to ineffective uterine contractility or due to obstructed labour in relation to maternal body mass index, European Journal of Obstetrics Gynecology and Reproductive Biology, 145, 163-166, 2009	No separate data on effect of fetal monitoring on pregnancy outcomes
Cohen,W.R., Hayes-Gill,B., Influence of maternal body mass index on accuracy and reliability of external fetal monitoring techniques, Acta Obstetricia et Gynecologica Scandinavica, 93, 590-595, 2014	There was no outcome of interest for this review
Davies, G. A., Maxwell, C., McLeod, L., Gagnon, R., Basso, M., Bos, H., Delisle, M. F., Farine, D., Hudon, L., Menticoglou, S., Mundle, W., Murphy-Kaulbeck, L., Ouellet, A., Pressey, T., Roggensack, A., Leduc, D., Ballerman, C., Biringer, A., Duperron, L., Jones, D., Lee, L. S., Shepherd, D., Wilson, K., Society of, Obstetricians, Gynaecologists of, Canada, Obesity in pregnancy, Journal of Obstetrics & Gynaecology Canada: JOGC, 32, 165-73, 2010	Uterine contractility monitoring
Euliano,T.Y., Nguyen,M.T., Marossero,D., Edwards,R.K., Monitoring contractions in obese parturients: electrohysterography compared with traditional monitoring, Obstetrics and Gynecology, 109, 1136-1140, 2007	Uterine activity monitoring during labour
Everden, C., Kirkpatrick, A., Modarres, M., Fetal monitoring in labour in obese mothers, BJOG: An International Journal of Obstetrics and Gynaecology, 122, 290-291, 2015	The study did not compare different fetal monitoring techniques on pregnancy outcomes
Farkas, B., Racz, S., Marton, S., Bodis, J., Investigating the potential intrapartum impact of maternal obesity on the fetal	The study did not compare different fetal monitoring techniques on pregnancy outcomes

Study	Reason for exclusion
electrocardiogram, International Journal of Gynecology and Obstetrics, 131, E365-E366, 2015	
Iftikhar, N., Chaudry, M., Audit on the management of obese women in pregnancy, BJOG: An International Journal of Obstetrics and Gynaecology, 121, 54, 2014	Audit data
Jacod, B. C., Graatsma, E. M., Van Hagen, E., Visser, G. H., A validation of electrohysterography for uterine activity monitoring during labour, Journal of Maternal-Fetal & Neonatal Medicine, 23, 17-22, 2010	Monitoring of uterine contraction during labour
Kaplan-Sturk, R., Akerud, H., Volgsten, H., Hellstrom-Westas, L., Wiberg-Itzel, E., Outcome of deliveries in healthy but obese women: obesity and delivery outcome, BMC Research Notes, 6, 50, 2013	Not comparing different fetal monitoring techniques on pregnancy outcomes
Ojala,T., Aaltonen,J., Siira,S., Jalonen,J., Ekholm,E., Ekblad,U., Laitinen,K., Fetal cardiac sympathetic activation is linked with maternal body mass index, Early Human Development, 85, 557-560, 2009	Not comparing different fetal monitoring techniques on pregnancy outcomes
Racz, S., Hantosi, E., Marton, S., Toth, K., Ruzsa, D., Halvax, L., Bodis, J., Farkas, B., Impact of maternal obesity on the fetal electrocardiogram during labor, Journal of Maternal-Fetal and Neonatal Medicine, 29, 3712-3716, 2016	Comparison outside of interest: obese versus non-obese women
Rahman,H., Renjhen,P., Dutta,S., Reliability of admission cardiotocography for intrapartum monitoring in low resource setting, Nigerian Medical Journal, 53, 145-149, 2012	No obese pregnancy
Rahman,H., Renjhen,P., Dutta,S., Kar,S., Admission cardiotocography: Its role in predicting foetal outcome in high-risk obstetric patients, The Australasian Medical Journal, 5, 522-527, 2012	High risk population did not include obese pregnancy
Rauf, Z., Ommani, S., Payne, B., Brown, R., Hassan, S., Hayes-Gill, B. R., Cohen, W., Alfirevic, Z., Intrapartum external fetal monitoring in obese women, Archives of Disease in Childhood: Fetal and Neonatal Edition, 96, Fa9, 2011	There was no outcome of interest for this review
Ray,A., Hildreth,A., Esen,U.I., Morbid obesity and intra-partum care, Journal of Obstetrics and Gynaecology, 28, 301-304, 2008	The study did not compare different fetal monitoring techniques on pregnancy outcomes
Sheth Thakkar, S., Lammers, S., Hahn, P. M., Waddington, A., The Use of Intermittent Auscultation in Parturients of Varying BMI Categories: Experience From a Mid-Sized Tertiary Care Obstetrical Unit, Journal of Obstetrics & Gynaecology Canada: JOGC, 37, 310-3, 2015	There was no outcome of interest for this review
Thakkar, S. S., Lammers, S., Hahn, P. M., Waddington, A., The Use of Intermittent Auscultation in Parturients of Varying BMI Categories: Experience From a Mid-Sized Tertiary Care Obstetrical Unit, Journal of Obstetrics and Gynaecology Canada, 37, 310-313, 2015	This study reports the use of intermittent auscultation in women according to BMI
Veerabadran,K., Melachuri,V.K., Gandhi,S., Survey of existing anaesthetic guidelines for managing morbidly obese parturients in the North-West region, International Journal of Obstetric Anesthesia, #20090521 Conference End, S33-, 2009	Conference abstract publication only
Vlemminx, M. W. C., De Lau, H., Vullings, R., Peters, C. H. L., Oei, S. G., Real-time electrohysterography to monitor contractions in obese women, Journal of Maternal-Fetal and Neonatal Medicine, 27, 182-183, 2014	Uterine contractility monitoring on pregnancy outcomes
Vlemminx, Marion W. C., Thijssen, Kirsten M. J., Bajlekov, Galin I., Dieleman, Jeanne P., Van Der Hout-Van Der Jagt, M. Beatrijs, Oei, S. Guid, Could electrohysterography be the solution for external uterine monitoring in obese women?,	Electrohysterography or external tocodynamometry was not intervention of interest

Study	Reason for exclusion
Journal of perinatology : official journal of the California Perinatal Association, 2018	
Vricella,L.K., Louis,J.M., Mercer,B.M., Bolden,N., Impact of morbid obesity on epidural anesthesia complications in labor, American Journal of Obstetrics and Gynecology, 205, 370-376, 2011	The study did not compare different fetal monitoring techniques
Wahba, J., Jasmat, I., Patel, A., Noori, M., Akmal, S. A., An audit into the management of obesity in pregnancy at a major London teaching hospital, BJOG: An International Journal of Obstetrics and Gynaecology, 122, 229, 2015	The study did not compare different fetal monitoring techniques on pregnancy outcomes
Wiberg-Itzel, E. M., Outcome in obese deliveries, Journal of Maternal-Fetal and Neonatal Medicine, 25, 50, 2012	The study did not compare different fetal monitoring techniques
Wu, P., McMillan, M., Moss, H., Gibson, J. L., Use of ultrasound in management of obesity in pregnancy - Current practise in the West of Scotland, Archives of Disease in Childhood: Fetal and Neonatal Edition, 98, 2013	The study did not compare different fetal monitoring techniques on pregnancy outcomes

Economic studies

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity – optimal position

Clinical studies

Study	Reason for exclusion
Desseauve, D., Gachon, B., Bertherat, P., Fradet, L., Lacouture, P., Pierre, F., In which position do women give birth in 2015? Results from a prospective multicenter study, Gynecologie Obstetrique et Fertilite, 44, 548-556, 2016	Full text in French
Downe,S., Gerrett,D., Renfrew,M.J., A prospective randomised trial on the effect of position in the passive second stage of labour on birth outcome in nulliparous women using epidural analgesia, Midwifery, 20, 157-168, 2004	Interventions were not stratified by BMI/maternal birth weight
Elvander, Charlotte, Ahlberg, Mia, Thies-Lagergren, Li, Cnattingius, Sven, Stephansson, Olof, Birth position and obstetric anal sphincter injury: a population-based study of 113 000 spontaneous births, BMC Pregnancy and Childbirth, 15, 252, 2015	Population outside of scope; BMI/body weight of women included unclear
Moraloglu, Ozlem, Kansu-Celik, Hatice, Tasci, Yasemin, Karakaya, Burcu Kisa, Yilmaz, Yasar, Cakir, Ebru, Yakut, Halil Ibrahim, The influence of different maternal pushing positions on birth outcomes at the second stage of labor in nulliparous women, The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians, 30, 245-249, 2017	Population outside of scope; BMI/body weight of women included unclear
Serati, Maurizio, Di Dedda, Maria Carmela, Bogani, Giorgio, Sorice, Paola, Cromi, Antonella, Uccella, Stefano, Lapenna, Martina, Soligo, Marco, Ghezzi, Fabio, Position in the second stage of labour and de novo onset of post-partum urinary incontinence, International Urogynecology Journal, 27, 281-6, 2016	Population outside of scope; BMI/body weight of women included unclear
Somprasit, C., Tanprasertkul, C., Rattanasiri, T., Saksiriwutth, P., Wongkum, J., Kovavisarach, E., Jongfueangparinya, K., Panichakul, P., Wuthiwong, J.,	No relevant intervention

Study	Reason for exclusion
High pre-pregnancy body mass index and the risk of poor obstetrics outcomes among Asian women using BMI criteria for Asians by World Health Organization Western Pacific Region (WPRO): a large cohort study, Journal of the Medical Association of Thailand, 98 Suppl 2, S101-7, 2015	
Zhang, Hongyu, Huang, Shurong, Guo, Xiaolan, Zhao, Ningning, Lu, Yujing, Chen, Min, Li, Yingxia, Wu, Junqin, Huang, Lihua, Ma, Fenglan, Yang, Yuhong, Zhang, Xiaoli, Zhou, Xiaoyu, Guo, Renfei, Cai, Wenzhi, A randomised controlled trial in comparing maternal and neonatal outcomes between hands-and-knees delivery position and supine position in China, Midwifery, 50, 117-124, 2017	Population outside of scope; RCT excluded women with BMI 30 or more

Economic studies

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity – equipment needs

Clinical studies

Study	Reason for exclusion
Alfoudri, H., Catling, S., Davies, S., Management of parturients with obesity in UK obstetric units. OAA approved Survey, International Journal of Obstetric Anesthesia, 21, S40, 2012	Conference proceeding; survey of anaesthetists
Algeo, M., Caird, L., RCOG/CMACE guideline management of women with obesity in pregnancy and its effect on the Raigmore Obstetric Unit, Journal of Obstetrics and Gynaecology, 31, 779, 2011	Conference proceeding; study assesses compliance with CMACE/RCOG recommendations
Anquandah, J., Dafalla, A., Tackore, N., Mariona, F. G., Use of self-retaining retractors in obese and extremely obese pregnant women, Obstetrics and Gynecology, 127, 153S, 2016	Conference proceeding; better quality evidence available
Dadebo, B., Misfar, N., Sutherland, J., Rawstron, J., Fleming, A., Krishnamoorthy, U., Optimising standards of safety & quality in clinical care environment for maternal obesity through assessing availability of bariatric equipment, Archives of Disease in Childhood: Fetal and Neonatal Edition, 97, A47-A48, 2012	Conference proceeding; evaluation of CMACE/RCOG recommendation implementation
Dunn He, Olson G. Saade G., Does the Alexis o-ring wound retractor decrease surgical blood loss: A secondary analysis of a randomized controlled trial, American Journal of Obstetrics and Gynecology, 214, S280, 2016	Conference proceeding
Hardy-Fairbanks, Abbey J., Mackenzie, Todd, McCarthy, Martin, Jr., Goldman, Marlene B., Lauria, Michele R., A randomized controlled trial comparing two types of retractors at caesarean delivery, Journal of obstetrics and gynaecology : the journal of the Institute of Obstetrics and Gynaecology, 37, 1009-1014, 2017	Outcomes were outside of scope
Harper, A., Reducing morbidity and mortality among pregnant obese, Best Practice and Research: Clinical Obstetrics and Gynaecology, 29, 427-437, 2015	Non-systematic review
Heslehurst,N., Lang,R., Rankin,J., Wilkinson,J.R., Summerbell,C.D., Obesity in pregnancy: a study of the impact of maternal obesity on NHS maternity services,	Study design; survey

Study	Reason for exclusion
BJOG: An International Journal of Obstetrics and Gynaecology, 114, 334-342, 2007	
James, D. C., Maher, M. A., Caring for the extremely obese woman during pregnancy and birth, MCN, American Journal of Maternal Child Nursing, 34, 24-30, 2009	Non-systematic review
Rabia, M., Das, S., Alexis-O in C-section of women with BMI more than 35 kg/m2, BJOG: An International Journal of Obstetrics and Gynaecology, 121, 138, 2014	Conference proceeding
Scolari Childress, K. M., Gavard, J. A., Ward, D. G., Berger, K., Gross, G. A., A barrier retractor to reduce surgical site infections and wound disruptions in obese patients undergoing cesarean delivery: a randomized controlled trial, American Journal of Obstetrics & Gynecology, 214, 285.e1-285.e10, 2016	Outcomes were outside of scope
Treadgold, R., Hussain, S., Morris, S., Nicholson, D., Collis, R., A bigger needle for a big problem?, International Journal of Obstetric Anesthesia, 20, S8, 2011	Conference proceeding; outcomes were not relevant
Yamasato, Kelly, Yoshino, Kurt, Chang, Ann L., Caughey, Aaron B., Tsai, Pai-Jong, Cesarean delivery complications in women with morbid obesity, The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstetricians, 29, 3885-8, 2016	Outcomes were outside of scope; complications

Economic studies

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Appendix E – Clinical evidence tables

Intrapartum care for women with obesity – fetal presentation

No clinical evidence was identified for this review and so there are no evidence tables.

Intrapartum care for women with obesity – anaesthesia and analgesia

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Full citation
Sahin, T., Balaban, O., Sahin, L., Solak, M., Toker, K., A randomized controlled trial of preinsertion ultrasound guidance for spinal anaesthesia in pregnancy: Outcomes among obese and lean parturients - Ultrasound for spinal anesthesia in pregnancy, Journal of</td>
<td>Sample size
Data for obese (≥30 body mass index [BMI]) participants were reported separately and were included in this review.

Characteristics
Inclusion criteria
≥ 18 years, 8 hour fasting and elective caesarean section for term pregnancy under subarachnoid block.
Exclusion criteria
Women pregnant with twins,</td>
<td>Interventions
Ultrasound group
Ultrasound was performed by the same operator who had extensive experience in ultrasonographic identification of the intervertebral structures in parturients (~150 examinations). With the parturient in a sitting position, an anaesthesiologist with more than 5 years of experience in obstetric</td>
<td>Details
The primary endpoint was the rate of successful puncture at the first puncture site. With the (two-sided) α error set at 0.05 and β error set at 0.2 (power of 80%) 19 participants per group were needed. To account for a 25% loss from potential withdrawals and technical failures, the target sample</td>
<td>Results
<table>
<tr><th>Outcomes</th><th>Unit</th><th>Ultrasound (n=25)</th><th>Palpation only (n=25)</th></tr>
<tr><td>Adverse effects
i) Paresthesia
ii) Backache
iii) Bloody CSF
iv) Headache</td><td>n (%)</td><td>4(16)
0
6(24)
2(8)</td><td>6(24)
3(12)
7(28)
1(4)</td></tr>
<tr><td>Needle redirection (≥3)</td><td>n (%)</td><td>1(4)</td><td>10(40)</td></tr>
<tr><td>Puncture attempts (≥3)</td><td>n (%)</td><td>0</td><td>8</td></tr>
<tr><td>Successful at first attempt</td><td>n (%)</td><td>23(92)</td><td>11(44)</td></tr>
<tr><td>Duration of spinal procedure</td><td>[median(IQR)](s)</td><td>22(30)</td><td>52(184)</td></tr>
<tr><td>Spinal success</td><td>n (%)</td><td>23(92)</td><td>23(92)</td></tr>
</table>
</td>
<td>Limitations
Cochrane Collaboration's tool for assessing risk of bias
Selection bias
i) Random sequence allocation - Unclear randomisation method
ii) Allocation concealment - Yes - sealed envelope method
LEVEL - UNCLEAR
2. Performance bias
Blinding of participants and personnel - Unclear
LEVEL - UNCLEAR
3. Detection bias
Blinding of outcome assessments - Blinding of anaesthesiologist to pre-determined US.
LEVEL - LOW
4. Attrition bias</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Anesthesia, 28, 413-9, 2014 **Ref Id** 427285 **Country/ies where the study was carried out** Turkey **Study type** Randomised controlled study **Aim of the study** To examine if preinsertion lumbar ultrasound (USG) scanning helps with performance of spinal puncture, as a tool for decreasing the number of puncture attempts and spinal procedure time	contraindicated for subarachnoid block (infection at the puncture site, coagulopathy, participant refusal, hypovolaemia or abnormal spinal anatomy), or were undergoing urgent or emergency caesarean section.	anaesthesia identified L4-L5 space using anatomical references, followed by lumbar USG with an Esaote Mylab 30 (Florence, Italy). A convex transducer of 2-5 MHz was used. USG visualisation in the paramedian longitudinal and transverse planes were performed. After USG imaging of L4-L5 intervertebral space, an anesthesiologist (4 years of experience in performing neuraxial blocks for spinal anesthesia) blinded to the ultrasound depth (UD - distance	size was increased to 25 participants per group.	Adverse effects include Paresthesia, Backache, Bloody CSF and Headache. The extent of sensory block was evaluated by cold and the degree of motor block according to Bromage scale. Subarachnoid block was classified as a failure if the surgical procedure could not begin without the addition of general anesthesia. The duration of spinal procedure was accepted as the time from the picking-up of spinal needle to observe free flow of cerebrospinal fluid and was measured by an observer with a stopwatch. The number of puncture attempts (every separate insertion of the needle) and the number of puncture levels (moving to a second interspace after three times insertion of needle) were recorded.	Incomplete outcome data - Prior sample size determined (n=19). Number of sample recruited justified. LEVEL - LOW 5. Reporting bias Selective reporting - The outcomes reported in the method and result sections were justified. LEVEL - LOW 6. Others Other sources of bias - Not reported LEVEL – LOW **Other information** None

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr><td>and increasing the success rate.

Study dates
Not reported

Source of funding
Not reported</td><td></td><td>from the skin to the subarachnoid space) located the subarachnoid space through the pre-determined insertion point.
Control group
The puncture site was located by only palpation and the subarachnoid space was confirmed by backflow of cerebrospinal fluid (CSF).</td><td></td><td></td><td></td></tr>
<tr><td>Full citation
Wang, Q., Yin, C., Wang, T. L., Ultrasound facilitates identification of combined spinal-epidural puncture in obese parturients, Chinese Medical</td><td>Sample size
n=60

Characteristics
Obese women scheduled for Caesarean section under CSE anesthesia, had BMI ≥ 30 and were under American Society of Anesthesiologists'</td><td>Interventions
All combined spinal-epidural (CSE) procedures were performed by an anaesthesiologist with more than 10 years of experience in obstetric anaesthesia. The L3-4 intervertebral</td><td>Details
The primary endpoint was the rate of successful puncture at the first puncture site (50% in the palpation group and 90% in the ultrasound group). With the two-sided α error set at</td><td>Results
Primary endpoint - Rate of successful puncture at the first puncture site
<table><tr><td>Outcomes</td><td>Unit</td><td>Ultrasound (n=30)</td><td>Control (n=30)</td></tr><tr><td>Successful rate at first puncture site</td><td>n (%)</td><td>30(100)</td><td>21(70)</td></tr><tr><td>Successful rate at first attempt</td><td>n (%)</td><td>19(63.3)</td><td>13(43.3)</td></tr></table></td><td>Limitations
Cochrane Collaboration's tool for assessing risk of bias
Selection bias
i) Random sequence allocation - 'Sequence of random numbers'
ii) Allocation concealment - Unclear; the two groups were similar in terms of age, body weight, height, BMI and gestational age
LEVEL - UNCLEAR</td></tr>
</table>

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Journal, 125, 3840-3, 2012

Ref Id
386443

Country/ies where the study was carried out
China

Study type
Randomised controlled study

Aim of the study
To determine whether ultrasound imaging improves the success rate of combined spinal-epidural (CSE) puncture in obese parturients.

Study dates
Not reported</td>
<td>(ASA) physical status classification I or II were chosen.
Inclusion criteria
Age ≥ 20 years, BMI ≥ 30 and fasted for 8 hours
Exclusion criteria
Contraindication to neuraxial block, previous surgery to the lumbar region, twin pregnancy, or emergency caesarean section.</td>
<td>space was the primary level selected for the puncture. With the participant in right-lateral position, the puncture sites were located.

USG Portable ultrasound machine (M-Turbo with a 5-10 MHz convex probe, Sonosite, USA) was used. The transducer was initially placed longitudinally over the sacral region and then moved cranially. L3-4 intervertebral space was centered on the ultrasound screen and the skin overlying</td>
<td>0.05 and β error set at 0.2 (power of 80%), 19 participants per group were needed.</td>
<td>
<table>
<tr><td>Number of attempts</td><td>n (%)</td><td>0</td><td>9(30)</td></tr>
<tr><td>Time to determine puncture site</td><td>mean± SD (min)</td><td>2.6±0.61</td><td>0.30±0.12</td></tr>
<tr><td>Duration of CSE procedure</td><td>mean± SD (min)</td><td>9.37±1.35</td><td>7.67±1.52</td></tr>
<tr><td>Haemorrhage</td><td>n (%)</td><td>2(6.7)</td><td>6(20)</td></tr>
</table>
Number of puncture attempts - every redirection of the advancement of the needle was considered as a separate attempt.
Duration of CSE procedure - from the time the participant was placed in the right lateral position to the time at which the puncture site was located.
Post-procedural headaches - orthostatic headaches caused by intracranial hypotension and back pain was recorded on 3rd day after the procedure.
No neural damage or paraesthesia, post-procedure headaches and back pain were observed.
</td>
<td>2. Performance bias
Blinding of participants and personnel - Not reported
LEVEL - UNCLEAR
3. Detection bias
Blinding of outcome assessments - Not reported
LEVEL - UNCLEAR
4. Attrition bias
Incomplete outcome data - Prior sample size calculated. Sample size justified.
LEVEL - LOW
5. Reporting bias
Selective reporting - The outcomes reported in method and result sessions were justified.
LEVEL - LOW
6. Others
Other sources of bias - Not reported.
LEVEL – LOW

Other information
None</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Source of funding Local hospital grant		each was marked. A midline of the spine was drawn over the L3-4 spinous processes. The intersection point was used as L3-4 puncture site. The L2-3 puncture site was located using the same technique. Control In the palpation group, the puncture site was located by palpation. An imaginary line between iliac crests located L4 or the L3-4 intervertebral space where it crossed the spine was defined as the puncture site. The needle-through-needle CSE technique			

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
		was used in all patients. A 16G Tuohy epidural needle was inserted perpendicular to the skin. The position of the spinal needle tip in the subarachnoid space was confirmed by the backflow of CSF. If there was no backflow of CSF when the needle was inserted over 3 times, the neighbouring intervertebral space was used. The epidural catheter was inserted 3-4 cm in the epidural space. The patient was placed in supine position after the epidural catheter was fixed properly.			

<table>
<tr><th>Study details</th><th>Participants</th><th>Interventions</th><th>Methods</th><th>Outcomes and Results</th><th>Comments</th></tr>
<tr>
<td>Full citation
Urfalioglu, Aykut, Bilal, Bora, Oksuz, Gozen, Bakacak, Murat, Boran, Omer Faruk, Oksuz, Hafize, Comparison of the landmark and ultrasound methods in cesarean sections performed under spinal anesthesia on obese pregnants, The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal</td>
<td>Sample size
N=97 (n=48 in ultrasound group versus n=49 in landmark group)
Characteristics
Average age =30.5 years
Pre-pregnancy average BMI = 33.5 kg/m^2
Inclusion criteria
Prepregnancy and post-pregnancy BMI > 30 kg/m^2 at gestational Week 37 or later who were planned to have elective caesarean section under spinal anaesthesia
Women aged over 18 years
Exclusion criteria
Contraindications to subarachnoid block (infection, coagulopathy, participant unwillingness,</td>
<td>Interventions
All operations were performed by a single anaesthetist (AU), an obstetric anaesthesia consultant with minimum of 5 years of experience of several thousand conventional spinal anaesthetist procedures and >100 ultrasound-guided spinal anaesthesia procedures.
USG group:
Esaote My Lab five (Esaote, Genoa, Italy)
USG device and a Biosound CA 421 (1.8-5 Hz) convex probe were used for preoperative examinations.
L4-L5 intervertebral</td>
<td>Details
Randomisation: by pulling numbered balls from a bag
Selection: Three participants (2 from USG group and 1 from land-mark) were excluded as the block could not be applied in this way.</td>
<td>Results
<table>
<tr><th></th><th>USG (n=48)</th><th>Landmark (n=49)</th></tr>
<tr><td>Total procedure time(min)*</td><td>8±2</td><td>5±1</td></tr>
<tr><td>Blockage duration(min)</td><td>4±1</td><td>4±1</td></tr>
<tr><td>Number of punctures*</td><td>1±0</td><td>2±1</td></tr>
<tr><td>Number of needle passes*</td><td>1±1</td><td>3±2</td></tr>
<tr><td>Backache*</td><td>7</td><td>21</td></tr>
<tr><td>Headache</td><td>7</td><td>5</td></tr>
<tr><td>Operation time (min)</td><td>35±6.5</td><td>32±4</td></tr>
</table>
p<0.05</td>
<td>Limitations
Cochrane Collaboration's tool for assessing risk of bias
Selection bias
i) Random sequence allocation - Unjustified
ii) Allocation concealment - Unclear
LEVEL - HIGH
2. Performance bias
Blinding of participants and personnel - Unclear
LEVEL - UNCLEAR
3. Detection bias
Blinding of outcome assessments - Unclear
LEVEL - UNCLEAR
4. Attrition bias
Incomplete outcome data - Yes
LEVEL - LOW
5. Reporting bias
Selective reporting - Pregnancy outcomes were not reported
LEVEL - HIGH
6. Others
Other sources of bias - No
LEVEL – LOW

Other information</td>
</tr>
</table>

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
Societies, the International Society of Perinatal Obstetricians, 30, 1051-1056, 2017 **Ref Id** 800276 **Country/ies where the study was carried out** Turkey **Study type** Randomised controlled trial **Aim of the study** To examine preoperative ultrasound examination in comparison with conventional palpating method in identifying bony	haemodynamic disorder, etc), pregnancy-related disease (preeclampsia, eclampsia, gestational diabetes, etc), Persistent spinal anatomy, BMI > 30 kg/m^2 or requiring emergent surgery	space and L3-L4 intervertebral space were determined and marked. Landmark group: In sitting position, needle insertion sites were determined and marked before spinal anaesthesia by palapting crista iliaca and spinous processes and identification of the line between upper level of crista iliacas and the L4 vertebral spinous process or L4-L5 intervertebral space. After needle site confirmation, 1-2 ml of 2% lidocaine HCL was inserted into L4-L5 before introduction of			None

Study details	Participants	Interventions	Methods	Outcomes and Results	Comments
landmarks for spinal anaesthesia during caesarean section in obese women **Study dates** Not reported **Source of funding** Not reported		120 mm 250 gauge quincke spinal needle. After CSF fluid flow, 0.5% hyperbaric bupivacaine 100 mg was used and sensory loss was evaluated by pin prick test. Sensory block at level of T6 or higher was termed as successful block.			

ASA: American Society of Anesthesiologists; BMI: body mass index; CSE: combined spinal-epidural; CSF: cerebrospinal fluid; SD: standard deviation; UD: ultrasound depth; USG: ultrasound-guided

Intrapartum care for women with obesity – fetal monitoring

No clinical evidence was identified for this review and so there are no evidence tables.

Intrapartum care for women with obesity – optimal position

No clinical evidence was identified for this review and so there are no evidence tables.

Intrapartum care for women with obesity – equipment needs

No clinical evidence was identified for this review and so there are no evidence tables.

Appendix F – Forest plots

Intrapartum care for women with obesity – fetal presentation

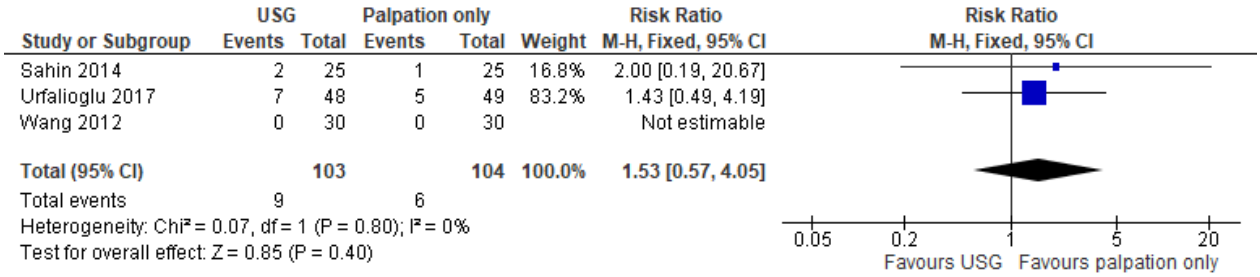
No meta-analysis was undertaken for this review and so there are no forest plots.

Intrapartum care for women with obesity – anaesthesia and analgesia

Figure 8: Major morbidity: blood loss

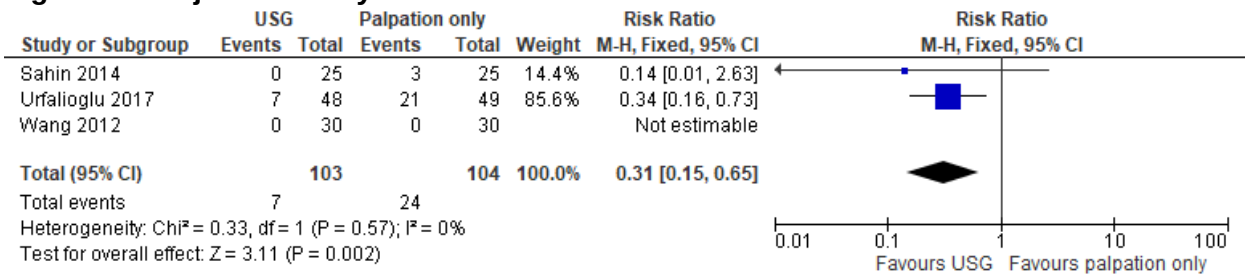
CI: confidence interval; M-H = Mantel-Haenszel; USG: ultrasound guidance

Figure 9: Major morbidity: postdural puncture headache



CI: confidence interval; M-H = Mantel-Haenszel; USG: ultrasound guidance

Figure 10: Major morbidity: backache



CI: confidence interval; M-H = Mantel-Haenszel; USG: ultrasound guidance

Intrapartum care for women with obesity – fetal monitoring

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

Intrapartum care for women with obesity – optimalposition

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

Intrapartum care for women with obesity – equipment needs

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

Appendix G – GRADE tables

Intrapartum care for women with obesity – fetal presentation

No clinical evidence was identified for this review and so there are no GRADE tables.

Intrapartum care for women with obesity - anaesthesia and analgesia

Table 8: Clinical evidence profile for ultrasound-guided versus palpation only needle siting, outcomes for the woman

Quality assessment							Number of women		Effect			
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Ultrasound	Palpation only	Relative (95% CI)	Absolute	Quality	Importance
Failed analgesia - failed subarachnoid block												
1 (Sahin 2014)	Randomised trials	Very serious[1]	Not applicable	No serious indirectness	No serious imprecision	None	2/25 (8%)	2/25 (8%)	RR 1.00 (0.15 to 6.55)	0 fewer per 1000 (from 68 fewer to 444 more)	⨁⨁⊖⊖ LOW	CRITICAL
Major morbidity - blood loss (puncture site haemorrhage or blood CSF)												
2 (Sahin 2012, Wang 2012)	Randomised trials	Serious[1,2]	No serious inconsistency	No serious indirectness	Very serious[3]	None	8/55 (14.5%)	13/55 (23.6%)	RR 0.62 (0.28 to 1.35)	90 fewer per 1000 (from 170 fewer to	⨁⊖⊖⊖ VERY LOW	IMPORTANT

Quality assessment							Number of women		Effect		Quality	Importance
Number of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Ultrasound	Palpation only	Relative (95% CI)	Absolute		
										83 more)		
Major morbidity - postdural puncture headache												
3 (Sahin 2014, Urfalioglu 2017, Wang 2012)	Randomised trials	Very serious[1,2,4]	No serious inconsistency	No serious indirectness	Very serious[3]	None	9/103 (8.7%)	6/104 (5.8%)	RR 1.53 (0.57 to 4.05)	31 more per 1000 (from 25 fewer to 176 more)	⨁⊖⊖⊖ VERY LOW	IMPORTANT
Major morbidity - backache												
3 (Sahin 2014, Urfalioglu 2017, Wang 2012)	Randomised trials	Very serious[1,2,4]	No serious inconsistency	No serious indirectness	No serious imprecision	None	7/103 (6.8%)	24/104 (23.1%)	RR 0.31 (0.15 to 0.65)	159 fewer per 1000 (from 81 fewer to 196 fewer)	⨁⨁⊖⊖ LOW	IMPORTANT

CI: confidence interval; CSF: cerebrospinal fluid; MID: minimally important difference; RR: risk ratio

[1] Sahin 2014 - unclear randomisation, unclear blinding of participants and personal, most of the critical outcomes considered in this review were not reported

[2] Wang 2012 - unclear allocation concealment, unclear blinding, most of the critical outcomes considered in this review were not reported

[3] The quality of the evidence was downgraded by 2 levels if 95% CI crosses 2 default MID thresholds

[4] Urfalioglu 2017 - inappropriate randomisation, unclear blinding, most of the critical outcomes considered in this review were not reported

Intrapartum care for women with obesity - fetal monitoring

No clinical evidence was identified for this review and so there are no GRADE tables.

Intrapartum care for women with obesity - optimal position

No clinical evidence was identified for this review and so there are no GRADE tables.

Intrapartum care for women with obesity - equipment needs

No clinical evidence was identified for this review and so there are no GRADE tables.

Appendix H – Economic evidence study selection

Intrapartum care for women with obesity - fetal presentation

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - anaesthesia and

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - fetal monitoring

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling

Intrapartum care for women with obesity - optimal position

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - equipment needs

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Appendix I – Economic evidence tables

Intrapartum care for women with obesity - fetal presentation

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - anaesthesia and analgesia

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - fetal monitoring

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - optimal position

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - equipment needs

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Appendix J – Health economic evidence profiles

Intrapartum care for women with obesity - fetal presentation

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - anaesthesia and analgesia

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - fetal monitoring

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - optimal position

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - equipment needs

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Appendix K – Health economic analysis

Intrapartum care for women with obesity - fetal presentation

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - anaesthesia and analgesia

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - fetal monitoring

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - optimal position

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Intrapartum care for women with obesity - equipment needs

See Supplement 2 (Health economics) for details of economic evidence reviews and health economic modelling.

Appendix L – Research recommendations

Intrapartum care for women with obesity - fetal presentation

Should we provide a routine ultrasound scan at 36 weeks to pregnant women with a BMI over 30 kg/m^2?

Why this is important

Obesity is now a rapidly growing problem and is associated with several complications in pregnancy (such as fetal macrosomia, intrauterine growth restriction, malpresentation, amniotic fluid abnormalities). Further difficulty in abdominal palpation in obese women is also well-established. Thus, clinical examination to detect complications in obese women is of limited value compared to non-obese women. An ultrasound scan would more accurately detect these complications but entails a cost to the NHS. Ultrasound scans are now readily available in all NHS hospitals. It is also an essential requirement of obstetrician/gynaecologist trainees to be competent in basic fetal biometry. A routine ultrasound scan at 36 weeks is already being undertaken in an informal manner without evidence of benefit.

This research question will aim to determine the cost effectiveness of a routine ultrasound scan at 36 weeks.

Research recommendation rationale

Research question	**Should we provide a routine ultrasound scan at 36 weeks to pregnant women with a BMI over 30 kg/m^2?**
Importance to 'patients' or the population	Avoidance of undiagnosed malpresentations is particularly important in pregnant women with a BMI over 30 kg/m^2, due to their higher complication rate from operative delivery. Ultrasound scan at 36 weeks will allow optimal delivery planning. Not performing an ultrasound scan at 36 weeks may deny the woman and the team the opportunity to prepare for management of some uncommon but serious fetal or maternal problems. Hence, it is important to target the use of ultrasound to those who are most likely to benefit from it.
Relevance to NICE guidance	The committee searched for evidence on this topic but found no high quality evidence. The committee therefore made a broad unanimous recommendation to 'consider' ultrasound scan when there is uncertainty over fetal presentation. However, the benefit of ultrasound scan extends beyond the diagnosis of fetal presentation to include diagnosis of intrauterine growth restriction, macrosomia and amniotic fluid abnormalities. It would therefore be pertinent to assess the effectiveness of this simple and safe intervention in the third trimester. A research recommendation would therefore be appropriate to inform future updates of this guideline, since no definitive guideline on this topic has been published elsewhere. As the focus of the review question was only on fetal presentation, outcome of this evidence will enable us to make a stronger, broader recommendation
Relevance to NHS	This question is of high and immediate priority to the NHS. Since the potential harms of not undertaking an ultrasound scan are substantial, the overall burden of morbidity and direct NHS cost created by not having a definitive answer to the question is

Research question	Should we provide a routine ultrasound scan at 36 weeks to pregnant women with a BMI over 30 kg/m^2?
	high. Further, undertaking only a limited assessment on ultrasound may leave the NHS open to medicolegal scrutiny. Evidence from this trail would permit a more structured and tailored use of ultrasound
National priorities	Each Baby Counts is the RCOG's national quality improvement programme to reduce the number of babies who die or are left severely disabled as a result of incidents occurring during term labour. Each Baby Counts project is committed to reducing this unnecessary suffering and loss of life by 50% by 2020
Current evidence base	Of poor quality
Equalities	N/A

N/A: not applicable; NHS: National Health Service; NICE: National Institute for Health and Care Excellence; RCOG: Royal College of Obstetricians and Gynaecologists

Research recommendation PICO

Criterion	Explanation
Population	Pregnant women who are obese
Intervention	Ultrasound scan at 36 weeks
Comparator	Healthy pregnant women with BMI <30 or Obese pregnant women without a routine ultrasound scan
Outcomes	• Stillbirth • Apgar <6 at 5 minutes • Birth weight • NICU admission • Operative birth rate • Induction of labour • Postpartum haemorrhage
Study design	RCT
Timeframe	6 months

BMI: body mass index; NICU: neonatal intensive care unit; RCT: randomised controlled trial

Intrapartum care for women with obesity - anaesthesia and analgesia

Does the use of ultrasound of the lumbar spine improve siting of regional anaesthetic needles in pregnant women with a BMI over 30 kg/m^2 at the booking appointment?

Why this is important

Pregnant women with a BMI over 30 kg/m^2 are more likely to require anaesthesia during childbirth as the rates for operative birth are at least double the baseline (Balki 2009). In pregnant women with a BMI over 30 kg/m^{2}surface landmark anatomy of the lumbar spine may be more difficult to identify. Ultrasound imaging of the lumbar spine may assist in identification of the lumbar interspace (level in the back), and location of the epidural and spinal space, although the images obtained might be of poorer quality because of increased adipose tissue.

This research question will aim to determine the effectiveness of the use of ultrasound scan for improving needle siting in central neuraxial blockade anaesthesia and analgesia among obese women.

Research recommendation rationale

Research question	Does the use of ultrasound of the lumbar spine improve siting of regional anaesthetic needles in pregnant women with a BMI over 30 kg/m^2 at the booking appointment?
Importance to 'patients' or the population	1) Might improve chances of successful placement a) reducing the need for general anaesthesia (which is especially hazardous in the obese parturient) b) enabling women to have effective analgesia in labour 2) Reduce the number of attempts required to site a regional block which could improve the experience for the woman 3) Reduce the risk of complications such as bloody tap*, inadvertent dural puncture, infection (risk increases with number of attempts), neurological damage (increased risk if spinal is inserted in too high and interspace)
Relevance to NICE guidance	Although clinical experience suggests that regional blocks are more difficult to site in pregnant women with a BMI over 30 kg/m^2, there is no evidence as to the magnitude of the effect or of what if any intervention might improve success rates. There is some evidence in the non-obstetric population that the use of ultrasound reduces the number of attempts or time taken to site regional blocks
Relevance to NHS	Minimising harm and maximising positive outcomes including maternal satisfaction is important to the NHS
National priorities	This supports NHSE aim to reduce maternal morbidity and mortality
Current evidence base	Three randomised studies looked at spinal or combined spinal epidural insertion for anaesthesia for an elective caesarean section and found no difference in any outcomes of interest (Sahin 2014, Urfalioglu 2017, Wang 2012). None were statistically powered to look for complications such as postdural puncture headache, neurological damage or infection. In 1 study the 'obese' population were women with a BMI >30 at term (≥37 weeks) (Urfalioglu 2017). In current UK practice such women are 'normal in terms of siting blocks'. In the other 2 studies obesity was defined as a BMI ≥30 (Sahin 2014; Wang 2012). Current guidelines suggest that women should see an anaesthetist antenatally if they have a BMI >35 at booking, currently most units only see women with a BMI >40 at booking
Equalities	N/A

BMI: body mass index; N/A: not applicable; NHS: National Health Service; NHSE: National Health Service England; NICE: National Institute for Health and Care Excellence
** This does not mean 'haemorrhage at puncture site' which is always trivial*

Research recommendation PICO

Criterion	Explanation
Population	Pregnant women who are obese
Intervention	Ultrasound scan of lumbar spine for insertion of regional blockade
Comparator	Insertion, using landmark method, without ultrasound
Outcomes	• Rates of failed insertion • Time taken to insert

Criterion	Explanation
	• Maternal satisfaction with insertion • Regional block complications including bloody tap, low pressure headache, infection (epidural abscess/ meningitis) • Neurological complication related to anaesthetic procedure
Study design	RCT
Timeframe	One year or longer if neurological complications are included as in a mixed obese/non-obese population these occur 1 in 80 000 to 1 in 320 000 according to the National Audit Project 3 (Cook 2009)

RCT: randomised controlled trial

Intrapartum care for women with obesity – fetal monitoring

Is continuous electronic fetal monitoring preferred over intermittent auscultation for fetal monitoring in labour in pregnant women with a BMI over 30 kg/m^2?

Why this is important

Obesity is a risk factor for stillbirth and operative birth. Electronic fetal monitoring (EFM) increases the operative birth rates. This is justified if the fetal benefit (decrease in stillbirth, neonatal hypoxia, neonatal seizures and hypoxic ischemic encephalopathy) is unequivocal. Current practice is to offer intermittent auscultation (IA) to low risk women and EFM to high risk women for fetal monitoring in labour. NICE guideline on intrapartum care for healthy women and babies (CG190) identifies obesity with BMI >35kg/m^2 as a factor indicating increased risk. It therefore follows that pregnant woman with a BMI >35 require continuous EFM. Yet there is reluctance to use EFM due to its various demerits as it restricts maternal mobility and it is invasive. This research question will aim to provide the evidence to support or refute the role of continuous EFM in labour for obese pregnant women.

Research recommendation rationale

Research question	**Is continuous electronic fetal monitoring preferred over intermittent auscultation for fetal monitoring in labour in pregnant women with a BMI over 30 kg/m^2?**
Importance to 'patients' or the population	Avoidance of stillbirth and fetal complications. Overzealous use of continuous EFM may worsen maternal morbidity (increased operative delivery rates, wound complications) without improvement in perinatal outcomes. On the other hand, inadequate use of continuous EFM may increase perinatal morbidity and mortality rates. Both of these outcomes are equally undesirable. It is therefore critical for the obese women to be recommended the most suitable fetal monitoring technique to maximise benefit while simultaneously minimising harm. Targeting the use of continuous EFM to the appropriate population is our desired goal
Relevance to NICE guidance	The committee searched for evidence on this topic but were unable to find any. The committee therefore made a broad consensus recommendation, which incorporated a range of possible views. A research recommendation would therefore be appropriate to inform future updates of this guideline, since no definitive guideline on this topic has been published elsewhere. Further the committee will be able to make a stronger recommendation, based on the higher strength of the evidence

Research question	Is continuous electronic fetal monitoring preferred over intermittent auscultation for fetal monitoring in labour in pregnant women with a BMI over 30 kg/m^2?
Relevance to NHS	This question is of extremely high priority and a pressing need to the NHS. Since the potential harms of making the incorrect decision (EFM inadequately used leads to stillbirth – a devastating complication, over enthusiastically used – unnecessary operative interventions with high morbidity) are so serious, the overall burden of morbidity and direct NHS cost created by not having a definitive answer to the question is high. Outcome of the trial will help to standardise the use of continuous EFM in the obese parturient
National priorities	This research recommendation has relevance to the maternal and neonatal health safety collaborative, since it supports their objective of "reducing the rates of maternal and neonatal deaths, stillbirths, and brain injuries that occur during or soon after birth by 20% by 2020". Each Baby Counts is the RCOG's national quality improvement programme to reduce the number of babies who die or are left severely disabled as a result of incidents occurring during term labour. Each Baby Counts project is committed to reducing this unnecessary suffering and loss of life by 50% by 2020
Current evidence base	No high quality trials with direct head to head comparison of IA versus continuous EFM
Equalities	N/A

EFM: electronic fetal monitoring; IA: intermittent auscultation; N/A: not applicable; NICE: National Institute for Health and Care Excellence; RCOG: Royal College of Obstetricians and Gynaecologists

Research recommendation PICO

Criterion	Explanation
Population	Pregnant women who are obese with no other maternal or fetal complications
Intervention	Continuous EFM
Comparator	Obese pregnant women with no other maternal of fetal complications being monitored by IA
Outcomes	• Stillbirth • Apgar<6 at 5 minutes • Birth weight • NICU admission • Operative delivery rate
Study design	RCT
Timeframe	6 months

EFM: electronic fetal monitoring; IA: intermittent auscultation; NICU: neonatal intensive care unit; RCT: randomised controlled trial

Is obesity an independent risk factor for perinatal morbidity and mortality?

Why this is important

Current practice in the management of women with a BMI over 30 kg/m^2 in labour varies nationally and a lack of consensus about appropriate antenatal and intrapartum pathways exists. For example, whether women with uncomplicated obesity should be offered continuous

fetal monitoring in labour, receive further antenatal ultrasound scanning including amniotic fluid volume assessment and umbilical artery Doppler's or be induced earlier than low-risk women.

Research to date has not established the effect of stratified BMI on perinatal outcomes that include antepartum pre-term stillbirth, antepartum term stillbirth and intrapartum stillbirth. The current research is predominantly retrospective, using data dating back to the 1970s and 1980s. BMI is usually self-reported and is not stratified according to WHO categorisation. The type of intrapartum fetal monitoring is not used in regression analysis. Conclusions about fetal monitoring in labour were drawn from the secondary analysis of the UK prospective Birthplace Study (Hollowell 2014). It found perinatal morbidity and mortality was not increased above that of a low risk primigravid woman. However, the study did not stratify according to WHO categorisation (the analysis compared BMI 35-39.9kg/m^2 with <35kg/m^2) as the data was secondary to place of birth analysis for low risk women.

The purpose of the study is to establish whether obesity is an independent risk factor for adverse perinatal outcomes. Obesity as an independent risk factor for perinatal outcomes will be stratified according to WHO BMI ranges. The results can be used to determine appropriate maternity care pathways including monitoring in labour, frequency of antenatal scanning, lead professional (midwife or obstetrician), timing and place of birth.

Research recommendation rationale

Research question	Is obesity an independent risk factor for perinatal morbidity and mortality?
Importance to 'patients' or the population	Obesity in the UK is increasing yet current practice for the management of women with obesity during labour is variable across units. The evidence regarding perinatal outcomes associated with obesity is uncertain
Relevance to NICE guidance	High priority: Recommendations about fetal monitoring in labour have been based on clinical consensus. Perinatal outcomes associated with uncomplicated obesity are required to establish antenatal and intrapartum care pathways
Relevance to NHS	With an increasingly obese population and finite resources, the NHS needs to understand whether obesity is an independent risk factor for stillbirth. If it is not, it is important to preserve resources and direct them elsewhere and likewise if it, ensure obese women receive care in line with other high-risk groups
National priorities	This research is supportive of the Government's maternity strategy to reduce the number of stillbirths in the UK
Current evidence base	Research to date has not prospectively established the effect of stratified BMI on perinatal outcomes that include antepartum pre-term stillbirth, antepartum term stillbirth and intrapartum stillbirth and early neonatal death. The current research is predominantly retrospective, using data dating back to the 1970s and 1980s. BMI is usually self-reported and is not stratified according to WHO categorisation. The antenatal and intrapartum fetal monitoring is not used in regression analysis. Secondary analysis from the UK prospective Birthplace Study (Hollowell 2014) found perinatal morbidity and mortality was not increase above that of a low risk primigravid woman. However, the study did not stratify according WHO (the analysis compared BMI 35-39.9kg/m^2 with <35kg/m^2) as the data was secondary to place of birth analysis for low risk women
Equalities	N/A

BMI: body mass index; N/A: not applicable; NICE: National Institute for Health and Care Excellence; WHO: World Health Organization

Research recommendation PPRO

Criterion	Explanation
Population	Women giving birth (during labour and up to 7 days after birth)
Prognostic factor/Index test	BMI categories: • 25-29.9 • 30-34.9 • 35-39.9 • 40-44.9 • 45-49.9 • ≥50 Confounding factors (for logistic regression analysis): • Diabetes • Hypertension • Parity • Twins • Age • Smoking • Non-English speaking • Monitoring in labour • Induction of labour
Reference standard	BMI: 18.5-24.9

Outcomes	Primary outcomes:
	• Term stillbirth
	• Intrapartum stillbirth
	• Early neonatal death
	
	Secondary outcomes:
	• Neonatal morbidity:
	  ○ Apgar <7 at 5 minutes
	  ○ Admission to neonatal unit
	  ○ Shoulder dystocia
	  ○ Macrosomia
	  ○ <3rd and 10th birth weight centile

Study design	Prospective cohort study
Timeframe	3 years

BMI: body mass index

Intrapartum care for women with obesity - optimal position

No research recommendations were made for this review question.

Intrapartum care for women with obesity - equipment needs

No research recommendations were made for this review question.