Centre for Maternal and Child Enquiries
Improving the health of mothers, babies and children

Royal College of Obstetricians and Gynaecologists
Setting standards to improve women's health

CMACE/RCOG Joint Guideline

Management of Women with Obesity in Pregnancy

March 2010

This guideline was produced on behalf of the Centre for Maternal and Child Enquiries and the Royal College of Obstetricians and Gynaecologists by:

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and reviewed by the RCOG Guidelines Committee.

The final version is the responsibility of both CMACE and the Guidelines Committee of the RCOG. Updates of this guideline will be the responsibility of the Guidelines Committee of the RCOG.

DISCLAIMERS

CMACE ACKNOWLEDGEMENTS AND DISCLAIMER

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The recommendations contained in this guideline represent the view of CMACE, the CMACE Obesity Consensus Standards Group and the RCOG Guideline Committee. They do not override healthcare professionals' individual responsibility to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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The Guidelines review process will commence in 2013
unless otherwise indicated

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CMACE

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CMACE/RCOG JOINT GUIDELINE
MANAGEMENT OF WOMEN WITH OBESITY IN PREGNANCY

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1. Purpose and scope

Maternal obesity has become one of the most commonly occurring risk factors in obstetric practice. Obesity in pregnancy is usually defined as a Body Mass Index (BMI) of 30 kg/m^2 or more at the first antenatal consultation. BMI is a simple index of weight-for-height and is calculated by dividing a person's weight in kilograms by the square of their height in metres (kg/m^2). There are three different classes of obesity: BMI 30.0–34.9 (Class I); BMI 35.0–39.9 (Class 2); and BMI 40 and over (Class 3 or morbid obesity),[1,2] which recognise the continuous relationship between BMI and morbidity and mortality.[2]

While the majority of the recommendations within this guideline pertain to women with a BMI ≥30, some recommendations are specific to women in the higher classes of obesity only. Obese women with a BMI below the threshold specified may also benefit from the particular recommendation; however, the chosen BMI cut-offs reflect careful consideration given to the balance of medical intervention versus risk, differences in local prevalence of maternal obesity, and resource implications for local healthcare organisations. Local maternity services may wish to implement these standards for all women with maternal obesity after consideration of these issues.

The recommendations cover interventions prior to conception, during and after pregnancy.

This guideline does not address the following areas: Management of pregnancy following bariatric surgery; anti-obesity drugs in pregnancy; technique and frequency of ultrasound scanning; gestational weight gain; dietary and exercise advice; and postnatal contraception. The National Institute for Health and Clinical Excellence (NICE) is currently developing a guideline on Weight Management in Pregnancy and after Childbirth. The guideline is due to be published in July 2010 and will cover dietary and physical activity interventions and monitoring weight.

2. Background and introduction

The prevalence of obesity in the general population in England has increased markedly since the early 1990s.[3] The prevalence of obesity in pregnancy has also been seen to increase, rising from 9–10% in the early 1990s to 16–19% in the 2000s.[4,5]

Obesity in pregnancy is associated with an increased risk of a number of serious adverse outcomes, including miscarriage,[6] fetal congenital anomaly,[7] thromboembolism,[8,9] gestational diabetes,[10] pre-eclampsia,[11] dysfunctional labour,[12] postpartum haemorrhage,[10] wound infections,[10] stillbirth[13,14] and neonatal death.[14-16] There is a higher caesarean section rate[17] and lower breastfeeding rate[18] in this group of women compared to women with a healthy BMI. There is also evidence to suggest that obesity may be a risk factor for maternal death: the Confidential Enquiry into Maternal and Child Health's report on maternal deaths in the 2003–2005 triennium showed that 28% of mothers who died were obese,[19] whereas the prevalence of obesity in the general maternity population within the same time period was 16-19%. [4,5]

3. Methodology

This CMACE/RCOG guideline is based on standards of care developed as part of a national enquiry project on Obesity in Pregnancy conducted by the Centre for Maternal and Child Enquiries (CMACE) and funded by the National Patient Safety Agency and by contributions from all the UK nations. The development of standards included searching for and preparing scientific evidence, consulting with stakeholders, establishing an expert multidisciplinary group, and developing standards through a formal consensus process. Further details of the consensus and review processes can be found in Appendix 1.

Medline, EMBASE and the Cochrane Database of Systematic Reviews were searched using terms relating to obesity, pregnancy, services and interventions. Searches were limited to humans and restricted to the titles of English language articles published between January 1998 and January 2008. Meta-analyses, systematic reviews, intervention studies and observational studies were selected if they: 1) related to general care issues for pregnant

obese women, 2) focused on the management of obesity or obesity-related complications in pregnancy, or 3) focused on the relationship between maternal Body Mass Index (BMI) and pregnancy-related outcomes. A list of articles meeting the selection criteria was reviewed by the CMACE Obesity Project's External Advisory Group, a multidisciplinary group of nine senior healthcare professionals with expertise in pregnancy and obesity, and two lay representatives. Additional articles recommended by the External Advisory Group were located and assessed according to the criteria above.

All articles that met the selection criteria were tabulated and organised into categories according to the clinical focus and outcomes of the study.

The National Guidelines Clearing House, the National Electronic Library for Health, OMNI, TRIP and E guidelines were also searched for relevant guidelines.

4. Pre-pregnancy care

4.1. What care should be provided in the primary care setting to women with obesity of childbearing age?

Primary care services should ensure that all women of childbearing age have the opportunity to optimise their weight before pregnancy. Advice on weight and lifestyle should be given during family planning consultations, and weight, body mass index and waist circumference should be regularly monitored.

D

Women of childbearing age with a BMI ≥30 should receive information and advice about the risks of obesity during pregnancy and childbirth, and be supported to lose weight before conception.

D

Compared to women with a healthy pre-pregnancy weight, pregnant women with obesity are at increased risk of miscarriage,[6] gestational diabetes,[10] pre-eclampsia,[11] venous thromboembolism,[8,9] induced labour,[20] caesarean section,[17] anaesthetic complications[21,22] and wound infections,[10] and they are less likely to initiate or maintain breastfeeding.[18] Babies of obese mothers are at increased risk of stillbirth,[13 14] congenital anomalies,[7] prematurity,[23] macrosomia [10,15,20] and neonatal death.[14-16] Intrauterine exposure to maternal obesity is also associated with an increased risk of developing obesity and metabolic disorders in childhood.[24] Please see table in Appendix 3 for further information on risks.

It is important that women are aware of the increased risk of maternal and fetal complications associated with obesity, and they should be advised about the possible strategies to minimise them prior to conception.

Evidence level 2++

A Swedish population-based observational study of 151,025 women examined the association of change in BMI between successive pregnancies with adverse outcomes during the second pregnancy. The risk of pre-eclampsia, gestational diabetes mellitus (GDM), large-for-gestational-age babies, caesarean section and stillbirth was linearly related to interpregnancy weight gain.[25]

Evidence level 2+

Interpregnancy weight reduction among women with obesity has been shown to significantly reduce the risk of developing GDM. A population-based cohort study of 4102 non-diabetic women with maternal obesity prior to their first singleton pregnancy found that a weight loss of at least 4.5 kg before the second pregnancy reduced the risk of developing GDM by up to 40%.[26] Although it has been suggested that some weight loss regimens during the first trimester may increase the risk of fetal neural tube defects (NTD), weight loss prior to pregnancy does not appear to carry this risk.[27]

Evidence level 2-

4.2. What nutritional supplements should be recommended to women with obesity who wish to become pregnant?

Women with a BMI ≥30 wishing to become pregnant should be advised to take 5mg folic acid supplementation daily, starting at least one month before conception and continuing during the first trimester of pregnancy.

B

In the general maternity population, maternal folate deficiency is associated with fetal congenital malformations,[28] and periconceptional use of folic acid supplementation reduces the risk of the first occurrence, as well as the recurrence, of NTDs (relative risk (RR) 0.28, 95% confidence interval (CI) 0.13–0.58).[29]

In women at high risk of fetal NTD (due to previous pregnancy with NTD), a randomised double-blind prevention trial has shown that a higher dose of folic acid supplementation (4mg/day) reduces the risk of a subsequent NTD-affected pregnancy by 72% (RR 0.28, 95% CI 0.12–0.71).[30]

† Evidence level 1++

Women with a raised BMI are at increased risk of NTD, with a meta-analysis of 12 observational cohort studies reporting an odds ratio (OR) of 1.22 (95% CI 0.99–1.49), 1.70 (95% CI 1.34–2.15) and 3.11 (95% CI 1.75–5.46) for women defined as overweight, obese and severely obese, respectively, compared with healthy-weight women.[7]

Evidence level 2++

There is evidence from cross-sectional data that, compared to women with a BMI <27, women with a BMI ≥27 are less likely to use nutritional supplements and less likely to receive folate through their diet. However, compared to women with a BMI <27, women with a BMI ≥27 have lower serum folate levels even after controlling for folate intake.[31]

Evidence level 2+

The findings from the studies above suggest that obese women should receive higher doses of folate supplementation in order to minimise the increased risk of fetal NTDs.

Health professionals should take particular care to check that women with a booking BMI ≥30 are following advice to take 10micrograms Vitamin D supplementation daily during pregnancy and while breastfeeding.[32] ‡

C

Pre-pregnancy BMI is inversely associated with serum vitamin D concentrations among pregnant women, and women with obesity (BMI ≥30) are at increased risk of vitamin D deficiency compared to women with a healthy weight (BMI<25).[33] Cord serum Vitamin D levels in babies of obese women have also been found to be lower than babies born to non-obese women.[33]

* Evidence level 2+

The main source of vitamin D is synthesis on exposure of the skin to sunlight. However, in the UK there is limited sunlight of the appropriate wavelength, particularly during winter. A recent survey in Britain showed that about a quarter of British women aged 19–24 and a sixth of those aged 25–34 are at risk of vitamin D deficiency.[34] Maternal skin exposure alone may not always be enough to achieve the optimal vitamin D status needed for pregnancy and the recommended oral intake of 10micrograms Vitamin D daily for all pregnant and breastfeeding women cannot usually be met from diet alone.

5. Provision of antenatal care

5.1. How should antenatal care be provided for women with obesity?

Management of women with obesity in pregnancy should be integrated into all antenatal clinics, with clear policies and guidelines for care available.

D

† Evidence extrapolated to women with obesity and used to derive grade of standard
‡ Additional standard identified by the RCOG Guideline Committee
* Evidence level used to derive grade of standard

The prevalence of obesity in pregnancy has increased significantly since the early 1990s,[4,5] and this is expected to continue in parallel with increasing prevalence in the general population. Specialist clinics are unlikely to be feasible in areas of high prevalence due to resource issues, and it is important that all health professionals providing maternity care are aware of the maternal and fetal risks and the specific interventions required to minimise these risks.

6. Measuring weight, height and BMI

6.1. How and when should maternal weight, height and BMI be measured in the general maternity population?

All pregnant women should have their weight and height measured using appropriate equipment, and their body mass index calculated at the antenatal booking visit. Measurements should be recorded in the handheld notes and electronic patient information system.

D

Appropriate management of women with maternal obesity can only be possible with consistent identification of those women who are at risk. The NICE Antenatal Care guideline (2008) recommends that maternal height and weight should be recorded for all women at the initial booking visit (ideally by 10 weeks gestation) to allow the calculation of BMI.[35] Semi-structured interviews of health professionals in the North East Government Office Region of England suggested that self-reported rather than measured height and weight are used at some community booking visits due to lack of availability of appropriate equipment.[36] However, self-reported height is often overestimated and self-reported weight underestimated, particularly in obese women,[37] which may lead to inaccurate risk assessment during pregnancy.

Mandatory height and weight data fields in electronic patient information systems, and functionality allowing the automatic calculation of BMI, may be useful to enable local organisations to achieve 100% compliance with this standard.

For women with obesity in pregnancy, re-measurement of maternal weight during the third trimester will allow appropriate plans to be made for equipment and personnel required during labour and delivery.

7. Information-giving during pregnancy

7.1. What information should be provided to women with maternal obesity?

All pregnant women with a booking BMI ≥30 should be provided with accurate and accessible information about the risks associated with obesity in pregnancy and how they may be minimised. Women should be given the opportunity to discuss this information.

D

While pre-conception advice and care is the ideal scenario for women with obesity, those women presenting for the first time during pregnancy should be given an early opportunity to discuss potential risks and management options with a healthcare professional. The aim is to provide appropriate information sensitively, which empowers the woman to actively engage with health professionals and the services available to her. Relevant information will include the increased risk of pre-eclampsia, gestational diabetes and fetal macrosomia requiring an increased level of maternal and fetal monitoring; the potential for poor ultrasound visualisation of the baby and consequent difficulties in fetal surveillance and screening for anomalies; the potential for difficulty with intrapartum fetal monitoring, anaesthesia and caesarean section which would require senior obstetric and anaesthetic involvement and an antenatal anaesthetic assessment; and the need to prioritise the safety of the mother at all times. Women should be made aware of the importance of healthy eating and appropriate exercise during pregnancy in order to prevent excessive weight gain and gestational diabetes. Dietetic advice by an appropriately trained professional should be provided early in the pregnancy.

The table in Appendix 3 provides further information on the risks of specific outcomes.

8. Risk assessment during pregnancy

8.1. What specific risk assessments are required for women with maternal obesity?

Pregnant women with a booking BMI ≥40 should have an antenatal consultation with an obstetric anaesthetist, so that potential difficulties with venous access, regional or general anaesthesia can be identified. An anaesthetic management plan for labour and delivery should be discussed and documented in the medical records.

D

Obese pregnant women are at higher risk of anaesthesia-related complications than women with a healthy BMI, and obesity has been identified as a significant risk factor for anaesthesia-related maternal mortality.[19,38] Women with class III obesity will be at highest risk and it is recommended that local anaesthetic resources are focused on this group of women. Maternity services may decide to use a lower BMI threshold, taking into consideration the local prevalence of maternal obesity.

Evidence level 3

Epidural re-site rates have been reported to increase with increasing BMI,[21] and the initial failure rate of epidural cannulation in parturients with morbid obesity has been reported to be as high as 42% in one hospital.[39] For these reasons, an early epidural may be advisable.

It is recognised that obesity may increase the risk of aspiration of gastric contents under general anaesthesia, difficult endotracheal intubation and postoperative atelectasis.[22] These women are also more likely to have co-morbidites such as hypertension and ischaemic heart disease.

Evidence level 2-

Women with a booking BMI ≥40 should have a documented assessment in the third trimester of pregnancy by an appropriately qualified professional to determine manual handling requirements for childbirth and consider tissue viability issues.

D

Manual handling requirements include consideration of safe working loads of beds and theatre tables, the provision of appropriate lateral transfer equipment, hoists, and appropriately sized thromboembolic deterrent stockings (TEDS). There is also an increased risk of pressure sores when a woman may be relatively immobile and regular inspection of potential pressure areas is important.[40] A formal assessment of this risk should be made using validated scoring tools, and appropriate plans put in place with regard to body positions, repositioning schedules, skin care and support surfaces.

For women with obesity in pregnancy, re-measurement of maternal weight during the third trimester will allow appropriate plans to be made for equipment and personnel required during labour and delivery.

Some women with a booking BMI <40 may also benefit from assessment of manual handling requirements in the third trimester and this should be decided on an individual basis by the lead health professional providing maternity care.

9. Thromboprophylaxis

9.1. What precautions should be taken to minimise the risk of thromboembolism in women with maternal obesity?

Women with a booking BMI ≥30 should be assessed at their first antenatal visit and throughout pregnancy for the risk of thromboembolism. Antenatal and post delivery thromboprophylaxis should be considered in accordance with the RCOG Clinical Green Top Guideline No. 37.[41]

B

Maternal obesity is associated with a significant risk of thromboembolism during both the antenatal and postnatal period. A retrospective case-control study in Denmark, including 129 women with deep vein thrombosis (DVT) or pulmonary embolism (PE) during pregnancy or the puerperium and 258 controls (pregnant women with no venous thromboembolism), showed a significant association between venous thromboembolism and BMI ≥30 (adjusted OR (aOR) 5.3, 95% CI 2.1–13.5).[9] More recently, a national matched case-control study conducted by the United Kingdom Obstetric Surveillance System (UKOSS) reported that a BMI ≥30 was associated with an aOR of 2.65 (95% CI 1.09–6.45) for antenatal pulmonary thromboembolism (PTE).[42]

* Evidence level 2++

The RCOG Clinical Green Top Guideline No. 37 advises that:

- A woman with a BMI ≥30 who also has two or more additional risk factors for thromboembolism should be considered for prophylactic low molecular weight heparin (LMWH) antenatally. This should begin as early in pregnancy as practical.
- All women receiving LMWH antenatally should usually continue prophylactic doses of LMWH until six weeks postpartum, but a postnatal risk assessment should be made.

Women with a booking BMI ≥30 requiring pharmacological thromboprophylaxis should be prescribed doses appropriate for maternal weight, in accordance with the RCOG Clinical Green Top Guideline No. 37.[41]

D

The RCOG Clinical Green Top Guideline No. 37 gives the following weight-specific dosage advice:

Weight (kg)	Dose
91-130	60 mg Enoxaparin; 7500 units Dalteparin; 7000 units Tinzaparin daily
131-170	80 mg Enoxaparin; 10000 units Dalteparin; 9000 units Tinzaparin daily
>170	0.6 mg/kg/day Enoxaparin; 75 units/kg/day Dalteparin; 75 units/kg/day Tinzaparin

Women with a BMI ≥30 should be encouraged to mobilise as early as practicable following childbirth to reduce the risk of thromboembolism.

B

Both immobility and obesity are independently associated with thromboembolism; in combination, however, they can pose a much greater risk. This interaction has been demonstrated by a large case-control study that reported an aOR of 62.3 (95% CI 11.5–337.6) for antenatal venous thromboembolism (VTE) and 40.1 (95% CI 8.0–201.5) for postnatal VTE in women with a BMI ≥25 where there was evidence of immobilisation, compared with women with a BMI <25 and no immobilisation.[8] In contrast, women with a BMI ≥25 without evidence of immobilisation had a much lower aOR of 1.8 (95% CI 1.3–2.4) for antenatal VTE and 2.4 (95% CI 1.7–3.3) for postnatal VTE.

* Evidence level 2++

All women with a BMI ≥40 should be offered postnatal thromboprophylaxis regardless of their mode of delivery.

D

This recommendation is in line with the recently updated RCOG Guideline No. 37, which states that for these women thromboprophylaxis should be continued for a minimum of one week.[41] In addition, the guideline recommends the following:

- Women with a BMI ≥30 who have one or more additional persisting risk factors for thromboembolism should also be considered for LMWH for seven days after delivery.
- Women with a BMI ≥30 who have two or more additional persisting risk factors should be given graduated compression stockings in addition to LMWH.

10. Maternal surveillance and screening

10.1. What specific considerations should be given to maternal surveillance for women with obesity?

An appropriate size of arm cuff should be used for blood pressure measurements taken at the booking visit and all subsequent antenatal consultations. The cuff size used should be documented in the medical records. **C**

The effects of three different arm cuff sizes (standard (12x23cm), large (15x33cm) and thigh (18x36cm)) on blood pressure measurement were evaluated in 1240 adults. The differences in readings between the three cuffs were smallest in non-obese subjects and became progressively greater with increasing arm circumference in the obese population. Less error was introduced by using too large a cuff than by too small a cuff.[43]

* Evidence level 2+

Women with a booking BMI ≥35 have an increased risk of pre-eclampsia and should have surveillance during pregnancy in accordance with the Pre-eclampsia Community Guideline (PRECOG), 2004.[44] **B**

A number of good-quality observational studies have shown clearly that obesity is associated with an increased risk of pre-eclampsia.[10,11,15,23,45-49]

A Swedish cohort study of 805,275 pregnancies to women delivering between 1992 and 2001 found that the incidence of pre-eclampsia ranged from 1.4% among women with a BMI 19.8–26.0 to 3.5% among those with morbid obesity (BMI >40) (aOR 4.82, 95% CI 4.04–5.74).[15] Similar increases in risk have been reported for pregnancy induced hypertension and pre-eclampsia in an Australian cohort study, in which the incidence ranged from 2.4% in women with a BMI 19.8-26.0 to 14.5% (aOR 4.87, 95% CI 3.27–7.24) in women with a BMI >40.[23]

A systematic review of risk factors for pre-eclampsia found that, compared to a healthy BMI, a raised booking BMI, as defined within each study, was associated with a 50% increase in the risk of pre-eclampsia, while a booking BMI >35 doubled the pre-eclampsia risk.[47]

* Evidence level 2++

The PRECOG Guideline states that:

- Women with a booking BMI ≥35 who also have at least one additional risk factor for pre-eclampsia should have referral early in pregnancy for specialist input to care. Additional risk factors include: first pregnancy, previous pre-eclampsia, ≥10 years since last baby, ≥40 years, family history of pre-eclampsia, booking diastolic BP ≥80mmHg, booking proteinuria ≥1+ on more than one occasion or ≥0.3g/24 hours, multiple pregnancy, and certain underlying medical conditions such as antiphospholipid antibodies or pre-existing hypertension, renal disease or diabetes.
- Women with a booking BMI ≥35 with no additional risk factor can have community monitoring for pre-eclampsia at a minimum of 3 weekly intervals between 24 and 32 weeks gestation, and 2 weekly intervals from 32 weeks to delivery.

The NICE Clinical Guideline on Hypertensive disorders during pregnancy (in draft, due to be published April 2010) states that although moderate risk factors for pre-eclampsia (including obesity, first pregnancy, maternal

age >40 years, family history of pre-eclampsia, multiple pregnancy) are poorly defined in the published literature, it is the considered opinion of the NICE Guideline Development Group that women with more than one moderate risk factor may benefit from taking 75mg aspirin daily from 12 weeks' gestation until birth of the baby.[50]

All pregnant women with a booking BMI ≥30 should be screened for gestational diabetes, as recommended by the NICE Clinical Guideline No. 63 (Diabetes in Pregnancy, July 2008).[51]

B

Maternal obesity is known to be an important risk factor for GDM with a number of large cohort studies reporting a three-fold increased risk compared to women with a healthy weight.[10,23,45,46,49]

Evidence level 2++

A randomised controlled trial of 1000 women with GDM found that treatment, comprising dietary advice, blood glucose monitoring and insulin therapy as needed, significantly reduced the risk of a composite measure of serious adverse perinatal outcome (death, shoulder dystocia, bone fracture, and/or nerve palsy) compared to routine care, where women and their care providers were unaware that GDM was present (adjusted RR 0.33, 95% CI 0.14–0.75).[52]

† Evidence level 1+

The NICE Clinical Guideline No. 63 recommends that women with a BMI>30 should have a 2 hour 75g oral glucose tolerance test at 24-28 weeks,[51] using the criteria defined by the World Health Organisation.

11. Planning labour and delivery

11.1. What should be discussed with women with maternal obesity regarding labour and delivery?

Women with a booking BMI ≥30 should have an informed discussion antenatally about possible intrapartum complications associated with a high BMI, and management strategies considered. This should be documented in the notes.

D

Observational studies have shown that there is a higher incidence of intrapartum complications among women with obesity compared to women with a healthy weight. There is an increased risk of slow labour progression,[12,46] shoulder dystocia[15,20] and emergency caesarean section.[10,20] There is also an increased risk of primary postpartum haemorrhage.[10,20]

A meta-analysis of 33 cohort studies showed that the OR for caesarean section (either elective or emergency) was 1.46 (95% CI 1.34–1.60) and 2.05 (95% CI 1.86– 2.27) respectively among women defined as overweight and obese in individual studies, compared to women with a normal weight.[17] Caesarean section can be more technically difficult in these women and there is a higher risk of anaesthetic complications compared to healthy-weight women.[21,22] The decision for mode of delivery should therefore be taken only after careful consideration of the individual circumstances and in conjunction with the full multidisciplinary team and the woman herself.

Evidence level 2++

Women should be given the opportunity to discuss how the complications outlined above can be minimised. They should also be aware of the possible technical difficulties with intravenous access, regional anaesthesia and fetal surveillance in labour, and how these are likely to be addressed (see section 12).

Women with a booking BMI ≥30 should be referred to a consultant obstetrician to enable this discussion. The timing of the referral should be agreed by local maternity services, taking into account the local prevalence of maternal obesity and the antenatal care structures in place.

Women with a booking BMI ≥30 should have an individualised decision for VBAC (vaginal birth after caesarean) following informed discussion and consideration of all relevant clinical factors.

D

Deciding the planned mode of delivery following previous caesarean section requires consideration of the circumstances surrounding the previous caesarean and the current clinical situation, with full involvement of the woman. Women with obesity have additional risks needing consideration. Obesity is a risk factor for unsuccessful VBAC,[53-55] and morbid obesity carries a greater risk for uterine rupture during trial of labour and neonatal injury.[53] Emergency caesarean section in women with obesity is associated with an increased risk of serious maternal morbidity because anaesthetic and operative difficulties are more prevalent in these women compared to women with a healthy BMI,[22] and this should also be taken into account when discussing the risks and benefits of VBAC.

12. Care during childbirth

12.1. Where should women with obesity give birth?

Women with a BMI ≥35 should give birth in a consultant-led obstetric unit with appropriate neonatal services, as recommended by the NICE Clinical Guideline No. 55 (Intrapartum Care, Sept 2007).[56]

B

Women with obesity are at significantly higher risk of shoulder dystocia[15,20] and postpartum haemorrhage[10,20] and immediate obstetric intervention is vital in these situations. In addition, babies born to mothers with obesity are up to 1.5 times more likely to be admitted to a neonatal intensive care unit than babies born to mothers with a healthy weight.[10,20,46] The odds of admission have been shown to increase with each increasing BMI category, similar to those defined by WHO.[23] Please see the table in Appendix 3 for the specific risks associated with maternal obesity.

* Evidence level 2++

The NICE Clinical Guideline No. 55 recommends that women with BMI ≥35 should be advised to give birth in an obstetric unit to reduce the increased risk of maternal and fetal adverse outcomes. It recommends an individual risk assessment regarding planned place of birth for women with a booking BMI of 30 – 34.

12.2. Is maternal obesity an indication for induction of labour?

In the absence of other obstetric or medical indications, obesity alone is not an indication for induction of labour and a normal birth should be encouraged.

D

Induction of labour carries the risk of failed induction and emergency caesarean section, which can be a high risk procedure in women with obesity. Induction of labour should therefore be reserved for situations where there is a specific obstetric or medical indication, with recourse to senior obstetric and anaesthetic help in the event that abdominal delivery becomes necessary.

12.3. What lines of communication are required during labour and delivery in women with maternal obesity?

The duty anaesthetist covering labour ward should be informed when a woman with a BMI ≥40 is admitted to the labour ward if delivery or operative intervention is anticipated. This communication should be documented by the attending midwife in the notes.

D

An opportunity for early assessment will allow the duty anaesthetist to review documentation of the antenatal anaesthetic consultation, identify potential difficulties with regional and/or general anaesthesia, and alert senior colleagues if necessary. An early epidural may be advisable depending on the clinical scenario.

Women with a BMI ≥40 have the highest risk of anaesthetic complications and it is recommended that local anaesthetic resources are focused on this group of women. Maternity services may decide to use a lower BMI threshold, taking in consideration the local prevalence of maternal obesity.

Operating theatre staff should be alerted regarding any woman whose weight exceeds 120kg and who is due to have an operative intervention in theatre. **D**

An operating table with the appropriate safe working load and appropriate lateral transfer equipment should be available prior to the woman's transfer to theatre.

An obstetrician and an anaesthetist at Specialty Trainee year 6 and above, or with equivalent experience in a non-training post, should be informed and available for the care of women with a BMI ≥40 during labour and delivery, including attending any operative vaginal or abdominal delivery and physical review during the routine medical ward round. **D**

RCOG Good Practice No. 8 (March 2009)[57] recommends that if the trainee obstetrician on duty for the labour ward has not been assessed and signed-off as competent to carry out caesarean section on women with a BMI>40, the consultant on-call for labour ward should attend in person or be immediately available. Operative vaginal and abdominal deliveries are often technically difficult in women with morbid obesity, and appropriately experienced clinicians should be present to perform or supervise delivery. Regular senior medical review also supports timely identification of any potential intrapartum complications.

12.4. What midwifery support should be available during labour to women with a high BMI?

Women with a BMI ≥40 who are in established labour should receive continuous midwifery care. **D**

Continuous midwifery care is recommended for all women in established labour. Women with morbid obesity need extra vigilance with regard to care of pressure areas and ensuring normal labour progress. Fetal heart rate monitoring can be a challenge, and close surveillance is required with recourse to fetal scalp electrode or ultrasound assessment of the fetal heart if necessary.

12.5. What specific interventions are required during labour and delivery for women with maternal obesity?

Women with a BMI ≥40 should have venous access established early in labour. **D**

Establishing venous access in women with morbid obesity is more likely to be difficult than in women with lesser degrees of obesity, and it is important that this is not attempted for the first time in an emergency situation when urgent venous access is required for intravenous medication or for resuscitation.

All women with a BMI ≥30 should be recommended to have active management of the third stage of labour. This should be documented in the notes. **B**

Obesity is associated with an increased risk of postpartum haemorrhage.[10] | Evidence level 2++

There is strong evidence from the general maternity population that active management of the third stage of labour reduces the risk of postpartum haemorrhage, post partum anaemia and the need for blood transfusion.[58] Active management in all women is associated with a reduced incidence of prolonged third stage of labour and with a reduction in the use of therapeutic oxytocic drugs.

† Evidence level 1++

Women with a BMI ≥30 having a caesarean section have an increased risk of wound infection, and should receive prophylactic antibiotics at the time of surgery, as recommended by the NICE Clinical Guideline No. 13 (Caesarean Section, April 2004).[59]

B

A retrospective observational study of 287,213 singleton pregnancies reported an aOR of 2.24 (99% CI 1.91–2.64) for wound infection in obese women compared with healthy-weight women.[10]

Evidence level 2++

In the general maternity population, a systematic review of randomised trials in women undergoing elective or non-elective caesarean sections showed that the incidence of wound infections was significantly reduced with antibiotic prophylaxis compared with no prophylaxis.[60] The RR of infection for elective caesarean section was 0.73 (95% CI 0.53–0.99), for non-elective caesarean section 0.36 (95% CI 0.26–0.51), and for all caesareans 0.41 (95% CI 0.29–0.43).

† Evidence level 1++

The NICE clinical guideline No 13 recommendation applies to all women regardless of BMI and recommends that women undergoing caesarean section should be offered a single prophylactic dose of first generation cephalosporin or ampicillin in order to reduce the risk of postoperative infections (endometritis, urinary tract or wound infections).

As recommended by the NICE Clinical Guideline No. 13 (Caesarean Section, April 2004), women undergoing caesarean section who have more than 2cm subcutaneous fat, should have suturing of the subcutaneous tissue space in order to reduce the risk of wound infection and wound separation.[59] ‡

A

Two RCTs randomised 76 and 91 women, respectively, who had at least 2cm subcutaneous fat to closure or non-closure of the subcutaneous tissue space.[61,62] Meta analysis of these RCTs showed that closure of the subcutaneous space decreased the incidence of wound complications (RR 0.42, 95% CI 0.22 to 0.81).[59]

* Evidence level 1++

13. Postnatal care and follow-up after pregnancy

13.1. How can the initiation and maintenance of breastfeeding in women with maternal obesity be optimised?

Obesity is associated with low breastfeeding initiation and maintenance rates. Women with a booking BMI ≥30 should receive appropriate specialist advice and support antenatally and postnatally regarding the benefits, initiation and maintenance of breastfeeding.

B

‡ Additional standard identified by the RCOG Guideline Committee

Maternal obesity is associated with reduced breastfeeding rates, both in terms of breastfeeding initiation and duration.[18,63] This is likely to be multifactorial in origin; women's perception of breastfeeding; difficulty with correct positioning of the baby; and the possibility of an impaired prolactin response to suckling.[64]

Evidence level 2++

Evidence derived from randomised controlled trials in the general maternity population shows that breastfeeding education and support is associated with higher breastfeeding initiation rates and, in some instances, longer durations of breastfeeding.[65,66]

† Evidence level 1+

Women with obesity should have an opportunity during the antenatal period to discuss the benefits of breastfeeding and the support that will be available to them, so that they can make an informed decision regarding feeding choices. Dedicated breastfeeding support during the postnatal period is also needed to overcome any potential difficulties with feeding.

13.2. What ongoing care should be provided to women with maternal obesity following pregnancy?

Women with a booking BMI ≥30 should continue to receive nutritional advice following childbirth from an appropriately trained professional, with a view to weight reduction.

C

A small number of randomised controlled trials have assessed the effect of postnatal lifestyle interventions on weight reduction. Modification of dietary and physical activity behaviour are associated with a significant reduction in body weight compared to no lifestyle intervention.[67-69] Maternity services need to identify what services are available locally to provide this follow up.

† Evidence level 1-

All women with a booking BMI ≥30 who have been diagnosed with gestational diabetes should have a test of glucose tolerance approximately 6 weeks after giving birth.

D

Women with a booking BMI ≥30 and gestational diabetes who have a normal test of glucose tolerance following childbirth, should have regular follow up with the GP to screen for the development of type 2 diabetes.

B

A systematic review and meta-analysis found that women with GDM had an increased risk of developing type 2 diabetes compared with those who had a normoglycaemic pregnancy (RR 7.43, 95% CI 4.79–11.51).[70]

In an earlier systematic review, there was a steep increase in incidence of type 2 diabetes within the first 5 years following a pregnancy with GDM; however after 5 years the conversion of GDM to type 2 diabetes appeared to plateau.[71]

* Evidence level 2++

Data from an observational cohort study of 330 Danish women with diet-treated GDM showed that 41% of these women developed diabetes during a median of 10 years follow-up.[72] This reflected a doubling of the risk compared to an earlier cohort of 241 women with GDM followed by the same research group ten years previously. Pre-pregnancy overweight and obesity were found to be significant risk factors for the development of type 2 diabetes in these women (aOR 2.0 (95% CI 1.1–3.4) and 2.6 (95% CI 1.5–4.5), respectively).

Evidence level 2+

All women with a booking BMI ≥30 who have been diagnosed with gestational diabetes should have annual screening for cardio-metabolic risk factors, and be offered lifestyle and weight management advice.

B

There is good evidence from a number of large randomised controlled trials that lifestyle interventions can prevent or delay the development of diabetes in high-risk individuals. Compared to standard care, exercise plus diet interventions in high-risk populations, primarily those with impaired glucose tolerance, are associated with a RR of 0.63 (95% CI 0.49–0.79) for developing diabetes.[73]

† Evidence level 1++

14. Local guidelines

14.1. What should be included in local guidelines on the management of maternal obesity?

All maternity units should have accessible multidisciplinary guidelines which are communicated to all individuals and organisations providing care to pregnant women with a booking BMI ≥30. These guidelines should include consideration of:

D

- **Referral criteria**
- **Facilities and equipment**
- **Care in pregnancy**
- **Place of birth and care in labour**
- **Provision of anaesthetic services**
- **Management of obstetric emergencies**
- **Postnatal advice**

Obesity in pregnancy is recognised by the NHS Litigation Authority (NHSLA)'s Clinical Negligence Scheme for Trusts as one of the high risk conditions requiring the availability of a local guideline at all maternity units.[74]

15. Facilities and equipment

15.1. What are the processes to ensure that maternity units have appropriate facilities and equipment for women with obesity?

All maternity units should have a documented environmental risk assessment regarding the availability of facilities to care for pregnant women with a booking BMI ≥30. This risk assessment should address the following issues:

D

- **Circulation space**
- **Accessibility including doorway widths and thresholds**
- **Safe working loads of equipment (up to 250kg) and floors**
- **Appropriate theatre gowns**
- **Equipment storage**
- **Transportation**
- **Staffing levels**
- **Availability of, and procurement process for, specific equipment:**
  - large blood pressure cuffs
  - sit-on weighing scale
  - large chairs without arms
  - large wheelchairs
  - ultrasound scan couches
  - ward and delivery beds

- theatre trolleys
- operating theatre tables
- lifting and lateral transfer equipment

A minimum requirement for maternity services within the NHSLA's Clinical Negligence Scheme for Trusts (CNST) is the availability of suitable equipment for women with a high BMI, and it is recommended that units should have a documented process to assess this on a regular basis.[74] It is also recognised good practice for maternity units to have an ultrasound machine and extra-long spinal and epidural needles available at all times on the labour ward.

Maternity units should have a central list of all facilities and equipment required to provide safe care to pregnant women with a booking BMI ≥30. The list should include details of safe working loads, product dimensions, where specific equipment is located and how to access it.

D

16. Education of health professionals

16.1. What are the education and training needs for health professionals specific to maternal obesity?

All health professionals involved in the care of pregnant women should receive education about maternal nutrition and its impact on maternal, fetal and child health.

D

Dietary and lifestyle choices contribute to obesity in both general and maternity populations. A study of 2394 pregnant women with complete dietary, weight and height data found that women classified as obese were significantly more likely to be in the lowest versus the highest diet quality tertile compared with underweight women (OR 1.87, 95% CI 1.37–2.55).[75]

Evidence level 2+

All health professionals involved in maternity care should receive training in manual handling techniques and the use of specialist equipment which may be required for pregnant and postnatal women with obesity.

D

17. Areas for further research

Research is needed to determine the optimal weight gain during pregnancy for women in different BMI categories.

Evidence-based guidance is required on the optimal caesarean section technique for women with obesity in pregnancy.

18. Auditable standards

- Proportion of women with booking BMI ≥30 who commenced 5mg folic acid supplementation daily prior to conception
- Proportion of women with booking BMI ≥30 who commenced 10 micrograms of vitamin D daily before or during pregnancy
- Proportion of pregnant women who have a record of maternal height, weight and BMI in the maternity hand held notes and on the electronic patient information system
- Proportion of maternity health care professionals who have had training in manual handling techniques and the use of specialist bariatric equipment within the previous year
- Proportion of women with a booking BMI ≥40 who had an antenatal anaesthetic review
- Proportion of women with a booking BMI ≥30 plus two other risk factors for VTE, as outlined in RCOG Green- top Guideline No. 37 (2004), who had pharmacological thromboprophylaxis prescribed antenatally
- Proportion of women with a booking BMI ≥40 who had pharmacological thromboprophylaxis prescribed postnatally
- Proportion of women with a booking BMI ≥30 who had a glucose tolerance test during pregnancy
- Proportion of women with a booking BMI ≥30 who had active management of the third stage of labour
- Indications for induction of labour in women with booking BMI ≥30
- Proportion of operative vaginal deliveries and caesarean sections in women with a booking BMI ≥40, which were attended by an obstetrician and anaesthetist at Specialty Trainee level 6 or above

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APPENDIX 1: Process for developing the consensus standards

1. Stakeholder consultation

Forty four stakeholder organisations representing healthcare professionals, researchers or patients with an interest in the area of obesity in pregnancy were identified and invited to suggest aspects of care or service provision that should be addressed by the standards. Twelve organisations responded during the 4-week consultation period in February 2008. Thirty broad areas of care were identified and subsequently presented to the Consensus Standards Group (see below) for consideration.

2. Multidisciplinary consensus standards group

A multidisciplinary group (Consensus Standards Group, CSG) was convened. This comprised 23 members representing disciplines relevant to obesity and pregnancy (see table 1), and two lay representatives with personal experience of obesity and pregnancy. The group included representation from the relevant Royal Colleges: the Royal College of Anaesthetists (RCoA), the Royal College of General Practitioners (RCGP), the Royal College of Midwives (RCM), the Royal College of Obstetricians and Gynaecologists (RCOG), the Royal College of Physicians (RCP) and the Royal College of Paediatrics and Child Health (RCPCH).

Table 1. Disciplines represented by the Consensus Standards Group

Anaesthesia
Dietetics
Endocrinology
General practice
General medicine
Manual handling
Midwifery
Neonatology
Obstetrics
Physiotherapy
Public health
Ultrasonography

3. Consensus process

Evidence tables and the proposed process for standards development were sent to all CSG members in advance of the first meeting. During the meeting the group agreed: 1) the broad areas for the standards, 2) the iteration process for achieving consensus, and 3) the scoring system to include or exclude standards. The process for developing the standards, using a modified Delphi approach,[76] is illustrated in Figure 1.

3.1. First iteration

After the first meeting, an open-ended questionnaire containing the broad areas for standards was sent to the CSG. Members submitted draft standards within their area of expertise, together with the rationale for the standard and references for the supporting evidence. A total of 498 standards were suggested by the group.

Draft standards were sorted and categorised according to common themes by a researcher and senior clinician based at CMACE. Duplicate standards were removed and the remaining 198 standards then edited by CMACE. The CSG provided feedback on any essential re-wording prior to the second iteration.

3.2. Second iteration

The CSG was sent the 198 standards with anonymised supporting rationales and references. Group members were requested to: 1) score each standard on importance (based on potential clinical impact and level of available evidence) and feasibility (based on likelihood of successful implementation), 2) provide a rationale for their scores, 3) consider auditability of the standard, and 4) consider the most appropriate BMI cut-off for specific standards. Importance and feasibility scoring was on a 5-point scale (see table 2 below). Members had the option of not scoring if they felt they lacked sufficient knowledge in the specific area addressed by the standard.

Table 2. The 5-point scale used for scoring standards on importance and feasibility

Importance scale	Feasibility scale
1: Not at all important	1: Not at all feasible
2: Slightly important	2: Slightly feasible
3. Moderately important	3. Moderately feasible
4: Very important	4: Very feasible
5: Extremely important	5: Extremely feasible
X: Unable to score due to insufficient knowledge	X: Unable to score due to insufficient knowledge

Responses to the second iteration were analysed quantitatively to determine whether consensus had been reached. Consensus was defined as 80% of responses occurring within two adjacent scores (e.g. 80% scoring 4 or 5). If ≥80% of members scored a standard highly (4 or 5) for importance, and there were no outliers (scores of 1 or 2), the standard was automatically included. If ≥80% scored a standard poorly (1 or 2) for importance, and there were no outliers (scores of 4 or 5), the standard was automatically excluded. A minimum of five scores were required for each standard; standards without a minimum of five scores remained in the process, regardless of the distribution of scores.

3.3. Third iteration

The CSG was provided with bar charts showing the distribution of importance and feasibility scores from the second iteration, and anonymised comments made to support each importance score. Individual scores were fed back to those who had submitted them so that members were able to review their own scores in comparison to all responses.

For those standards that did not meet the inclusion or exclusion criteria after the first scoring round, members were requested to: 1) re-score each standard for importance and feasibility, 2) provide any comments that had not been made previously in order to support their scores, and 3) where relevant, re-select the appropriate BMI cut-off. During this round, members were also asked to suggest how each of the standards which had already met the inclusion criteria could be audited. Responses to the third iteration were analysed using the methodology described above and the distribution of scores and members' anonymised comments fed back to the group.

3.4. Agreement of standards

Twenty two CSG members representing all the disciplines in Table 1 attended a second meeting. Standards that had not yet met either the inclusion or exclusion criteria were reviewed at the meeting and consensus reached for each standard. CSG members were given the opportunity to suggest essential re-wording of the final agreed standards to maximise clarity. This feedback was reviewed by the project researcher and senior clinician at CMACE, who were responsible for final editing.

3.5. Levels of evidence

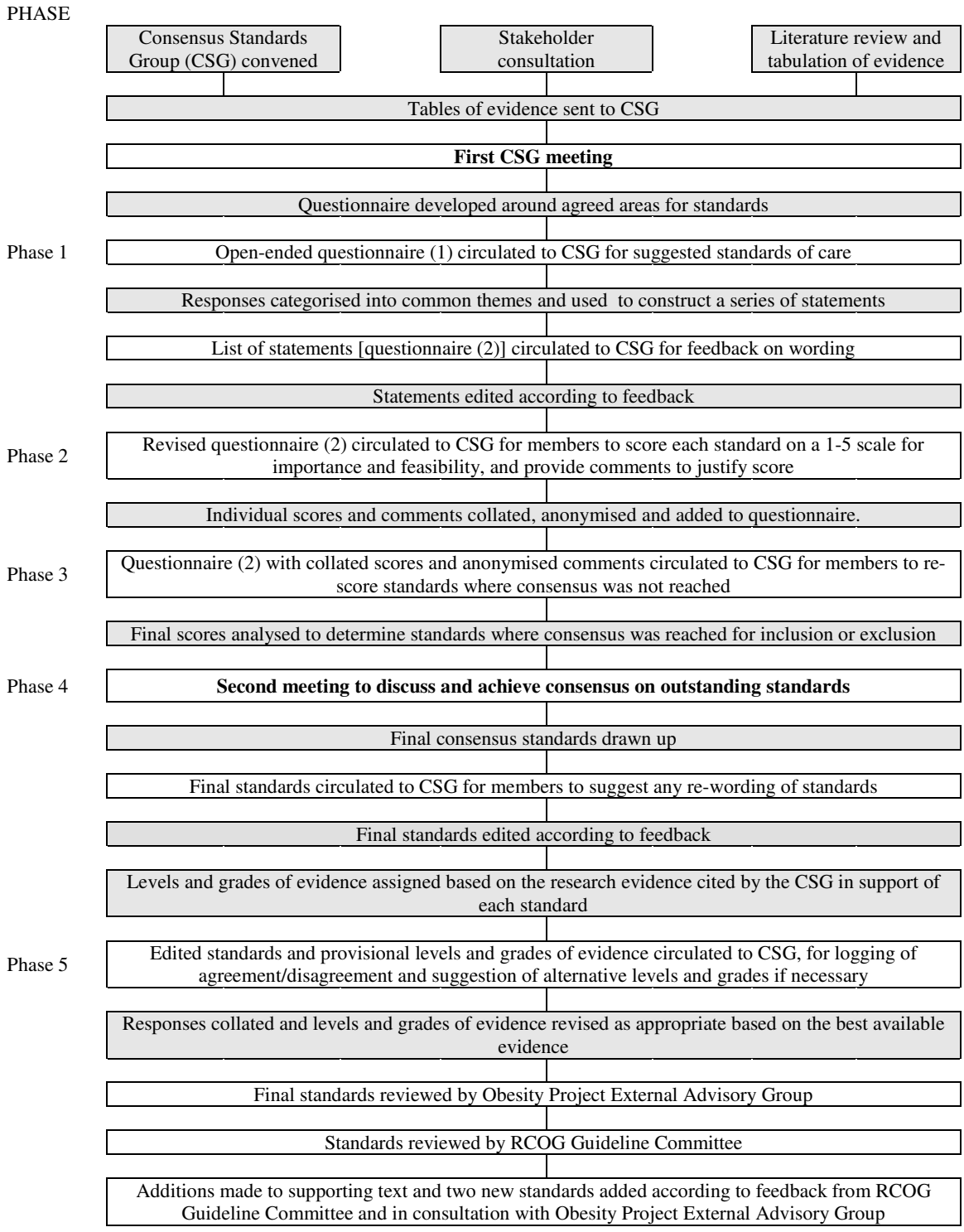
Levels of evidence were provisionally assigned to each standard based on supporting evidence cited by CSG members during the consensus process. The levels and grades of evidence were assigned according to the guidance for the development of RCOG Green-top Guidelines.[77] Since all standards were derived through a process of formal consensus, which corresponds to Evidence level 4, the lowest assigned grade of recommendation was D (refer to Appendix 2). CSG members reviewed the provisional levels and grades of evidence via an online questionnaire. Members logging any disagreement were prompted to recommend a revised level and/or grade of evidence, together with references supporting the revision(s).

All responses were reviewed by CMACE, and levels and grades of evidence were revised where relevant in light of any new supporting evidence. Any changes to the levels of evidence were reviewed and approved by the project's External Advisory Group.

3.6. Standards reviewed by RCOG Guideline Committee

The consensus standards developed by the CMACE Consensus Standards group were reviewed by the RCOG Guideline Committee. Revisions were made to the supporting text according to the committee's feedback and two additional standards relevant to women with obesity identified from existing guidelines. These standards have been footnoted in the text.

Figure 1. Process for developing the standards of maternity care for women with obesity: The modified Delphi Method



Members of the Consensus Standards Group by discipline

Discipline	Name	Organisation
Obstetrics (Chair)	Professor Ian Greer*	CEMACH /The Hull York Medical School
Anaesthesia	Dr Martin Dresner*	Leeds General Infirmary
Anaesthesia	Dr Anne McCrae	RCoA representative, Department of Anaesthesia, Critical Care and Pain Medicine, Royal Infirmary of Edinburgh
Dietetics	Fiona Taylor	Dietitians in Obesity Management (DOMUK)
Endocrinology	Dr Stephen Robinson*	Imperial College School of Medicine at St. Mary's Hospital, London
General Medicine (Obstetrics)	Dr Catherine Nelson-Piercy	RCP representative, St Thomas' Hospital, London
General Practice	Dr David Haslam	National Obesity Forum / Centre for Obesity Research at Luton & Dunstable Hospital
General Practice	Dr Victoria Tzortziou	RCGP representative
Lay representative	Alex Farrall*	Not applicable
Lay Representative	Stacey Grant*	Not applicable
Midwifery/Practice & Standards Development Advisor for RCM	Mervi Jokinen	RCM representative
Midwifery	Dr Jane Rogers*	Southampton University Hospitals Trust
Manual handling	Mary Muir	National Back Exchange
Neonatology	Dr Helen Budge*	Queens Medical Centre - Nottingham
Neonatology/Paediatrics	Dr Laura De Rooy	RCPCH representative, St Georges Hospital
Obstetrics	Professor Andrew Calder	Reproductive and Developmental Sciences, University of Edinburgh
Obstetrics	Dr Andrew Loughney	RCOG representative/ Royal Victoria Infirmary, Newcastle Upon Tyne
Obstetrics	Dr Daghni Rajasingam*	Guys and St. Thomas' NHS Trust, London
Obstetrics	Dr T G Teoh	St Mary's Hospital
Perinatal epidemiology	Dr Marian Knight*	National Perinatal Epidemiology Unit
Physiotherapy	Maria Jones	Central Manchester and Manchester Children's University Hospitals NHS Trust
Public Health	Dr Ruth Bell	FPH representative, Institute of Health and Society, Newcastle University, Medical School
Public Health	Dr Nicola Heslehurst*	Teesside University (Health and Social Care Institute)
Ultrasonography	Raj Dave	UCLH
Welsh representative/Midwifery	Karen Jewell	Cardiff and Vale Trust

*Consensus Standards Group and External Advisory Group member

APPENDIX 2: Levels and grades of evidence

Classification of evidence levels

Level	Evidence
1++	High-quality meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias
1-	Meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a high risk of bias
2++	High-quality systematic reviews of case–control or cohort studies or high quality case–control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well-conducted case–control or cohort studies with a low risk of confounding, bias or chance and a Moderate probability that the relationship is causal
2-	Case–control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal
3	Non-analytical studies; e.g. case reports, case series
4	Expert opinion/Formal consensus

Grades of evidence

Level	Evidence
A	At least one meta-analysis, systematic reviews or randomised controlled trial rated as 1++ and directly applicable to the target population; or A systematic review of randomised controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+
	Good practice point Recommended best practice based on the clinical experience of the guideline development group

APPENDIX 3: Maternal and fetal risks in women with a BMI ≥30 kg/m^2 compared to women with a healthy BMI

Risk	Study	Pop.	Odds ratio [95% Confidence interval]*
Gestational diabetes	NW Thames 1989 – 97 [1] Aberdeen 1976 – 2005 [2]	287213 24241	3.6 [3.3-4.0] [a] 2.4 [2.2-2.7]
Hypertensive disorders	NW Thames 1989 – 97 [1] Aberdeen 1976 – 2005 [2]	287213 24241	2.1[1.9-2.5] [a] 3.3 [2.7-3.9]
Venous thromboembolism	Denmark 1980 – 2001 [3]	71729	9.7 [3.1-30.8]
Slower labour progress 4 – 10cm	USA 1995 – 2002 [4]	612	7 versus 5.4 hrs p<0.001
Caesarean	Meta-analysis of 33 studies		2.1 [1.9-2.3]
Emergency caesarean	NW Thames 1989 – 97 [1] Cardiff 1990 – 99 [5]	287213 8350	1.8 [1.7-1.9] 2.0 [1.2-3.5]
Postpartum haemorrhage	NW Thames 1989 – 97 [1] Aberdeen 1976 – 2005 [2]	287213 24241	1.4 [1.2-1.6] [a] 2.3 [2.1-2.6]
Wound infection	NW Thames 1989 – 97 [1]	287213	2.24 [1.91-2.64] [a]
Birth defects	Australia [6]	11252	1.6 [1.0-2.5]
Prematurity	Aberdeen 1976 – 2005 [2] Australia 1998 – 2002 [6]	24241 11252	1.2 [1.1-1.4] 1.2 [0.8-1.7]
Macrosomia	NW Thames 1989 – 97 [1] Sweden 1992 – 2001 [7]	287213 805275	2.4 [2.2-2.5] [a] 3.1 [3.0-3.3] [b]
Shoulder dystocia	Sweden 1992-2001 [7] Cardiff 1990 – 99 [5]	805275 8350	3.14 [1.86-5.31] [b] 2.9 [1.4-5.8]
Admission to NNU	NW Thames 1989 – 97 [1] Cardiff 1990 – 99 [5]	287213 8350	1.3 [1.3-1.4] [a] 1.5 [1.1-2.3]
Stillbirth	Meta-analysis of 9 studies [8]		2.1 [1.5-2.7]
Neonatal death	Denmark 1989 – 96 [9]	24505	2.6 [1.2-5.8]

[a] 99% Confidence intervals
[b] OR for morbidly obese
* Unless otherwise stated

References for Appendix 3

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6. Callaway LK, Prins JB, Chang AM, McIntyre HD. The prevalence and impact of overweight and obesity in an Australian obstetric population. *Medical Journal of Australia* 2006;184(2):56-9.

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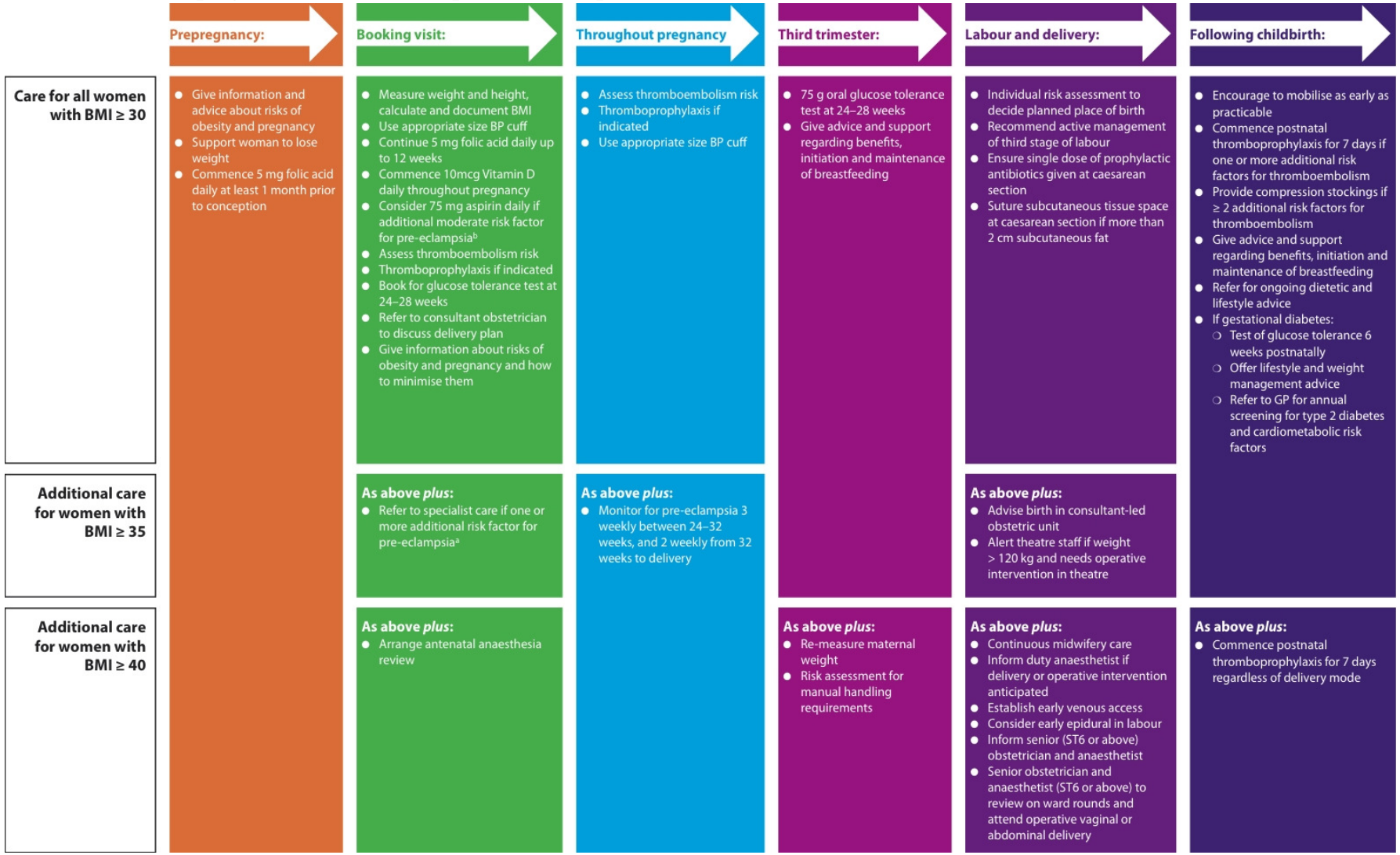
APPENDIX 4: Pre-pregnancy, antenatal and postnatal care pathway for women with obesity



[a]first pregnancy, previous pre-eclampsia, ≥10 years since last baby, ≥40 years, family history of pre-eclampsia, booking diastolic BP≥80mmHg, booking proteinuria ≥1+ on more than one occasion or ≥0.3g/24 hours, multiple pregnancy, and certain underlying medical conditions such as antiphosopholipid antibodies or pre-existing hypertension, renal disease or diabetes.

[b]first pregnancy, maternal age>40 years, family history of pre-eclampsia, multiple pregnancy