Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Obesity in pregnancy

Queensland Government

Document title:	Obesity in pregnancy
Publication date:	December 2015
Document number:	MN15.14-V5.R20
Document supplement:	The document supplement is integral to and should be read in conjunction with this guideline
Amendments:	Full version history is supplied in the document supplement
Amendment date:	Full review of original document published in 2010
Replaces document:	MN10.14-V4.R15
Author:	Queensland Clinical Guidelines
Audience:	Health professionals in Queensland public and private maternity and neonatal services
Review date:	December 2020
Endorsed by:	Queensland Clinical Guidelines Steering Committee Statewide Maternity and Neonatal Clinical Network (Queensland)
Contact:	Email: Guidelines@health.qld.gov.au URL: www.health.qld.gov.au/qcg

Disclaimer

These guidelines have been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach.

Information in this guideline is current at time of publication.

Queensland Health does not accept liability to any person for loss or damage incurred as a result of reliance upon the material contained in this guideline.

Clinical material offered in this guideline does not replace or remove clinical judgement or the professional care and duty necessary for each specific patient case.

Clinical care carried out in accordance with this guideline should be provided within the context of locally available resources and expertise.

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible to:

- Discuss care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes the use of interpreter services where necessary
- Advise consumers of their choice and ensure informed consent is obtained
- Provide care within scope of practice, meet all legislative requirements and maintain standards of professional conduct
- Apply standard precautions and additional precautions as necessary, when delivering care
- Document all care in accordance with mandatory and local requirements

Flow Chart: Obesity in pregnancy

Pre and inter-conception

- Analysis of BMI and waist circumference
- Risk counselling – increased risk of adverse maternal and fetal outcome
- Discuss benefits of inter-pregnancy weight loss – refer to dietitian, stabilise weight loss before conception
- Advise re lifestyle interventions – weight loss, activity, behaviour modification, smoking cessation
- Folic Acid 5 mg daily at least one month prior to conception

Antenatal

- Comprehensive history (including previous bariatric surgery)
- Document pre-pregnancy BMI
- Folic Acid 5 mg daily until 12 weeks
- Initial laboratory investigations (BMI >30 kg/m^2):
  - OGTT or HbA1c at entry to care
  - Baseline liver and renal function, transaminases
  - Urine protein creatinine ratio
- Develop care plan with woman that identifies strategies to reduce risk
- Referrals:
  - Dietetic services for nutritional advice
  - If BMI > 35 kg/m^2, obstetric consult
  - If BMI > 40 kg/m^2, anaesthetic consult
  - Other specialist referrals as indicated
- Counsel about:
  - Maternal and fetal risks of obesity
  - Implications for birthing, model of care, breastfeeding and transfer of care
  - Recommended weight gain during pregnancy
  - Physical activity
- Clinical assessments:
  - Document GWG at each visit
  - Risk of VTE
  - Surveillance for preeclampsia – consider low dose aspirin
  - If initial OGTT/HbA1c negative, repeat OGTT at 24–28 weeks
  - Fetal surveillance to identify/exclude fetal malformations, macrosomia, growth restriction
  - Awareness of psychosocial wellbeing

Labour and birth

- Team approach with frequent communication between care providers
- Obesity alone not an indication for IOL or CS
- Ensure bariatric equipment available intra and postpartum
- Early consultation with anaesthetist/operating theatre
- Early assessment of IV access
- If BMI > 35 kg/m^2 water immersion not recommended
- If BMI > 40 kg/m^2 recommend continuous fetal monitoring
- If CS, give higher dose prophylactic antibiotics
- Surveillance for increased risk of shoulder dystocia/PPH
- Active third stage management
- Consider need for blood products

Postpartum

- Surveillance for risk of airway compromise (particularly after narcotics, sedatives)
- Encourage early mobilisation
- Actively assess risk of VTE and requirement for thromboprophylaxis
- Increased surveillance for wound infection
- Additional support for breastfeeding
- Advice re: bed sharing/co-sleeping
- Counselling/referral for ongoing lifestyle interventions
- If GDM, repeat OGTT at 6–12 weeks

Principles of care

- Plan care in consultation with the woman
- Use clinical judgement to provide a safe service
- Determine local criteria for safe care provision
- Liaise/consult early with anaesthetist
- Use multidisciplinary case review
- Ensure necessary resources available (human and equipment)
- Audit care

BMI calculation (kg/m^2)

- Use pre-pregnancy weight to calculate BMI at entry to care
- As part of the overall assessment for safe birth:
  - Monitor GWG throughout pregnancy
  - Recalculate BMI at 36 weeks
- BMI impacted by ethnic variations

BMI classification (kg/m^2)

Underweight	< 18.5
Normal	18.5–24.9
Overweight	25.0– 29.9
Obese I	30.0–34.9
Obese II	35.0–39.9
Obese III	> 40
Extreme obesity	> 50

Gestational weight gain

Trimester 1	kg
All women	0.5-2.0
Trimester 2+3	**(kg/week)**
Underweight	0.45
Normal	0.45
Overweight	0.28
Obese	0.22
Total GWG	**kg**
Underweight	12.5–18
Normal	11.5–16
Overweight	7–11.5
Obese	5–9

BMI: body mass index, **CS:** caesarean section, **GDM:** gestational diabetes mellitus **GWG:** gestational weight gain, **IOL:** induction of labour, **OGTT:** oral glucose tolerance test, **PPH:** postpartum haemorrhage, **VTE:** venous thromboembolism, **>** greater than, **<** less than

Queensland Clinical Guideline:
Obesity in pregnancy Guideline No: MN15.14-V5-R20

Abbreviations

AOR	Adjusted odds ratio
BMI	Body mass index
CI	Confidence interval
CS	Caesarean section
CTG	Cardiotocograph
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
HbA1C	Haemoglobin A1c (also referred to as glycated haemoglobin)
IOL	Induction of labour
LGA	Large for gestational age
OGTT	Oral glucose tolerance test
OR	Odds ratio
PTB	Preterm birth
SGA	Small for gestational age
USS	Ultrasound scan
VBAC	Vaginal birth after caesarean section
VTE	Venous thromboembolism

Definition of terms

Bariatric equipment	Refers to equipment intended for use with larger women. No specific BMI is defined. May also be commonly referred to as large patient equipment
Multidisciplinary team	As is relevant to the circumstances a multidisciplinary health care team may include: midwives, obstetricians, physicians, sonographers, maternal fetal medicine specialists, anaesthetists, dietitians, physiotherapists, occupational therapists, psychologists, social workers, lactation consultants, general practitioners, and other allied health care professionals. Membership is determined within the context of locally available resources and expertise. Additional expertise is sought when and/as required and may utilise a variety of communication modes (e.g. telehealth)
Weight management[1]	Includes: • Assessing and monitoring body weight • Assisting someone to avoid becoming overweight (body mass index (BMI) 25–29.9 kg/m²) or obese (BMI greater than or equal to 30 kg/m²) • Helping someone to achieve and maintain a healthy weight before, during and after pregnancy by eating healthily, managing gestational weight gain and being physically active and gradually losing weight after pregnancy
Extreme obesity	Body mass index greater than or equal to 50 kg/m^2
Shared decision making	Shared decision making involves the integration of a woman's values, goals and concerns with the best available evidence about benefits, risks and uncertainties of treatment, in order to achieve appropriate health care decisions. It involves clinicians and patients making decisions about the woman's management together. In partnership with their clinician, patients are encouraged to consider available screening, treatment, or management options and the likely benefits and harms of each, to communicate their preferences, and help select the course of action that best fits these.[2]

Table of Contents

List of Tables

1 Introduction

Obesity is a significant health issue for women during pregnancy and the puerperium. It is well recognised that maternal obesity is associated with an increased risk of antenatal, peripartum and neonatal complications.[3,4] Obesity not only has direct implications for the health of the pregnancy but also impacts on the weight of the child in infancy and beyond.[5,6]

There is little high level evidence on best practice management of obesity (i.e. body mass index greater than 30 kg/m^2) in pregnancy and the puerperium from randomised trials. This guideline summarises current information and makes consensus recommendations.

1.1 Body mass index

Table 1. Body mass index

Aspect	Consideration
Context	• Body mass index (BMI) provides the most useful albeit crude population level measure of obesity and can be used to estimate the relative risk of disease in most people[7] • Other functional criteria of obesity may include: o Weight and girth exceeds or appears to exceed the identified safe working load/capacity of standard hospital equipment o Mobility is restricted due to size in terms of height or weight
BMI calculation	• BMI calculation: weight in kilograms divided by the square of the height in metres (kg/m^2) • Calculate BMI at entry to care o Use pre-pregnancy weight if known/available (self-reported or clinician measured) o If pre-pregnancy weight is unknown or unreliable, use first weight measurement of current pregnancy (including by primary care givers) • As part of the overall risk assessment for safe birth: o Monitor gestational weight gain (GWG) throughout pregnancy o Recalculate BMI at 36 weeks gestation as a practical aid to clinical decision making (note: there is no evidence related to BMI in late pregnancy and outcomes) • Refer to Section 4.3 Weight measurement
Ethnic variations	• Ethnic origin may impact on health risks associated with various BMI levels o Asian populations: health risks associated with obesity may occur at lower BMI[4] o Polynesian populations: health risks associated with obesity may occur at higher BMI[8]

1.2 Classification of obesity

The World Health Organisation (WHO) classifies obesity according to BMI[7] as outlined in Table 2. Classification of obesity. Additionally, in this document extreme obesity is used to denote a BMI greater than or equal to 50 kg/m^2.

Table 2. Classification of obesity

Classification	BMI (kg/m^2)
Underweight	Less than 18.5
Normal	18.5–24.9
Overweight	25–29.9
Obese I	30–34.9
Obese II	35–39.9
Obese III	Greater than or equal to 40

1.3 Incidence

Obese pregnant women are more likely to be of lower socioeconomic status, more likely to be single and to smoke.[9] A dose-response relationship has been found between pre-pregnancy BMI and lower diet quality.[10] Obesity is more prevalent in Indigenous women.[11] Refer to Table 3 for Queensland data by Indigenous status 2013.

Table 3. Mothers by BMI and Indigenous status in Queensland 2013

	Indigenous		Not Indigenous		Not Stated		Total	
BMI Category (kg/m^2)	No.	%	No.	%	No.	%	No.	%
Underweight (≤ 18)	278	7.4	2,053	3.5	-	-	2,331	3.7
Normal (19–24)	1,182	31.5	24,821	42.5	2	28.6	26,005	41.8
Overweight (25–29)	713	19.0	11,299	19.3	-	-	12,012	19.3
Obese class I (30–34)	478	12.8	5,389	9.2	1	14.3	5,868	9.4
Obese class II (35–39)	207	5.5	2,459	4.2	-	-	2,666	4.3
Obese class III (≥ 40)	123	3.3	1,644	2.8	-	-	1,767	2.8
Not Stated	766	20.4	10,750	18.4	4	57.1	11,520	18.5
Total	**3,747**	**100**	**58,415**	**100**	**7**	**100**	**62,169**	**100**

Source: Perinatal Data Collection, Department of Health (Extracted Jan 22, 2015)

1.4 Clinical standards

Table 4. Clinical standards

Aspect	Consideration
Principles of care	• Use the principles of shared decision making [refer to definition of terms] to plan and discuss care in consultation with the woman • Exercise clinical judgement to provide a safe service • Consider routine multidisciplinary case conference for obese women • Determine local criteria that will prompt individual case review (e.g. service and resource availability, comorbidities, BMI) • Incorporate into service delivery planning that at different times, there may be sufficient (or insufficient) local obstetric, medical and anaesthetic expertise to provide safe care • Establish processes to ensure early collaborative decision making by the anaesthetic and obstetric departments to determine the appropriate place for intrapartum care • Follow standard risk management practices for the care of bariatric women (e.g. manual handling, equipment safe working loads, risk assessment, transfer and movement procedures) • Use audit processes to monitor and review care provision and clinical outcomes of obese women
Anaesthetic consultation	• Identify and agree the referral pathway from antenatal clinic to anaesthetic pre-assessment • Identify local strategies to: o "Flag" the medical record of women with complex care needs (e.g. coexisting comorbidities, alerts related to previous anaesthetic, obstetric or neonatal history) following anaesthetic assessment o Notify the anaesthetic department of the admission of women in labour with a BMI greater than 40 kg/m^2
Resource capabilities	• Ensure necessary resources (human and equipment) are available to provide the level of care required—ask: o Is the appropriate equipment available? o Are the staff, who are sufficiently skilled to manage anaesthetising and operating on the woman (should it be required) available? • Refer to Appendix B: Resource considerations and as required Table 5. Referral and transfer

1.5 Referral and transfer

Table 5. Referral and transfer

Aspect	Consideration
Local decision making	• Transfer or referral to higher level facilities may be required for safe provision of care • Develop local protocols relevant to service capabilities, that identify considerations for transfer o Refer to Section 1.4 Clinical standards • Ideally, transfer decisions are made prior to the onset of labour • Involve all members of the multidisciplinary team and the family in the decision making process (including representatives from the facility to which the woman would be transferred if required)[12]
Transfer of care	• Consider the potential for transfer early in pregnancy and regularly review with the woman the considerations and decision points relevant to individual circumstances • When determining if transfer is indicated, consider: o Capability of the service o Resources available o Individual clinical circumstances and co morbidities of the woman [refer to Sections 2 and 4 and their subsections] o Risks associated with birthing away from family/community/country • Consider whether consultation with a higher level facility (as opposed to transfer) may be a safe option for care • When transfer of care is agreed, discuss with the receiving facility as soon as possible • Take into consideration restrictions on weight capacity of the various modes of transport • Refer to Appendix B: Resource considerations • If transfer declined, refer to Section 1.6 If care recommendations declined

1.6 If care recommendations declined

Table 6. If care recommendations declined

Aspect	Consideration
Assessment of risk	• Discuss risks, concerns and possible scenarios with the woman particularly with respect to the care that may not be immediately available should complications develop, for example (but not limited to): o Difficulties with establishing IV access or epidural if emergency CS or operative birth required o Limited availability of necessary equipment and/or skilled personnel if complications develop • Conduct an individual risk assessment and formulate a risk management plan in consultation with the woman
Documentation	• Where practical, involve the woman and her family with a documented acknowledgement of discussions • Make clear and detailed records of all conversations and plans in the health record

2 Risks associated with obesity in pregnancy

Pre-pregnancy BMI is a greater determinant of healthy outcomes for the woman and her newborn than gestational weight gain (GWG).[1] The higher the pre-pregnancy BMI the greater the associated risk.

Table 7. Risks of obesity in pregnancy

Period	Health risk
Preconception	• Infertility[13] • Pre diabetes (e.g. impaired fasting glucose or impaired glucose tolerance) • Type 2 Diabetes
Antenatal	• Antepartum stillbirth[14] • Miscarriage[1,15] • Maternal mortality[16] • Diabetes (Gestational diabetes mellitus and Diabetes in Pregnancy)[14] • Preeclampsia[14] • Obstructive sleep apnoea—may be related to adverse fetal outcomes[14] • Thromboembolic disease[14] • Cholecystitis[14] • Depression[4] • Difficulties with abdominal palpitation and obtaining adequate auscultation of fetal heart and cardiotocograph (CTG) • Suboptimal ultrasonography[5] • Diagnosis of congenital abnormality[17] • Preterm birth (PTB)—mostly associated with comorbidities[14,18] • Increased odds of dizygous twinning[19] • Small for gestational age (SGA)[20]
Anaesthetic	• Increased failure of epidural analgesia during labour[21,22] • Difficult intubations[23,24] • Increased risk of gastrooesophageal regurgitation[25]
Intrapartum	• Vaginal birth after caesarean section is less likely[14] • Induction of labour[14] • Failed induction of labour[14] • Caesarean section (CS)[14] • Operative and complicated vaginal birth[14] • Difficult surgical access[26] • Shoulder dystocia[14] • Obstructed labour[15] • Peripartum death
Postpartum	• Haemorrhage[14] • Chest, genital tract, wound and urinary infections[14] • Reduced rate of breastfeeding[14] • Postnatal depression[27] • Thromboembolic disease
Neonatal/ childhood	• Admission to neonatal intensive care units[14] • Macrosomia[14] • Congenital malformations[17] • Obesity[14] and metabolic syndrome[28] • Neurodevelopmental disorders (e.g. autism, developmental delays)[29] • Asthma[30]

2.1 Association between outcome and BMI

The frequency of adverse outcome increases with increasing BMI. The following table is based on analysis of 75,432 women birthing at Mater Mothers Hospital Brisbane1998–2009.[20]

Table 8. Association between outcome and BMI

Variable	BMI (kg/m^2) <18.5	18.5–<25	25–<30	30–<35	35–<40	≥40
Maternal outcome (%)						
Hypertension in pregnancy	1.1	1.7	3.3	5.1	7.0	9.6
GDM	1.0	1.2	2.1	3.4	5.5	6.9
Type 1 and 2 diabetes mellitus	0.2	0.5	0.3	1.7	2.8	4.1
Spontaneous vaginal birth	61	54.4	50.4	47.1	46.9	43.6
Assisted birth	13.3	12.9	10.0	8.4	5.9	4.9
CS	25.7	32.7	39.6	44.5	47.1	51.5
Neonatal outcomes (%)						
Perinatal death	0.5	0.7	1.0	1.1	1.5	1.8
Stillbirth	0.2	0.4	0.5	0.7	0.8	0.7
Neonatal death	0.3	0.3	0.5	0.5	0.7	1.1
Macrosomia	5.4	10.6	15.9	18.7	20.1	20.8
SGA	12.4	10.9	12.2	13.4	15.7	18.7
LGA	10.5	11.0	12.4	13.3	14.0	15.9
Preterm birth < 37 weeks	8.5	6.7	7.5	8.5	9.5	11.3
Respiratory distress syndrome	4.2	4.3	5.3	5.7	6.4	7.3
Mechanical ventilation	5.9	4.7	5.8	6.5	8.6	10.4
Jaundice	6.4	4.7	5.4	6.4	7.5	9.3
Hypoglycaemia	1.1	0.9	1.3	1.8	3.0	2.5

SGA = small for gestational age, LGA= large for gestational age, ≥ greater than or equal to, < less than,
Source: adapted from McIntyre HD, Gibbons KS, Flenady VJ, Callaway LK. Overweight and obesity in Australian mothers: epidemic or endemic? Med J Aust. 2012; 196(3):184-8.

2.1.1 Extreme obesity

Women with a BMI greater than 50 kg/m^2 are at increased risk of maternal and fetal adverse outcomes during the peripartum period when compared to class I and class II obese women.[31] Therefore, clinical surveillance and screening for potentially modifiable outcomes (e.g. LGA, SGA, GDM, and preeclampsia) is particularly important in this group of women.

Additionally, logistic issues become more pronounced with increasing BMI including availability of:

- Appropriate clinical expertise after hours
- Equipment with appropriate safe working load
- Ancillary staff to support patient care

3 Planning pregnancy

Encourage weight reduction programs including diet, physical activity and behaviour modification before attempting the first pregnancy and between subsequent pregnancies.[32]

Table 9. Pre and interconception counselling

Aspect	Consideration
Context	• Obesity is a modifiable risk factor ideally addressed preconception[6,26] and between pregnancies • Preconception obesity is associated with an increased rate of congenital defects and a range of pregnancy complications[31] • Pre-pregnancy obesity and excessive GWG are independent risk factors for fetal macrosomia in women with GDM[33] • Interconception weight loss can: o Reduce the risk of GDM in subsequent pregnancies[14] o Improve vaginal birth after caesarean section (VBAC) rates[34] • Routinely offer referral to dietitian services • Bariatric surgery prior to pregnancy may improve pregnancy outcomes [refer to Section 4.2 Previous bariatric surgery
Recommendation	• Encourage and support women of childbearing age to optimise their weight and BMI before conception through a balanced eating plan and participating in regular physical activity[4,35,36] • Obtain accurate height and weight measurement and BMI calculation • Provide preconception counselling about the potential pregnancy complications of obesity[15] • Encourage and support obese women to lose weight before beginning infertility treatment[15] • Recommend stabilising weight (for 2–3 months) prior to conception, (especially after bariatric surgery) to avoid impact of weight loss on the developing fetus • If previous GDM, screen for diabetes prior to the next pregnancy • Screen for hypertension and Type 2 diabetes

3.1 Supplements

Table 10. Supplements

Aspect	Consideration
Folate	• Folate supplementation (usually as Folic Acid) is known to prevent neural tube defects[17] • Obese women have lower serum concentrations of folate than non-obese women[37] • Recommend Folic Acid 5 mg daily, ideally commencing one month before conception and continuing until the end of the first trimester[37]
Vitamin D	• Prepregnancy BMI is inversely associated with serum Vitamin D concentrations among pregnant women[37], therefore obese women are at increased risk of Vitamin D deficiency • There is no conclusive evidence on the benefits of maternal vitamin D supplementation on pregnancy outcomes, however supplementation in women who are vitamin D deficient may be beneficial for long term maternal health[38]

4 Antenatal care

The management of obesity in pregnancy requires a multidisciplinary approach which may include access to a range of health care professionals. Assessment and care options will depend on the clinical circumstances, presence of comorbidities and the resources and services available at each facility. All routine antenatal care is indicated.

Table 11. Planning care

Aspect	Consideration
Care plan	• Consider an early booking visit to plan care (ideally as soon as pregnancy confirmed) • Discuss and develop a plan of care early in pregnancy with the woman in order to mitigate (where possible) antenatal, intrapartum and postnatal risks o Refer to Table 7. Risks of obesity in pregnancy • Identify the schedule of antenatal contacts/visits appropriate to the level of risk and/or presence of comorbidities o Consider increased frequency of antenatal visits in the third trimester due to the risk of preeclampsia and undetected growth restriction
Multidisciplinary referrals	• If BMI is greater than 35 kg/m^2 in the first trimester, recommend consultation with an obstetrician[39] • If BMI is greater than 40 kg/m^2, recommend anaesthetic consultation • Routinely offer obese women referral to: o A dietitian for nutritional support o Specialist lactation support/education (individual or group) • In the third trimester, consider an individual mobility assessment to identify equipment, workforce and procedural requirements for safe delivery of care • Consider the requirement for additional growth scans as clinical assessment can be unreliable in the obese woman • All other specialist referrals as clinically indicated
Documentation	• Discuss and document specific requirements regarding intended place of birth, and possible antenatal and intrapartum complications[37] • Include information on measured and documented body weight and BMI in referral letters and health records across reproductive health

4.1 Assessment

All routine antenatal assessments are indicated.

Table 12. Assessments

Aspect	Consideration
Review history	• Obtain a comprehensive medical, surgical, obstetric and social history • Consider cardiac evaluation with preexisting medical conditions especially smoking, Type 2 diabetes or hypertension • Assess clinical risk factors for preeclampsia: o Consider Aspirin 100 mg/day before 16 weeks gestation[40,41] o Use an appropriate sized cuff to estimate blood pressure (BP) and document the cuff size in the medical record o Refer to Queensland Clinical Guideline *Hypertensive disorders of pregnancy*[42]
Initial investigations	• Test for diabetes in pregnancy[43]: o Oral Glucose Tolerance Test (OGTT) or HbA1C at the initial antenatal visit or in the first trimester o If initial OGTT or HbA1C negative, repeat OGTT at 24–28 weeks o Refer to Queensland Clinical Guideline *Gestational diabetes mellitus*[43] • Establish baseline renal and liver function: o Assists in distinguishing chronic renal dysfunction secondary to maternal chronic hypertension and/or diabetes from pregnancy associated hypertensive disorders[26] o Repeat renal and liver function tests for clinical indications (e.g. hypertensive features) • Laboratory investigations—include: o Transaminases (for non-alcoholic steatohepatitis (NASH)) • Urine protein creatinine ratio
VTE prophylaxis	• BMI greater than 30 kg/m^2 is a known risk factor for venous thromboembolism (VTE): o Actively assess for clinical risk for VTE[44] o Refer to Queensland Clinical Guideline *Venous thromboembolism prophylaxis in pregnancy and the puerperium*[44]
Anaesthetic assessment	• Obese women are over represented in maternal deaths related to anaesthesia[16] • An antenatal anaesthetic consultation is recommended for women with a BMI greater than 40 kg/m^2 • The complexity of anaesthetic management increases with increasing BMI. Consider: o Potentially difficult intubation o Potentially difficult neuraxial techniques o Difficult intravenous access o Difficulties with noninvasive blood pressure monitoring o Appropriate postoperative monitoring o Access to ultrasound is required to facilitate neuraxial and vascular access • Develop an anaesthetic management plan and/or plan for birth in consultation with the treating obstetric team

4.2 Previous bariatric surgery

Bariatric surgical procedures can be classified as:

- Restrictive (e.g. gastric banding, sleeve gastrectomy),
- Malabsorptive (e.g. biliopancreatic diversion with or without duodenal switch)
- Combination of restrictive and malabsorptive (e.g. gastric bypass)

Restrictive procedures are generally less invasive and have less complications in pregnancy than malabsorptive or combination procedures.

Table 13. Previous bariatric surgery

Aspect	Consideration
Context	• Bariatric surgery is the only therapy with evidence of sustained weight loss for Class II and Class III obesity, although it has well recognised complications[45,46] • Ascertain the type of bariatric surgery and document in the clinical notes • A multidisciplinary health care approach is required
Pregnancy outcomes associated with previous bariatric surgery	• Reduced risk of: o Gestational diabetes mellitus [OR 0.25 95% CI0.13–0.47] [47] o Excessive fetal growth [OR 0.33, 95% CI 0.24–0.44] [47] o Preeclampsia [OR 0.45, 95% CI 0.25–0.80][48] • Increased risk of[47]: o SGA [OR 2.20 95% CI 1.64–2.95] • Evidence is unclear/inconclusive about[48]: o Effect on neonatal mortality (stillbirth and neonatal death)[47] o Premature rupture of membranes o CS
Clinical surveillance	• Intestinal obstruction as a complication of bariatric procedures may present as abdominal complaints (e.g. pain or distension/bloating), morning sickness, reflux or uterine contractions[49] • Early pregnancy nausea and vomiting may require partial or complete deflation of laparoscopic–adjustable gastric banding[6,14,50] • For women who have had malabsorptive procedures, the OGTT may contribute to dumping syndrome o Refer to *Queensland Clinical Guideline: Gestational diabetes mellitus*[43] for alternative tests • Bariatric surgery is not a contraindication to breastfeeding
Nutritional supplementation	• Nutritional deficiencies are common after malabsorptive bariatric surgery[51] • Consider evaluation of nutritional deficiencies and correction by appropriate supplements[50] • Encourage continuation of prescribed nutritional supplements • Refer to Appendix C: Nutrient requirements in pregnancy post bariatric surgery
Recommendation	• Routinely refer to a dietitian as part of the multidisciplinary health care approach • Recommend a routine fetal ultrasound scan (USS) at 28–32 weeks gestation to assess fetal growth • Seek expert advice and/or refer to a bariatric surgeon as required • Maintain a high index of suspicion[49] for complications of bariatric surgery as they may present as common pregnancy complaints

4.3 Weight measurement

Include assessment and management of GWG as part of routine antenatal care for all women[4]

Table 14. Weight measurement

Aspect	Consideration
Context	• Appropriate steady weight gain during pregnancy is important to optimise the health outcomes (short and long term) for the woman and her baby[4,36] o Steady weight gain helps avoid adverse effects on specific fetal organ systems during critical periods[36] o Overweight and obese women who have GWG within recommendations have less preeclampsia and emergency CS[52]
Initial assessment	• Calculate BMI at entry to care o Refer to Table 1. Body mass index • Utilise standard procedures for routine measurement to improve consistency of serial measurements[4]
Recommended GWG	• Refer to Table 15. Target weight gains for recommended GWG[4] • Teenagers, short women and racial and ethnic groups have the same GWG ranges as those recommended for the whole population[4] • Optimal GWG for twin pregnancy is uncertain. Institute of Medicine (IOM) recommend GWG[4]: o Normal: 16–24 kg o Overweight: 14–23 kg o Obese: 11–19 kg • Seek expert guidance if tailoring individual recommendations for GWG
Lower GWG	• Lower GWG during pregnancy can occur with adoption of a healthy lifestyle, although there is limited evidence about safety, particularly long term neonatal outcomes[53,54] • Lower GWG or weight loss may reflect inappropriate restriction of dietary intake and/or improved diet quality and is associated with: o Increased risks of PTB and SGA[52,54,55] o Decreased risks of LGA, gestational hypertension, preeclampsia[54] • Advising lower GWG so as to avoid facility BMI transfer thresholds is not recommended and requires further study before it can be supported
Weight monitoring	• Discuss with the woman and document in the health record the range of desirable total weight gain and rate of gain[4,56] • Weigh at each antenatal consultation[52] • Review the pattern and rate of gain relative to desired GWG[53] • Plot weight against gestation to assist identification of trends[4] o A Queensland Health weight tracker is available for free download[57]: • Document GWG in the health record(s) • Discuss with the woman how BMI informs clinical decision making (e.g. recommendation for anaesthetic consultation and continuous intrapartum fetal monitoring if BMI 40 kg/m^2 or more) o Each 3 kg of weight gain equates to an increase of approximately 1 unit of BMI (e.g. a pre-pregnancy BMI 39 kg/m^2 with 9 kg total GWG, increases BMI to 42.7 kg/m^2)

Table 15. Target weight gains

Pre-pregnancy BMI (kg/m^2)	Rate of gain 2nd and 3rd trimester (kg/week)*	Recommended total gain range (kg)
Less than 18.5	0.45	12.5–18
18.5 to 24.9	0.45	11.5–16
25.0 to 29.9	0.28	7–11.5
Greater than or equal to 30.0	0.22	5–9

* Calculations assume a 0.5–2 kg weight gain in the first trimester

4.4 Psychosocial support

Table 16. Psychosocial support

Aspect	Consideration
Information	• Provide women and their families with comprehensive information about obesity including: o Maternal and fetal risks o Implications for care provision o Nutritional and physical activity recommendations o The importance of breastfeeding for mother and baby
Healthy lifestyle	• Pregnancy is a significant life event when interventions to address obesity may be most effective[6] • Offer referral and support access to healthcare professionals who are: o Able to assist with the adoption of a healthy lifestyle o Experienced in the management of maternal obesity • Counsel about the benefit of modifiable lifestyle choices including smoking cessation
Weight stigma	• Overweight and obese women may experience discrimination and prejudice due to their body weight and appearance • Experiencing weight stigma has a negative effect on multiple domains of life including mental health (e.g. depression, anxiety, disordered eating, self-esteem, exercise avoidance)[58,59] • Healthcare provider beliefs and attitudes about obesity can impact interactions with obese women, the care they receive and their outcomes[60] • A positive therapeutic relationship and communication behaviours such as empathy, encouragement and rapport building, improve patient satisfaction and can support behaviour changes and adherence to care recommendations[61] • Minimise weight stigma by ensuring: o A non-judgmental, sensitive approach to care o Comfort, modesty and privacy are maintained with appropriately sized equipment and gowns o Measurement and discussion of body weight and weight gain occurs in private o Engage in self-reflection about perceptions and attitudes to obesity and the care of obese women
Childhood trauma	• Adults who report childhood trauma (physical, emotional sexual, general) are significantly more likely to be obese [OR 1.28, 95% CI 1.13–1.46] and there is a positive dose-response association[62] • Maintain an awareness that childhood trauma may be implicated in obesity and can impact on relationships, intimate examinations, breastfeeding and compliance with care
Psychosocial wellbeing	• Perform a psychosocial assessment and refer to services for support and/or counselling as required • Maintain an awareness that depression, is a is a well-known key determinant of weight gain and obesity[27]

4.5 Fetal surveillance

Table 17. Fetal surveillance

Aspect	Consideration
Context	• Maternal obesity can limit the accuracy and effectiveness of antenatal clinical and ultrasound examinations of the fetus and the estimation of fetal weight.[28] This: o Increases the likelihood of an undetected fetal structural abnormality on USS[56,63] o May lead to unrecognised growth restriction (which is associated with stillbirth[64]) • Prenatal diagnostic procedures such as chorionic villus sampling (CVS) or amniocentesis may be more difficult • Development of bariatric imaging pathways may minimise the risk of workplace injury to sonographers and improve diagnostic abilities • Transvaginal ultrasound assessment may improve visualisation of fetal structures
Recommendation	• Include BMI on all requests for USS • If BMI greater than 40 kg/m^2 o Routine Nuchal scan between 11 weeks 4 days and 13 weeks 6 days gestation o Ultrasound assessment between 14–16 weeks gestation to reduce the problem of impaired acoustic window and may allow for early morphological assessment of some structures o Morphology scan at 20–22 weeks gestation (slightly later than is routine for non-bariatric women at 19 weeks) as fetal structures are often larger in size ▪ Take into account the potential for delay of detection of structural anomalies and subsequent care requirements • Where clinical assessment is limited by obesity, growth scan at 28–32 weeks gestation to aid detection of late onset fetal growth restriction • Consider serial scans if there is a demonstrated growth issue

4.6 Nutrition

Table 18. Nutrition

Aspect	Consideration
Context	• There is evidence that dietary interventions can reduce excessive GWG and may improve selected outcomes[65,66] • There is increasing awareness of the importance of perinatal nutrition on the development of disease in adulthood and in relation to cognitive development and future bone mass in the fetus[36] • Australian Dietary Guidelines recommend: o Eat a wide variety of nutritious foods from the five food groups (vegetable, fruit, grain, lean meat, dairy) and to drink plenty of water o Limit intake of foods and drinks containing saturated fat, added salt, and added sugars o For women who are pregnant or breastfeeding, not drinking alcohol is the safest option
Recommendation	• Provide nutritional advice as per the Australian Dietary Guidelines[36] • Offer nutritional consultation[15] ideally with a dietitian • Advise not to restrict dietary intake below the recommended food group requirements for pregnancy[4,36] • Encourage adherence to target weight gains[56] • Consider cultural food practices/preferences when discussing nutrition • Advise to cease prescription and over the counter weight loss medications and preparations

4.7 Physical activity

Use clinical judgement when advising individual women as to the type, intensity, duration and frequency of physical activity.[67] A physiotherapy/exercise physiologist consultation may assist with assessment and individual physical activity prescription.

Table 19. Physical activity

Aspect	Consideration
Context	• Assess levels of current physical activity[68] o If minimal increase duration of moderate physical activity slowly • Physical activity can include aerobic exercise (such as walking, stationary cycle, swimming, aquatic activities, exercise machines, antenatal exercise classes) and light or moderate resistance exercises[68,69] and can be broken up into shorter time periods • Avoid activities that[68,70]: o Involve lying flat on the back o Increase the risk of falling or abdominal trauma (e.g. contact sports, most racquet sports, horseback riding, water skiing) o Are at extreme altitudes (e.g. scuba diving, mountain climbing) o Involve excessive stretching • Discuss modifications to the physical activity program as pregnancy progresses (particularly in the third trimester as the body's centre of gravity is altered)
Recommendation	• Recommend 30 minutes of physical activity on most days of the week[69] • Advise women that moderate physical activity is associated with a range of health benefits and is not associated with adverse outcomes[68,69] • Individually assess and discuss contraindications and indications to stop physical activity

4.7.1 Cautions for physical activity

Consider individual circumstances with advising about physical activity.

Table 20. Cautions for physical activity

Aspect	Consideration
Cautions	• Hemodynamically significant heart conditions • Restrictive lung conditions • Incompetent cervix/cerclage • Multiple gestation at risk for premature labour • Persistent second or third trimester bleeding • Placenta praevia after 26 weeks of gestation • Premature labour during the current pregnancy • Ruptured membranes • Preeclampsia • Intrauterine growth restriction
Advise to cease, and seek advice if:	• High heart rate • Dyspnoea prior to or during exertion • Dizziness, faintness, nausea • Headache • Decreased fetal movements • Uterine contractions, vaginal bleeding, amniotic fluid leakage • Back or pelvic pain • Chest pain • Muscle weakness • Calf pain or swelling or sudden swelling of ankles, hands and/or face

4.8 Timing and mode of birth

Table 21. Timing and mode of birth

Aspect	Consideration
Previous caesarean section	• VBAC is less likely for obese women • There are higher operative and anaesthetic risks[32,37] • Women with BMI greater than 40 kg/m^2 (obesity class III) have an increase in composite maternal morbidity and risk of neonatal injury compared to women in overweight or obese classes I and II[71] • Discuss risks in a manner that supports shared decision making • Anaesthetic consultation early in labour is recommended • Document the discussion and decision regarding mode of birth in the health record • Refer to the Queensland Clinical Guideline: *Vaginal birth after caesarean section*[72]
Induction of labour (IOL)	• There is a higher incidence of IOL among obese women compared to women of normal BMI[73], likely due to the increased: o Association with prolonged pregnancy [AOR:1.69 95%, CI 1.23–2.31][18] o Preexisting medical comorbidities and pregnancy related complications • Obese women have increased rates of failed IOL compared to women of normal BMI, which may be associated with their: o Increased failure to achieve active labour with prostaglandin alone[74] o Increased dose and duration of Oxytocin requirements[74] o Slower progress of labour and greater time to transition to active labour[75] • Refer to Queensland Clinical Guideline: *Induction of labour*[76]
Recommendation	• Involve the multidisciplinary team in discussions • Individualise decision making about mode and timing of birth based on assessment of potential risk factors for poor birth outcomes[77] [refer to Section 2 Risks associated with obesity in pregnancy] • In the absence of other obstetric or medical indications, obesity alone is not an indication for elective CS or IOL[37] however, a low threshold for IOL at term may be appropriate because of the increased risk of stillbirth

5 Intrapartum care

Individualise decision making based on assessment of potential risk factors for poor birth outcomes[77]

Table 22. Intrapartum care

Aspect	Consideration
Communication	• A multidisciplinary team approach that includes frequent communication between care providers is essential • Notify anaesthetic and theatre staff when a woman with a BMI greater than 35 kg/m^2 presents to birth suite in labour or for induction (or as recommended in anaesthetic preassessment review) • Ensure bariatric equipment is accessible in the intrapartum and postnatal period (for example bed, hoists, limb lifters, transfer equipment)
Anaesthetic considerations	• Labour and opioid analgesia delay gastric emptying, especially of food[78] • For women with a BMI greater than 40 kg/m^2, ensure: o Early notification of anaesthetic team o Early insertion of cannula for IV access o Early consideration of epidural analgesia where acceptable to the woman • Restriction of oral intake to clear high-calorie fluids during active labour, preferably isotonic drinks[78] • H_2-receptor antagonists oral every 6 hours for antacid prophylaxis in labour[78] • If anaesthesia is required for birth, give an H_2-receptor antagonist IV (if not already administered) to reduce the risk of aspiration at extubation[78]
Fetal monitoring	• Ultrasonography may be required to accurately determine fetal position • If greater than 40 kg/m^2 continuous intrapartum fetal monitoring is recommended[79] • If 30–40 kg/m^2 and pregnancy is otherwise uncomplicated, there is no specific requirement for continuous fetal monitoring • If a satisfactory recording cannot be obtained by external fetal monitoring, consider internal fetal monitoring • Refer to Queensland Clinical Guideline: *Intrapartum fetal surveillance*[80]
Maternal care	• Obese nulliparous and multiparous women have longer duration and slower progression of the latent phase of the first stage of labour than normal weight women but there is no difference in median time of labour progression after 6 cm dilation[35,81] • Increasing BMI is not associated with longer second stage[82] • Maintain an awareness of the increased risk of shoulder dystocia • Water immersion is not recommended if BMI is greater than 35 kg/m^2 o Refer to Queensland Clinical Guideline: *Normal Birth*[83]
Third stage	• Maintain an awareness of the increased risk of postpartum haemorrhage • Recommend active third stage management o Consider factors which may impact on the effectiveness of uterotonic drugs, including the site of administration and the length of the needle used • Consider the possible requirement for additional blood products[15] o Consider Blood Group and Hold • Refer to Queensland Clinical Guidelines: *Normal birth*[83] and *Primary postpartum haemorrhage*[84]

5.1 Caesarean section

Table 23. Caesarean section

Aspect	Considerations
Risks	• In the absence of other obstetric or medical indication, obesity alone is not an indication for elective CS • CS is frequently technically more difficult • Women with BMI greater than or equal to 30 kg/m^2 have an increased risk of wound infection[37] and excessive blood loss[15] following CS compared with healthy weight women • Consult with specialist postoperative wound care teams as required
Procedure	• CS on a woman with BMI greater than 40 kg/m^2 is complex surgery o Ensure sufficiently skilled, experienced and credentialed staff are available • Consider the requirement for procedures and devices to elevate the panniculus (e.g. Alexis Retractor, panniculus taping procedures) • Consider use of negative pressure dressings on closure[85] to reduce fluid collection in wound • For women who have more than 2 cm subcutaneous fat, suturing the subcutaneous tissue space reduces the risk of wound infection and wound separation[15,37]
Antibiotics	• Adjust routine preoperative antibiotic prophylaxis according to BMI[74,86] o Less than 30 kg/m^2 or (weight 80–120 kg) give Cefazolin 2 g IV o More than 30 kg/m^2 or (weight greater than 120 kg) give Cefazolin 3 g IV

6 Postpartum care

Table 24. Postpartum care

Aspect	Consideration
Clinical surveillance	• More frequent clinical observations may be required due to the increased risk of aspiration from airway compromise and/or obstructive sleep apnoea (particularly following narcotic and sedative medications) o Consider bed allocation that facilitates close clinical surveillance • Due to the increased risk of infection (chest, urinary, wound or breast) increase clinical surveillance for signs of infection including: o Regular wound care (abdominal and perineal) o Thorough assessment of elevated maternal temperature • Actively assess the requirement for postpartum thromboprophylaxis o Refer to Queensland Clinical Guideline *Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium*[44]
Rh immunoglobulin	• There is limited evidence that higher BMI is associated with lower serum peak levels of anti-D Ig following IM administration[87] • The Australian Red Cross Blood Service Consensus Statement recommends[88]: o No specific additional testing is required for women with a BMI greater than 30 kg/m^2 o Consider factors which may impact on the adequacy of the injection, including the site of administration and the length of the needle used
Mobilisation	• Encourage early mobilisation: o Review and update mobility assessment as required o Consider regular physiotherapy to encourage mobilisation, particularly following caesarean birth • Consider pressure area care requirements during periods of immobility
Bed sharing/co-sleeping	• The risk of sudden infant death associated with shared sleep surface environments is significantly increased by maternal obesity[89] • Provide information about safe shared sleeping and the danger of falling asleep while breastfeeding lying down (risk of smothering/overlaying)[90]

6.1 Breastfeeding

Table 25. Breastfeeding

Aspect	Consideration
Context	• Obese women are more likely to experience reduced initiation, duration and exclusivity of breastfeeding than normal weight women[91] • Contributing factors include mechanical, delayed onset of lactogenesis II, hormone imbalances, psychosocial factors (e.g. reduced confidence, body image concerns, childhood trauma) and mammary hypoplasia[91] • The effect of diet and exercise on lactation is inconclusive[92] but weight loss of approximately 0.5 kg per week during lactation has not been found to compromise the quality or quantity of breast milk or the health of the newborn[93] • The additional energy requirements of breastfeeding may help some women return to their pre-pregnancy weight[1] • There is growing evidence that breastfeeding has short and long term benefits for mothers with Type 2 and gestational diabetes mellitus o Refer to Queensland Clinical Guideline *Gestational diabetes mellitus*[43] • Breastfeeding is reported to have a small but consistent protective effect against obesity in children[94]
Recommendation	• Encourage and support breastfeeding • As appropriate: o Refer to a lactation consultant (antenatal and/or postpartum) o Provide early postpartum feeding support o Time discharge so as to allow for establishment of breastfeeding prior to discharge • Refer to or continue access to breastfeeding support services post discharge

6.2 Discharge

Table 26. Discharge

Aspect	Consideration
Discharge planning	• Apply usual discharge criteria in determining readiness for discharge • If hormonal methods of contraception are considered, conduct a risk assessment for venous thromboembolism • Refer for specialist follow up as required • Encourage women to continue with weight management postpartum
Information	• Provide information to women with GDM about the importance of OGTT screening at 6–12 weeks postpartum o Refer to Queensland Clinical Guideline *Gestational diabetes mellitus*[43] • Provide information about the benefits of inter-pregnancy weight loss • Assist with identification of community supports to achieve a healthy lifestyle (e.g. GP, postnatal depression support, weight management, physical activity, infant feeding support) • Women may be eligible for a referral from their GP to allied health support under the Team Care Arrangements

References

1. National Institute of Health and Clinical Excellence. Weight management before, during and after pregnancy. NICE public health guidance 27. 2010.

2. Australian Commission on Safety and Quality in Health Care. Shared decision making. 2014 [cited 2015 June 15]. Available from: http://www.safetyandquality.gov.au/our-work/shared-decision-making/.

3. Callaway L, Prins J, Chang A, McIntyre D. The prevalence and impact of overweight and obesity in an Australian obstetric population. MJA. 2006; 184(2):56-9.

4. IOM (Institute of Medicine) (US). Weight gain during pregnancy; reexamining the guidelines. Washington DC: The National Academy Press; 2009.

5. Catalano PM, Ehrenberg HM. The short- and long-term implications of maternal obesity on the mother and her offspring. BJOG: An International Journal of Obstetrics & Gynaecology. 2006; 113(10):1126-33.

6. Birdsall KM, Vyas S, Khazaezadeh N, Oteng-Ntim E. Maternal obesity: a review of interventions. International Journal of Clinical Practice. 2009; 63(3):494-507.

7. World Health Organization. Obesity: preventing and managing a global epidemic. WHO Tech Rep Ser. 2000; 894:1-4.

8. World Health Organization. The Asia-Pacific perspective: redefining obesity and its treatment. Health Communications Australia Pty Ltd; 2000.

9. Fyfe EM, Anderson NH, North RA, Chan EH, Taylor RS, Dekker GA, et al. Risk of first-stage and second-stage cesarean delivery by maternal body mass index among nulliparous women in labor at term. Obstetrics & Gynecology. 2011; 117(6):1315-22.

10. Laraia BA, Bodnar LM, Siega-Riz AM. Pregravid body mass index is negatively associated with diet quality during pregnancy. Public Health Nutr. 2007; 10(9):920-6.

11. Thrift A, Callaway L. The effect of obesity on pregnancy outcomes among Australian Indigenous and non-Indigenous women. MJA. 2014; 201:592-5.

12. Statewide Anaesthesia and Perioperative Care Clinical Network (SWAPNET). Anaesthesia: non-bariatric surgery in obese patients. Document Number # QH-GDL-395:2013. Department of Health [online]. 2013 [cited 2015 January 14]. Available from: http://www.health.qld.gov.au/qhpolicy/docs/gdl/qh-gdl-395.pdf.

13. Grodstein F, Goldman MB, Cramer DW. Body mass index and ovulatory infertility. Epidemiology. 1994; 5(2):247-50.

14. Rowlands I, Graves N, de Jersey S, McIntyre HD, Callaway L. Obesity in pregnancy: outcomes and economics. Seminars in Fetal and Neonatal Medicine. 2010; 15:94-99.

15. American College of Obstetricians and Gynecologists. ACOG committee opinion. Number 549, January 2013. Obesity in pregnancy. Obstetrics & Gynecology. 2013.

16. Lewis G, editor. The confidential enquiry into maternal and child health (CEMACH). Savings mothers' lives: reviewing maternal deaths to make motherhood safer -2003-2005. The seventh report on confidential enquiries into maternal deaths in the United Kingdom. London: CEMACH; 2007.

17. Stothard KJ, Tennant PW, Bell R, Rankin J. Maternal overweight and obesity and the risk of congenital anomalies: a systematic review and meta-analysis. JAMA. 2009; 301(6):636-50.

18. Kobayashi N, Lim BH. Induction of labour and intrapartum care in obese women. Best Pract Res Clin Obstet Gynaecol. 2015; 29(3):394-405.

19. Reddy UM, Branum AM, Klebanoff MA. Relationship of maternal body mass index and height to twinning. Obstetrics & Gynecology. 2005; 105(3):593-7.

20. McIntyre HD, Gibbons KS, Flenady VJ, Callaway LK. Overweight and obesity in Australian mothers: epidemic or endemic? Med J Aust. 2012; 196(3):184-8.

21. Bamgbade O, Khalaf W, Ajai O, Sharma R, Chidambaram V, Madhavan G. Obstetric anaesthesia outcome in obese and non-obese parturients undergoing caesarean delivery: an observational study. International Journal of Obstetric Anesthesia. 2009; 18(3):221-225.

22. Dresner M, Brocklesby J, Bamber J. Audit of the influence of body mass index on the performance of epidural analgesia in labour and the subsequent mode of delivery. BJOG: An International Journal of Obstetrics and Gynaecology. 2006; 113(10):1178-81.

23. Cook T, Woodall N, Frerk C. Major complications of airway management in the United Kingdom: 4th national audit project of the Royal College of Anaesthetists and the Difficult Airway Society. National Audit Project. 2011 [cited 2015 September 01]; 4. Available from: http://www.rcoa.ac.uk.

24. Quinn AC, Milne D, Columb M, Gorton H, Knight M. Failed tracheal intubation in obstetric anaesthesia: 2 yr national case–control study in the UK. British Journal of Anaesthesia. 2013; 110(1):74-80.

25. Eslick GD. Gastrointestinal symptoms and obesity: a meta-analysis. Obesity Reviews. 2012; 13(5):469-479.

26. Catalano PM. Management of obesity in pregnancy. Obstetrics & Gynecology. 2007; 109(2):Part 1, 419-433.

27. Australian Institute of Health and Welfare. Experience of perinatal depression: data from the 2010 Australian National Infant Feeding Survey. Canberra: AIHW; 2012.

28. Maxwell C, Glanc P. Imaging and obesity: a perspective during pregnancy. AJR Am J Roentgenol. 2011; 196(2):311-9.

29. Krakowiak P, Walker CK, Bremer AA, Baker AS, Ozonoff S, Hansen RL, et al. Maternal metabolic conditions and risk for autism and other neurodevelopmental disorders. Pediatrics. 2012; 129(5):e1121-8.

30. Harpsoe MC, Basit S, Bager P, Wohlfahrt J, Benn CS, Nohr EA, et al. Maternal obesity, gestational weight gain, and risk of asthma and atopic disease in offspring: a study within the Danish National Birth Cohort. J Allergy Clin Immunol. 2013; 131(4):1033-40.

31. Lutsiv O, Mah J, Beyene J, McDonald SD. The effects of morbid obesity on maternal and neonatal health outcomes: a systematic review and meta-analyses. Obes Rev. 2015.

32. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists. Management of obesity in pregnancy. College Statement C-Obs 49. 2013 [cited 2015 January 10]. Available from: www.ranzcog.edu.

33. Black MH, Sacks DA, Xiang AH, Lawrence JM. The relative contribution of prepregnancy overweight and obesity, gestational weight gain, and IADPSG-defined gestational diabetes mellitus to fetal overgrowth. Diabetes Care. 2013; 36(1):56-62.

34. Callegari LS, Sterling LA, Zelek ST, Hawes SE, Reed SD. Interpregnancy body mass index change and success of term vaginal birth after cesarean delivery. Am J Obstet Gynecol. 2014; 210(4):330 e1-7.

35. Arabin B, Stupin JH. Overweight and obesity before, during and after pregnancy: part 2: evidence-based risk factors and interventions. Geburtshilfe Frauenheilkd. 2014; 74(7):646-655.

36. National Health and Medical Research Council. Australian dietary guidelines. Canberra: National Health and Medical Research Council; 2013.

37. Centre for Maternal and Child Enquiries and the Royal College of Obstetricians and Gynaecologists. Management of women with obesity in pregnancy. 2010.

38. Australian Health Ministers' Advisory Council. Clinical practice guidelines: antenatal care – module II. Australian Government Department of Health, Canberra. 2014.

39. Australian College of Midwives. National midwifery guidelines for consultation and referral. 3rd ed; 2010.

40. Xu TT, Zhou F, Deng CY, Huang GQ, Li JK, Wang XD. Low-dose aspirin for preventing preeclampsia and its complications: a meta-analysis. J Clin Hypertens (Greenwich). 2015; 17(7):567-73.

41. Bartsch E, Park AL, Kingdom JC, Ray JG. Risk threshold for starting low dose aspirin in pregnancy to prevent preeclampsia: an opportunity at a low cost. PLoS One. 2015; 10(3):e0116296.

42. Queensland Clinical Guidelines. Hypertensive disorders of pregnancy. 2015 [cited 2015 June 10]. Available from: www.health.qld.gov.au/qcg.

43. Queensland Clinical Guidelines. Gestational diabetes mellitus. 2015 [cited 2015 June 10]. Available from: www.health.qld.gov.au/qcg.

44. Queensland Clinical Guidelines. Venous thromboembolism prophylaxis in pregnancy and the puerperium. 2014 [cited 2015 January 10]. Available from: www.health.qld.gov.au/qcg.

45. Sjostrom L, Narbro K, Sjostrom CD, Karason K, Larsson B, Wedel H, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. New England Journal of Medicine. 2007; 357(8):741-52.

46. Chang S-H, Stoll CR, Song J, Varela JE, Eagon CJ, Colditz GA. The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003-2012. JAMA Surg. 2014; 149(3):275-87.

47. Johansson K, Cnattingius S, Naslund I, Roos N, Trolle Lagerros Y, Granath F, et al. Outcomes of pregnancy after bariatric surgery. N Engl J Med. 2015; 372(9):814-24.

48. Galazis N, Docheva N, Simillis C, Nicolaides KH. Maternal and neonatal outcomes in women undergoing bariatric surgery: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol. 2014; 181:45-53.

49. Maggard M, Li Z, Yermilov I, Maglone M, Suttorp M, Carter J, et al. Bariatric surgery in women of reproductive age: special concerns for pregnancy. Evidence Report/Technology Assessment No 169. Rockville, MD: Agency for Healthcare Research and Quality; 2008.

50. Guelinckx I, Devlieger R, Vansant G. Reproductive outcome after bariatric surgery: a critical review. Human Reproduction Update. 2009; 15(2):189-201.

51. Jans G, Matthys C, Bogaerts A, Lannoo M, Verhaeghe J, Van der Schueren B, et al. Maternal micronutrient deficiencies and related adverse neonatal outcomes after bariatric surgery: a systematic review. Advances In Nutrition (Bethesda, Md.). 2015; 6(4):420-429.

52. Rasmussen KM, Abrams B, Bodnar LM, Butte NF, Catalano PM, Maria Siega-Riz A. Recommendations for weight gain during pregnancy in the context of the obesity epidemic. Obstetrics & Gynecology. 2010; 116(5):1191-5.

53. American College of Obstetricians and Gynecologists. ACOG committee opinion. Number 548, January 2013. Weight gain during pregnancy. 2013 [cited 2015 January 20]. Available from: www.acog.org.

54. Kapadia MZ, Park CK, Beyene J, Giglia L, Maxwell C, McDonald SD. Can we safely recommend gestational weight gain below the 2009 guidelines in obese women? A systematic review and meta-analysis. Obesity Reviews. 2015; 16(3):189-206.

55. Beyerlein A, Schiessl B, Lack N, von Kries R. Associations of gestational weight loss with birth-related outcome: a retrospective cohort study. BJOG: An International Journal of Obstetrics & Gynaecology. 2011; 118(1):55-61.

56. Ramachenderan J, Bradford J, McLean M. Maternal obesity and pregnancy complications; a review. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2008; 48:228-235.

57. Queensland Health. Pregnancy weight gain chart for BMI ≥ 25 kg/m^2. 2014 [cited 2015 September 20]. Available from: https://www.health.qld.gov.au/nutrition/resources/antenatal_wtoverwt.pdf

58. Hilbert A, Braehler E, Haeuser W, Zenger M. Weight bias internalization, core self-evaluation, and health in overweight and obese persons. Obesity (Silver Spring). 2014; 22(1):79-85.

59. Molyneaux E, Poston L, Ashurst-Williams S, Howard LM. Obesity and mental disorders during pregnancy and postpartum: a systematic review and meta-analysis. Obstetrics & Gynecology. 2014; 123(4):857-67.

60. Huizinga MM, Bleich SN, Beach MC, Clark JM, Cooper LA. Disparity in physician perception of patients' adherence to medications by obesity status. Obesity (Silver Spring). 2010; 18(10):1932-7.

61. Gudzune KA, Beach MC, Roter DL, Cooper LA. Physicians build less rapport with obese patients. Obesity (Silver Spring). 2013; 21(10):2146-52.

62. Hemmingsson E, Johansson K, Reynisdottir S. Effects of childhood abuse on adult obesity: a systematic review and meta-analysis. Obes Rev. 2014; 15(11):882-93.

63. Zozzaro-Smith P, Gray LM, Bacak SJ, Thornburg LL. Limitations of aneuploidy and anomaly detection in the obese patient. Journal of Clinical Medicine. 2014; 3:795-808.

64. Gardosi J, Madurasinghe V, Williams M, Malik A, Francis A. Maternal and fetal risk factors for stillbirth: population based study. BMJ. 2013; 346:f108.

65. Thangaratinam S, Rogozinska E, Jolly K, Glinkowski S, Roseboom T, Tomlinson JW, et al. Effects of interventions in pregnancy on maternal weight and obstetric outcomes: meta-analysis of randomised evidence. BMJ. 2012; 344:e2088.

66. Muktabhant B, Lawrie T, Lumbiganon P, Laopaiboon M. Diet or exercise, or both, for preventing excessive weight gain in pregnancy. Cochrane Database of Systematic Reviews 2015, Issue 6. Art. No.: CD007145. DOI: 10.1002/14651858.CD007145.pub3. 2015.

67. Royal College of Obstetricians and Gynaecologists. Exercise in pregnancy. Statement No. 4. 2006.

68. Colberg SR, Castorino K, Jovanovic L. Prescribing physical activity to prevent and manage gestational diabetes. World J Diabetes. 2013; 4(6):256-62.

69. Sports Medicine Australia. The benefits and risks of exercise during pregnancy. Position statement. [cited 2014 December 11]. Available from: www.sma.org.au.

70. US Department of Health Human and Services. 2008 Physical activity guidelines for Americans. 2008 [cited 2014 December 11]. Available from: www.health.gov/paguidelines.

71. Hibbard JU, Gilbert S, Landon MB, Hauth JC, Leveno KJ, Spong CY, et al. Trial of labor or repeat cesarean delivery in women with morbid obesity and previous cesarean delivery. Obstetrics & Gynecology. 2006; 108(1):125-33.

72. Queensland Clinical Guidelines. Vaginal birth after caesarean section. 2015 [cited 2015 June 10]. Available from: www.health.qld.gov.au/qcg.

73. Arrowsmith S, Wray S, Quenby S. Maternal obesity and labour complications following induction of labour in prolonged pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology. 2011; 118(5):578-88.

74. Pevzner L, Swank M, Krepel C, Wing DA, Chan K, Edmiston CE, Jr. Effects of maternal obesity on tissue concentrations of prophylactic cefazolin during cesarean delivery. Obstetrics & Gynecology. 2011; 117(4):877-82.

75. Gunatilake RP, Smrtka MP, Harris B, Kraus DM, Small MJ, Grotegut CA, et al. Predictors of failed trial of labor among women with an extremely obese body mass index. Am J Obstet Gynecol. 2013; 209:532e1.

76. Queensland Clinical Guidelines. Induction of labour. 2011 [cited 2015 July 10]. Available from: www.health.qld.gov.au/qcg.

77. Homer CS, Kurinczuk JJ, Spark P, Brocklehurst P, Knight M. Planned vaginal delivery or planned caesarean delivery in women with extreme obesity. BJOG: An International Journal of Obstetrics & Gynaecology. 2011; 118(4):480-7.

78. Mushambi MC, Kinsella SM, Popat M, Swales H, Ramaswamy KK, Winton AL, et al. Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics. Anaesthesia. 2015; 70(11):1286-306.

79. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists. Intrapartum fetal surveillance clinical guideline - third edition. 2014 [cited 2015 January 10]. Available from: www.ranzcog.edu.

80. Queensland Clinical Guidelines. Intrapartum fetal surveillance. 2015 [cited 2015 June 10]. Available from: www.health.qld.gov.au/qcg.

81. Norman SM, Tuuli MG, Odibo AO, Caughey AB, Roehl KA, Cahill AG. The effects of obesity on the first stage of labor. Obstetrics & Gynecology. 2012; 120(1):130-5.

82. Robinson BK, Mapp DC, Bloom SL, Rouse DJ, Spong CY, Varner MW, et al. Increasing maternal body mass index and characteristics of the second stage of labor. Obstetrics & Gynecology. 2011; 118(6):1309-13.

83. Queensland Clinical Guidelines. Normal birth. 2012 [cited 2015 January 10]. Available from: www.health.qld.gov.au/qcg.

84. Queensland Clinical Guidelines. Primary postpartum haemorrhage. 2012 [cited 2015 July 10]. Available from: www.health.qld.gov.au/qcg.

85. Chaboyer W, Anderson V, Webster J, Sneddon A, Thalib L, Gillespie BM. Negative pressure wound therapy on surgical site infections in women undergoing elective caesarean sections: a pilot RCT. Healthcare. 2014; 2:417-428.

86. Swank ML, Wing DA, Nicolau DP, McNulty JA. Increased 3-gram cefazolin dosing for cesarean delivery prophylaxis in obese women. Am J Obstet Gynecol. 2015; 213(3):415e1-415e8.

87. Qureshi H, Massey E, Kirwan D, Davies T, Robson S, White J, et al. BCSH guideline for the use of anti-D immunoglobulin for the prevention of haemolytic disease of the fetus and newborn. Transfusion Medicine 2014; 24:8-20.

88. Australian Red Cross and National Blood Authority. Expert panel consensus position statement regarding the use of Rh(D) Immunoglobulin in patients with a body mass index >30. 2015 [cited 2015 June 20]. Available from: http://transfusion.gooddogdesign.com/node/612.

89. Queensland Government. Safe infant sleeping policy. 2012. Available from: http://www.health.qld.gov.au/qhpolicy/docs/pol/qh-pol-362.pdf.

90. Queensland Courts: Office of the State Coroner. Inquest into the death of Bela Heidrich. 2011 [cited 2015 January 19]. Available from: http://www.courts.qld.gov.au/__data/assets/pdf_file/0007/95515/cif-heidrich-b-20110629.pdf.

91. Bever Babendure J, Reifsnider E, Mendias E, Moramarco MW, Davila YR. Reduced breastfeeding rates among obese mothers: a review of contributing factors, clinical considerations and future directions. Int Breastfeed J. 2015; 10:21.

92. Amorim AR, Linne YM, Lourenco PM. Diet or exercise, or both, for weight reduction in women after childbirth. Cochrane Database Syst Rev. 2007; (3):CD005627.

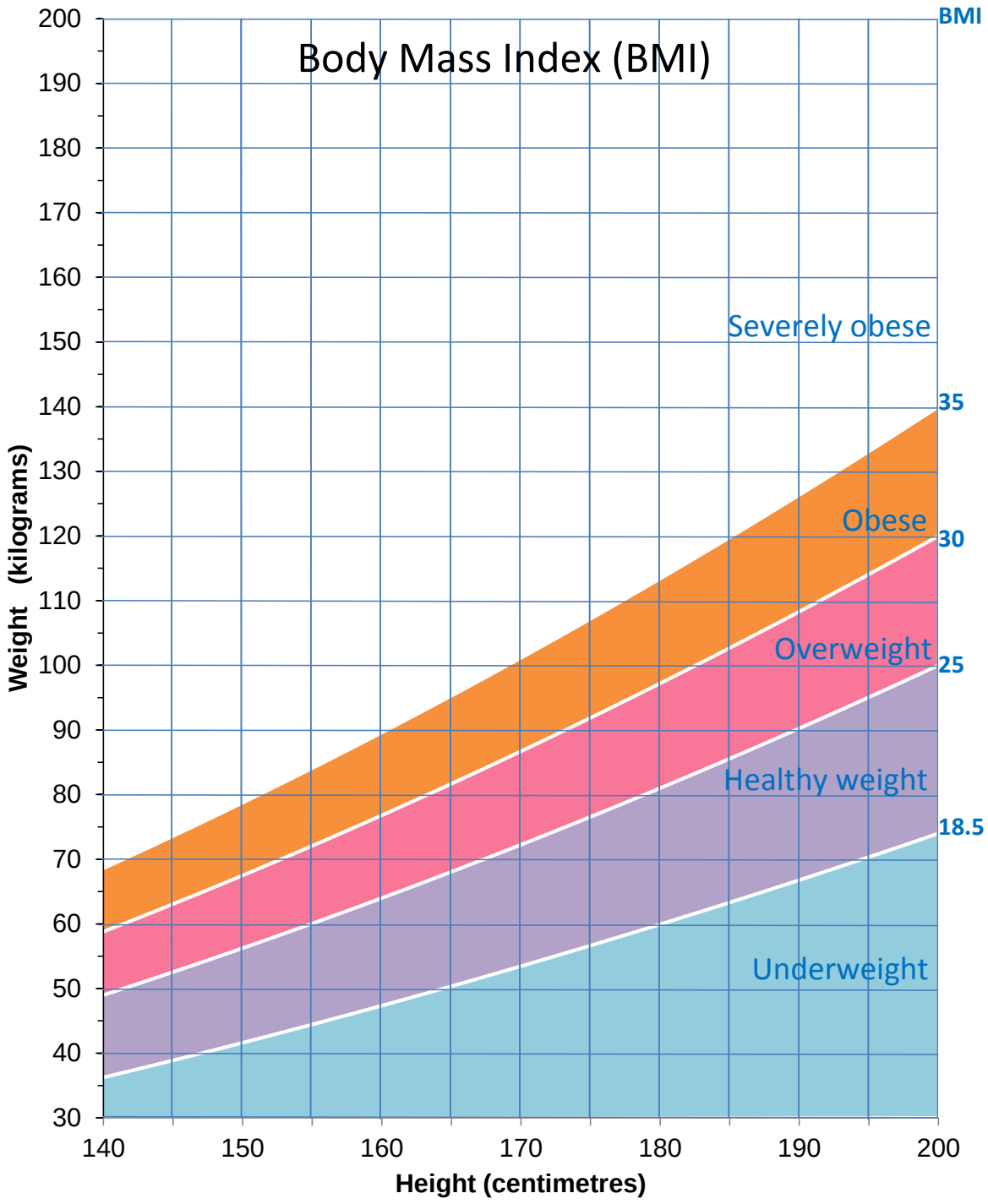
93. Lovelady CA, Garner KE, Moreno KL, Williams JP. The effect of weight loss in overweight, lactating women on the growth of their infants. N Engl J Med. 2000; 342(7):449-53.

94. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity: a systematic review. Int J Obes Relat Metab Disord. 2004; 28(10):1247-56.

95. Queensland Health Corporate Workplace Health & Safety Reform Unit. Large patient management plan and equipment database. [online]. 2007 [cited 2015 January 20]. Available from: http://qheps.health.qld.gov.au/safety/ergo/documents/ohws1583_bariatric07.pdf.

96. Willcox JC, Campbell KJ, van der Pligt P, Hoban E, Pidd D, Wilkinson S. Excess gestational weight gain: an exploration of midwives' views and practice. BMC Pregnancy Childbirth. 2012; 12:102.

Appendix A: BMI graph



Source: Queensland Clinical Guidelines

Appendix B: Resource considerations

Aspect	Consideration
Service capability	• Consider the physical and service delivery capabilities of the facility in determining appropriate care, referral or transfer of obese women, including (but not limited to): o Facility design (e.g. width of access doors and pathways, turning circles for bariatric equipment, availability of suitable accommodation) o Availability of bariatric equipment with appropriate safe working loads (SWL) and widths o Workforce capabilities (e.g. access to a range and number of appropriately skilled health care professionals) o Capability to manage the potential risks and complications of obesity • Develop a facility or Hospital and Health Service management plan that outlines the facility's response to the planned or unplanned admission of an obese woman[95] • Inform the community of limitations within the service regarding the care of obese women
Equipment	• Calibrated bariatric scales • Large blood pressure cuffs • Bariatric equipment that has sufficient SWL and appropriate size/width to accommodate patient girth is required (for example hoists, beds, shower chairs, lateral transfer devices, wheelchairs, bed-side chairs) • Maintain an inventory of bariatric equipment including equipment location, accessibility and contact person • Clearly label bariatric equipment with SWL • Develop standard operating procedures for the safe use, movement and storage of all bariatric equipment
Workforce	• Additional workforce may be required to care for obese women • Access to a range of allied health staff is recommended • Provide task specific training, including safe handling procedures and the use of bariatric equipment to all staff involved in the care of obese women • Consider work allocation and rotation of staff to minimise physical strain on the workforce • Support clinical staff to develop communication skills that enable positive and non-judgemental discussions about obesity and weight gain with pregnant women[1,96]

Transport weight restrictions for Retrieval Services Queensland

Mode of transport	Maximum weight (kg)	Comment
Road ambulance stretcher	160	
Fixed wing aircraft	160	Width of patient (hip to hip) not greater than 80 cm to allow entrance through aircraft door
Rotary Helo A139	180	No width restrictions through aircraft door
Rotary Helo Bell 412	250	No width restrictions through aircraft door
Bariatric ambulance	300	Only two in Queensland—both in Brisbane

Appendix C: Nutrient requirements in pregnancy post bariatric surgery

Surgery Type	Recommendation
Lap band	Pregnancy specific supplement usually suffices
Bypass or Gastric sleeve	In addition to pregnancy specific supplements: • 1-2 adult multivitamin plus mineral (each containing iron, folic acid and thiamine) supplements in chewable form • Calcium 600–1000 mg (citrate form) • B_{12} 1000 microgram oral/day • Vitamin D 1500 IU (or more, dependent on pathology and amount in Multivitamin) • Iron (dependent on pathology and amount in Multivitamin)

Underlined and bolded text in the table below indicates the appropriate amount to recommend/prescribe for each nutrient per day to pregnant women post bariatric surgery. May be derived from diet and/or supplements as indicated.

	Post-surgery requirements* (per day)	Recommended dietary intake in pregnancy# (per day)	Upper limit in pregnancy# (per day)	Comment
Iron	**45-60 mg**	27 mg	45-70 mg	Increased requirement due to decreased absorption (less gastric acid and bypass of sites).
B_{12}	**1000 mircrogram**	2.6 microgram	Not determined	Deficiency risk is high due to decreased gastric acid and less intrinsic factor (for Bypass and Gastric sleeve). Estimate that patients only absorb 1% from oral form.
Folate	400 microgram	**600-800 microgram**	1000 microgram (as Folic Acid)	Aim for 600 microgram/day from dietary sources. Additional 400-500 mg from supplemental form.
Vitamin D	**3000 IU**	2000 IU	Not determined	Titrate according to biochemistry.
Calcium	**1200-1500 mg**	1000–1300 mg	2500 mg	Decreased efficiency of absorption as less gastric acid and bypass of absorption sites (not in Lap Band). Derive from diet and as citrated supplement in divided doses not greater than 600 mg/dose. Avoid taking with iron sources.
Thiamine	**1-3 mg**	1.4 mg	Not determined	High risk of deficiency with frequent vomiting. Needs prompt treatment if suspected.
Iodine	N/A	**220 microgram**	1100 microgram	Supplement 150 microgram/day.
Vitamin A	Increased requirement in pregnancy, though high levels increase risk of teratogenicity. Unlikely increased risk of deficiency unless malabsorption occurs. Unless a good reason to suspect deficiency, prudent to avoid supplements with Retinol or Retinyl esters. Betacarotene or mixed carotenoids are safe.			
Vitamin E, K	May be compromised especially in Bypass surgery. More likely if fat malabsorption present. Monitor biochemistry			
Zinc, Copper	Increased requirement, important to ensure patients are meeting recommended daily intake.			

IU = international unit, mg = milligram

Adapted from a presentation by Fiona Sammut, Accredited Practising Dietitian, Queensland (2014)

* American Society for Metabolic & Bariatric Surgery (2013), *Clinical practice guidelines for the perioperative nutritional, metabolic and nonsurgical support of bariatric surgery patient*

Australian Government National Health and Medical Research Council (2006) *Nutrient reference values for Australia and New Zealand including recommended dietary intakes.*

Acknowledgements

Queensland Clinical Guidelines gratefully acknowledge the contribution of Queensland clinicians and other stakeholders who participated throughout the guideline development process particularly:

Working Party Co-Clinical Leads
Professor Leonie Callaway, Deputy Head, School of Medicine, The University of Queensland, Specialist in Obstetric and Internal Medicine, Royal Brisbane and Women's Hospital
Dr Victoria Eley, Obstetric Anaesthetist, Royal Brisbane and Women's Hospital
Dr Matthew Smith, Consultant Obstetrician and Gynaecologist, Royal Brisbane and Women's Hospital

QCG Program Officer
Ms Jacinta Lee, Manager Queensland Clinical Guidelines

Working Party Members
Mrs Anne Barnes, Midwife, Redland Hospital
Mrs Alison Barry, Midwife, Credentialled Diabetes Educator, Mater Health Service
Ms Jane Cairney, Assistant Director Nutrition and Dietetics, Townsville Hospital
Ms Sharon Chambers, Clinical Midwife, Diabetes Royal Brisbane and Women's Hospital
Dr Susan de Jersey, Senior Dietitian Nutritionist, Royal Brisbane and Women's Hospital
Mrs Di-Marie Dixon, Midwife, Gladstone Hospital
Dr Wendy Dutton, Director of Obstetrics and Gynaecology, Redland Hospital
Dr Hasthika Ellepola, Staff Specialist Obstetrics and Gynaecology, Logan Hospital
Ms Deborah Everding, Complex Case Manager, Royal Brisbane and Women's Hospital
Ms Tina Hamlyn, Team Leader Ultrasound, Redcliffe Hospital
Dr Chris Hegerty, Senior Medical Officer, Warwick Hospital
Associate Professor Rebecca Kimble, Clinical Director, Royal Brisbane and Women's Hospital
Dr Thomas McHattie, Clinical Director Obstetrics and Gynaecology, Bundaberg Base Hospital
Professor David McIntyre, Head of Academic Discipline of Medicine, The University of Queensland School of Medicine
Ms Debbie Mitchell, Clinical Facilitator, Emerald Hospital
Mrs Sumant Naidu, Sonographer Team Leader, Logan Hospital
Mrs Cristal Newman, Senior Dietitian, Roma Hospital
Dr Sophie Poulter, Clinical Director Obstetric Medicine, Nambour General Hospital
Ms Jenny Ramsay, Consumer Representative, Friends of the Birth Centre
Dr Thangeswaran Rudra, Senior Staff Specialist Obstetrics and Gynaecology, Hervey Bay Hospital
Mrs Latisha Ryder, Consumer Representative, Maternity Choices Australia
Dr Huda Safa, Staff Specialist Obstetrics and Gynaecology, Mater Health Services
Ms Heather Scanlan, Midwife, Cairns Base Hospital
Mrs Bernadette Sellwood, Senior Dietitian, Cairns Base Hospital
Ms Alecia Steines, Consumer Representative, Maternity Choices Australia
Dr Shelley Wilkinson, Senior Research Dietitian, Mater Health Service
Dr Rebecca Wright, Staff Specialist Obstetrics and Gynaecology, Cairns Base Hospital

Queensland Clinical Guidelines Team
Associate Professor Rebecca Kimble, Director
Ms Jacinta Lee, Manager
Ms Lyndel Gray, Clinical Nurse Consultant
Ms Stephanie Sutherns, Clinical Nurse Consultant
Dr Brent Knack, Program Officer
Steering Committee

Funding: This clinical guideline was funded by Queensland Health, Healthcare Innovation and Research Branch.