Queensland Health
Clinical Excellence Queensland

Queensland Clinical Guidelines

Translating evidence into best clinical practice

Clinical Guideline

Gestational Diabetes Mellitus (GDM)

Queensland Government

Document title:	Gestational Diabetes Mellitus (GDM)
Publication date:	July 2025
Document number:	MN25.33-V8-R30
Document supplement:	The document supplement details development processes and implementation activities, and is integral to and should be read in conjunction with this guideline
Amendments:	Full version history is supplied in the document supplement
Amendment date:	July 2025
Replaces document:	MN21.33-V7-R26
Author:	Queensland Clinical Guidelines
Audience:	Health professionals in Queensland public and private maternity and neonatal services
Review date:	July 2030
Endorsed by:	Queensland Clinical Guidelines Steering Committee Queensland Maternity and Neonatal Clinical Network
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Acknowledgement

The Department of Health respectfully acknowledges the Traditional Owners and Cultural Custodians of the lands, waters and seas across Queensland. We pay our respects to Elders past and present, while recognising the role of current and future leaders in shaping a better health system.

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The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances, may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making, including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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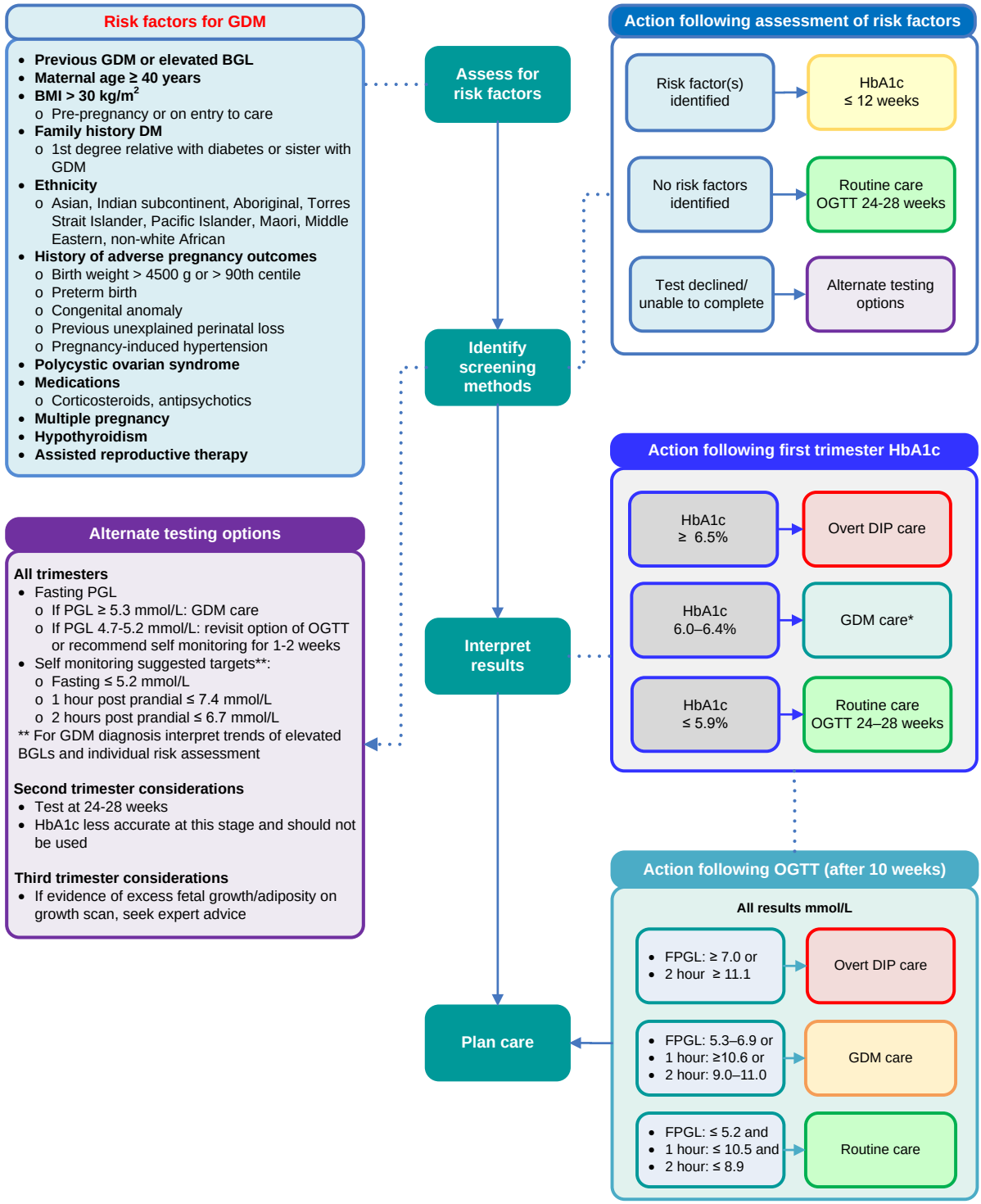
Recommended citation: Queensland Clinical Guidelines. Gestational Diabetes Mellitus (GDM). Guideline No. MN25.33-V8-R30. Queensland Health. 2025. Available from: http://www.health.qld.gov.au/qcg

Flowchart: Screening and diagnosis of GDM

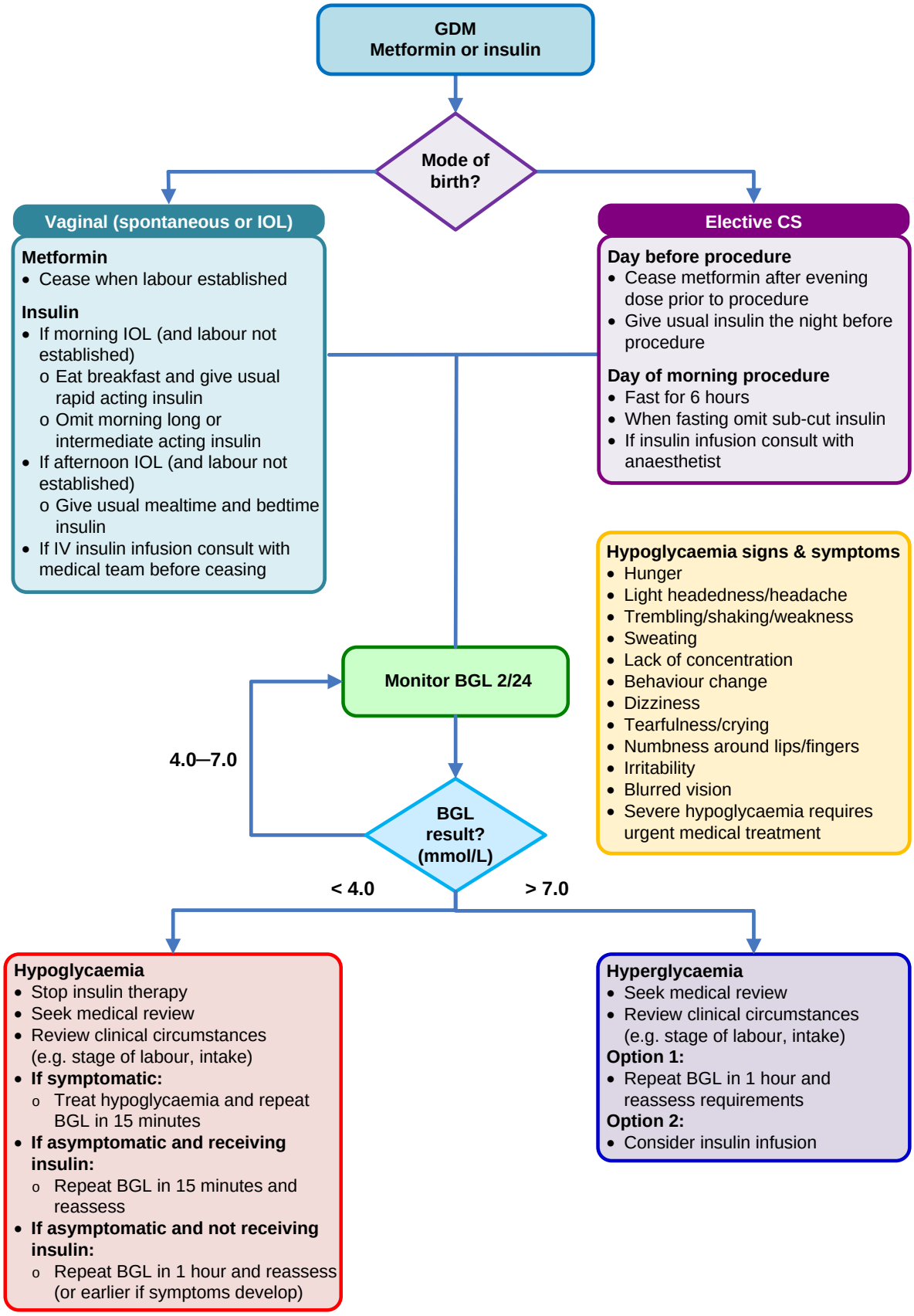


BGL: blood glucose level **BMI:** body mass index **DM:** diabetes mellitus **FPGL:** fasting plasma glucose level **GDM:** gestational diabetes mellitus **HbA1c:** glycated haemoglobin **OGTT:** oral glucose tolerance test **Overt DIP:** Overt diabetes in pregnancy **USS:** ultrasound **≥:** greater than or equal to **<:** less than **≤:** less than or equal to

*with option of confirmatory OGTT based on informed decision making

Queensland Clinical Guideline. *Gestational diabetes mellitus (GDM)*. Flowchart: F25.33-1-V10-R30

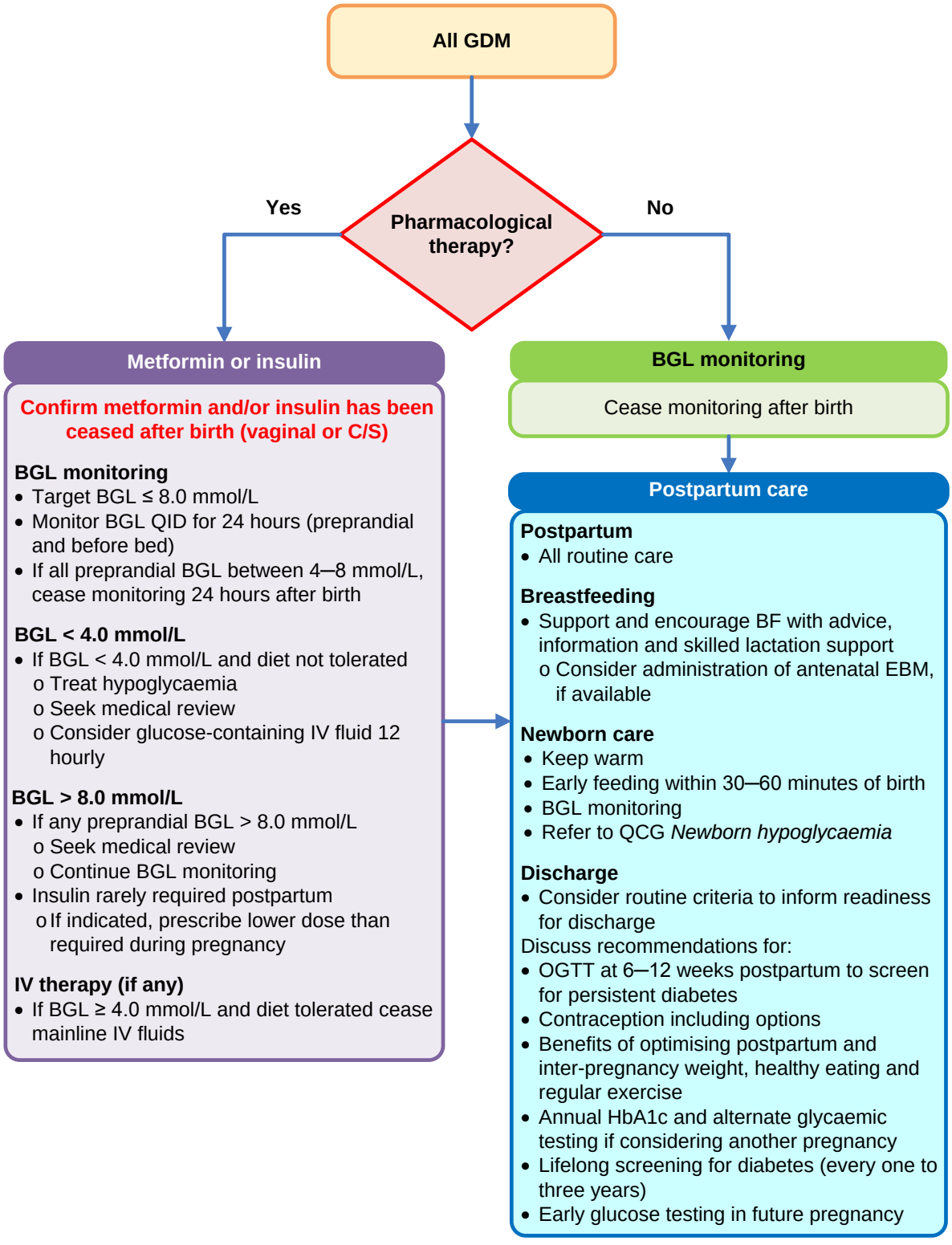
Flowchart: Intrapartum management of women with GDM requiring metformin and/or insulin



BGL: blood glucose level **CS:** caesarean section **GDM:** gestational diabetes mellitus **IOL:** induction of labour **IV:** intravenous **OGTT:** oral glucose tolerance test **sub cut:** subcutaneous **>:** greater than **<:** less than

Queensland Clinical Guideline. *Gestational diabetes mellitus (GDM)*. Flowchart: F25.33-2-V3-R30

Flowchart: Postpartum care of women with GDM



BGL: blood glucose level **BF:** breast feed **CS:** caesarean section **GDM:** gestational diabetes mellitus **IV:** intravenous **OGTT:** oral glucose tolerance test **QCG:** Queensland Clinical Guidelines **QID:** four times a day **sub cut:** subcutaneous **>:** greater than **≥:** greater than or equal **<** less than **≤:** less than or equal

Queensland Clinical Guideline. *Gestational diabetes mellitus (GDM)*. Flowchart: F25.33-3-V3-R30

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Abbreviations

AC	Abdominal circumference
ADIPS	Australasian Diabetes in Pregnancy Society
BGL	Blood glucose level(s)
BMI	Body mass index
CS	Caesarean section
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
HbA1c	Glycated haemoglobin
IFG	Impaired fasting glucose
IGT	Impaired glucose tolerance
IOL	Induction of labour
LGA	Large for gestational age
MNT	Medical nutrition therapy
NDSS	National Diabetes Services Scheme
OGTT	Oral glucose tolerance test–75 gram glucose load
Overt DIP	Overt diabetes in pregnancy
PGL	Plasma glucose level
SGA	Small for gestational age
USS	Ultrasound scan

Definitions

Antenatal contact	In this guideline the term *antenatal contact* includes all forms of interaction between the pregnant woman and health professionals for the purpose of providing antenatal care. For example, telephone consults or SMS messaging, email, home visits, scheduled hospital appointments, videoconference or telehealth discussions.
Dumping syndrome	Also known as postprandial syndrome[1]. Linked to post-bariatric surgery. See below.
Early gestational diabetes mellitus	GDM diagnosed before 20 weeks' gestation.
Impaired fasting glucose (IFG)	BGL is higher in the fasting state but not high enough to be classified as diabetes.[2] Included in the definition of 'pre-diabetes'.
Impaired glucose tolerance (IGT)	BGL is above normal but not high enough to be classified as diabetes[2] and applies only to women who are not pregnant. Included in the definition of 'pre-diabetes'.
Large for gestational age (LGA)	EFW[3] or birth weight[4] greater than or equal to 90th centile for gestational age
Macrosomia	Growth beyond an absolute birth weight regardless of gestational age, variably defined as greater than 4000–4500 g.[4]
Multidisciplinary team	May include midwife, nurse practitioner, endocrinologist, obstetric physician, physician, dietitian, obstetrician, credentialled diabetes educator, general practitioner (GP), GP obstetrician, paediatrician/neonatologist, lactation consultant, Indigenous health worker, exercise physiologist or other health professional as appropriate to the clinical circumstances.[5]
Postprandial syndrome	Occurs within 60 minutes of ingestion of food, usually rapidly absorbed carbohydrates resulting in dizziness, flushing and palpitations.[1] Is a side effect of bariatric surgery. Also called dumping syndrome.
Pre/postprandial	Before/after eating a meal.[6]
Pre-existing diabetes	Diabetes that is diagnosed prior to onset of pregnancy, such as type 1, type 2 or maturity onset diabetes of the young (MODY).[7]
Psychosocial services	Any services, organisation (government or non-government) or health discipline that provides counselling, support, mental wellbeing assessment, psychiatric care, peer support, or other psychological or psychosocial care.
Small for gestational age (SGA)	Birth weight below the 10th centile[8], not necessarily implying fetal growth restriction as baby may be constitutionally small.
Woman/women	QCG recognise that individuals have diverse gender identities. In QCG documents, although the terms *woman* and *women* are used, these guidelines are inclusive of people who are pregnant or give birth and who do not identify as female. Refer to Queensland Clinical Guideline: *Position Statement: Gender associated language.*[9]

1 Introduction

Gestational diabetes mellitus (GDM) is one of the most common medical complications of pregnancy.[10,11] It is defined as glucose intolerance that is first diagnosed or recognised during pregnancy, and which does not meet criteria for overt diabetes outside pregnancy. If glucose levels are consistent with a diagnosis of diabetes outside pregnancy, the term overt diabetes in pregnancy (overt DIP) is preferred.

Overt DIP can represent undiagnosed diabetes mellitus detected for the first time during pregnancy[12,13], however the diagnosis requires confirmation in the postpartum period. Although GDM usually resolves following birth, it may be associated with significant morbidity for the woman and baby in the perinatal period, and in the longer term.[14-16]

There is a lack of consensus on the best approach for diagnosis of early GDM. This guideline recommends HbA1c as a single test to screen for and diagnose early GDM in the first trimester (without the need for confirmatory OGTT). An alternate pathway of HbA1c followed by confirmatory OGTT between 10–14 weeks can be considered based on informed decision-making between the woman and health professional.

1.1 Diabetes classification

Table 1. Diabetes Classification

Classification	Description
GDM[10]	• Glucose intolerance with onset or first recognition during pregnancy • Elevated blood glucose levels less severe than overt diabetes • Refer to Table 11. Glucose level
***Overt DIP**[10]	• Hyperglycaemia first detected in pregnancy that meets criteria for diabetes outside of pregnancy • May indicate undiagnosed or pre-existing diabetes outside pregnancy, but a definitive diagnosis of non-gestational diabetes cannot be made until the postpartum period • Additional management (beyond that required for lower abnormal blood glucose level) may be required • Refer to Table 11. Glucose level
***Type 1 diabetes mellitus**[10]	• Relative or absolute insulin deficiency as a result of pancreatic β cell destruction leading to hyperglycaemia as glucose cannot enter body cells to be used for energy • Diagnosis is usually established outside of pregnancy (before or after) • Daily insulin via injection or a continuous subcutaneous insulin infusion (CSII) pump is required
***Type 2 diabetes mellitus**[12]	• Hyperglycaemia resulting from insulin resistance and/or insufficient production of insulin • Diagnosis is usually established outside of pregnancy (before or after) or may present as overt DIP (confirm diagnosis postpartum) • Lifestyle modification (diet and physical activity) is the cornerstone of management • Oral hypoglycaemic medication and/or insulin therapy usually required • Non-insulin injectables (e.g. GLP1 agonists) are to be ceased pre-conception however if they have continued, cease at pregnancy diagnosis, due to lack of safety data during pregnancy
***Pre-diabetes**[2,12]	• A condition diagnosed outside of pregnancy in which blood glucose levels are higher than normal but not high enough to be diagnostic of diabetes • Includes: o Impaired fasting glucose (IFG) and/or o Impaired glucose tolerance (IGT) • Associated with a higher risk of early onset GDM
***Maturity onset diabetes of the young (MODY)**	• A collection of different types of inherited forms of diabetes • Also called monogenic diabetes

*Management not discussed in this guideline

1.2 Prevalence

Table 2. Prevalence in Australia

Aspect	Consideration
GDM diagnosis	• Incidence tripled since 2000–2001 • Increase in rates may be associated with[17,18]: o Increase in average maternal age (with age group 45–49 years more than four times as likely compared with younger women) o Increase in body mass index (BMI) o Changing definitions of GDM o Changing ethnic diversity within Australian population • Increases with socioeconomic disadvantage[17,19]
Incidence[17]	• Australia 2021–2022: o 17.9% of birthing women o Increased prevalence among First Nations women compared with other Australian women (20.8% vs 17.8%) • Queensland 2021: o 15.3% of birthing women
Treatment[17]	• Australia 2020–2021: o 49% treated with nutrition and physical activity modifications o 47.4% treated with pharmacological therapy

1.3 Clinical standards

Table 3. Clinical standards

Aspect	Consideration
Standard care	• Refer to Queensland Clinical Guideline: *Standard care*[5] o Includes for example: privacy, consent, decision making, sensitive communication, medication administration, staff education and support, culturally appropriate care • Support clinical staff to develop communication skills that enable positive and non-judgemental discussions about obesity and weight gain[20]
Local protocols	• Develop locally agreed protocols to support management including: o Consultation mechanisms, or processes with higher clinical services capability framework (CSCF) levels including the use of telehealth o Standardised forms or communications that support care planning (e.g. peripartum insulin management plan) o Mechanisms for offering medical nutrition therapy, blood glucose monitoring and blood glucose lowering therapy[21]
Model of care	• Establish local models of care for women with GDM • A multidisciplinary team approach is recommended[22,23] • Increased breastfeeding rates reported in women with diabetes in pregnancy who receive consistent support[24]
Complex care	• Increased clinical surveillance from a multidisciplinary team if: o Pre-existing diabetes (type 1 or type 2) o Diagnosis of overt DIP o GDM requiring pharmacological therapy o GDM with other medical or pregnancy complications
Diabetes related products	• Support access to free or subsidised blood glucose meter and consumables programs (e.g. via NDSS or local agreements) • Advise to register (requires approved clinician support) with National Diabetes Services Scheme (NDSS) to access diabetes related products at subsidised cost[25] o Free registration for Medicare eligible women[25] o Aids accurate national data collection, and creates a recall system for women and their GP for postnatal glucose testing, and ongoing surveillance for type 2 diabetes • Some continuous glucose monitors (CGM) are approved by the Therapeutic Goods Administration (TGA) for GDM management[26] o No universally agreed targets for diagnosis and treatment of GDM o Not subsidised by NDSS for use in GDM management

2 Potential health implications

There is a clear relationship between increased plasma glucose levels (PGL) during pregnancy, and adverse maternal and fetal outcomes independent of other known factors.[14,27] Immediate and longer term complications may be minimised by adequate treatment.[15,28]

2.1 Maternal risks

Table 4. Maternal risks

Aspect	Consideration
Maternal shorter term risks	• Pre-eclampsia[3,14,15] • Hypertension in pregnancy • Polyhydramnios[29] • Induced labour[30] • Instrumental birth[3,16] • Shoulder dystocia[15] • Caesarean section[15] • Preterm birth[15] • Postpartum haemorrhage[29] • Infection[29], including urinary and vaginal tract infections[31] • Birth trauma
Maternal longer term risks	• Recurrent GDM in subsequent pregnancies • Onset of glucose intolerance including: o Increased risk of developing a disorder of glucose metabolism[32] (e.g. IFG, IGT or Type 2 diabetes) • Metabolic syndrome[30] • Cardiovascular disease[16,33] • Renal disease[33]

2.2 Fetal and neonatal risks

Table 5. Fetal/neonatal risks

Aspect	Consideration
Fetal/ neonatal shorter term risks	• Especially if severe maternal hyperglycaemia treated with insulin[34] o Prematurity[14,16] o Macrosomia[14,35] • Increased birth weight[14] and adiposity[36] • Cardiac anomalies (e.g. hypertrophic cardiomyopathy and consequent left ventricular outflow tract obstruction)[37] • Stillbirth (late) if persistently elevated glucose levels[38] • Birth trauma—risk increases as fetal growth accelerates and weight increases[14,35] o Bone fracture o Nerve palsy • Hypoglycaemia[14,16] • Respiratory distress syndrome[16] • Hyperbilirubinemia[14,35] • Hypocalcaemia[16] • Polycythaemia/hyperviscosity[39]
Neonatal longer term risks	• Increased risk for: o Impaired glucose tolerance[16,40] o Development of type 2 diabetes[16,40] o Overweight and obesity[11,32] childhood obesity/increased measures of adiposity 10–14yrs old • Insufficient evidence for whether management of diabetes in pregnancy reduces long term risks for the baby[41]

2.3 Early GDM

Early onset of GDM is associated with adverse pregnancy outcomes more comparable to women with type 2 diabetes than those diagnosed with GDM after 24 weeks.[42] Early detection of GDM provides the opportunity to intervene earlier and to have positive impacts on both maternal and neonatal outcomes.[43]

Table 6. Early GDM burden of disease

Aspect	Consideration
Maternal	• When compared with standard GDM (GDM diagnosed after 24 weeks gestational age), early GDM is associated with greater risk of: o Pregnancy-induced hypertension[44,45] o Postpartum haemorrhage[45] o Postpartum glucose abnormalities[45] o Caesarean section[44]
Neonatal	• When compared with standard GDM, early GDM is associated with greater risk of: o Prematurity[45,46] o Stillbirth[45,46] o LGA [44,45] o Neonatal admission and care[45] o Jaundice • Early detection and treatment may be linked with SGA[47]

3 GDM risk factors

Table 7. GDM risk factors

Aspect	Risk factors
Assessment	• It is not known if all risk factors are of equivalent predictive value[13] • Assess women early in pregnancy for risk factors associated with gestational diabetes[13]
Ethnicity[13]	• Asian • Indian subcontinental (India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, and the Maldives) • First Nations • Pacific Islander • Māori • Middle Eastern • Non-white African
Maternal history	• Previously elevated blood glucose level[8,13] or previous GDM[8] • Maternal age greater than or equal to 40 years • Obesity (BMI greater than 30 kg/m^2)[3] • Family history of diabetes mellitus (first degree relative with diabetes or sister with GDM)[8,15] • History of adverse pregnancy outcomes: o Previous LGA baby o Preterm birth o Congenital anomaly o Previous unexplained perinatal loss[3] o Pregnancy-induced hypertension • Polycystic ovarian syndrome (PCOS)[3] • Medications–corticosteroids[3,8], antipsychotics • Multiple pregnancy[48] • Hypothyroidism • Assisted reproductive therapy (ART)[49]

3.1 Risk reduction

Table 8. Risk reduction

Aspect	Consideration
Nutrition and physical activity interventions	• Discuss the benefits of achieving and maintaining healthy eating, regular physical activity and recommended gestational weight gain[15,21] • Advise women that structured nutrition and physical activity interventions before and during pregnancy may reduce the risk of GDM[50,51] o Commencement before the 15th week of pregnancy most effective
Probiotics	• No proven role in GDM prevention in pregnant women who are overweight or obese[52]
Vitamin D	• Limited evidence to link low Vitamin D levels with increased risk of GDM
Pre-eclampsia prophylaxis	• Early GDM and/or overt DIP is associated with higher risk of gestational hypertension and pre-eclampsia • Consider aspirin prophylaxis with greatest benefit if started before 16 weeks gestation • Refer to Queensland Clinical Guideline: *Hypertension and pregnancy*[53]

4 Diabetes diagnosis

HbA1c can be used to diagnose early GDM in first trimester.[46] An alternate option using HbA1c and follow up OGTT between 10–14 weeks can be considered based on informed decision making between the woman and health professional.

Factors that may influence decision making include:

- OGTT not tolerated in first trimester
- OGTT declined or unable to complete
- OGTT is not practical due to clinical, geographical or logistical circumstances
- History of bariatric surgery[54]
- Pathophysiology changes such as iron deficiency anaemia and haemoglobinopathies
- Woman's preference

4.1 Universal screening

Table 9. Screening for GDM

Aspect	Consideration
No risk factor(s)	• Recommend an OGTT at 24–28 weeks gestational age[13,55]
With risk factor(s)	• Recommend HbA1c with first antenatal bloods[13,55] o 6.5% or more: diagnostic of overt DIP o 6.0–6.4%: following discussion and informed decision making: ▪ Diagnosis and treatment of GDM **or** ▪ Early OGTT (prior to 20 weeks and ideally between 10–14 weeks) o 5.9% or less: recommend routine OGTT at 24–28 weeks • If no first trimester HbA1c result, recommend OGTT prior to 20 weeks
Preparation advice for OGTT	• Maintain normal diet • Fast for 8–12 hours before the OGTT • Drink small amounts of water during fasting to prevent dehydration • Continue any usual medications, with the exception as below • Do not smoke during fasting period • Follow local laboratory recommendations
Maternal medications	• OGTT not recommended if steroids given within one week preceding (betamethasone/dexamethasone/prednisolone) o If unable to delay testing or cease steroid use, discuss alternative options or interpretation (e.g. BGL monitoring) • Metformin (e.g. for polycystic ovarian syndrome) affects OGTT results o Consider withholding for 3–5 days prior to OGTT (due to long elimination half life[56]) o Seek expert advice regarding interpretation of HbA1c or alternate testing results
If bariatric surgery	• Following any form of bariatric surgery OGTT may result in[3]: o Inaccurate results due to altered gastric emptying[1] o Severe post testing hypoglycaemia[1,57] o Vomiting or postprandial syndrome • Some laboratories may decline to process an OGTT for women who have had bariatric surgery • Consider alternate testing options o Refer to Table 11. Diagnostic tests • Refer to Queensland Clinical Guideline: *Obesity and pregnancy (including post bariatric surgery)*[58]

4.2 If OGTT declined or not tolerated

Table 10: OGTT declined or not tolerated

Aspect	Consideration
Risk and benefit	• Advise women that OGTT is the preferred diagnostic test for pregnant women without risk factors for diagnosis of GDM o HbA1c can be used for early GDM diagnosis in the first trimester • After 14 weeks gestation, offer alternative options in individual circumstances as part of informed decision making that includes discussion of risks and benefits (e.g. potential for missed diagnosis of GDM, missed opportunity for identification of future risk[59]) • Refer to Table 11. Diagnostic tests
Implications for access to care	• Women without a diagnosis of GDM: o Can not access subsidised testing equipment o Cost of equipment may impede their ability to test • If undiagnosed, GDM may increase potential costs due to: o Increased hospital admissions and length of stay o Neonatal unit admission o Maternal and neonatal morbidity and mortality • Consider option of loan or subsidised equipment for pre-diagnosis testing

4.3 Diagnostic tests

Table 11. Diagnostic tests

Aspect	Consideration
Context	• Use a single set of diagnostic criteria for GDM and overt DIP • Refer to Table 13. Glucose level for diagnosis
OGTT	• Main value is to identify women with any degree of hyperglycaemia[55] • Suitable for use at any time in pregnancy, ideally after 10 weeks gestation
HbA1c	• HbA1c is less sensitive than OGTT in diagnosing GDM • Levels can be impacted by: o Physiological increases in red blood cell turnover during pregnancy, causing HbA1c levels to fall[12] o Known haemoglobinopathy which can affect the accuracy of HbA1c due to decreased erythrocyte survival[60] o Iron deficiency, leading to falsely elevated HbA1c • For MBS eligibility document “at high risk of diabetes” on pathology request form o Eligible for one MBS rebate per twelve month period • Refer to Appendix A: Conversion table for HbA1c measurement • Refer to Appendix E: Interpretation of results
Plasma glucose	• Blood collected via venepuncture and formally tested in a laboratory • Fasting PGL (8–12 hours after eating) is used as it is less influenced by time and recent food intake[61] • Can help to stratify the risk of hyperglycaemia related complications • Quasi experimental and epidemiologic studies suggest women with fasting PGL less than 4.7 mmol/L have[62,63]: o A low absolute risk of hyperglycaemia related complications o Similar perinatal outcomes to women who do not have GDM
Blood glucose	• Capillary blood collected via lancet and tested on a glucometer • Variables associated with accuracy[64]: o Haematocrit o Hypotension o Equipment/operator error • There is no established evidence to guide duration of monitoring or glucose thresholds

4.4 Alternate testing options

Table 12: Alternate testing options

Aspect		Consideration
All trimesters	**Fasting laboratory PGL**	• Greater than or equal to 5.3 mmol/L is diagnostic of GDM • 4.7–5.2 mmol/L, recommend self-monitoring for one to two weeks to obtain further information or consider OGTT
	Self-monitoring	• No definitive evidence to support criteria for GDM diagnosis in the absence of formal diagnostic testing o Diagnostic levels from BGL self-monitoring differ to diagnostic levels from OGTT • Suggested approach: If trend is persistently elevated, consider GDM equivalent: o Fasting greater than 5.2 mmol/L o One hour post prandial greater than 7.4 mmol/L o Two hour post prandial greater than 6.7 mmol/L • Interpret in context of an individualised risk assessment
Second trimester		• Test at 24–28 weeks • HbA1c is less accurate at this stage of pregnancy and is not used for diagnosis
Third trimester		• If evidence of excess fetal growth/adiposity on growth scan, seek expert advice[1] • Refer to Table 15. Fetal surveillance

4.5 Diagnostic results

Worldwide (including Australia), HbA1c measurement and reporting has been standardised using Systeme International (SI) units. Refer to Appendix A: Conversion table for HbA1c measurement

Table 13. Glucose level for diagnosis

Diagnosis	Test	Test result
GDM	**2 hr 75 g OGTT**	Plasma glucose level **(one or more)**
	Fasting[65]	5.3–6.9 mmol/L
	1 hour[65]	Greater than or equal to 10.6 mmol/L
	2 hour[65]	9.0–11.0 mmol/L
	HbA1c[46]	First trimester: 6.0–6.4% Second/third trimester: Not used
Overt DIP[10,13,55,65]	**2 hr 75 g OGTT**	Plasma glucose level **(one or more)**
	Fasting	Greater than or equal to 7.0 mmol/L
	1 hour	*A one hour level is not used*
	2 hour	Greater than or equal to 11.1 mmol/L
	Random BGL	Greater than or equal to 11.1 mmol/L Confirm with additional standardised testing
	HbA1c	Greater than or equal to 6.5% at any time in pregnancy

5 Antenatal care

Table 14. Antenatal care

Aspect	Consideration
Aims	• Effectively manage hyperglycaemia • Monitor for maternal complications • Prevent fetal/neonatal complications
Antenatal contact	• Individualise antenatal contact schedule to clinical circumstances[22,66] • If BGL are suboptimal or there are complicating factors (e.g. hypertension, macrosomia) more frequent antenatal contact is required
At GDM diagnosis	• Review history (e.g. previous GDM, medications) • Provide psychosocial assessment and support–refer as required • Commence BGL self-monitoring and discuss targets • First line therapy consists of dietary and physical activity modification[8,28]: o Discuss nutrition, physical activity and smoking cessation (if applicable) • Review pre-pregnancy BMI[27,67] and discuss individualised weight gain recommendations in pregnancy[68]
Initial clinical assessment	• Develop an individualised plan of care with the woman[22] • Recommend ultrasound scan (USS) at 28+0–30+6 weeks gestation[22] to assess fetal growth including fetal abdominal circumference (AC), and to establish a baseline for future evaluation • Order laboratory evaluation of serum creatinine
Referrals	• Refer for diabetes educator and dietitian consult within one week of diagnosis • Psychosocial supports and referrals, as required • Provide request forms for USS and laboratory investigations including serum creatinine at 28+0–30+6 weeks gestation • If BMI greater than 30 kg/m^2 consider anaesthetist review o Refer to Queensland Clinical Guideline: *Obesity and pregnancy (including post bariatric surgery)*[58]
Timing of antenatal care/follow up	• If pharmacological therapy commenced regular contact is recommended • Review timing of next contact (at clinic, by phone, telehealth or email/other electronic means) at each appointment • Suggested review frequency: o Weekly contact and review of BGL such as via electronic means o Fortnightly visits until 36+0 weeks gestation then weekly until birth o Individualise care and increase as indicated

5.1 Maternal care

Table 15. Maternal care

Aspect	Consideration
Increased surveillance	• Women with GDM require increased surveillance • Assess for associated conditions • Refer to Table 4. Maternal risks
Clinical assessment	• At each antenatal contact: o Reassess requirements for frequency of contacts o Review BGL self-monitoring records o Assess psychosocial needs, and offer support or referrals as appropriate o Review health behaviour factors (e.g. nutrition, physical activity, smoking cessation (if applicable) and weight gain trends o USS as indicated [refer to Table 15. Fetal surveillance]
Weight	• Discuss gestational weight gain (GWG) in a sensitive and non-judgemental manner that minimises weight stigma and maternal anxiety[20] o Refer to Table 4. Maternal risks • Discuss recommended GWG and pattern of GWG o GWG recommendations for the woman with GDM are the same as other pregnant women o Refer to Appendix B: Gestational weight gain o Refer to Appendix C: Antenatal schedule of care o Refer to Queensland Clinical Guideline: *Obesity and pregnancy (including post bariatric surgery)*[58] • Offer to weigh woman at each visit o Rapid GWG may indicate polyhydramnios or significant peripheral oedema o Inadequate GWG or weight loss may reflect inappropriate restriction of dietary intake and/or improved diet quality o If unexplained or excessive consider alternative pathology (e.g. nausea and vomiting of pregnancy, gastrointestinal disease or malignancy) • If not already receiving dietetic care, offer referral to a dietitian • Refer to Australian Dietary Guidelines[69]

5.2 Special considerations

Table 16. Special considerations

Aspect	Consideration
Antenatal expressing	• If no contraindications, offer advice about hand expressing[70] o No more than twice per day commencing from 36+0 weeks gestation • Not linked to higher incidence of preterm birth for women with diabetes and with no additional risk factors[70] • Not recommended if history of preterm labour or threatened preterm labour, shortened cervix or cervical incompetence, cervical cerclage, antepartum haemorrhage, placenta praevia, or before 36 weeks • Refer to local policies and guidelines
Breastfeeding	• Advise women of benefits of breastfeeding after GDM, including reduction in risk of newborn hypoglycaemia, childhood obesity and diabetes[27]
Ramadan fasting	• Pregnant women are one of the groups exempt from fasting if it poses a risk to their health, however some women still choose to fast • Fasting among women with GDM during Ramadan is: o Associated with lower mean glucose levels and higher rates of hypoglycaemia than non-fasting women[71] • If fasting, involve health care team[72] to discuss individualised care
Shift workers	• Test fasting levels after longest fast/sleep

5.3 Fetal surveillance

Table 17. Fetal surveillance

Aspect	Consideration
Context	• Limited evidence or consensus regarding specific antenatal tests or their frequency, for fetal wellbeing[73] • Monitoring type and frequency is influenced by the presence of other pregnancy complications (e.g. antepartum haemorrhage, pre-eclampsia, fetal growth restriction) as well as severity of maternal hyperglycaemia[14] • Fetal AC on USS greater than or equal to 75th centile for gestational age, measured at 29+0–33+6 weeks, correlates with evidence of excess fetal growth/adiposity and an increased risk for birth of a LGA baby[74]
Ultrasound scanning	• Prediction of accelerated fetal growth or LGA on USS biometry may have significant margins of error[75,76] • Trend is more useful than a single measurement
Clinical assessment	• Perform clinical assessment of fetal size and amniotic fluid volume[3] • Assess the fetal growth response to maternal GDM by USS measurement of fetal AC commencing at 28+0–30+6 weeks gestation[3,77] • If abnormal on first USS, longitudinal growth assessment is superior to a single measurement late in pregnancy • Accelerating AC is clinically significant
If complications	• Consider 2–4 weekly USS if: o Unstable blood glucose levels / pharmacological therapy required o Comorbid risk factors present (e.g. obesity, hypertension, LGA or SGA, previous stillbirth)[3] • If fetal growth restriction suspected, follow usual imaging fetal surveillance including umbilical artery and middle cerebral artery Doppler[3] consider: o Review of medication (including metformin) o Review of treatment targets • If excessive fetal growth or AC above 75th centile, consider more intensive management[74,78] which *may* include: o Lower blood glucose targets for glycaemic management[74] o Addition of pharmacologic therapy o Altered frequency of scans and interpretation

5.4 Psychosocial support and education

Table 18. Psychosocial support and education

Aspect	Consideration
Context	• Pregnancy is a time of psychological vulnerability and the diagnosis of GDM adds to the psychological burden[79] • Women have reported feeling guilt, fear, isolation, judgement, and shame relating to their GDM diagnosis[79] • Emotional well-being is important for care and self-management[79,80] • Barriers to effective treatment response include depression, eating disorders, stress and anxiety[81], poor health literacy, illness acceptance[82,83] perception of conflicting information and cost • Engagement in care may be improved with the use of appropriate education and access to technology[83]
Education considerations	• Individualise the approach to management[79] • Support woman to make positive long-term health behaviour changes • Use strategies to support behaviour change including self-monitoring, goal setting, problem solving and motivational interviewing
Information	• Offer information about GDM to aid in self-management including[23]: o Implications of GDM for the woman and baby (short and long term) o Advice about seeking urgent medical advice if hyperglycaemic or unwell o Importance of long-term follow-up • Discuss risk of newborn hypoglycaemia, and need for BGL monitoring and management of baby after birth for at least the first 24 hours o Refer to Queensland Clinical Guideline parent information *Hypoglycaemia-newborn*[84]

5.5 BGL self-monitoring

Table 19. BGL Self-monitoring

Aspect	Consideration
Interpretation	• Trend patterns and mean values of BGL are more important than individual results[13] • Limited evidence about optimal treatment targets for self-monitoring capillary BGL[13] • Targets currently recommended are not supported by strong evidence and are an area for future research
Benefit	• Provides a baseline from which to evaluate the effectiveness of interventions • Can inform the need for pharmacological treatment
Support and education[6]	• Provide individual or group teaching by a clinician experienced in diabetes education including: o Importance of hand washing o Use of glucometer o Use of lancing device and safe disposal of sharps o Recording of BGL results (e.g. BGL diary in paper or electronic form) o Potential causes of errors in monitoring techniques and results o Understanding results and the impact of exercise, dietary intake, stress and illness o Use of a food diary for improved awareness of dietary intake and effect on BGL
Frequency of monitoring	• Advise BGL self-monitoring four times per day, either: o Fasting and one hour postprandial (each main meal) or o Fasting and two hours postprandial (each main meal)
BGL targets	• A range of targets are used worldwide, with limited supporting evidence • Consider all clinical information available • Consensus recommendations for BGL targets are[85,86]: o Fasting—less than or equal to 5.2 mmol/L o 1 hour after commencing meal—less than or equal to 7.4 mmol/L o 2 hours after commencing meal—less than or equal to 6.7 mmol/L
Review	• Advise woman to record BGL for review at each appointment • If BGL is elevated on two occasions at the same test point within one week, review recent dietary modifications, physical activity interventions and pharmacologic interventions • If average BGL at the same time point is above target consider commencing/escalating pharmacological therapy[74,87]

5.6 Medical nutrition therapy

Table 20. Medical nutrition therapy

Aspect	Consideration
Aims	• Achieve target BGL • Maintain GWG within recommendations • Promote optimal nutrition for maternal and fetal health in pregnancy and beyond • Minimise risk of subsequent development of type 2 diabetes
Evidence summary	• Limited evidence about which specific types of dietary interventions are most suitable[88,89] • Medical nutrition therapy (MNT) involves individualised advice based on nutritional assessment, but include the recommended 175 g of carbohydrate per day[90,91] and a low glycaemic index (GI) diet[92] • Individualised dietary advice is associated with a decrease in BGL, lower medication use, less macrosomia and lower birth weight [89] • Refer women who have had bariatric surgery to specialist team for nutrition care
Medical nutrition therapy (MNT)	• Provide dietary advice that is culturally appropriate and individualised[93] • Offer written and/or digital information about: o Healthy eating (e.g. avoiding ultra-processed foods, increasing fibre intake and eating minimally processed foods) o Meeting the nutritional requirements of pregnancy (five food groups) o Carbohydrate foods and influence on BGL o Aim for carbohydrate intake that achieves 175 g per day[88,94], divided evenly and tailored to individual needs o GI and influence on BGL[88] o Individual weight gain recommendations during pregnancy o Dietary restriction sufficient to cause weight loss is not recommended o Safe foods for pregnancy o Label reading o Self-monitoring of dietary intake as appropriate
Schedule of dietetic visits	• Refer to an Accredited Practising Dietitian within one week of diagnosis[93] • Appointments may be in person, or by phone, telehealth or email • Consider minimum schedule of dietetic appointments[93]: o One hour initial counselling session o Two review appointments (minimum) one week after initial visit and then within 2–3 weeks[93] o Additional reviews scheduled 2–3 weekly based on clinical need o One postnatal follow up o Further review is recommended if pharmacological treatment is initiated • Women who receive at least three dietetic appointments are less likely to require pharmacotherapy[95]

5.7 Physical activity

Table 21. Physical activity

Aspect	Consideration
Context[96]	• Physical activity is a recognised adjunctive therapy for GDM[93,97] o Both aerobic and resistance training are beneficial[98,99] • Moderate physical activity o Improves BGL o Not associated with adverse outcomes[98] o May reduce fetal macrosomia, CS rates and requirement for pharmacological intervention[97,100]
Intensity	• Assess levels of current physical activity[97,98] o If minimal, increase duration of moderate physical activity slowly o If already active, maintain or lower intensity during pregnancy rather than attempting to progress to higher levels • Intensity can be assessed using rating of perceived exertion scales[98] o Physical activity of moderate intensity enables the woman to talk, but not sing whilst exercising[98] • Refer to Appendix D: Exercise and exertion
Duration	• Recommend 30 minutes of physical activity on most, preferably all days of the week[93] • Physical activity may be broken into shorter periods of at least 10 minute periods of moderate effort[101]
Type	• Can include aerobic exercise (e.g. walking, stationary cycle, swimming, aquatic activities, conditioning machines, prenatal exercise classes) and light or moderate resistance exercises (e.g. pilates)[102] • Discuss modifications to the physical activity program as pregnancy progresses (particularly in the third trimester as the body's centre of gravity is altered)[97]
Exercise to avoid	• Avoid activities that[101,102] o Involve lying flat on the back o Increase the risk of falling or abdominal trauma, or require frequent changes in direction (e.g. contact sports, most racquet sports, horseback riding, water skiing) o Add extra load to the pelvic floor (e.g. bouncing or jumping) o Are at extreme altitudes (e.g. scuba diving, mountain climbing)
Cautions/contra-indications[103]	• Haemodynamically significant heart conditions • Pre-eclampsia • Restrictive lung conditions • Incompetent/shortened cervix/cerclage, increased risk of premature labour • Vaginal bleeding/ placenta praevia • Ruptured membranes • Intrauterine growth restriction
Cease physical activity and seek advice from care provider[102]	• Advise to stop physical activity and contact health care provider if concerned and/or experience any of the following: o Chest pain, high heart rate, dyspnoea prior to or during exertion o Dizziness, faintness, nausea o Headache o Decreased fetal movements, uterine contractions, vaginal bleeding, amniotic fluid leakage o Back or pelvic pain, muscle weakness o Calf pain or swelling or sudden swelling of ankles, hands and/or face • Refer to Appendix D: Exercise and exertion
Recommendation	• Assess each woman individually and tailor recommendations for physical activity to suitability and clinical circumstances • Discuss contraindications and indications to stop physical activity • Advise to record daily activity and duration • Avoid o Dehydration during and after physical activity o Exercising in high temperatures and humidity • Discuss contraindications and indications to stop physical activity

6 Pharmacological therapy

Before commencing pharmacological glycaemic therapy, provide MNT, initiate BGL self-monitoring and review results. Individualise the period of BGL monitoring based on clinical circumstances and the degree of hyperglycaemia. Individualise decisions about medication commencement. Consider:

- Gestational age (e.g. anticipated date of birth, or if early pregnancy, hyperglycaemia requiring intensive management to achieve euglycaemia)
- Degree and pattern of hyperglycaemia (fasting or postprandial) to inform most appropriate type of pharmacological therapy
- Fetal growth (macrosomia or SGA) and AC
- Maternal preference

6.1 Metformin

Table 22. Metformin

Aspect	Consideration
Actions	• Reduces hepatic glucose production and increases peripheral utilisation of glucose[104] • Up to 50% of women treated with metformin require supplemental insulin to achieve glycaemic targets[105,106] • Lower rates of severe hypoglycaemia in newborn babies of women who used metformin than in women using insulin[107,108]
Safety profile	• Short term data on safe use in pregnancy and fetal development reassuring[107,108] • Long term follow up data of children exposed in utero is limited[104,108] and shows changes in fat distribution, the significance of which is not known • Crosses the placenta, but no evidence of teratogenesis [107,109]
Contraindications	• Conditions that may alter renal function[104] • Severe hepatic impairment[104] • Fetal growth restriction or SGA on USS • Slowing growth velocity on USS • Persistent nausea and vomiting or other intolerable gastrointestinal effects • Consider ceasing if woman develops pre-eclampsia • Lactic acidosis • Severe sepsis
Indications	• Average BGL over one week is elevated (BGL monitored at the same time intervals each day) after consideration of dietary and physical activity factors • USS shows tendency to excess fetal growth (AC above the 75th centile) at diagnosis or accelerating fetal growth to 95th centile • Mild overall elevated BGL or elevated fasting BGL
Side effects	• Nausea, loss of appetite[104] • Diarrhoea[104]; vomiting[104] • Malabsorption of vitamin B12[104] (generally if longer term therapy) o Consider checking in late pregnancy if metformin commenced prior to 20 weeks gestation • May be associated with preterm birth prior to 37 weeks gestation[106]
Administration	• Advise woman to take metformin after a meal[104] • Commencement dose: 500 mg (extended release) oral daily with or after food • Maximum dose: 3000 mg (immediate release) or 2000 mg (extended release) oral daily[13,104] • Titrate dose every 3-4 days according to BGL and tolerability • Review BGL within one week of commencement

6.2 Insulin therapy

Table 23. Insulin therapy

Aspect	Consideration
Action	• Rapid acting analogues preferred for control of postprandial hyperglycaemia[27] • Intermediate acting insulin (bedtime dosing) preferred to treat fasting hyperglycaemia
Safety profile	• Insulin therapy is safe to use in pregnancy[110] • There is no evidence for superiority of a specific insulin type or insulin regimen for GDM
Indications	• Hyperglycaemia in excess of targets despite optimisation of non-pharmacological therapies[15] and/or metformin • Maternal preference
Potential side effects[110]	• Hypoglycaemia • Localised (injection site) reactions • Systemic reaction (e.g. skin eruptions) • Weight gain
Combination therapy	• Insulin added to metformin: o May be required to improve glycaemic control o Linked to less GWG compared to taking insulin alone[106]
Commencement	• Consult with expert clinician for dosage calculation and prescribing of appropriate insulin therapy • Individualise dosage as requirements vary • Provide details on how to seek advice if any concerns with insulin therapy • Review BGL (e.g. by phone or email) within one week post insulin commencement • Refer to 4.2.1 Insulin type by glycaemic abnormality for type of insulin
Titration[111]	• Insulin requirements can be anticipated to rise throughout the third trimester as a result of increasing maternal insulin resistance o Tends to plateau at 36–38 weeks gestation • Insulin dose can be titrated every two to three days as required with suggested increments of 2–4 units (no greater than 20% dose increase) until targets are met • Review doses if: o The woman experiences hypoglycaemia more than 1-2 times per week **or** o Any episode of severe hypoglycaemia

*Refer to an Australian pharmacopoeia for complete drug information

6.2.1 Insulin type by glycaemic abnormality

Table 24. Insulin type by glycaemic abnormality

Abnormality	Suggested insulin type	Action profile	
Elevated fasting glucose	• Single bedtime injection of **intermediate or long-acting** insulin* will often suffice	Onset Peak Duration	1–2.5 hours 4–12 hours 16 to 24 hours
Postprandial hyperglycaemia	• Pre-meal **rapid acting** insulin*	Onset Peak Duration	10–20 mins 0.5–1.5 hours 3–5 hours
Fasting *and* postprandial hyperglycaemia	• Basal-bolus insulin regimen o Pre-meal **rapid acting** and bedtime intermediate-acting insulin* ***or***	As for elevated fasting glucose and postprandial hyperglycaemia	
	o Twice daily **mixed i**nsulin* (less commonly used. Consider if woman is reluctant to inject four times per day)	Onset Peak Duration	0.5–1 hour 2–12 hours 16 to 24 hours

*Refer to an Australian pharmacopoeia for complete drug information

6.3 Education for safe self-administration of insulin therapy

Table 25. Education for safe self-administration of insulin

Aspect	Consideration
Safety	• Ideally provided by a credentialled diabetes educator or clinician trained in teaching self-administration of insulin • Can be individual or group sessions, noting that group sessions have been reported as positive due to peer support through a shared experience[112] • Confirm type of insulin and dose ordered
Demonstrate	• Insulin delivery device • Needle size • Applying needle to device • Priming device and dialling dose • Injection sites and rotation • Self-injection technique • Use of skin fold (if required)
Discussion points	• Hand washing • Insulin action and profile • Timing of injection • Recognition of hypoglycaemia symptoms and treatment o Refer to Table 24. Hypoglycaemia in women receiving glucose lowering medication • Potential side effects • Discuss lipohypertrophy • Safe disposal of sharps • Safe driving[113] • Storage and handling of insulin • Expiry of insulin (opened and unopened) • Confirm and update NDSS registration to enable access to free insulin needles • Travelling—NDSS card or letter authorising woman to carry insulin and needles in hand luggage[114]

6.4 Hypoglycaemia

Hypoglycaemia is uncommon in women with GDM, particularly those not receiving pharmacological therapy. In the absence of symptoms of hypoglycaemia, confirm the accuracy of results prior to initiating treatment. If not receiving pharmacotherapy, BGL greater than or equal to 3.5 mmol/L and without symptoms is normal in pregnancy and does not require treatment.

Table 26. Hypoglycaemia in women receiving glucose lowering medication

Aspect	Consideration
Definitions[115]	• **Mild hypoglycaemia:** o BGL less than 4.0 mmol/L and o May or may not be associated with symptoms of a low BGL • **Severe hypoglycaemia:** o BGL is very low, generally less than 3.0 mmol/L and o May be associated with confusion and potentially loss of consciousness o Medical assistance may be required to manage the episode
Causes	• Excess physical activity • Too much insulin • Missed, delayed or inadequate carbohydrate with meal[104] • Alcohol intake as decreases blood glucose (use not recommended in pregnancy)[104]
Symptoms[104,115]	• Hunger • Light headedness/headache • Trembling/shaking/weakness • Sweating • Lack of concentration • Behaviour change • Dizziness • Tearfulness/crying • Numbness around the lips/fingers • Irritability • Blurred vision
Treatment[115]	• Assess level of consciousness o If reduced, oral management contraindicated o Seek medical help • Consume one 15 g serve of fast acting carbohydrates (one of the following) o 5–7 glucose jellybeans ***or*** o Glass of soft drink (not sugar-free) 150 ml ***or*** o Half a glass of fruit juice 125 ml ***or*** o Lucozade® 100 mL ***or*** o 3 heaped teaspoons of sugar or honey dissolved in water • If after 15 minutes symptoms persist or BGL remains less than 4.0 mmol/L repeat one serve of fast acting carbohydrates • **Do not over-treat** with fast acting carbohydrates as this may lead to rebound hyperglycaemia • When BGL is 4.0 mmol/L or above eat longer lasting carbohydrate o Eat a snack (e.g. sandwich or crackers, glass of milk) or usual meal if within 30 minutes o Avoid over treatment of hypoglycaemia resulting in hyperglycaemia o Document BGL, time of hypoglycaemic episode and any preceding factors
If bariatric surgery	• Seek expert advice for management of hypoglycaemia • First line treatment options may not be appropriate post bariatric surgery
Hypoglycaemia prevention	• Eat regular meals with adequate carbohydrate serving • Always carry a food snack (including while exercising) • Aim to take long or intermediate acting insulin at the same time each day • Identify causal factors of the hypoglycaemic episode and avoid/mitigate for the future • Always carry blood glucose meter so BGL can be checked if symptoms present

7 Birthing

The decision on timing and mode of birth is primarily intended to minimise the risk of intrapartum complications associated with the birth of a LGA or macrosomic infant.

Table 27. Birth

Aspect	Consideration
Context	• There is little quality evidence to inform timing and management between induction of labour (IOL) at term, expectant management or CS[116,117]
Timing of birth	• If well managed with MNT and no fetal macrosomia or other complications, wait for spontaneous labour (unless there are other indications for IOL)[73] • Pharmacological therapy alone is not an indication for birth before term
Antenatal corticosteroids	• If steroids (betamethasone or dexamethasone) are required for fetal lung maturity, continue to monitor BGL • s, consider admission and commencement of, or intensified insulin therapy[118,119]
Induction of labour	• No clear evidence that women with GDM and a normally grown fetus have different indications for IOL than women without GDM[117] • Consider concomitant complications (e.g. pre-eclampsia, growth restriction, obesity) that influence the risk of stillbirth when counselling about expectant management versus IOL • For IOL before 39+0 weeks o Consider the challenges inherent in USS diagnosis of macrosomia against short and long term outcomes for babies[4,77]
Mode of birth	• If fetal weight is estimated at: o Less than 4000 g, vaginal birth is usually appropriate o 4000–4500 g, consider other individual factors (e.g. maternal stature, obstetric and birth history, previous macrosomia with or without shoulder dystocia, limitations of estimating fetal weight) o More than 4500 g, consider elective CS[4,73]—counsel about the risks and benefits ▪ Insufficient data to determine if CS indicated to reduce risk of birth trauma[76]
Communication	• Discuss recommendations according to individual circumstances for: o Intrapartum management o Pharmacological therapy (if any) when birth approaches/labour commences [refer to Section 5.1 Pharmacotherapy as birth approaches] • Refer to Queensland Clinical Guideline: *Standard care*[5]

7.1 Pharmacotherapy as birth approaches

Develop and document an individual pharmacotherapy plan.
If an insulin infusion is required for unstable BGL, consult with an expert regarding the need for a simultaneous glucose infusion (e.g. preoperative period)

Table 28. Pharmacotherapy as birth approaches

Labour/birth	Metformin	Insulin
Spontaneous onset	• Cease metformin when in established labour	• Titrate insulin requirements according to BGL during labour
IOL	• Cease metformin when in established labour	**If morning IOL commencement** • Eat early morning breakfast • Administer usual dose of rapid acting insulin with breakfast • Omit or reduce long or intermediate acting insulin in the morning • Cease subcutaneous insulin when in established labour **If afternoon/evening IOL commencement** • Administer usual dose of rapid acting insulin with evening meal • If not in established labour, administer long or intermediate acting insulin before bedtime • Cease subcutaneous insulin when in established labour
Caesarean section	• Cease metformin evening before elective procedure (after evening dose)	• Administer usual rapid and intermediate/long acting insulin the night before o Consider individual clinical situation including fasting BGL o May require reduced dose of intermediate/long acting insulin • Monitor BGL • Fast for six hours prior to elective CS o If fasting, omit all subcutaneous insulin on the morning of the CS

7.2 Intrapartum BGL monitoring

Refer to Queensland Clinical Guideline: *Intrapartum fetal surveillance (IFS)*[120]

Table 29. Intrapartum BGL monitoring

Aspect	Monitoring
All women	• Aim for BGL 4.0–7.0 mmol/L irrespective of GDM therapy during pregnancy[121] • Ensure adequate glucose during labour to meet high energy requirements • Recommend continuous cardiotocography (CTG) during labour if during pregnancy o Insulin or metformin required o Suboptimal BGL o Fetal macrosomia o Refer to Queensland Clinical Guideline: *Intrapartum fetal surveillance (IFS)*[122]
If non-pharmacological therapy during pregnancy	• BGL on arrival then 4 hourly monitoring o Increase frequency according to BGL o Refer to Table 28. Intrapartum BGL monitoring • It is uncommon to experience hypoglycaemia or to require insulin
If pharmacological therapy during pregnancy	• BGL on arrival, then 2 hourly monitoring o Increase frequency according to BGL o Refer to Table 28. Intrapartum BGL monitoring o If required, insulin requirements are commonly lower during labour (usually no insulin necessary)

7.3 Intrapartum BGL management

The aim of intrapartum BGL management is to maintain optimal BGL while avoiding hypoglycaemia. Maintain BGL during labour 4–7 mmol/L to minimise risk of neonatal hypoglycaemia.[8]

Table 30. Intrapartum BGL management

Aspect	Consideration
BGL more than 7.0 mmol/L	• If BGL greater than 7.0 mmol/L seek medical review • Consider clinical circumstances (e.g. stage of labour, imminency of birth, intake, effects of increased stress levels) when determining management • Management may include: o Repeat BGL in 1 hour and reassess **or** o Consider insulin infusion
BGL less than 4.0 mmol/L or symptomatic	• Cease insulin therapy • If symptomatic, treat hypoglycaemia and repeat BGL in 15 minutes • If asymptomatic and had been receiving insulin, repeat BGL in 15 minutes and reassess • If asymptomatic and not receiving insulin, repeat BGL in 1 hour and reassess (or earlier if becomes symptomatic) • Refer to Section 4.4. Hypoglycaemia

7.3.1 Insulin infusion

An insulin infusion is **rarely** needed during labour for women with GDM. Seek expert opinion before commencement. If no local policy or procedure exists, the following example insulin infusion regimen may be considered, but individualised doses are required.

Table 31. Example insulin infusion

Aspect	Recommendation	
IV Infusion	• Administer via infusion pump	
Mainline	• Commence 1 litre glucose containing fluid at 80 mL/hour, for example: o Glucose 4% with sodium chloride 0.18% or o Compound sodium lactate (Hartmann's solution) with glucose 5%	
Sideline	• Add 50 units (0.5 mL of 100 units per mL) neutral insulin to 49.5 mL of sodium chloride 0.9% to give a concentration of 1 unit/mL • Prime infusion line with insulin admixture down to connection port	
BGL monitoring	• Commence and adjust insulin infusion according to BGL • Monitor BGL hourly while insulin infusion being administered • Medical review two hours after commencement to assess individual requirements	
Insulin infusion starting doses and BGL targets	**Starting doses only–adjust according to individual needs**	
	BGL (mmol/L)	**Insulin infusion**
	Less than 4.0 mmol/L	• Discontinue infusion • Notify and review by medical officer
	4.0–6.0 mmol/L	• 1 mL/hour = 1 unit/hour
	6.1–8.0 mmol/L	• 2 mL/hour = 2 unit/hour
	8.1–10.0 mmol/L	• 3 mL/hour = 3 unit/hour
	10.1 mmol/L or more	• Continue infusion • Notify and review by medical officer

8 Postpartum care

Limited evidence/consensus regarding the frequency and type of postpartum BGL monitoring if well managed during pregnancy with non-pharmacological therapy

Table 32. Postpartum BGL monitoring

Aspect	Consideration
Postpartum target	• Less than or equal to 8.0 mmol/L (preprandial)
Non-pharmacological therapy	• Cease BGL monitoring after birth
Pharmacological therapy	• Cease pharmacological therapy (metformin and insulin) immediately after birth (vaginal or CS) • Continue BGL monitoring four times per day for 24 hours (preprandial and before bed) • If all preprandial BGL 4.0–8.0 mmol/L discontinue monitoring 24 hours after birth • If BGL greater than or equal to 4.0 mmol/L and diet tolerated, cease mainline IV fluids • If BGL less than 4 mmol/L: o Treat with one 15 g serve of fast acting carbohydrates. o Repeat BGL at 15 minutes o If symptoms persist and/or BGL remains less than 4.0 mmol/L repeat one 15 g serve of fast acting carbohydrates • If diet not tolerated and BGL less than 4.0 mmol/L, seek medical review o Consider glucose 4%/sodium chloride 0.18% or compound sodium lactate (Hartmann's solution) with glucose 5% IL IV 12 hourly
Elevated BGL	• If any preprandial BGL is greater than 8.0 mmol/L o Seek medical review o Continue BGL monitoring • Insulin is rarely required postpartum o If required, prescribe lower dose than required during pregnancy
Newborn baby care	• Keep baby warm • Support early feeding and skin to skin contact within first hour of life • Monitor BGL • Refer to Queensland Clinical Guideline: *Hypoglycaemia-newborn*[84]

8.1 Breastfeeding

Table 33. Breastfeeding

Aspect	Consideration
Context	• Women with GDM are less likely to breastfeed and if they do, continue for a shorter duration compared with women without GDM[123] o This is more pronounced if insulin therapy required or obese[123,124] • Metformin and insulin are both safe for breastfeeding women • Refer to Table 14. Special considerations
Maternal benefits	• Longer duration of breastfeeding reduces risk of progression to type 2 diabetes[123,125] • Exclusive breastfeeding for greater than one month reduces the recurrence rate of GDM[126] • Metabolic adaptations during lactation can reverse atherogenic and diabetogenic effects of pregnancy for the woman with DIP[127]
Recommendation	• Support and encourage breastfeeding • Provide advice and information about the maternal and baby benefits of breastfeeding • Offer early additional skilled lactation support and assistance with breastfeeding to women with GDM[124] • Refer to the Queensland Clinical Guideline: *Establishing breastfeeding*[128]

8.2 Discharge planning

Consider routine criteria to inform readiness for discharge.

Table 34. Discharge planning

Aspect	Consideration
Contraception	• Suggest contraception until postpartum OGTT test is completed and continue until planning for next pregnancy • Discuss risks and benefits of methods and women's preferences o Recommend progesterone only contraceptive options for women planning to breastfeed (can commence estrogen containing alternatives once breastfeeding established)[129] • Consider increased risk of metabolic syndrome[130] • If other risk factors (e.g. hypertension) suggest IUD or progesterone only agent[10]
Future pregnancies	• Advise women to plan in consultation with healthcare provider • Provide advice about interpregnancy and pre-conception weight management o Significant increase in the risk of GDM occurring in subsequent pregnancies with each unit of BMI gained *between* pregnancies[131] o Women who are classified as overweight or obese at their index pregnancy, but who subsequently lose weight lower their future risk of GDM by almost 80%[131] • Pre-conception screen for diabetes • Recommend pre-conception folic acid supplementation[132] • Perform early glucose testing in a future pregnancy
Post bariatric surgery	• Continue specialist dietary advice to optimise macro and micronutrient supplementation and dietary intake • Refer to Queensland Clinical Guideline: *Obesity and pregnancy (including post bariatric surgery)*[58]
Referral and follow-up	• Provide timely written advice to the woman's primary health carer(s) (e.g. GP) about maternal and/or neonatal outcomes including diabetes management in pregnancy o Recommend follow up with GP for OGTT at 6–12 weeks postpartum with results based on non-pregnancy diagnostic criteria[13,73] o The National Gestational Diabetes Register sends reminders to women and their GPs to have diabetes checks postpartum o Recommend support for maintaining healthy eating and physical activity to support reducing the future risk of type 2 diabetes mellitus • If GDM, lifelong screening is required to detect for the development of: o Type 2 diabetes/IGT/IFG ▪ If contemplating another pregnancy recommend an annual HbA1c or alternate glycaemic testing[13,133] ▪ If no further pregnancies planned recommend diabetes or pre-diabetes screening every 1 to 3 years[133] • Lifelong cardiovascular and renal disease screening

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Appendix A: Conversion table for HbA1c measurement

Worldwide (including Australia), HbA1c measurement and reporting has been standardised using Systeme International (SI) units.

HbA1c as percentage	HbA1c in mmol/mol
5.0	31
6.0	42
6.5	48
7.0	53
8.0	64
9.0	75
10.0	86
11.0	97
12.0	108

Appendix B: Gestational weight gain

The National Academy of Medicine (formerly the Institute of Medicine) have recommended weight gain for women with singleton and twin pregnancies.

Pre-pregnancy BMI (kg/m^2)	Mean rate of gain 2nd and 3rd trimester (kg/week)	Recommended range of total gain (kg)
Singleton pregnancy		
Less than 18.5	0.51	12.5 to 18
18.5 to 24.9	0.42	11.5 to 16
25.0 to 29.9	0.28	7 to 11.5
Greater than or equal to 30	0.22	5 to 9
Twin pregnancy		
Less than 18.5	N/A	N/A
18.5 to 24.9	N/A	17–25
25.0 to 29.9	N/A	14–23
Greater than or equal to 30	N/A	11–19

Source: National Academy of Medicine. Weight gain during pregnancy. 2009 [cited 2024 December 18]. Available from: https://www.nap.national academies.org

Appendix C: Antenatal schedule of care

Testing

Consideration	Result	Plan
Risk factors for GDM: ❑ 1st trimester: HbA1c with option of confirmatory OGTT ❑ If after 1st trimester: OGTT	**HbA1c** (%) _____ **OGTT** (mmol/L) Fasting: _____ 1 hour: _____ 2 hour: _____	**If normal:** OGTT at 24–28 weeks gestation ***or*** **If indicated:** Commence GDM or overt DIP care
Alternate testing options if unable to have/tolerate recommended test: ❑ Fasting PGL	**HbA1c** (%) _____ **FPGL (**mmol/L) _____	**If elevated:** Self-monitoring or reconsider OGTT ***or*** **If indicated:** Commence GDM care
No risk factors or history: ❑ 24–28 weeks OGTT	**OGTT** (mmol/L) Fasting: _____ 1 hour: _____ 2 hour: _____	**If indicated:** Commence GDM care

At initial GDM diagnosis

Discuss/Review/Refer	Considerations
❑ Review history	Previous GDM, medications
❑ Diabetes educator consult	Refer within 1 week of diagnosis for GDM education
❑ Dietitian consult	Refer within 1 week of diagnosis for MNT
❑ Psychosocial assessment/support	Refer as required
❑ BGL self-monitoring	Commence self-monitoring
❑ BMI (pre-pregnancy)	Discuss healthy weight gain targets
❑ Health behaviour advice	Physical activity, healthy eating, smoking cessation
❑ Baseline ultrasound scan (USS)	At 28–30+6 weeks gestation
❑ Initial laboratory investigations	❑ Serum creatinine
❑ If *Overt diabetes in pregnancy (DIP)*	❑ Additional management by MDT required

Each Visit

Discuss/Review/Refer	Considerations
❑ Clinical surveillance	Complications (e.g. pre-eclampsia)
❑ Offer to weigh	Weight gain trends, nutrition, physical activity
❑ Review BGL self-monitoring record	Patterns, trends and mean BGL
❑ Psychosocial assessment/support	Refer as required
❑ Fetal growth and wellbeing (including AC)	USS 2–4 weekly as indicated (after 28–30 weeks)
❑ If pharmacological therapy commenced	❑ Suggested review frequency: ❑ Weekly contact and review of BGL such as via electronic means ❑ Fortnightly visits until 36+0 and then weekly ❑ Individualise care and increase as indicated
❑ Multidisciplinary team approach	❑ Review local model of care criteria ❑ Diabetes clinic ❑ Obstetric ❑ Other _____
❑ Review next contact requirements	❑ Dietitian ❑ Diabetes educator ❑ Consider frequency of contact (suboptimal BGL, early diagnosis, pharmacological therapy)

AC: abdominal circumference **BGL**: blood glucose levels **BMI**: body mass index **GDM**: gestational diabetes mellitus **HbA1c**: glycated haemoglobin **MDT**: multi-disciplinary team **MNT**: medical nutrition therapy **OGTT**: oral glucose tolerance test **Overt DIP**: overt diabetes in pregnancy **USS**: ultrasound scan

Queensland Clinical Guideline. *Gestational diabetes mellitus (GDM)*. Flowchart: F25.33-4-V3-R30

Appendix D: Exercise and exertion

Target heart rate ranges for pregnant women

Consider individual clinical circumstances when prescribing physical activity. Use the following heart rate ranges as a guide only.

Maternal age (years)	Fitness level or BMI	Heart rate range (beats/minute)
< 20		140–155
20–29	Low	129–144
	Active	135–150
	Fit	145–160
	BMI > 25 kg/m^2	103–124
30–39	Low	128–144
	Active	130–145
	Fit	140–156
	BMI > 25 kg/m^2	101–120
40+		125–140

< less than; **>** greater than

Adapted from: Sports Medicine Australia. Pregnancy and exercise. Fact sheet. n.d. [cited 2024 December 18]. Available from: www.sma.org.au.

Rating of perceived exertion

Rating of perceived exertion (RPE) is a widely used and reliable indicator to monitor and guide exercise intensity. The scale allows individuals to subjectively rate their level of exertion during exercise or exercise testing.

Rating of perceived exertion			Talk test
6		**How you feel when lying in bed or sitting relaxed in a chair. Little or no effort**	**Can talk normally**
7	Very, very light		
8			
9	Very light		
10			
11	Fairly light		
12		**Target in pregnancy: How you should feel with physical activity**	
13	**Somewhat hard**		**Can talk but not sing**
14			
15	Hard	**How you felt with the hardest work ever done**	**Hard to talk**
16			
17	Very hard		
18			
19	Very very hard		
20	**Maximum exertion**	**Don't work this hard**	

Adapted from: Sports Medicine Australia. Pregnancy and exercise. Fact sheet. n.d. [cited 2024 December 18]. Available from: www.sma.org.au.

Appendix E: Interpretation of results

Test type	Consideration
OGTT	• Reported as mmol/L • Comprises of 3 tests: o Fasting PGL: reflects hepatic glucose output o One hour PGL following 75 gram glucose load o Two hour PGL following initial 75 gram glucose load: reflects glucose load and hepatic glucose output • Main value is to identify women with any degree of hyperglycaemia • Suitable for use at any time in pregnancy, ideally after 10 weeks gestation o Fasting glucose prior to 10 weeks may represent a false positive
HbA1c	• Reported as a percentage • Glycated haemoglobin is the main biomarker used to assess long-term glycaemia control o Reflects average blood glucose over the lifespan of the red blood cells o Correlates with the development of complications • Has a high specificity for GDM (although lacks sensitivity) • Outside of pregnancy increasingly used as a diagnostic tool: o Greater than or equal to 6.5% diagnostic of diabetes mellitus o 5.7–6.4% diagnostic of pre-diabetes • HbA1c greater than or equal to 6.0% in first trimester identifies women at higher risk and is linked to increased risk of adverse pregnancy outcomes including: o LGA o Macrosomia o Caesarean section o Hypertensive disorders of pregnancy o Major congenital anomaly o Shoulder dystocia o Perinatal death • Available evidence suggests HbA1c can predict risk of hyperglycaemia related pregnancy complications: o A result of 4.8% or less in early pregnancy is associated with risk comparable to women without GDM o A result of 5.9% or more in early pregnancy is associated risk comparable to women with GDM

Acknowledgements

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

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Funding: This clinical guideline was funded by Healthcare Improvement Unit, Queensland Health