Diabetes in pregnancy		
Related National Guidance	Diabetes in pregnancy: management from preconception to the postnatal period NICE guideline [NG3] Published: 25 February 2015. Last updated: 16 December 2020	
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Purpose	To provide advice and care for women with diabetes with the aim to achieve a good outcome for mother and baby.	
Primary Specialty	Obstetrics	
Related Specialties	Endocrinology	
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Clinical guideline content: Clinical Guidelines assist in decision-making; they do not replace clinical judgement. Regardless of the strength of evidence, it remains the responsibility of the clinician to interpret the application of the clinical guidance to local circumstances and the needs and wishes of the individual patient. Where variations of any kind do occur, it is important to document the variations and the reason for them in the patient's health record. If in doubt, seek senior advice.

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Rationale

This guideline has been written in line with NICE NG3.

Dissemination and related guidance

Updates to be shared at Obstetrics and Gynaecology QIPS.

Related Guidance

- CG 1050 Management of Diabetic Ketoacidosis in Adults
- CG 1771 Variable Rate Insulin Infusion in Adults
- CG 466 Hypoglycaemia in adults
- CG 143 Antenatal Corticosteroids
- CG 177 Induction of labour
- CG 2064 Preterm labour and birth
- CG 1015 Hypertensive Disorders in Pregnancy
- CG 1005 Thromboprophylaxis in pregnancy and the puerperium
- CG 172 Caesarean Section (CS)

Training

- All junior doctors should make it their responsibility to familiarise themselves with local and regional guidance regarding care of the diabetic patient in pregnancy.
- All SpRs should be rotated to work in the joint diabetes clinic.

Patient Information

- Antenatal Glucose Tolerance Test (GTT – Test for Diabetes) Glucose Tolerance Test (GTT)
- Diabetes in Pregnancy: Glucose Tolerance Test Diabetes in Pregnancy
- Diabetes in Pregnancy: Contraception for women with diabetes
- Diabetes in Pregnancy: Avoiding hypoglycaemia (hypos) in pregnancy
- Diabetes in Pregnancy: Diabetes and breastfeeding
- Diabetes in Pregnancy: Metformin treatment in pregnancy
- Diabetes in Pregnancy: Planning a family – things to do before you get pregnant
- Diabetes in Pregnancy: Planning a family (key facts)
- Diabetes in Pregnancy: Postnatal for gestational diabetes
- Diabetes in Pregnancy: Type 1 diabetes in pregnancy – what to do if unwell
- Diabetes in Pregnancy: What is gestational diabetes
- Healthy Eating for Diabetes in Pregnancy

Audit & Monitoring

Audit title	Audit Lead	Monitoring method and frequency	Committee responsible
The involvement of the multidisciplinary team including the obstetrician, midwife, diabetes physician, diabetes specialist nurse and dietician in the provision of care when appropriate	O&G Governance Consultant	Documentation Audit 2 Yearly	Obstetrics and Gynaecology Audit Meeting
The timetable of antenatal appointments	O&G Governance Consultant	Documentation Audit 2 Yearly	Obstetrics and Gynaecology Audit Meeting
The requirement to document an individual management plan in the health records that covers the pregnancy and postnatal period up to six weeks	O&G Governance Consultant	Documentation Audit 2 Yearly	Obstetrics and Gynaecology Audit Meeting

Targets for glycaemia control	O&G Governance Consultant	Documentation Audit 2 Yearly	Obstetrics and Gynaecology Audit Meeting
How women who are suspected of having diabetic ketoacidosis are admitted immediately to a high dependency unit where they can receive both medical and obstetric care	O&G Governance Consultant	Documentation Audit 2 Yearly	Obstetrics and Gynaecology Audit Meeting

Changes from previous version	
Date	**Updated information**
March 2023	Transferred to new template. Re-formatted for clarity. Removed glibenclamide as a treatment option due to discontinuation. Incorporate COP 786 (review of GTT results). Change to fasting CBG target to <5.3 mmol/L, and other minor changes as per NICE NG3.

Contents

Definitions

Diabetes Mellitus – is defined as a metabolic disorder characterised by chronic hyperglycaemia with disturbances of carbohydrate, protein and fat metabolism resulting from defects in insulin secretion, insulin action, or both (1).

Type 1 Diabetes – is a disease of severe insulin deficiency. It is predominantly immune origin in origin.

Type 2 Diabetes – is a disease of insulin resistance and less severe insulin deficiency.

Gestational Diabetes – Carbohydrate intolerance with onset during pregnancy.

Acronyms/abbreviations

CBG	Capillary Blood Glucose
VRIII	Variable Rate Intravenous Insulin Infusion
FBG	Fasting blood glucose
IOL	Induction of labour
HbA1c	Glycated haemoglobin test
ACEi	Angiotensin Converting Enzyme inhibitors
ARBs	Angiotensin-II receptor blockers
LSCS	Lower segment caesarean section
DSN	Diabetic specialist Nurse

Introduction

Diabetes is the most common metabolic disorder of pregnancy with up to 5% of pregnant women affected according to NICE (2). Of these the majority (87%) have gestational diabetes, 7% have type 1 diabetes and 5% have type 2 diabetes. More recent data suggests the prevalence of GDM to have increased to a median of 7.8% of pregnancies in Europe (3).

All forms of the disorder are associated with adverse obstetric and neonatal outcomes. These include an increased risk of preeclampsia, preterm birth, large for gestational age (LGA), stillbirth, neonatal hyperglycemia and neonatal unit admission (4). Indeed, perinatal mortality is 4 times higher in comparison to unaffected pregnancy (2). In addition, babies born to mothers suffering from diabetes are at longer term increased risk of obesity, hypertension and T2DM (5). These complications are summarized in table 1. Maternally, women who suffer from GDM are at higher risk of the development of T2DM in later life (6).

The primary clinical aim for the management of diabetes in pregnancy should be to approximate outcomes for the pregnancy to those of a non-diabetic pregnancy.
These guidelines aim to match the latest NICE guidance to achieve this aim. Where this differs, evidence is provided where relevant, alternatively a pragmatic decision based on resources has been taken.

Scope

Guidance for the management of women in pregnancy with pre-existing or gestational diabetes.

Multi-disciplinary diabetes care is designed to reduce maternal and perinatal morbidity associated with the condition. This guideline should therefore be used by all health professionals involved with the care of diabetic patients in pregnancy, including midwives, obstetricians, and GPs.

Roles and Responsibilities

All teams

1) To risk assess and arrange glucose tolerance testing of women
2) To communicate to women their diagnosis and counsel on management
3) To identify at risk women with pre-existing diabetes and refer appropriately
4) To work in partnership with appropriate teams to ensure collaborative working
5) Ensure appropriate documentation is completed in the patient's records
6) Ensure all staff are familiar with the pathways for Diabetes in pregnancy
7) To ensure appropriate information is provided to the women's community team to ensure further testing is performed as appropriate

Specialist Midwife/Nursing Team

1) To provide in-reach and management support in routine cases of diabetes in pregnancy
2) To provide midwifery oversite of testing pathways including blood glucose monitoring.
3) To provide a point of contact for women with diabetes in pregnancy
4) To ensure retinal screening referral is performed for women with pre-existing diabetes in pregnancy as appropriate

Obstetrician

1) To identify emerging obstetric complications requiring further assessment for diabetes in pregnancy
2) To review fetal monitoring
3) To identify women at risk of maternal complications of diabetes in pregnancy and manage as appropriate

Endocrinologist

1) To optimize management in pre-existing diabetes
2) To support the development of treatment plans for gestational diabetes
3) To provide inpatient in-reach in complex diabetic management
4) To provide a postnatal plan for women with pre-existing diabetes in pregnancy

Clinical guidance

Table 1: Complications in pregnant women with diabetes

Risk to the mother	Risk to the baby
- Miscarriage - Hypoglycaemia/Hyperglycaemia - Keto-acidosis - Caesarean section - Retinopathy - Hypertension/pre-eclampsia - Nephropathy - Birth trauma to mother - Psychological Injury - Clinical Attendance Burden	- Miscarriage - Congenital Malformation - Fetal Macrosomia - Premature delivery - Still birth/neonatal death - Birth trauma - Neonatal hypoglycaemia - Neonatal polycythaemia - Neonatal hypocalcaemia - Neonatal hyperbilirubinaemia - Neonatal cardiomyopathy - Future obesity and diabetes - Future cardiovascular disease

Pre-conception care for pre-existing diabetes

1. All women with type 1 or type 2 diabetes mellitus should be encouraged to attend for pre-conception counselling either with their general practitioner or where this is poorly controlled or complicated by other health needs to a pre-conception clinic slot. Women should be provided with information about how diabetes affects pregnancy and how pregnancy affects diabetes.

   This clinic consultation should include:

2. Optimum glycaemic control is a pre-requisite for a healthy pregnancy and healthy baby.

   a. Women with type 1 and type 2 diabetes planning to conceive are advised to aim for the same blood glucose target ranges:

      - A fasting plasma glucose level of 5–7 mmol/L (on waking)
      - Plasma glucose level of 4–7 mmol/L before meals at other times during the day.

   b. Advise women to increase the frequency of self-monitoring of blood glucose levels to include fasting and post-meal glucose levels plus pre- meals if necessary.

c. Offer blood ketone testing strips and a meter to women with type 1 diabetes who are planning a pregnancy and advise them to test for ketonaemia if they become hyperglycaemic or unwell.

d. Advise women to avoid unplanned pregnancy and to use effective contraception until diabetes is well controlled.

3. Prior to conception the HbA1c level should be ≤48 mmol/mol (<6.5%), if this is possible without risking hypoglycaemia, to reduce the risk of congenital malformations in the fetus.

   a. Strongly advise women to avoid pregnancy if HbA1c >86 mmol/mol (>10%).

   b. Offer monthly measurement of HbA1c.

4. Women who are planning to conceive are advised to maintain a healthy lifestyle. Information and advice should be given to stop smoking, avoid alcohol, eat a healthy balanced diet with low glycaemic index diet and to keep active with regular to moderate exercise for at least 30 minutes every day. Offer referral to dietician for individualised dietary advice.

5. Encourage women with BMI >27kg/m^2 to lose weight before planning to conceive. Advise the patient's GP to consider referral for weight management in those with a BMI of >35.

6. Pre-pregnancy optimisation of diabetes related complications such retinopathy, nephropathy is essential to reduce maternal complications during pregnancy. This includes completing the following assessments and referrals:

   - Baseline blood tests: FBC, U&E, HbA1c, ACR/PCR.
   - Refer to nephrologist if serum creatinine ≥120 micromol/L, urinary protein to creatinine ratio (PCR) >30 mg/mmol, or eGFR <45 mL/minute/1.73m^2.
   - Retinal assessment if not had in last 6 months.
   - Defer rapid optimisation of blood glucose levels until after retinopathy assessment and treated. Referral can be made via the diabetes specialist nurse.
   - Optimise blood pressure with anti-hypertensive medications suitable in pregnancy (refer to *CG 1015 Hypertensive Disorders in Pregnancy*).

Pre-pregnancy treatment for pre-existing diabetes

Medications to start / continue.

1. Women with diabetes are advised to take **folic acid** orally 5mg once daily while trying to conceive and continued until 12 weeks of pregnancy to reduce the risk of

fetal neural tube defects.

2. Women with diabetes taking **metformin** and/or **insulin** should continue with the same medications.

Medication that must be stopped

1. All other oral **hypoglycaemic drugs** (i.e., not metformin) should be discontinued before pregnancy and substituted with insulin if needed.
2. **Angiotensin Converting Enzyme inhibitors** (ACEi) and **angiotensin-II receptor blockers** (ARBs) should be discontinued before pregnancy or on confirmation of pregnancy. These should be substituted with antihypertensive medications suitable in pregnancy.
3. **GLP-1 agonist injections** should be discontinued 3 months prior to conception (7).
4. **Statins** should be discontinued before conception or as soon as pregnancy confirmed.

Screening and diagnosis of Gestational Diabetes Mellitus (GDM)

Identification and treatment of gestational diabetes mellitus (GDM) is recommended to reduce the incidence of fetal macrosomia, birth injury, and neonatal unit admission.

1. Offer screening for GDM from 24-26 weeks with a 75g 2-hour oral glucose tolerance test (OGTT) for women who are at high risk of developing GDM.
2. If this routine GTT is missed another should be offered ASAP and can be up to 34 weeks. After 34 weeks home blood glucose monitoring should be offered.
3. If a patient DNA's x2 GTT appointments a discussion with her community midwife should be undertaken
4. Routine GTT's should be booked via SWFT_Q. Only emergency GTTs should be booked via fetal wellbeing unit.

Risk factors for GDM

- Previous GDM* (see below)
- BMI >30kg/m^2
- Previous macrosomic baby weighing 4.5kg or above.
- First degree relative with diabetes of any type
- An ethnicity with a high prevalence of diabetes, such as South Asian, Middle Eastern, Afro-Caribbean, African.

- Glycosuria of 2+ or above on one occasion or of 1+ or above on 2 or more occasions
- Maternal age ≥40 years old
- Consider screening in conditions such as previous history of PCOS, polyhydramnios in current pregnancy,
- Consideration for women over 35 years with concomitant co-morbidities including hypertension, cardiovascular disease and systemic inflammatory conditions.

5. *Offer women who have had gestational diabetes in their previous pregnancies:
    - A 75g 2-hour OGTT at 16 weeks or before if presents with osmotic symptoms (polydipsia, polyuria).
    - Add a further 75g 2-hour OGTT at 24–26 weeks if the results of the first OGTT are normal.
    - If both OGTT tests are normal, but patient was on hyperglycaemia treatment during previous pregnancy, consider home blood glucose monitoring (HBGM) if baby EFW >90th centile in growth.
6. Consider further testing to exclude gestational diabetes in women with glycosuria detected on urine dipstick during routine antenatal care:
    - Glycosuria 2+ or above on 1 occasion,
    - Glycosuria 1+ or above on at least 2 occasions.
7. Advise all women even if GTT normal to continue to follow a healthy diet.
8. Women who have undergone gastric weight loss surgery such as gastric sleeve or bypass should not have a GTT these women should be asked to monitor their home blood glucose for 5-7 days. Specialist advice on management should be taken in this cohort with management as per the guideline on women undergoing previous weight loss surgery.

In women who are not able to tolerate GTT because of vomiting etc., a further GTT should be arranged 1 week later. If GTT cannot be done at the second appointment, home blood glucose monitoring should be arranged for 1 week. Follow up appointment to review the blood glucose monitoring should be arranged with the diabetes specialist nurse at the joint diabetic antenatal clinic.

Do not refer women for a GTT following an increased AC at the 20-week anomaly USS, this is not an indication for a GTT

A raised Abdominal circumference (AC) alone at any gestation with a normal fetal growth is not an indication for a GTT or home blood glucose monitoring. If a raised AC is accompanied with any other finding such as glycosuria or polyhydramnios this is when a GTT or home Blood glucose monitoring would be indicated.

Please ensure any woman that is offered home Blood glucose monitoring is referred to the Diabetes team on the electronic patient records

Diagnosis

GDM is diagnosed when glucose levels are as follows:

Fasting plasma glucose	≥5.6 mmol/L
2-hour plasma glucose	≥7.8 mmol/L

Antenatal care

Clinics and referrals

1. All women with diabetes should be referred to the **joint obstetric and diabetes clinic** for shared care throughout the pregnancy. Appendix 2 highlights the appointment schedule for women with Diabetes in pregnancy

    - Women with pre-existing diabetes should be referred early in the first trimester.
    - Aim to offer women with gestational diabetes a review within 1 week of diagnosis.
    - The diabetes team review these women regularly by contacting via phone or in the clinic to monitor glycaemic control.
    - The obstetric team review the women every 1–4 weeks according to need. If women develop pregnancy or diabetes complications, they are advised to attend the clinics more frequently.

2. All women should be given a management plan outlining minimum routine care plus any individual requirements (printed copies available in the clinic).

    - Discuss the necessity of optimising glycaemic control to reduce maternal and fetal complications in every contact with the patients.
    - Advice regarding healthy lifestyle, smoking cessation, avoidance of alcohol, and regular exercise.

3. All women should be reviewed by the dietician to ensure women are following a low sugar, low fat, low GI diet. Training in carbohydrate counting should be offered to help in cases where control is suboptimal.

4. Discuss the risk of hypoglycaemia and impaired awareness of hypoglycaemia during pregnancy, especially in first trimester if associated with vomiting.

    - Management of hypoglycaemia should be discussed.
    - Women and their partners should be provided with information leaflets and advised on suitable hypoglycaemia treatment kits to manage hypoglycaemia.

5. Preparation for birth

    - Offer women with diabetes and comorbidities – such as obesity or autonomic neuropathy – an anaesthetic assessment in third trimester of pregnancy.
    - Post-delivery treatment recommendations should be available in the hospital notes from 36 weeks.

Monitoring fetal growth and wellbeing

- Offer scans for monitoring growth and liquor volume every 4 weeks from 28 to 36 weeks gestation.
- Do not routinely offer fetal wellbeing tests (umbilical artery dopplers, liquor volume, CTG) before 38 weeks of gestation for women with diabetes, unless there is a risk of FGR or SGA, or other medical indication.
- An individualised approach to monitor fetal growth and wellbeing for women with diabetes at risk of fetal growth restriction (macro-vascular disease and / or nephropathy) should be taken and added to the routine care plan.

Additional actions for women with pre-existing diabetes

1. Advise women with Type 1 diabetes to monitor ketones if feeling unwell or have persistent hyperglycaemia to exclude diabetic ketoacidosis. For management of DKA, refer to *UHCW CG 1050*.
2. Offer the following prophylactic treatments:
    a. Continue **folic acid** 5mg orally once daily until 12 weeks of gestation.
    b. Low-dose **aspirin** 75-150mg orally once daily from 12 weeks gestation to until delivery to reduce the risk of pre-eclampsia. Refer to *CG 1015 Hypertensive disorders in pregnancy*.
    c. **Accrete D3® One-a-day chewable tablets** (calcium 1g (as calcium carbonate 2.5g) + colecalciferol 880 units) ONE tablet orally once daily should be prescribed throughout pregnancy as calcium may also lower the risk of pre-eclampsia [unlicensed indication]. Refer to *CG 1015 Hypertensive disorders in pregnancy*.
3. At booking women with pre-existing diabetes should have baseline blood tests including FBC, U&E, HbA1c, urinary ACR/PCR.
4. Antenatal HbA1c monitoring
   Measure HbA1c in every trimester to assess the level of risk for the pregnancy and compliance. HbA1c reduces over time in pregnancy – static or rising levels are significant.
5. Retinal assessment
   Offer retinal assessment for women with pre-existing diabetes at booking (unless had in last 3 months) and repeat at second and third trimester. Referral can be made via the Diabetes Specialist Nurse.

a. If diabetic retinopathy presents at booking, repeat retinal assessment at 16–20 weeks.

b. If known to have follow up with ophthalmologist is mandatory and usually done automatically by the retinal screening team.

6. Renal assessment
   Involve renal team if creatinine >120 mmol/L, Urinary ACR >30 mg/mol or total protein excretion exceeds 2 g/day.
   Monitor blood pressure and liaise with renal/diabetes team.
7. Thromboprophylaxis
   Thromboprophylaxis should be considered for women with proteinuria >5 g/day (ACR >220 mg/mmol).
8. Thromboprophylaxis should be considered for women who score high in VTE risk assessment. Refer to *CG 1005 Thromboprophylaxis in pregnancy and the puerperium*.
9. Antenatal screening
   a. Confirm viability and gestational age at 7–9 weeks in the EPAU on ward 23 if possible, followed by 12-week formal booking scan.
   b. Offer first trimester Trisomy screening as part of routine antenatal care (Quad test in second trimester less reliable in established diabetes but to AFP changes in women on insulin).
   c. Offer ultrasound scan at 20 weeks to detect fetal structural anomalies including examination of fetal heart (4 chambers, outflow tracts, and 3 vessels views). Consider referral to the Fetal Medicine Team in cases of HbA1c ≥86mmols/mol (10%).

Monitoring blood glucose levels in antenatal period

Standard monitoring of blood glucose levels will be via capillary blood glucose unless a continuous monitoring device is in place or felt indicated by the diabetic team.

1. Women with type 1 diabetes should be offered CGM
2. Women with type 2 DM should have an objective record of their blood glucose recorded in their hospital records / EPR and be offered alternatives (e.g. intermittently scanned CGM) to blood glucose monitoring if glycaemic targets are not achieved

Frequency of testing

Diabetes type / treatment	Testing frequency
Women with type 1 diabetes, or Women with type 2 diabetes or gestational diabetes on multiple daily insulin injection regimens.	Daily fasting, pre-meal, 1-hour post-meals, and bedtime.
Women with type 2 diabetes or gestational diabetes: *a)* On diet and exercise therapy, *or* *b)* Taking oral therapy, *or* c) Taking single-dose intermediate- or long-acting insulin.	Daily fasting and 1-hour post-meal blood glucose levels.

Target blood glucose level

Always maintain capillary blood glucose (CBG) **>4.0 mmol/L**, and:

Timing	Target CBG
Fasting	<5.3 mmol/L
1 hour post meal	<7.8 mmol/L
2 hours post meal	<6.4 mmol/L

* Those on continuous glucose monitoring should aim to be within this range >70% of the time and <5% of time above the target range (8).

Diabetic treatment options

Insulin and metformin are the only treatment options recommended for diabetes in pregnancy.

Pre-existing diabetes

Type 1 Diabetes

1. Basal Bolus Regimen consisting of:
    a. Long-acting (basal) insulin,

and

b. Rapid-acting (bolus) insulin).

2. CSII (Continuous Subcutaneous Insulin Infusion) pump:
    a. Those women with Type 1 Diabetes who have their own pump will manage this in liaison with the diabetic team.

Type 2 Diabetes

1. Continue or start metformin (if no contraindications – see BNF for information).
2. Consider adding insulin therapy, depending on blood glucose profile:
    a. Add in long-acting (basal) insulin, and/or
    b. Rapid-acting (bolus) insulin.

Gestational Diabetes

Offer treatment based on fasting plasma glucose level at diagnosis

Fasting plasma glucose level <7.0 mmol/L at diagnosis

1. Offer a trial of exercise and dietary intervention for 1–2 weeks.
2. If target blood glucose levels are not met within 1–2 weeks, offer **metformin** (if not contraindicated).

    Offer **insulin** if metformin is contraindicated or is not acceptable to the woman. If not tolerated consider modified release metformin prior to changing to insulin.
3. Consider adding **insulin** therapy if blood glucose levels remain greater than target despite metformin, or patient intolerant to metformin.

Fasting plasma glucose level ≥7.0 mmol/L at diagnosis **or** Fasting blood glucose is between 6.0–6.9 mmol/L at diagnosis, and complicated with macrosomia or hydramnios

1. Offer immediate treatment with insulin with or without metformin,
   and
2. Diet and exercise changes.

Metformin

Metformin tablets have been licensed for use in pregnancy as an adjunct or alternative to insulin since March 2022, following data from a large-scale study showing no safety concerns in pregnancy. (MHRA/CHM 2022).

- Metformin must be avoided in patients with an eGFR <45mL/min/1.73m^2.
- Gastrointestinal side effects are common on commencement of Metformin including: nausea, vomiting and diarrhoea. These usually resolve in the initial period but may persist in small groups of patients. Modified- release preparations may have increased tolerability.
- Other common side effects include: altered taste including a metallic taste, decreased appetite and stomach ache.
- Metformin is also commonly associated with reduced Vitamin B12 levels (affecting up to 1 in 10 patients who take it), and particularly occur in patients with long-term metformin use, co-existing gastrointestinal disorders, restricted diets (e.g., vegan and vegetarian), and concomitant medications known to reduce vitamin B12 absorption (e.g., omeprazole). Patients may be asymptomatic but may present with symptoms of megaloblastic anaemia and/or neuropathy. Other symptoms may include mental disturbance (depression, irritability, cognitive impairment), glossitis (swollen and inflamed tongue), mouth ulcers, and visual or motor disturbances. Consider periodic monitoring of vitamin B12 levels in patients at risk or presenting with symptoms.

<u>Typical Dose and frequency (This may alter dependent on the clinical situation)</u>

- Initiate therapy with 500mg daily for 1 week – dose to be taken with breakfast.
- Increase to 500mg twice daily (with breakfast and evening meal), then three times daily, at 1-week intervals.
- Maximum daily dose = 2g daily.
- Each dose should be taken with or after a meal.

Insulin therapy during pregnancy

Insulin analogues are recommended for use during pregnancy (not soluble insulin). Use of long-acting insulin, such as determire or glargine, in pregnancy is considered off-label. These may be continued where pre-conceptual use has established good control.

Insulin must always be prescribed using the brand name, and device type must be clearly specified.

The following subcutaneous insulin types are recommended during pregnancy:

- Long-acting insulin (detemir, e.g., Levemir or glargine, e.g., Lantus / Semglee)
- Rapid-acting insulin (aspart e.g., NovoRapid, or lispro, e.g., Humalog)

Ultra-rapid acting are not routinely recommended in pregnancy due to limited data on their safety profile (9). Whilst limited early data suggests no clear adverse effect. Use may be considered in selected cases requiring optimisation of control on discussion with an Endocrine consultant.

Labour and delivery

Timing and mode of delivery

Discuss care plan for timing, mode of delivery and management of birth at 32-34 weeks antenatal appointment, or earlier if complicated (senior input mandatory).

Timing is based on prior history, diabetes control, presence of fetal macrosomia, and other pregnancy complications.

- Diabetes alone is not a contraindication for vaginal birth or VBAC.
  - Caution with induction of labour in women with type 1 or 2 diabetes for VBAC as poor healing may increase risk of wound dehiscence.
- Consider elective caesarean section if estimated fetal weight >4.5kg.
- Diabetic retinopathy is not a contraindication for vaginal birth. Individual care plan should be discussed with ophthalmologist before delivery.

<u>Timing of delivery for women with type 1 or 2 diabetes</u>

- Women with no other complications should be delivered by **38^{+6} weeks.**
- Consider elective birth by induction of labour (IOL) or lower section caesarean section (LSCS) if indicated, between **37^{+0} and 38^{+6}** weeks of pregnancy.
- Women with severe maternal or fetal complications may require elective birth by IOL or LSCS, if indicated, before 37 weeks of pregnancy and an individualised birth plan should be made

<u>Timing of delivery for women with gestational diabetes controlled on metformin</u>

- Advise women with GDM controlled on Metformin with no fetal or maternal compromise to give birth between 39-39+6weeks of gestation.

Timing of delivery for women with gestational diabetes controlled with diet.

- Advise women with GDM controlled with diet with no fetal or maternal compromise to give birth between 40-40+6 weeks of gestation.

Please see Appendix 3 for table to base discussion regarding timing for IOL for women with diabetes in Pregnancy.

Spontaneous labour

- Inform the diabetes team of admission in cases complicated by poor intra-partum blood glucose control, systemic disease impacting on diabetic control or suspected diabetic ketoacidosis.
- Initiate hourly BM (blood glucose) monitoring in established labour.
- Aim for intrapartum blood glucose of 4-7mmol/L
- For women with type 1 diabetes, or type 2 or gestation diabetes managed with insulin therapy: Commence variable rate intravenous insulin infusion (VRIII) from the onset of established labour (See VRII section).
- Treatment with CSII pumps can be continued during labour/birth and self-managed by the woman. Switch to VRIII if self-management is not possible, if blood glucose >7 mmol/L on two consecutive reasons, or caesarean section is anticipated. CSII treatment can be safely stopped for up to 60 minutes if an urgent section is required but must be restarted immediately post-operatively to prevent DKA.
- For women in established labour with type 2 or gestational diabetes controlled with diet or metformin alone:
    - If capillary plasma glucose >7 mmol/L on two consecutive readings, initiate VRIII (the second CBG should be within half an hour of the first high reading to prevent any delay in starting VRIII)
    - Do not use insulin infusion (VRIII) during labour if capillary plasma glucose maintained between 4 and 7 mmol/L.
- U&Es should be checked 6-hourly whilst in labour to monitor for evidence of hypokalemia or hyperkalaemia secondary to VRII and/or syntocinon.
- Assess labour progress by cervical assessment every 4 hours as per routine intrapartum care and continue CTG monitoring throughout labour.
- Offer analgesia during labour as per routine care.

Induction of labour

- Women on insulin should be managed on labour ward throughout the induction process, but those with diabetes controlled by diet or metformin alone can be managed on ward 24 until labour established.
- If induction using prostaglandins (e.g., Prostaglandin gel or Propess®) and allow patient to eat and drink normally with usual insulin and/or metformin until labour established. Once labour is established, change to VRIII as for spontaneous labour for those women with Type 1 or Type 2 diabetesIf artificial rupture of membranes (ARM) is performed or oxytocin intravenous infusion is commenced for augmentation of labour. Hourly BM monitoring must commence when labour is established. If there are x2 readings of >7.8 a VRII should be commenced (the second CBG should be within half an hour of the first high reading to prevent any delay in starting VRIII)

Elective Lower Section Caesarean Section (LSCS)

- Women with diabetes should be admitted in the morning on the day of surgery.
- Advise women to eat and take their normal insulin and/or metformin (or other antidiabetic treatment) on the evening of the day before LSCS.
- Advise women to omit breakfast and antidiabetic treatment including insulin on the day of operation.
- Routine anaesthetic review on the day of operation.
- Women with diabetes on insulin should be first on elective list.
- Gastric acid suppression and antibiotics to be given as per routine care for LSCS (refer to *CG 172 Caesarean section*).
- If woman having LSCS under GA, monitor blood glucose level every 30 minutes until the baby is born and patient is fully conscious.
- If the caesarean section is uncomplicated, the woman may be fit to eat within 4 hours and women using insulin pre-pregnancy should resume their normal pre-pregnancy insulin dose pre-meals. The doses should be as pre-advised by diabetes team.

  If unable to eat, check blood glucose levels hourly and commence VRIII if capillary blood glucose >7 mmol/L.

Postpartum care for pre-existing diabetes

1. After uncomplicated vaginal delivery, the timing of stopping VRII is dependent on the existing treatment.
    a. Pre-existing diabetes treated with insulin: Reduce VRII infusion rate by 50%. VRII to be stopped 30-60 minutes after first meal. Commence the postpartum insulin regime as per the diabetic team plan.
    b. Pre-existing diabetes treated with oral antidiabetics: Stop VRII post- delivery. Monitor blood glucose 4-hourly until the first meal and thereafter pre-meals and pre-bedtime. Aim for a blood glucose of 6-10mmol/L to avoid hypoglycaemia. Commence postpartum medication regime as per the diabetic team plan.
2. Ensure plan for ongoing diabetes management in place at point of usual care if necessary, by liaison with DSN.
3. Advise women to monitor their blood glucose levels carefully to establish the appropriate dose fasting, pre &/or post-meal and before bedtime levels depending on situation should be recorded
4. If the woman was on variable rate insulin infusion and had an uncomplicated caesarean section, she may eat within 4 hours and should have normal insulin pre-meal and discontinue VRIII 30 mins post-meal.

    Re-start insulin at pre-pregnancy dose.
5. If the women unable to eat after the delivery:
    a. Check blood glucose levels hourly and continue or commence VRIII if BM >7mmol/L.
    b. Check U&Es to adjust the potassium supplements as required.
    c. Contact diabetes team for insulin dosage adjustments, if concerned.
6. Inform women on insulin that they are at increased risk of hypoglycaemia especially when breastfeeding and advise them to have a meal or snack before or during breastfeeding. Insulin dosage may need to be reduced to avoid hypoglycaemia (a reduction of up to 20% may be necessary).
7. Women with type 2 diabetes who are breastfeeding can continue or resume metformin immediately after birth but may need to avoid other hypoglycaemic medication (can be discussed with the diabetes / pharmacy team).
8. Postnatal follow up:
    a. Refer women with pre-existing diabetes back to their routine diabetes care arrangements.
    b. Remind women with diabetes of the importance of contraception and need for preconception care when planning future pregnancies.

Postpartum care for gestational diabetes

1. Stop VRIII immediately after delivery.
2. All other antidiabetic medications such as insulin and metformin should be discontinued after delivery unless advised otherwise by diabetes team – refer to plan in patient medical record.
3. Check blood glucose before and after meals for up to 24 hours after delivery in women diagnosed with gestational diabetes to exclude persistent hyperglycaemia before they are transferred to community care.
4. Remind women who were diagnosed with gestational diabetes of the symptoms of persistent hyperglycaemia.
5. Explain to women about the risks of GDM in future pregnancies and offer them testing for diabetes when planning future pregnancies.
6. For women with GDM and whose blood glucose levels returned to normal after the birth:
    a. Offer lifestyle advice including weight control, diet, and exercise.
    b. Offer a fasting plasma glucose (FPG) and HbA1c at or after 12 weeks after birth to exclude continuing diabetes (this will be arranged by DSN).
    c. Do not routinely offer a 75g 2-hour OGTT if blood glucose levels return to normal after birth.

Consider signposting referral to a post-GDM diabetes prevention programme via: https://preventing-diabetes.co.uk/

Postnatal test result	Action/advice
FPG <6.0 mmol/L and/or HbA1c <39 mmol/mol	- Low probability of having diabetes at present - Offer lifestyle advice (weight control, diet, exercise) - Offer annual HbA1c test - At moderate risk of developing type 2 diabetes
FPG 6.0–6.9 mmol/L and/or HbA1c 39–48 mmol/mol	- At high risk of developing type 2 diabetes - Offer an intense lifestyle change programme - Increase dietary fibre and reduce fat intake – especially saturated fat - Offer annual HbA1c test
FPG >7.0 mmol/L and/or HbA1c >48 mmol/mol	Likely to have type 2 diabetes.

Neonatal care – Please refer to CG 997 Hypoglycaemia: Prevention, Detection and Management in "at-risk" Neonates

Hypoglycaemia

Hypoglycaemia is usually defined as a blood glucose of <4.0 mmol/L.

Women with pre-existing diabetes are prone to hypoglycaemia in pregnancy. Discuss with the women and their family members about impaired awareness of hypoglycaemic symptoms in pregnancy, especially in the first trimester if associated with vomiting.

Women with type 1 diabetes and their family members should be trained to manage hypoglycaemia; They should be provided with leaflets regarding managing hypoglycaemia. The women should be able to recognise and treat hypoglycaemia. Those with a history of recurrent severe episodes of hypoglycaemia should have oral glucose treatments and/or glucagon IM injection available at home – the diabetes team will prescribe and instruct patients requiring this.

1. Women should be advised to treat hypoglycaemia promptly with 15-20 grams of fast acting carbohydrates, for example:
    - 150-200mL fruit juice
    - 4-5 Glucotabs or 5-7 Dextrasol tablets
    - 2 x 25g tubes of oral glucose gel (Glucogel 40%)
    - 3-4 teaspoons sugar dissolved in water
    - *Do not use: chocolate, hot tea/coffee, biscuits, Lucozade.*
2. Recheck blood glucose after 10–15 minutes and repeat administration of fast-acting carbohydrates if needed. Refer to CG 466 Treatment of hypoglycaemia in adults for further management if needed.
3. Once blood glucose >4.0 mmol/L, give long-acting carbohydrate of the patient's choice e.g., 2 biscuits, 1 slice of bread/toast.
4. Do not omit insulin doses if due: Usual insulin doses should be given as normal with meals and intermediate insulin as prescribed once recovered.

Refer to UHCW CG 466 Treatment of hypoglycaemia in adults

All medical and nursing staff involved in the care of women with diabetes should be trained to manage hypoglycaemia. For details regarding managing inpatient hypoglycaemia, refer to trust guidelines, which includes care if loss of consciousness, and when IV glucose or IM Glucagon will be required.

Diabetic ketoacidosis (DKA)

Euglycaemic ketoacidosis is not uncommon in pregnancy. Always monitor ketones in patients with type 1 diabetes if they are unwell.

Patients are diagnosed as being in diabetic ketoacidosis (DKA) if:

1. Diagnosis of diabetes mellitus *or* blood glucose ≥11.1 mmol/L,
   and
2. Capillary ketones ≥3.0 mmol/L *or* urinary ketones ≥3+ on urine dipstick,
   and
3. Metabolic acidosis: pH <7.30 or HCO3 <15.0 mmol/L.

DKA is a medical emergency: patients should be admitted to a high-dependency unit or intensive care and be managed as per **UHCW CG 1050 Management of Diabetic Ketoacidosis in Adults.**

Corticosteroids for patients at risk of preterm delivery

Diabetes should not be considered a contraindication to antenatal corticosteroids for fetal lung maturation or for tocolysis. Women with diabetes given steroids must be admitted to the antenatal unit as corticosteroids impair glucose control.

Refer to UHCW CG 143 Antenatal Corticosteroids and UHCW CG 2064 Preterm Labour and Birth.

- Corticosteroids should be administered as per the guideline above with adequate counselling around emergent evidence on risks/benefits for their use in caesarean section <39 weeks gestation. This should encompass the increased risks of both hypoglycaemia and respiratory distress in babies born to diabetic mothers.
- In women with insulin treated diabetes who are receiving steroids for fetal lung maturation, treat with VRIII and monitor closely (see below). Women with pre-existing diabetes on insulin pumps can be maintained on this in liaison with the diabetic team if required.
- Patients with diabetes not on insulin should also be admitted for hourly blood glucose monitoring and VRIII started if glucose levels rise above 7.8 mmol/L on two consecutive readings (the second CBG should be within half an hour of the first high reading to prevent any delay in starting VRIII).
- Continue regular metformin
- Stop bolus/rapid acting insulin whilst on the VRII

- Do not use betamimetics (e.g., terbutaline) for tocolysis in women with diabetes.
- The insulin infusion needs to be continued for at least 12 hours (occasionally up to 24 hours) after last dose of steroids.
- Discuss administration of antenatal corticosteroids for fetal lung maturity with women who will be delivering by elective caesarean section at <39 weeks gestation according to *UHCW CG 143*.Uncertainty over the evidence for steroid use in this indication should be balanced against the increased risk of respiratory distress in babies of diabetic mothers and women counselled on this as per national guidance (10).

Variable Rate Intravenous Insulin Infusion (VRIII) in pregnancy

Indications for VRIII in pregnancy

- Corticosteroid administration
  - Refer to CG 143 Antenatal corticosteroids for recommended corticosteroid regimen.
  - Start VRIII if BG levels are above target on two consecutive readings and continue 12 hours after the last corticosteroid dose.
- Hyperglycaemia with conditions such as vomiting or severe illness.
- During established labour and potentially during caesarean section for women on insulin-treated diabetes of any type (see labour and delivery, above)
  - Insulin requirements usually fall as labour progresses.
- Severe illness e.g., sepsis which requires tight glycaemic control.

Diabetic treatment during VRIII

- Metformin should be continued if VRIII is started.
- Bolus SC insulin should be stopped during VRIII.
- Basal insulin should be continued during VRIII.If VRIII is indicated, stop and remove CSII pumps immediately prior to starting VRIII.

Monitoring during VRIII

- Review insulin infusion rate hourly to achieve target range of glucose.
- Review and document the indication for VRIII daily.
- Review patient, including clinical fluid status, daily.
- Check urea and electrolytes every 4-6 hours to guide potassium replacement.

Capillary Blood Glucose

Monitor capillary blood glucose (CBG) levels every hour.

Indication	Target CBG
Sick non-laboring patient	4.0-7.8mmol/L*
Labouring patient	4.0-7.8mmol/L
Administration of antenatal steroids	4.0-7.8 mmol/L

**Whilst the target range for septic/unwell women remains the same higher readings can be anticipated as a component of the disease response/recovery therefore a higher threshold for commencement of interventional therapy should be taken as CBG control is likely to improve following disease resolution there is an absence of evidence for specific target ranges in this setting.*

Intravenous fluids

Always consider the clinical haemodynamic state of patient and review electrolytes before deciding on the type and rate at which IV fluids are prescribed and administered.
Caution is needed in women with preeclampsia who may require fluid restriction.

Intravenous fluids alongside VRIII		
Indication for VRIII	**Fluid**	**Infusion rate**
Sick non-labouring patient on fluid restriction	Glucose 5% with potassium chloride 40mmol in 1000mL consideration for those patients with hyponatremia	83 mL/hr
Sick non-labouring patient	Glucose 5% with potassium chloride 40mmol in 1000mL consideration for those patients with hyponatremia	125 mL/hr

Labouring patient	Sodium chloride 0.9% and glucose 5% with potassium chloride 20mmol in 500mL	50 mL/hr
Well patient receiving antenatal corticosteroids for fetal lung maturity	No additional IV fluids required if eating and drinking normally. Continue Metformin. Stop short-acting insulin.	N/A

VRIII administration

Review and document the indication for VRIII daily.
VRIII for pregnant women should be prescribed on an IV fluid prescription with the

Algorithm as below.

Preparation and dilution of VRIII

1. Withdraw 50 units Actrapid® (human insulin) (0.5mL) using an insulin syringe and add to a 50mL luer-lock syringe.
2. Dilute with sodium chloride 0.9% (49.5mL) to a total volume of 50mL. Mix thoroughly.
3. Final solution = 50 units in 50mL = 1 unit in 1mL.
4. Prime through an appropriate giving set with a non-return valve. Infuse using a rate-controlled syringe pump.
5. Discard any unused solution after 24 hours.

Rate of administration

- Most women should start on algorithm 1.
- Algorithm 2 should be used for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1).
- Use algorithm 3 for women who are not achieving target on algorithm 2 (no patient starts here without diabetes or medical review).
- Move to higher algorithm if BG is above target and is not dropping.
- Move to lower algorithm if BG falls <4.0 mmol/L or is dropping too fast.

Variable Rate Insulin Infusion in Pregnancy			
Algorithm →	**1**	**2**	**3**
Capillary blood glucose (BG) (mmol/L) ↓	For most women	For women not controlled on algorithm 1 or needing >80 units/day insulin	For women not controlled on algorithm 2 (after specialist advice)
	Infusion rate = units/hour = mL/hour		
<4.0	STOP INSULIN FOR 20 MINUTES Treat hypoglycaemia as per UHCW CG 466.		
4.0 – 5.5	0.2	0.5	1
5.6 – 7.0	0.5	1	2
7.1 – 8.5	1	1.5	3
8.6 – 11.0	1.5	2	4
11.1 – 14.0	2	2.5	5
14.1 – 17.0	2.5	3	6
17.1 – 20.0	3	4	7
≥20.1	4	6	8

Appendices

Appendix 1. Oral glucose tolerance test results

Appendix 2. Timetable of antenatal appointments

Appendix 3. Diabetes in pregnancy: Timing of Induction of labour taken from NICE NG3 (2020)

Appendix 4. Multi-Disciplinary Care of Pregnant Women with Pre-existing Diabetes Flowsheet

Appendix 5. Management of Gestational Diabetes Mellitus

Appendix 6. Obstetric Variable Rate Intravenous Insulin Infusion (VRIII) Chart

References

1) Scottish Intercollegiate Guidelines Network (SIGN). Management of Diabetes. Edinburgh: SIGN; 2017. (SIGN publication no. 116). [cited 25/06/23]. Available from URL: http://www.sign.ac.uk

2) National Institute of Health and Care Excellence. Diabetes in pregnancy: management from preconception to the postnatal period NICE guideline [NG3] Published: 25 February 2015. Last updated: 16 December 2020.

3) Wang H, Li N, Chivese T, Werfalli M, Sun H, Yuen L, Hoegfeldt CA, Elise Powe C, Immanuel J, Karuranga S, Divakar H, Levitt N, Li C, Simmons D, Yang X; IDF Diabetes Atlas Committee Hyperglycaemia in Pregnancy Special Interest Group. IDF Diabetes Atlas: Estimation of Global and Regional Gestational Diabetes Mellitus Prevalence for 2021 by International Association of Diabetes in Pregnancy Study Group's Criteria. Diabetes Res Clin Pract. 2022 Jan;183:109050. doi: 10.1016/j.diabres.2021.109050. Epub 2021 Dec 6. PMID: 34883186.

4) Ye W, Luo C, Huang J, Li C, Liu Z, Liu F et al. Gestational diabetes mellitus and adverse pregnancy outcomes: systematic review and meta-analysis BMJ 2022; 377 :e067946 doi:10.1136/bmj-2021-067946

5) Lowe WL Jr, Scholtens DM, Lowe LP, Kuang A, Nodzenski M, Talbot O, Catalano PM, Linder B, Brickman WJ, Clayton P, Deerochanawong C, Hamilton J, Josefson JL, Lashley M, Lawrence JM, Lebenthal Y, Ma R, Maresh M, McCance D, Tam WH, Sacks DA, Dyer AR, Metzger BE; HAPO Follow-up Study Cooperative Research Group. Association of Gestational Diabetes With Maternal Disorders of Glucose Metabolism and Childhood Adiposity. JAMA. 2018 Sep 11;320(10):1005-1016. doi: 10.1001/jama.2018.11628. PMID: 30208453; PMCID: PMC6143108.

6) Bellamy L, Casas JP, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. Lancet. 2009 May 23;373(9677):1773-9. doi: 10.1016/S0140-6736(09)60731-5. PMID: 19465232

7) Ozempic [package insert]. Plainsboro, New Jersey: Novo Nordisk, Inc.; 2017. FDA Reference: 4190425

8) Battelino T, Danne T, Bergenstal RM, Amiel SA, Beck R, Biester T, Bosi E, Buckingham BA, Cefalu WT, Close KL, Cobelli C, Dassau E, DeVries JH, Donaghue KC, Dovc K, Doyle FJ 3rd, Garg S, Grunberger G, Heller S, Heinemann L, Hirsch IB, Hovorka R, Jia W, Kordonouri O, Kovatchev B, Kowalski A, Laffel L, Levine B, Mayorov A, Mathieu C, Murphy HR, Nimri R, Nørgaard K, Parkin CG, Renard E, Rodbard D, Saboo B, Schatz D, Stoner K, Urakami T, Weinzimer SA, Phillip M. Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range. Diabetes Care. 2019 Aug;42(8):1593-1603. doi: 10.2337/dci19-0028. Epub 2019 Jun 8. PMID: 31177185; PMCID: PMC6973648.

9) Wong EY, Kroon L. Ultra-Rapid-Acting Insulins: How Fast Is Really Needed? Clin

Diabetes. 2021 Oct;39(4):415-423. doi: 10.2337/cd20-0119. PMID: 34866783; PMCID: PMC8603316.

10) Stock, SJ, Thomson, AJ, Papworth, S; the Royal College of Obstetricians, Gynaecologists. Antenatal corticosteroids to reduce neonatal morbidity and mortality. BJOG 2022; https://doi.org/10.1111/1471-0528.17027. 129: e35– e60.

11) UK Teratology Information Service. Metformin in pregnancy (version 2). September 2017. Available online via www.toxbase.org (accessed 29/06/22).

12) Pharmaceutical Press. The British National Formulary. Available via Trust Intranet (accessed: 29/06/22).

13) MHRA. Metformin in pregnancy: study shows no safety concerns. Drug Safety Update. 15 March 2022: 15(8).

14) Joint British Diabetes Societies for inpatient care (JBDS-IP). Managing diabetes and hyperglycaemia during labour and birth (JBDS 12). April 2022. Available online via https://www.diabetes.org.uk/professionals/resources/shared-practice/inpatient-and-hospital-care/joint-british-diabetes-society-for-inpatient-care.

15) Royal College of Obstetricians and Gynaecologists. Antenatal corticosteroids to reduce neonatal morbidity and mortality. Green-top Guideline No. 74. February 2022.UK Teratology Information Service. Use of Antidiabetics in pregnancy (version 2). March 2021. Available online via: https://uktis.org/monographs/use-of-antidiabetics-in-pregnancy/ (Accessed on 19/07/2023)

16) Briggs G, Towers C, Forinash A. Drugs in Pregnancy and Lactation (online). Twelfth Edition. 2022. Wolters Kluwer Health; Philadelphia. Available online via: https://www.medicinescomplete.com/#/browse/dpl (Accessed on 19/07/2023)

17) National Institute of Health and Care Excellence. Hypertension in pregnancy: diagnosis and management. NICE Guideline NG133. Published 25 June 2019, updated 17 April 2023.

18) MHRA. Metformin and reduced vitamin B12 levels: new advice for monitoring patients at risk. 20 June 2022. Available from: MedicinesComplete — Browse BROWSE > Drugs in Pregnancy and Lactation > Publication Home (Accessed on 19/07/2023).

19) The use of variable rate intravenous insulin infusion (VRIII) in medical inpatients. Joint British Diabetes Societies for Inpatient Care. October 2014. Available from: http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm

CG 1011 Appendix 1. Oral Glucose Tolerance Test Results

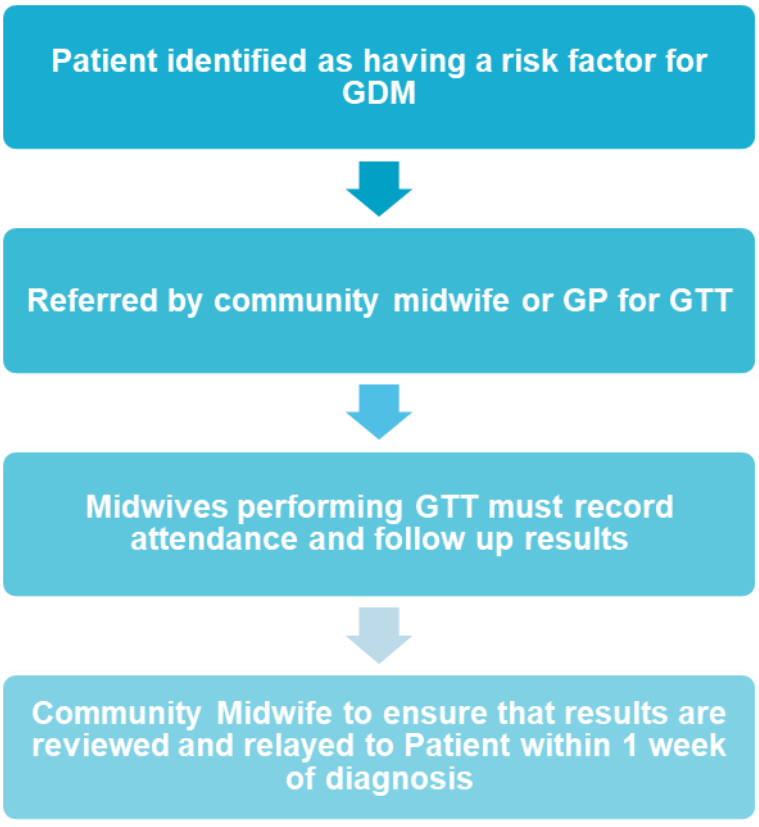
All Community midwives and GP's requesting and performing Glucose Tolerance Tests are responsible for ensuring that the results are reviewed, disseminated to the patient and appropriate referrals made to the specialist clinic as outlined within the Clinical Guideline.

All unacknowledged results of investigations requested within the Fetal Wellbeing Unit for patients are to be reviewed Monday-Friday; normal results will be relayed to the patients. Abnormal results will result in a referral to the antenatal clinic and an appointment sent to patients.

A log of requests made and results will be maintained within the Fetal Wellbeing Unit. Midwives who request or obtain results for GTTs need to ensure that this is documented within the patient's medical record.

Community Midwives and Antenatal clinic midwives will ensure that patients have received their results at the patient's next appointment to ensure that there are no missed abnormal results.

Results for Glucose Tolerance tests must not be auto acknowledged.



CG 1011 Appendix 2. Timetable of antenatal appointments

As taken from NICE NG3.

Appointment	Care for women with diabetes during pregnancy

Booking appointment (joint diabetes and antenatal care) – ideally by 10 weeks	- Discuss how diabetes will affect the pregnancy, birth and early parenting (such as breastfeeding and initial care of the baby).
	- If the woman has not had preconception care:
	  ○ Give information, education and advice
	  ○ Take a clinical history to establish the extent of diabetes-related complications (including neuropathy and vascular disease), and review medicines for diabetes and its complications.
	- If the woman has had preconception care, continue to provide information, education and advice on achieving optimal blood glucose control (including dietary advice).
	- Offer retinal assessment for women with pre-existing diabetes unless the woman has been assessed in the last 3 months.
	- Offer a renal assessment for women with pre-existing diabetes, if they have not had 1 in the last 3 months.
	- Arrange contact with the joint diabetes and antenatal clinic every 1 to 2 weeks throughout pregnancy for all women with diabetes.
	- Measure hba1c levels for women with pre-existing diabetes to determine the level of risk for the pregnancy.
	- Offer self-monitoring of blood glucose or a 75-g 2-hour oral glucose tolerance test (OGTT) as soon as possible for women with previous gestational diabetes who book in the first trimester.
	- Confirm the viability of the pregnancy and gestational age at 7 to 9 weeks.

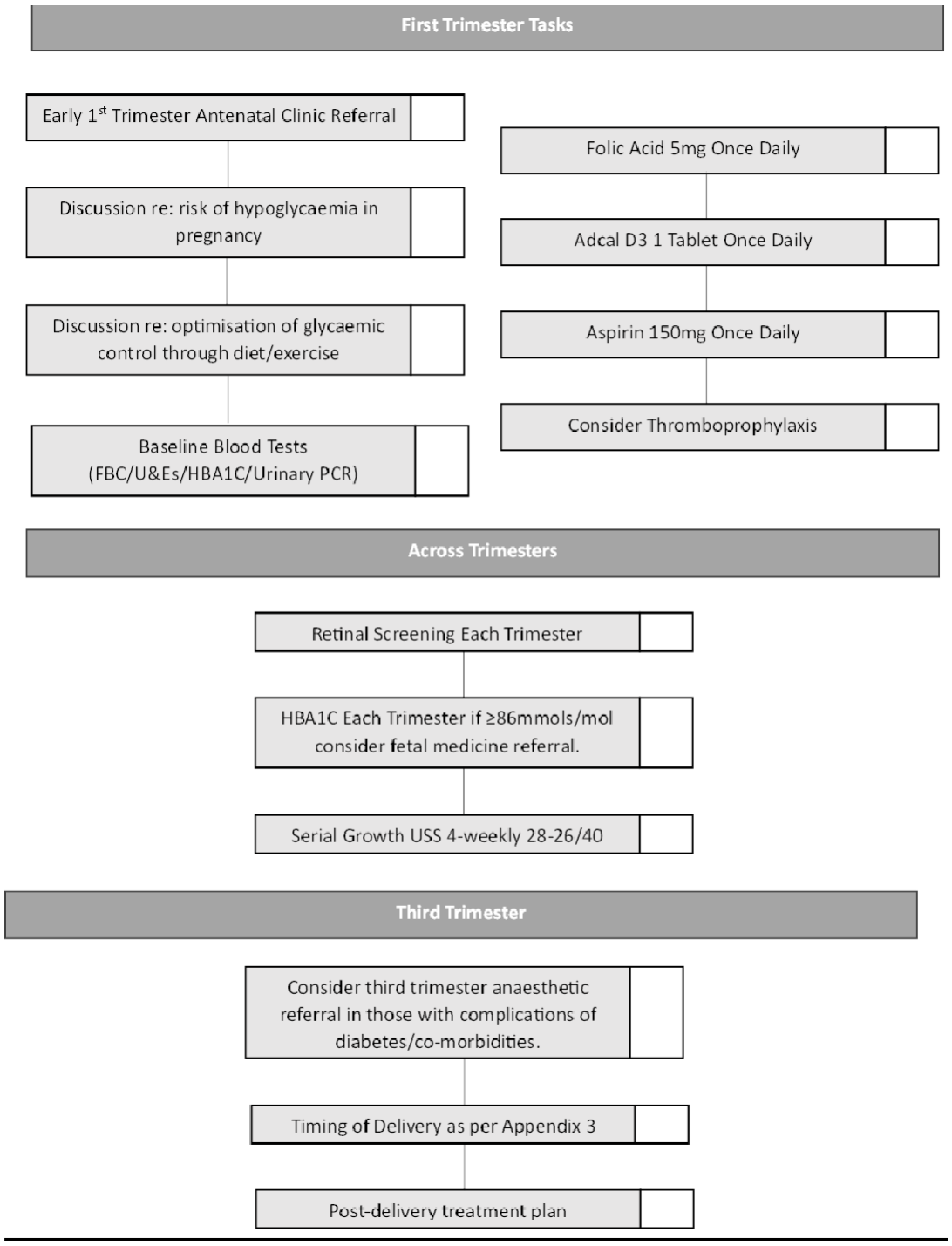
16 weeks	- Offer retinal assessment at 16 to 20 weeks to women with pre-existing diabetes who had diabetic retinopathy at their first antenatal clinic visit. - Offer self-monitoring of blood glucose or a 75-g 2-hour OGTT as soon as possible for women with previous gestational diabetes who book in the second trimester.

Appointment	Care for women with diabetes during pregnancy
20 weeks	- Offer an ultrasound scan to detect fetal structural abnormalities, including examination of the fetal heart (4 chambers, outflow tracts and 3 vessels).
28 weeks	- Offer ultrasound monitoring of fetal growth and amniotic fluid volume. - Offer retinal assessment to all women with pre-existing diabetes. - Women diagnosed with gestational diabetes as a result of routine antenatal testing at 24 to 28 weeks enter the care pathway.
32 weeks	- Offer ultrasound monitoring of fetal growth and amniotic fluid volume. - Offer nulliparous women all routine investigations normally scheduled for 31 weeks in routine antenatal care. - Discuss the possibility of Induction of labour and give the IOL patient information leaflet
34 weeks	- No differences in care for women with diabetes.
36 weeks	- Offer ultrasound monitoring of fetal growth and amniotic fluid volume. - Provide information and advice about: o Timing, mode and management of birth o Analgesia and anaesthesia o Changes to blood glucose-lowering therapy during and after birth o Care of the baby after birth o Starting to breastfeed and the effect of breastfeeding on blood glucose control o Contraception and follow-up. o Book an IOL if required following full discussion and informed consent of the patient
37 weeks to 38 weeks plus 6 days	- Offer induction of labour or (if indicated) caesarean section to women with type 1 or type 2 diabetes. Await spontaneous labour for other women.
38 weeks	- Offer tests of fetal wellbeing.
39 weeks	- Offer tests of fetal wellbeing. - Advise women with uncomplicated gestational diabetes to give birth no later than 40 weeks plus 6 days.

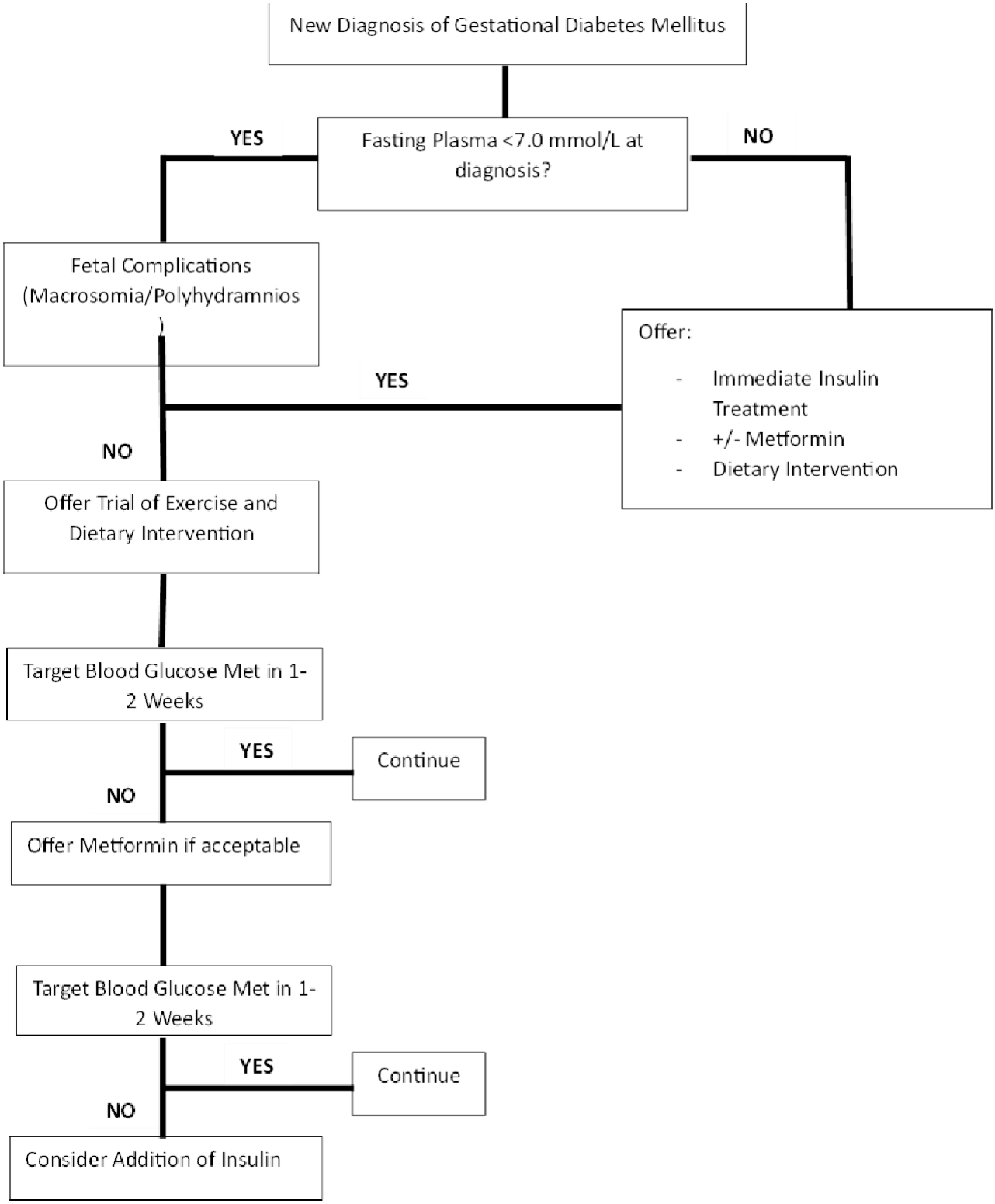
CG 1011 Appendix 3. Diabetes in pregnancy: Timing of Induction of labour taken from NICE NG3 (2020)

1	Type 1 / 2 DM with no maternal or fetal complications	Offer IOL 37+0 - 38+6	All women with Type 1 / 2 DM with no maternal or fetal complications should be offered IOL 37+0 - 38+6
2	Type 1 /2 DM with maternal or fetal complications	Individualised care plans	All women with Type 1 /2 DM with maternal or fetal complications should be given Individualised care plans
3	Gestational Diabetes **DIET CONTROLLED** with no maternal or fetal complications	Offer IOL 40+0 - 40+6	All women with Gestational Diabetes DIET CONTROLLED with no maternal or fetal complications should be offered IOL 40+0 - 40+6
4	Gestational Diabetes **METFORMIN CONTROLLED** with no maternal or fetal complications	Offer IOL 39+0 - 39+6	All women with Gestational Diabetes METFORMIN CONTROLLED with no maternal or fetal complications should be offered IOL 39+0 - 39+6
5	Gestational Diabetes **INSULIN CONTROLLED** with no maternal or fetal complications	Offer IOL 37+0 - 38+6	All women with Gestational Diabetes INSULIN CONTROLLED with no maternal or fetal complications should be offered IOL 37+0 - 38+6
6	Gestational Diabetes with maternal or fetal complications	Individualised care plans	All women with Gestational Diabetes with maternal or fetal complications should be given Individualised care plans

CG 1011 Appendix 4. Multi-Disciplinary Care of Pregnant Women with Pre-existing Diabetes Flowsheet



CG 1011 Appendix 5. Management of Gestational Diabetes Mellitus



CG 1011 Appendix 6. Obstetric Variable Rate Intravenous Insulin Infusion (VRIII) Chart – Page 1 of 2

Obstetric Variable Rate Intravenous Insulin Infusion (VRIII) Chart – Page 1 of 2

PID Label	Allergies	Indication for VRIII (Review daily)

Date	Time	Name of prescriber initiating chart	Signature	Grade	Bleep

Insulin Prescription

Date	Time	Prescription	Signature	Prepared by	Checked by	Batch No	Time Given
		50 units Actrapid with 49.5ml 0.9% Saline					
		50 units Actrapid with 49.5ml 0.9% Saline					
		50 units Actrapid with 49.5ml 0.9% Saline					

- Patients usually taking long-acting basal insulin should have this prescribed on their drug chart and continued alongside the VRIII. e.g. Lantus / Levemir / Tresiba / Toujeo / Abasaglar / Insulatard / Humulin I.
- Stop rapid-acting SC insulin, mixed insulin, or insulin pump (CSII) whilst on VRIII.

Standard Insulin Infusion Rate Regimens (ml/hour)

Select appropriate rate regimen and strike through other regimens. Commence on Algorithm 1 unless otherwise indicated.

Glucose (mmol/L)	Algorithm 1 (mL/hour)	Algorithm 2 (mL/hour)	Algorithm 3 (mL/hour)	Customized Scale (mL/hour)
<4.0	0*	0*	0*	0*
4.0 - 5.5	0.2	0.5	1	
5.6 - 7.0	0.5	1	2	
7.1 - 8.5	1	1.5	3	
8.6 – 11.0	1.5	2	4	
11.1 – 14.0	2	2.5	5	
14.1 – 17.0	2.5	3	6	
17.1 – 20.0	3	4	7	
≥20.1	4	6	8	

*Glucose <4.0mmol/l – Treat hypoglycaemia. IV infusion should recommence within 20 minutes.

Fluid Prescription - For use in line with CG 1011 (Diabetes in Pregnancy)

Date	Time	Fluid	Volume (ml)	Rate (ml/hr)	Potassium Chloride	Signature	Set up by	Date/Time Set up
		5% glucose	1000mls	125ml/h				
		5% glucose	1000mls	125ml/h				
		5% glucose	1000mls	125ml/h				

CBG Monitoring

Hourly

Potassium Supplementation Guide

Do not prescribe potassium for patients with CKD (eGFR <20ml/min).

Serum Potassium (mmol/l)	KCL per 1000ml via intravenous infusion
<3.5	Senior review
3.5-5.4	40 mmol/L
>5.5	0 mmol/L

For peripheral intravenous infusion, the concentration of potassium should not exceed 40mmol/L. The maximum infusion rate is 20mmol/hour. **Caution should be taken to avoid intrapartum fluid boluses using potassium supplemented fluids.**

Intravenous fluids alongside VRIII		
Indication for VRIII	**Fluid**	**Infusion rate**
Sick non-labouring patient on fluid restriction	Glucose 5% with potassium chloride 40mmol in 1000mL consideration for those patients with hyponatremia	83 mL/hr
Sick non-labouring patient	Glucose 5% with potassium chloride 40mmol in 1000mL consideration for those patients with hyponatremia	125 mL/hr
Labouring patient	Sodium chloride 0.9% and glucose 5% with potassium chloride 20mmol in 500mL	50 mL/hr
Well patient receiving antenatal corticosteroids for fetal lung maturity	No additional IV fluids required if eating and drinking normally. Continue Metformin. Stop short-acting insulin.	N/A

Fluid Balance

- Ensure that a fluid balance chart is commenced and recorded accurately for all patients.
- You must take into account a patient's individual fluid requirements following thorough clinical assessment.
- Patients at risk of fluid overload may require less intravenous fluid (ie.83mls/hour) or 10% glucose at 42mls/hour.

Adult Variable Rate Intravenous Insulin Infusion (VRIII) Chart – Page 2 of 2

Allergies

PID Label

Measure capillary blood glucose every hour and adjust VRIII accordingly (aim to keep CBG level between 4.0-7.8 mmol/L).
If CBG>7.8 mmol/L on 2 or more consecutive hours then seek senior advice, there may be a need to adjust to an alternative infusion

Date:																									
Time:																									
Capillary Blood Glucose	>25																								
	24																								
	23																								
	22																								
	21																								
	20																								
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	3																								
	<3																								
Insulin infusion rate (mls/hr)																									
Capillary Blood Glucose (CBG) (mmol/L)																									
Total insulin volume (ml) remaining in syringe																									
Capillary Ketone (mmol/L). [Check if CBG over 15mmol/L]																									
Rate Changed By (Nurses Signature)																									