

## Diabetes in Pregnancy

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## 1. Purpose of guideline

This guideline establishes the detection and management of diabetes in pregnancy at Women's Health, Auckland District Health Board (Auckland DHB).

## 2. Guideline management principles and goals

The principles of this guideline are that pre-existing diabetes poses a high risk for pregnancy and that some pre-existing diabetes is undetected until pregnancy.

Gestational diabetes also increases risk for both pregnancy and future health. Therefore, all pregnant women should be assessed for diabetes. Pre-pregnancy assessment should be offered where there is known pre-existing diabetes.

## 3. Definitions

Diabetes in pregnancy covers a group of disorders associated with abnormal glucose metabolism either prior to pregnancy or during pregnancy. Before addressing these disorders, it is useful to review normal glucose metabolism (see [other resources](#) for glucose metabolism in *Diabetes in Pregnancy - Background Paper*). Diabetes occurs when insulin production is deficient or inadequate (i.e. relatively deficient).

### Diagnosis of diabetes outside pregnancy

The diagnosis of diabetes can be made with a 75 g oral glucose tolerance test (OGTT), although this has been replaced outside pregnancy in New Zealand with HbA1c testing (see below).

Outside pregnancy, diabetes is present if the fasting plasma glucose is 7.0 mmol/L or higher, or a two hour post 75g glucose load is 11.1 mmol/L or higher.

The American Diabetes Association has stated that diabetes can be diagnosed in a person who has an HbA1c of 48 mmol/mol or above. In New Zealand, a cut-off 50 mmol/mol or above is used to diagnose diabetes outside pregnancy. There are several types of diabetes and it is important to know the correct diagnosis, as this does affect management (see [other resources](#) for types of diabetes in *Diabetes in Pregnancy - Background Paper*).

### Pre-diabetes: previously called impaired glucose tolerance (IGT) and/or impaired fasting glucose (IFG) outside pregnancy

- IGT is defined as OGTT 2 hour 7.8 - 11.0 mmol/l
- IFG is defined as fasting glucose 6.1 - 6.9 mmol/l (or 5.6 - 6.9 mmol/l in the USA)

In New Zealand, OGTTs are no longer performed outside pregnancy, but an HbA1c of 41 - 49 mmol/mol is used to diagnose pre-diabetes outside pregnancy (see [other resources](#) for impaired glucose tolerance in *Diabetes in Pregnancy - Background Paper*).

## Gestational diabetes mellitus (GDM)

Gestational diabetes mellitus is defined as abnormal glucose tolerance that is detected or develops in pregnancy.

Current New Zealand diagnostic criteria for GDM:

- 75g OGTT fasting  $\geq 5.5$  mmol/l or 2 hour glucose  $\geq 9.0$  mmol/L

In the majority of cases, GDM is diagnosed after 20 weeks' gestation and will be 'new onset' diabetes that has developed during pregnancy secondary to acquired insulin resistance. Some women diagnosed with GDM may have previously unrecognised type 2 diabetes or pre-diabetes or rarely type 1. If a woman with GDM has an HbA1c of  $\geq 50$  mmol/mol at diagnosis in pregnancy, they can be referred to as having previously unrecognised diabetes. This is a useful term to alert clinicians that this is a higher risk subgroup of women with GDM. Women with GDM may be reclassified with pre-diabetes or diabetes when they have postpartum follow-up screening.

It is important to remember that women with GDM are therefore a heterogeneous population. The pregnancy risks therefore vary widely within this group of women and some can be very high risk (see [other resources](#) for why we look for GDM – a history lesson in *Diabetes in Pregnancy - Background Paper*).

## 4. Pre-pregnancy assessment – women with known diabetes

All women with pre-existing diabetes should be offered pre-pregnancy counselling to assess her glycaemic control, identify complications and explain pregnancy risks. All women of childbearing years who have diabetes should have contraception discussed regularly (see [other resources](#) for pre-pregnancy assessment for women with pre-existing diabetes in *Diabetes in Pregnancy - Background Paper* and [patient information](#) for patient pre-pregnancy information). Also, see [checklist for investigations for planning/during pregnancy](#).

## 5. Screening and diagnostic testing in pregnancy – women who do not have known diabetes

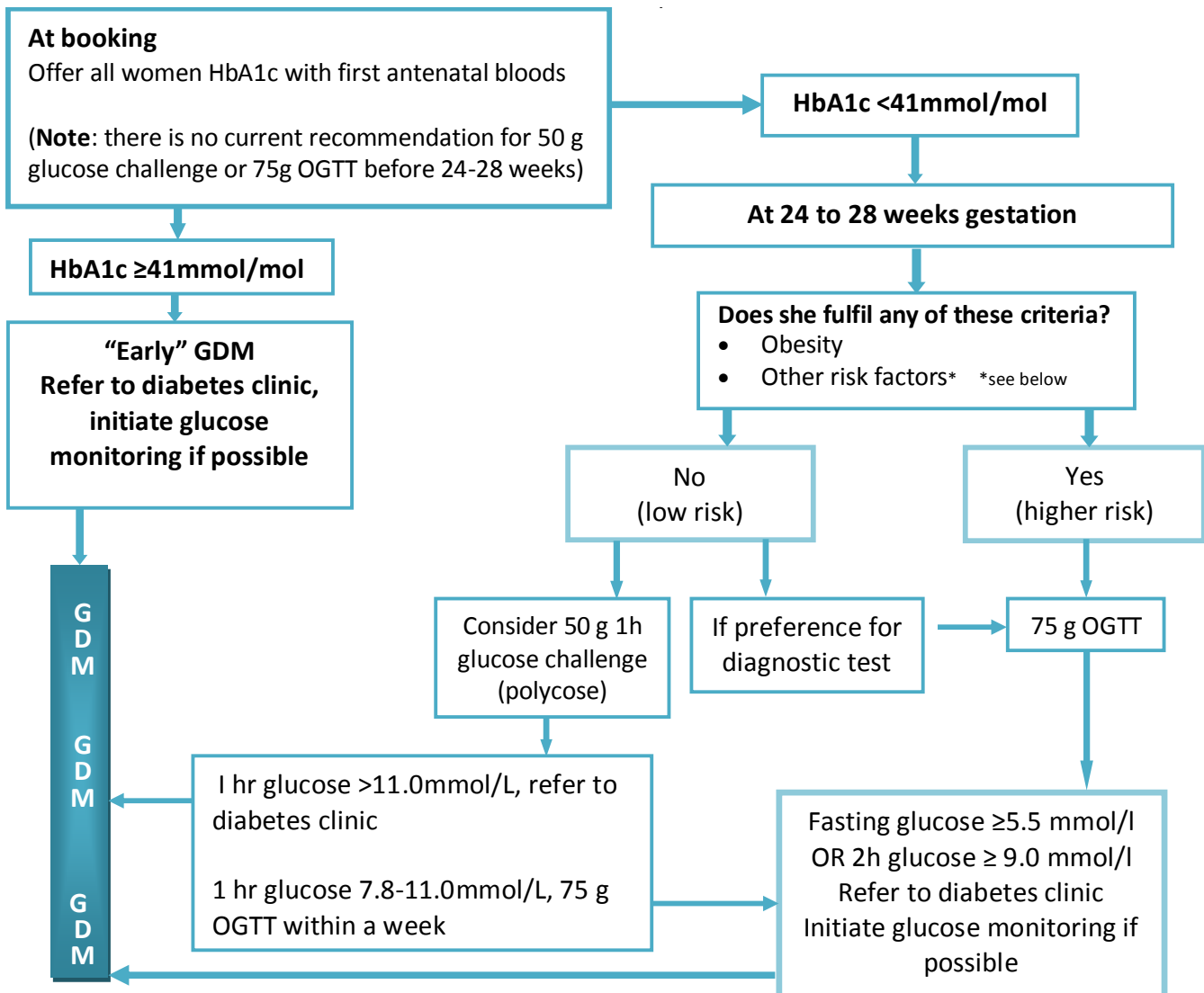
### Early pregnancy screening

It is recommended that women are screened for previously unrecognised diabetes/pre-diabetes by requesting an HbA1c with their first antenatal bloods. The threshold for referral is not clearly established. Recommendations for referral at NWH are summarised on the referral flow diagram (refer if booking HbA1c is  $>40$ mmol/mol). (see [flow diagram next page](#)).

### 24 - 28 weeks screening

All women who have an HbA1c  $< 41$  mmol/mol should be offered screening for GDM at 24 - 28 weeks gestation. A 50 g glucose challenge test (polydose) is falsely normal in 25% of women with GDM, so it is best to be offered only to low risk women. (see [flow diagram next page](#)):

## Screening for Diabetes in Pregnancy (2019)



**30-32 wks:** If the fetus is “macrosomic” (ie if SFH >90<sup>th</sup> or AC/EFW >90<sup>th</sup> on scan) or unexplained polyhydramnios or other concerns about GDM, request 75 g OGTT and refer if diagnostic. (Note: if SFH >90<sup>th</sup>, also request scan, but do not delay OGTT)

### Further screening after 32 weeks is for specific reasons only

If there are concerns a woman has unrecognised GDM, discuss with an obstetrician or the diabetes team to decide if further laboratory tests should be requested (and if so, which one).

Discussions about recommendations should be documented on HealthWare

### Other risk factors for GDM

\* PCOS, chronic hypertension, steroid or antipsychotic medications, family history of diabetes, glycosuria, macrosomia, booking HbA1c borderline. Previous: GDM, macrosomia, preeclampsia, perinatal loss, pre-term birth

## 6. Checklist for planning/during pregnancy for women with pre-existing diabetes

### **Pre-pregnancy discussion: pregnancy risks**

Women should be seen by clinicians who have specific knowledge about diabetes in pregnancy. Risks will depend on a woman's diabetes diagnosis, duration of diabetes, glycaemic control, complications and other risks relating to pregnancy outcomes e.g. age, BMI, other medical conditions and past obstetric history.

### **The following pre-pregnancy investigations are useful for the discussion:**

- HbA1c: every 3 months
- Serum creatinine: baseline and 3 monthly if abnormal
- Baseline LFTs: baseline and 3 - 6 monthly if abnormal
- FBC and ferritin: follow up if treatment required
- TFTs: T4 and TSH (note that an isolated low T4 may relate to iodine deficiency)
- For vegetarians and Indian women or bowel disorders also check B12
- Booking bloods – and include HIV if agreed to
- Thyroid antibodies for type 1: every 2 years if negative. If positive, no need to repeat
- Coeliac screen for type 1: every 2 - 5 years if negative. If positive, may require referral for endoscopy and biopsy to confirm diagnosis
- Check recent smear or if need to do swab
- MSU for infection, cells etc. as screen
- Urine ACR or if proteinuria, consider if needs baseline 24 hour urine protein and creatinine clearance: check with physician frequency of repeat
- If renal impairment, also check potassium, calcium, phosphate, albumin and urea
- Fasting lipids: baseline if not known and if requested by physician
- Chase last eye review
- ECG to be considered if has had diabetes for > 10 years (discuss), age > 40/45, younger age if other risk factors such as smoking, plus obesity, plus family history.

**Note:** Vitamin D deficiency should be considered especially in women with coeliac, very pale skin, no sun exposure, and women with darker pigmented (include all Indian women, as very high rates of vitamin D deficiency). Vitamin D supplements are recommended in high-risk women, at least for pregnancy and lactation (see [letters](#) for Vitamin D deficiency letter).

### **Medication review**

As well as recommending folic acid pre-conception, other frequently used medications should be discussed. Many women are taking a "statin", which we recommend stopping pre-pregnancy. Women taking an ACE-inhibitor/ART will have an individualised plan. Some stop prior to pregnancy and may change to alternative anti-hypertensive if required (see Hypertension guidelines). Other women will be advised to stop/change once pregnancy is confirmed. Most women are taking insulin. Women with type 2 diabetes on oral agents will have an individualised plan. Most continue metformin. Some will continue other medications until

conception, but generally insulin is required in order to achieve an HbA1c result as close to the reference range as possible for that woman. If it has been decided to continue an oral diabetes agent, here should be a clear plan as to whether it should continue in pregnancy (metformin), continue until changed to insulin (e.g. sulphonylureas) or stopped when pregnancy is recognised.

## 7. Management in early pregnancy: known diabetes and previously unrecognised diabetes (and “early” GDM)

Women should be under specialist care and are usually looked after in a multidisciplinary clinic where there is access to an obstetrician, physician, midwife diabetes educator and dietitian.

### Laboratory

- Request HbA1c if not done in last month.
- If they have not been for pre-pregnancy counselling, review the pre-pregnancy check list above, as this will guide which additional investigations are required.
- Review laboratory investigations with the physician to ensure appropriate tests are performed.
- Ensure routine first antenatal bloods have also been completed.

### Scans

- Accurate assessment of gestation is important: LMP, early US scan.
- Usual recommendation around nuchal scan.
- Anatomy scan at tertiary centre (or equivalent) at 19 - 20 weeks.
- Fetal ECHO at 22 - 24 weeks if any concern about cardiac anatomy (not done routinely in Auckland, but some centres do).

### Careful control of diabetes

- Typically, insulin requirements might increase, especially overnight in very early pregnancy, but between 9 - 13 weeks requirements usually decrease significantly, as women are more insulin sensitive and hypoglycaemia can be a problem.
- If vomiting is a problem, women can take their short-acting insulin analogue 10 - 30 minutes after the start of a meal, as a temporary measure (and go back to taking it before they eat as soon as possible).
- Hypoglycaemic unawareness may occur with tighter glycaemic control. Ensure women know about driving and hypoglycaemia (in general 5 before they drive and not to drive within 45 minutes of treating hypoglycaemia; ensure glucagon has not expired, recommend MedicAlert bracelet).

### Other medications

- Consider whether to recommend low dose aspirin for preeclampsia prevention, and also whether to recommend calcium.
- Check that medications have been reviewed and woman knows which ones to stop/continue (discuss with physician if needed).

## Other

- If they have not been seen pre-pregnancy, go through the pre-pregnancy checklist to ensure other screening up to date, e.g. eye review. Let the eye screening clinic know the woman is pregnant.
- Women are usually seen every 3 - 4 weeks and liaise closely with diabetes educators/diabetes midwives between visits.

## 8. Management in later pregnancy – all women with diabetes in pregnancy

- From 16 - 20 weeks, women usually become more insulin resistant. Women on insulin should be encouraged to increase their insulin doses adequately, especially their mealtime boluses, which typically increase more than the basal insulin (often end up with 2/3 insulin as bolus, 1/3 basal). Many women fall behind with their treatment between 20 - 28 weeks' gestation.
- In general, organise a fetal growth scan at 28 and 36 weeks gestation, plus others as indicated for obstetric concerns.
- Include HbA1c at 28 and 36 weeks with routine bloods (may do at 16 - 20 weeks as well as early pregnancy in pre-existing diabetes). Consider other lab tests of relevance such as creatinine or urate or liver function, ferritin etc.
- See in clinic 2 - 3 weekly from about 28 weeks, or earlier if concerns about blood pressure, fetal growth, diabetes control etc., then weekly from 34 - 36 weeks.
- Consider timing and mode of delivery.
- Monitor for complications.

## 9. Glucose control in pregnancy

### Testing

In Women's Health, women with type 2 diabetes and GDM check their capillary glucose levels first thing in the morning (fasting) and 2 hours after meals (from the start of the meal) each day (i.e. 4 tests per day). Women with type 1 diabetes usually test before each meal as well as after, and during the night as requested, particularly those on a pump, where overnight basal rates may be changed more than once a week during some stages of pregnancy. Sometimes, women with GDM or type 2 diabetes are asked to do additional pre-meal tests, particularly if concerned about snack size. Increasingly, women with type 1 diabetes have some form of continuous glucose monitoring. The benefits and limitations of this should be discussed with a physician to optimise their performance.



## Glucose targets

Glucose targets are: average fasting < 5.0 mmol/L and average 2 hour postprandial < 6.0 mmol/L (aim always < 6.5 mmol/L), based on data showing better pregnancy outcomes when these levels are achieved (Rowan *et al.*, 2010 – see [supporting evidence](#)).

If testing one hour after eating, the target is average < 7.0 mmol/L (always aim for < 7.5 mmol/L).

In women with type 1 diabetes, it is very difficult to achieve these targets and they may need to be modified.

## Management

Good control is achieved by paying attention to all aspects of lifestyle, plus medication if required.

## Diet

Diet is the cornerstone of treatment and appropriate intake should be guided by the dietitian. In type 2 and GDM, obesity is often an issue. Calorific restriction improves insulin sensitivity and control but it results in lipid utilisation for energy and associated ketone formation. There are uncertainties as to whether ketonaemia in pregnancy is associated with adverse effects on subsequent neuropsychological development of offspring and the aim is to avoid significant ketosis. Overall, dietary composition is usually recommended as 18 - 20% protein, < 10% saturated fat, < 10% polyunsaturated fat and the remaining 60 - 70% as monounsaturated fat and carbohydrate. We recommend up to 30% intake as fat and 50 - 60% carbohydrate, in general. It is recommended that obese women have at least 1700 cal/day and at least 170 g of carbohydrate/day. Restricted carbohydrate intake may decrease fetal lean mass and increase body fat percent. The calorie requirement increases in women with a lower BMI to maintain adequate weight gain.

## Exercise

Exercise is another cornerstone of therapy for type 2 diabetes and GDM. Strenuous exercise may be associated with fetal bradycardia and IUGR. Less strenuous exercises, such as walking, swimming and upper body exercises, seem to be safe and effective in improving insulin sensitivity. In women with type 1 diabetes, they may require further education about adjusting insulin doses around exercise. Usual recommendation is 30 minutes of exercise five or more days/week.

## Insulin

Insulin is safe to use in pregnancy. All women with type 1 diabetes should continue on insulin during their pregnancy. The few women with type 2 diabetes who do not require insulin in early pregnancy are usually on insulin by the second half of the pregnancy. About 70% of women with GDM at Auckland DHB require medication to maintain glycaemic control and insulin or oral agents can be considered (see below). Fetal abdominal growth is also considered in the decision to start medication in women with GDM in a number of centres, aiming for more aggressive glucose lowering if the fetus is becoming macrosomic.

## Other treatment options in women with GDM (and type 2)

### Metformin

Metformin is a safe and effective alternative to insulin for women with GDM. (Rowan *et al.*, 2008 – see [supporting evidence](#)). Offspring exposed to metformin in utero followed up to 9 years of age show similar adiposity and markers of insulin sensitivity compared with offspring whose mothers were treated with insulin alone ([supporting evidence](#)).

Avoidance of metformin is recommended if there is significant fetal growth restriction reflecting a probable placental problem (all right to use if constitutionally small fetus), ongoing maternal weight loss or there are maternal contra-indications such as sepsis, significant GI upset, preeclampsia, renal failure or conditions that put women at risk of lactic acidosis.

### Glibenclamide

Studies report undetectable or small amounts (more sensitive assays) of glibenclamide in cord blood. Glibenclamide is used in GDM in the USA. There are no follow-up data on mothers or offspring. In theory, glibenclamide may hasten progression to type 2 diabetes in the mother. Later effects on the offspring are possible, but the amount detected in the fetus is low. We rarely recommend glibenclamide at Auckland DHB.

## 10. Fetal complications

### Macrosomia

This is the commonest measurable problem but even this is beset with definition difficulties (e.g. estimated fetal weight > 90th centile, > 4000 g, > 4500 g does not accurately identify all macrosomic fetuses). Customised growth centiles may be helpful, but do not report relative growth of the abdomen. It is the pattern of abnormal growth, more than absolute weight, which is typical of macrosomia. This is very important with our multi-ethnic population. The marker for macrosomia on ultrasound scan is an increased abdominal circumference. Studies in poorly controlled diabetics give risk of macrosomia of around 30%, reducing to < 10% with good control. Macrosomia increases risks for the fetus of:

- Shoulder dystocia
- Birth trauma
- Need for LSCS (two-fold increased risk if macrosomic, from HAPO data).

### IUGR

IUGR is seen in situations of maternal vascular complications or superimposed hypertensive disorders.

It is also more likely if a woman has a very high HbA1c at conception, as this interferes with placental development.

### **Sudden intrauterine death**

This is rare with better control of diabetes using home blood glucose monitoring. It usually occurs in the last few weeks of pregnancy. More intensive fetal monitoring has not been shown to help prevent this outcome. Close attention to diabetes management and individualised delivery planning may help to reduce this risk. Women are asked to monitor fetal movements and come in for assessment if any concern arises.

### **Prematurity**

Prematurity is usually due to other maternal or fetal complications leading to early delivery, but there is also a small increase in spontaneous pre-term birth associated with hyperglycaemia. Of note, in women with poorly controlled type 2 diabetes, there is an increased rate of pre-term membrane rupture and delivery between 20 - 24 weeks.

## **11. Maternal complications**

Women are at increased risk of:

- Hypertensive disorders/preeclampsia (overall risk 25 - 30% of gestational hypertension or preeclampsia) and lower in women without vascular complications (8 - 15%). Rates of preeclampsia in women with GDM are 3 - 5%, and up to 15 - 20% overall in women with type 1 diabetes in Auckland. Good diabetes control reduces the risk of preeclampsia.
- Birth trauma.
- LSCS: rates at Auckland DHB about 37% in women with GDM (not increased compared with the background population) and 50 - 60% in women with type 1 or type 2 diabetes.
- Urinary tract infection.

## **12. Antenatal management issues**

### **12.1 Hyperemesis**

Women with diabetes who are admitted to the ward require additional input with respect to their diabetes management. Contact the diabetes team to inform them of the admission. After hours, phone the physician on call as needed.

#### **Information needed for appropriate management of hyperemesis**

- Type of diabetes (type 1 or type 2): this is very important as women with type 1 diabetes will require insulin even if they are not able to eat. They usually require a glucose insulin infusion (CR 3138: Maternity Diabetes Insulin Prescription and Blood Glucose Record in [clinical forms](#)). Women with type 2 diabetes may not require insulin or any other diabetes medication when they are vomiting.
- Usual medication plus doses and blood glucose readings over previous 48 hours if possible.
- Gestation, weight often useful.

- Whether eating at all and what intravenous fluids are already set up.

### **Management of hyperemesis**

In addition to the usual management of hyperemesis, the following needs to be considered:

#### **Type 1 diabetes and hyperemesis**

- If not eating and drinking, will require a glucose/insulin infusion (Maternity Service Glucose/Insulin Infusion - Antenatal in [clinical forms](#)). Note the antenatal infusion protocol does not routinely have potassium added. Clinicians should prescribe appropriate potassium replacement in other IV fluids or specifically request addition of potassium to the glucose/insulin infusion.
- Use the type 1 diabetes antenatal protocol, noting that in early pregnancy the insulin infusion rates may need to be decreased, especially if woman usually treated with insulin glargine (Lantus®), as the effect of the last dose may last 24 hours. Liaise with the physician if recommended glucose levels are not maintained, as the protocol may require modification on an individual basis.
- Monitor capillary glucose levels 1 - 2 hourly as requested by the physician.
- Once eating, the woman should change back to subcutaneous insulin and doses should be decided by physician. If eating is sporadic, some women keep infusion going for a while and the woman has small subcutaneous bolus of insulin using her insulin pen when she eats.
- If the woman is still vomiting intermittently after eating food, it may be wise to give the mealtime short-acting insulin bolus after eating then the dose can be adjusted according to volume eaten and whether the woman feels nauseated. It can be given within 30 minutes from start of eating. This should be a temporary measure only.
- In general, anything that helps a woman to eat is particularly useful (e.g. encourage the use of antiemetics).

#### **Type 2 diabetes/GDM and hyperemesis**

- Stop all oral diabetes medications. This is very important for metformin, which should not be taken during any acute illness or when vomiting.
- If on insulin, withhold insulin as well and monitor capillary glucose levels 2 hourly initially. If the woman's glucose levels are stable off medication, less frequent testing may be acceptable (discuss with physician).
- If glucose levels are increasing above 7 - 8.0 mmol/L during the time the woman is not eating, the woman is likely to require insulin. The physician may request glucose/insulin infusion and manage as a type 1 as detailed above. This is an uncommon situation.
- Once the woman starts eating, medication will be required when the glucose levels start to increase above the pregnancy ranges. There is no emergency and the physician should leave instructions about when to contact them/restart medication.

- If the woman is prescribed insulin once she starts to eat, but is still vomiting intermittently, it may be wise to give the mealtime short-acting insulin bolus after eating then the dose can be adjusted according to volume eaten and whether the woman feels nauseated. It can be given within 30 minutes from start of eating. This should be a temporary measure only.

### **All women with diabetes and hyperemesis at discharge**

- When the woman is discharged, ensure she knows her insulin/metformin doses.
- Check that she has been given a prescription for antiemetics and any other medication she requires.
- Make sure she has a follow-up appointment in clinic.
- Make sure she knows to return to hospital if she becomes unwell again.

### **12.2 Acute assessment (e.g. in Women's Assessment Unit, WAU)**

Contact the diabetes team to inform them of admission. After hours, contact the physician on call as required. They will want to know the following information:

- Type of diabetes
- Usual medication and doses
- Recent blood glucose recordings (the woman should have record paper or book)
- Gestation
- BMI (on risk sheet) and recent weight
- Reason for admission
- Whether eating or nil by mouth
- Whether there is a plan to give steroids

### **If eating**

Regular meals are required (especially important for women on insulin). Order:

- Morning tea with breakfast
- Afternoon tea with lunch
- Supper with dinner.

Ask women to check and document blood glucose levels when admitted and before and after meals during assessment. Check with assessment doctor when they would like to be informed immediately of a result (e.g. if above a certain reading, for example if above 7.0 or 9.0 mmol/L).

Often, women will be asked to continue their usual medication regimen. Check the woman has brought her medicines with her from home in order to take an accurate medication history. A woman's own medicines should be stored in the drug room in a green bag and returned to the woman (if still clinically appropriate) on discharge. Women are typically permitted to continue self-administering subcutaneous insulin, but this should be confirmed and prescribed by the medical team.

If a glucose level is elevated, the woman may be asked by the doctor to give extra insulin.

If level < 4.0 mmol/L for women taking insulin, treat for hypoglycaemia (see [section 18](#)). They will not have hypoglycaemia if diet-treated or on metformin alone. Although levels of 3.5 - 4.0 are not uncommon in these women, they do not represent true hypoglycaemia and do not require treatment.

## If nil by mouth

### Type 1 diabetes and NBM

- The woman will require insulin always, so start a glucose/insulin infusion according to antenatal protocol (CR 3138: Maternity Diabetes Insulin Prescription and Blood Glucose Record in [clinical forms](#)). She may require additional potassium either in infusion or with other IV fluids.
- Test blood glucose levels hourly and contact physician if levels outside range as listed on protocol.
- Keep the diabetes team/physician closely involved.
- Also determine what her glucose levels and insulin doses have been over the previous 24 - 48 hours.
- Inform the diabetes team if steroids are going to be given, as the dextrose/insulin infusion protocol will need to be modified (typically, insulin doses will need to be doubled at least from about 8 hours after first steroid injection).
- Some women with their own insulin pumps may be able to continue using their pump instead of requiring a glucose/insulin infusion. Check with the doctor.

### Type 2 diabetes/GDM and NBM

- Stop diabetes medication and inform diabetes team.
- A glucose/insulin infusion is not required routinely. Monitor glucose hourly initially and inform physician if levels persistently above 7.0 mmol/L. If stable and within range, change to 2-hourly monitoring.
- If steroids are given and she remains nil by mouth, a glucose/insulin infusion may be required from about 8 hours after initial steroid injection. Discuss with the physician.

## 12.3 Steroid administration

See Antenatal Corticosteroids to Improve Neonatal Outcomes guideline for information regarding obstetric usage (see [associated documents](#)).

Glucose levels in women with diabetes who are given steroids for fetal lung maturation can be difficult to manage. Communication is the key and the following points are vital:

- Liaise with the doctor who is going to manage the woman's diabetes before the first dose of steroids is given (or within a few hours if given at admission/during the night), so changes to insulin treatment can be planned appropriately. This is usually through contacting the diabetes team, the obstetric medicine registrar, diabetes physician or physician on call.

- The physician managing changes in insulin doses needs to be regularly contacted with the maternal blood glucose readings for at least 72 hours after steroids are initiated.

If the physician is contacted by phone, it is important to be able to tell the physician the following information:

- Maternal type of diabetes, gestation, weight, time of steroid injections.
- Indication for steroids and likelihood of delivering in next few days.
- Usual doses of diabetes medications and control (for example glucose readings and insulin doses in previous 48 hours).
- Whether the woman is eating and drinking or nil by mouth.

Women require extra insulin (typically double their usual doses) from about 8 hours after steroids are initiated until 24 - 36 hours after the second dose of steroids are given. Steroid effects often wane gradually after that, but occasionally women go back to their pre-steroid doses of insulin quite abruptly.

If the obstetricians have some flexibility about the timing of the steroid injections, it is useful to give the first injection before bed, so the increase in insulin dose can be started with breakfast (though a smaller increase in overnight insulin also needs to be considered). The after breakfast blood sugar reading should allow the physician to determine if an adequate dose increase has been made and to give an insulin correction if needed (see below). Then by lunch time, the physician should have a good idea of insulin doses for the next 36 hours. Alternatively, give the first steroid at breakfast time, so the first increased dose of insulin can be given at dinner and ongoing insulin doses should be reasonably clear by bedtime.

Women having steroids are obviously considered to be at risk of a pre-term delivery, possibly shortly after steroids are completed. Good maternal glucose control during this time may be very important for fetal well-being during steroid administration and in the neonatal period.

The commonest problem is that insulin doses are not increased enough, and once the glucose level becomes elevated it creates further insulin resistance so it is harder to bring the glucose level down. Liaising with an experienced clinician is important.

#### **12.4 Blood glucose monitoring and insulin regimen when woman is having steroids**

For women who are still eating and drinking while having steroids:

- Capillary glucose monitoring
  - Pre-meal
  - 2 hours post-meal
  - Pre-bed
  - Overnight depending on control: at least a 02:00 hours test; or if having problems with control, more frequently, especially if woman has type 1 diabetes with poor hypoglycaemic awareness. Testing may be 2 hourly, especially when establishing the insulin dose required.
  - Also check 1 and 2 hours after any correction dose is given.
  - Check after treating any hypoglycaemia, 10 - 15 minutes and 1 hour later.

### Insulin doses when giving steroids

If eating, women can be treated with subcutaneous insulin. In general, there is no need for glucose/insulin infusions, as bolus insulin should still be required with meals. Both the long-acting basal insulin and short-acting meal insulin will need to be increased as below. **As a general rule, the usual insulin doses can be doubled 8 hours after the first steroid injection. Women not taking insulin should have it started at 1.0 u/kg as initial total daily dose.**

Approximately 36 hours after the second dose of steroids are given; the woman can usually go back to her pre-steroid insulin doses.

### Women already on insulin and having steroids

Know the usual total daily dose of insulin for the woman and expect to approximately double the dose (basal and bolus doses) around 8 hours after the first steroid injection. Adjust according to glucose results (see below). The commonest problem is that a doubling of the dose is not enough.

If the initial increase in dose is not enough, the first problem encountered is that the glucose level after a meal is elevated. An appropriate correction dose at that point can be given to help decide how much extra insulin is required.

To do this logically, it is important to understand how to give a correction dose:

In general, a correction dose is the amount of insulin a person needs to bring their blood glucose down 1 mmol. This is calculated by adding up the total daily dose of insulin (short plus long-acting) and dividing by 100, e.g. if on 50 units/day, then 0.5 units decreases glucose by 1 mmol, if on 100 units/day, then 1 unit decreases it by 1 mmol.

Therefore, if a woman is taking 100 units/day usually, the initial increase during steroid administration should result in a daily dose of 200 units. If this dose is correct, then 2 units will bring the blood glucose down 1 mmol. So, if the capillary glucose level is elevated after the first insulin dose increase then give a correction to test whether doubling the dose is likely to work for the next injection.

Prior to the next meal, if the glucose level is above 4 mmol, then add a correction dose to bring the glucose down to 4 plus double the meal insulin (or further increase if it has been decided doubling is not enough, i.e. the correction dose was inadequate to drop the glucose level). After that meal, the glucose levels should be in range. If the glucose does not drop adequately, the dose of insulin might need a further 30 - 50% increase. If hypoglycaemia develops (uncommon), then use a bit less than double for next meal after checking the bolus is appropriate for the food that will be eaten, as hospital food is often different from home.

It is important to also increase the basal insulin in a similar manner, i.e. in general start with doubling the dose. If the first steroid has been given at breakfast and a double dose of bolus at dinner has been successful, it is appropriate to double the night time long acting. If the physician or woman does not have the confidence to do this and/or the glucose level is elevated during the night, a correction can be given with short-acting insulin.



Whenever a correction dose is given, the capillary glucose level should be checked 1 and 2 hours later to ensure further action is not required. If it is not decreasing, a further correction can be given, but remember there is already short-acting insulin still working.

For women with type 1 diabetes, it may be better to start with a less aggressive increase, as they could be very anxious about doubling their insulin and they may prefer initially to take a smaller dose and correct until they see the effect of steroids. So, it is reasonable to increase by 50 - 75 % with first increase in dose. Also, if a woman is on once daily insulin glargine (Lantus®), it can be useful to add a second dose in during steroid administration, as this allows adjustment of the daily dose more readily.

If the woman delivers while steroids are still having an effect, a woman with GDM or type 2 diabetes can stop insulin as usual at delivery, but should require ongoing monitoring and may need insulin at reduced doses until the steroids wear off.

If a woman with type 1 diabetes delivers during this time, also reduce the insulin dose, but not as aggressively as usual postpartum decrease.

### **Communication regarding dose adjustments during steroids – important**

The first few glucose levels need to be clearly relayed to the physician in a timely manner after the initial insulin dose adjustments are made. The physician cannot make a plan for the whole day until the effect of the first dose increase is assessed. There are several ways of managing this. One way is for the midwife to phone the physicians with each glucose level around the time initial dose adjustments are being made (usually 2 - 3 phone calls over 2 - 3 hours is enough). Alternatively, it is appropriate for some women to phone or text the physician directly so that information is immediate. Once the dose is clear, it is easy to write up further doses until the steroid effect is wearing off, with instructions for the physician to be phoned if levels are outside the recommended range (e.g. recurrent hypos or > 7.0 mmol/L).

### **Diet-treated GDM during steroid administration**

Most women will need insulin treatment during steroid administration. Anticipate starting insulin from approximately 12 hours after first steroid injection is given.

It can be hard to decide an accurate dose, as their insulin sensitivity is not so clear. Using a formula can be helpful:

Step	Calculation
1.	Start with calculating a 24-hour dose of 1.0 - 1.3 units/kg (depending on gestation, usual glucose levels, ethnicity, BMI etc.).  <b><i>As a rule of thumb start with 1 unit per kg of current weight.</i></b>  <b>Note:</b> this is double the usual starting dose of 0.4 - 0.7u/kg because of the steroid effect)
2.	Aim to give 1/3 of that dose as a night-time intermediate insulin, e.g. Protaphane® or Humulin N®.

Step	Calculation
3.	The other 2/3 should be divided as pre-meal short acting insulin analogue (e.g. Novorapid® or Humalog®).

**Note: Insulin brand names should be used when prescribing. Brands of insulin are NOT interchangeable**

Remember, many of these women should need much more than this and hypos tend to be mild in women with GDM or type 2 diabetes as they can switch off their own insulin production as their glucose level drops.

Women with preeclampsia are sometimes more insulin sensitive, as the placental function may be compromised, so in this situation, the first increase may be more cautious.

#### **Women who are nil by mouth and having steroids (as may require delivery any time)**

- Capillary glucose monitoring.
- Usually 2 hourly testing should be adequate, but may need 1 hourly testing if levels above 7 mmol/l or type 1 diabetes.

These women should require an antenatal glucose/insulin infusion (CR 3138: Maternity Diabetes Insulin Prescription and Blood Glucose Record in [clinical forms](#)). The infusion needs to be modified for a woman who is having steroids, typically by doubling the insulin doses from about 8 hours after first dose of steroids and adjusting further as required. This is best done by writing on the infusion document with new ranges of insulin doses and liaising by phone.

#### **12.5 Fetal surveillance/monitoring**

- Outpatient surveillance of fetal wellbeing is as per usual obstetric indications
- Routine CTG or BPP is not required solely for diabetes
- Reduced fetal movements in a diabetic woman is a worrying symptom and should always be fully investigated with a CTG and/or BPP
- If a woman is admitted antenatally for diabetes control she should have at least daily CTGs
- Otherwise inpatient monitoring is as indicated by the obstetric factors.

### **13. Timing and mode of birth**

Auckland DHB endorses the recommendations of the Ministry of Health, published in December 2014, in regards to timing and mode of birth for GDM. (See *Screening, Diagnosis and Management of Gestational Diabetes in New Zealand: A clinical practice guideline* in Ministry of Health publications by going to the Ministry of Health web site, clicking on the Publications tab and performing a search for “diabetes”).

However, it is noted the evidence base is extremely limited regarding timing and mode of birth for both GDM and pre-existing diabetes, and further research is urgently required.

Cochrane has reviewed this topic in 2018 for both pre-existing and gestational diabetes, and found only one trial (GINEXMAL trial Alberico, 2017) regarding planned birth for GDM, and no suitable trials regarding planned birth for pre-existing diabetes.

The GINEXMAL trial recruited 425 lower-risk women with GDM and compared induction of labour (IOL) from 38 weeks with expectant management. Women with previous caesarean, estimated fetal weight >4 kg and Bishop score >7 were excluded. The trial stopped before the recruitment target had been achieved, and was underpowered to detect differences in important outcomes, including caesarean section rate (which was low in both groups) and shoulder dystocia. There were more infants with hyperbilirubinemia in the IOL group, but no increase in other neonatal morbidity.

There is an additional trial identified in the Cochrane reviews, of 200 women from the early 1990s (reported twice by respectively Henry, 1992 and Kjos, 1993). This trial compared induction of labour from 38 weeks with expectant management, and found larger babies and more shoulder dystocia in the expectant group but no difference in caesarean rate.

Summary of recommendations regarding timing and mode of birth based on Ministry of Health guideline, noting that a number of these are good practice points only:

Recommendation	Strength of recommendation or good practice point (GPP)	Where to refer in guideline
15 Recommend vaginal birth for women with gestational diabetes whose pregnancy is progressing well, with good glycaemic control ( $\geq 90\%$ of glucose readings within treatment targets), normal fetal growth ( $\geq 10$ th to $\leq 90$ th percentile) and no obstetric complications.	CONDITIONAL	Chapter 6 (section 6.2)
16 Planned delivery before 40 weeks is not recommended for women with gestational diabetes who have good glucose control ( $\geq 90\%$ of blood glucose readings within treatment targets) unless there are other complications present.	GPP	Chapter 6 (section 6.3)
17 Assess timing of birth individually where women have poorly controlled gestational diabetes ( $< 90\%$ of blood glucose readings within treatment targets) or there are other maternal or infant comorbidities *(including hypertension, preeclampsia, large for gestational age infant $> 90$ th centile, maternal age $> 40$ years).	GPP	Chapter 6
18 Advise women to report any reduction or change in fetal movements from 28 weeks' gestational age onwards.	GPP	Chapter 6

\* Also includes suspected fetal growth restriction

Information about grading categories, refer to Cochrane in [supporting evidence](#).

Required information for induction of labour request for diabetes should include

- Indication

- If diabetes given as indication, specify what type of diabetes
- If diabetes given as indication, specify another reason for IOL to be accepted.

Usual obstetric indications for elective caesarean apply. In addition, where risk of shoulder dystocia is considered to outweigh the risk of caesarean delivery, elective caesarean should be offered.

See Antenatal Steroids guideline regarding use of corticosteroids according to timing and mode of birth. Specifically, there is insufficient evidence to support use of corticosteroids in patients with diabetes  $\geq$  35/40 gestation, regardless of mode of birth.

## 14. Induction and/or labour

Usual obstetric management of labour applies, bearing in mind the risk profile of the woman. Due to factors associated with diabetes (e.g. obesity, macrosomia), some obstetric or surgical complications may be more common so preparations should be made to manage these if they arise.

It is important that women with diabetes maintain good control of their blood glucose during labour as this may reduce the likelihood of neonatal hypoglycaemia.

Women with type 1 diabetes usually require a glucose/insulin infusion in labour, unless their labour is very fast. Women with type 2 diabetes or GDM on insulin rarely require an infusion, as their glucose levels usually remain stable once they are not eating and are in labour or due for LSCS.

Careful fetal monitoring in labour is important for women with diabetes. Most in established labour should have continuous electronic fetal monitoring, see RANZCOG recommendations which are part of the Women's Health guideline (see [associated documents](#) for Fetal Surveillance Policy).

Induction and early labour are a time of transition between the normal routine of antenatal diabetes care and being unable to eat normal meals when in established labour. The duration of this period varies widely and the way this is to be managed has to be tailored to the individual woman. The following are to be used as a guide in combination with common sense. Ask when uncertain. The diabetes team expects to be used as a resource - after hours, contact the physician on call.

### Diabetes care in labour for type 1 diabetes

- Let the diabetes team know the woman has been admitted. After hours, call the physician if any problems. See [section 18.2](#) regarding information required for phone consultation with physician if there are concerns about the woman's medication or glucose levels.
- Check in the clinical record whether there are any specific instructions about management of their medications in labour. Also, confirm there is a documented plan for insulin treatment after delivery, as doses will be less than pre-pregnancy doses immediately after delivery. If there is no plan, ask the diabetes team/physician for advice. If this is noticed in the middle of

the night, this can wait until morning and if the woman delivers overnight, a glucose/insulin infusion can continue until breakfast time.

- The woman should continue her usual subcutaneous insulin and meals and monitor blood glucose before breakfast and two hours after start of meals.
- If the woman appears to be in early labour and insulin is due check dosage with physician as this may need adjusting (reducing).
- If a glucose measurement is  $> 9.0$  mmol/L, contact diabetes team/physician, as insulin doses may need modifying.
- If the glucose is  $< 4.0$  mmol/L or the woman develops symptomatic hypoglycaemia, treat (see [section 18.1](#) on hypoglycaemia). Contact physician as insulin may need modifying.
- Once labour is established or the woman is NBM, she usually requires a glucose/insulin infusion, unless labour is progressing so quickly there is no time to set it up, or if the woman has a pump that she is comfortable to manage.
- Insulin should continue after delivery. If on a glucose/insulin infusion, change from antenatal protocol to postnatal protocol (halve the insulin rate – see Maternity Service Glucose/Insulin Infusion – Postnatal in [clinical forms](#)). Once a woman is ready to eat and it is daytime, she will require subcutaneous insulin and the infusion can be stopped once subcutaneous insulin has been started. In general, a woman's long-acting insulin should have continued, so she will have some background insulin on board. Ensure the woman is given the doses recommended postpartum (on HealthWare risk sheet) and if a postpartum plan cannot be found, phone the physician. Do not give the dose the woman was on prior to delivery, as this will be too much and the woman may develop severe hypoglycaemia.

### **Diabetes care in labour for GDM or type 2 diabetes managed with insulin (or insulin plus metformin)**

- Let the diabetes team know the woman has been admitted. After hours, call the physician if any problems. See information required for phone consultation with physician below if there are concerns about the woman's medication or glucose levels.
- Check in the patient's clinical record whether there are any specific instructions about management of their medications in labour.
- If not, the women should continue her usual subcutaneous insulin (and metformin) and meals and monitor blood glucose before breakfast and two hours after start of meals.
- If the woman appears to be in early labour and insulin is due, check dosage with physician as this may need adjusting (reducing).
- If a glucose measurement is persistently  $> 8.0$  mmol/L, contact diabetes team/physician, as insulin doses may need modifying.
- If the glucose is  $< 4.0$  mmol/L or the woman develops symptomatic hypoglycaemia, treat with glucose tablets first and subsequent complex carbohydrate and protein snack as appropriate (see [section 18.1](#) regarding management of hypoglycaemia). Contact the physician as insulin may need modifying.

- Once labour is established and the woman is admitted to the delivery unit, midwife should make an assessment and notify the registrar from the team of the day or LMC.
- Registrar or LMC to review antenatal management plan located on the risk sheet on HealthWare and consider current situation. Review or amend and document accordingly.
- If the woman is NBM she does not require a glucose/insulin infusion except on rare occasions, such as:
  - The woman has repeated episodes of hypoglycaemia that cannot be managed with oral glucose.
  - The blood glucose level remains above 8.0 mmol/L for more than an hour or if the glucose level is above 9.0 mmol/L.
  - But, use common sense: if labour is progressing very rapidly then an insulin/glucose infusion is not necessary.

Insulin should **not** be restarted after delivery unless requested by a physician. Occasionally, a woman with type 2 diabetes continues with high glucose levels (above 9 mmol/L) and the physician should be contacted to decide whether insulin should be restarted. This is not usually an emergency and the decision to restart insulin is usually made over 12 - 24 hours. However, it may be earlier if glucose levels are > 11 mmol/L.

#### **Diabetes care in labour for GDM managed with diet or metformin alone**

- While still eating, these women should continue testing capillary glucose levels before breakfast and two hours after the start of meals. Aim for glucose levels between 4.0 - 6.0 mmol/L overall. If glucose measurements are persistently > 8.0 mmol/L, contact the diabetes team/physician as insulin treatment may be required.
- Meals appropriate for women with diabetes should be ordered. If taking metformin with meals, continue medication until the woman is no longer eating (i.e. in established labour or nil by mouth for LSCS).
- Do not be concerned if a snack is missed or if the woman is not very hungry. She will not develop hypoglycaemia as she is not taking insulin.
- If intravenous fluids are required, avoid fluids containing glucose.
- Once labour is established and woman is admitted to the delivery unit, the midwife should make assessment and notify the registrar from the team of the day or LMC.
- Registrar or LMC to review antenatal management plan located on the risk sheet on HealthWare and consider current situation. Review or amend and document accordingly.
- Monitor glucose levels 2-hourly. Metformin should be stopped. If maternal glucose levels remain above 8.0 mmol/L for an hour or if it rises above 9.0 mmol/L, contact the diabetes team/physician (this is very uncommon). A glucose/insulin infusion is not required unless requested by the diabetes team.
- Metformin treatment should only be restarted after delivery if requested by the physician.

## 15. Elective caesarean

See [Section 13](#) regarding timing and mode of birth

### Peri-operative care for type 1 diabetes

- Always managed with insulin.
- Should be nil by mouth since midnight and be first or second on the morning list.
- Women with type 1 diabetes must always have insulin on board. In the past, most have been managed with a glucose/insulin infusion perioperatively. (See: Maternity Service Glucose/Insulin Infusion - Antenatal in [clinical forms](#)). Now that many women are on very long-acting insulin glargine (Lantus®) as their basal insulin, they usually have basal insulin in their system at admission and do not require a glucose/insulin infusion if their sugars are well controlled. Some will require a glucose-only infusion to avoid hypoglycaemia. This will be specified on the HealthWare risk sheet by the woman's lead diabetes physician.
- Women self-managing an insulin pump with good sugar control may not require a glucose/insulin infusion. They may suspend/detach their pump for 1 - 2 hours while in theatre and restart in recovery with their postnatal infusion rates.
- If pre-operative insulin/glucose infusion not required:
  - Woman advised to report to ORDA at 0700.
  - Capillary blood glucose monitoring hourly in ORDA.
  - Woman to be **first** on morning elective list.
- If pre-operative insulin/glucose infusion required:
  - Woman advised to report to Ward 98 at 0700.
  - Bed reservation to be made at time of CS booking.
  - Insulin infusion to be pre-prescribed by clinician who is arranging admission and finalising the HealthWare plan. (This does not need to be a physician if there is a clear plan documented on HealthWare already.)
  - Ward 98 midwife will set up and run insulin/glucose infusion.
  - Woman to be **second** on morning elective list.
  - If Ward 98 does not have a bed available when woman arrives:
    - If treatment room is free and sufficiently staffed, infusion can be set up and run here. Consider VIS nurse to facilitate this if staff busy.
    - If not able to accommodate on Ward 98, woman should be sent to WAU for infusion to be set up.
- The post-natal protocol should be with their records so that the insulin dose is appropriately decreased at delivery. If a woman has not had her insulin glargine (Lantus®) dose decreased the day before delivery, she may be at increased risk of hypoglycaemia for a number of hours postpartum and may require no insulin initially.
- These women should all have a postpartum treatment plan in their clinical record. If it is not documented, inform the diabetes team so it can be organised before the woman starts to eat and restart subcutaneous insulin.

### **Peri-operative care for GDM or type 2 diabetes**

- Managed with diet, metformin alone or insulin +/- metformin.
- Should be nil by mouth since midnight (for morning slot) or after early breakfast (afternoon slot). If taking metformin, the last dose of metformin is with their final meal. If taking insulin, the final dose should be either the night before, if morning slot, or with an early breakfast if afternoon slot. The diabetes team should have reduced the final insulin doses to avoid risk of hypoglycaemia once the woman is nil by mouth.
- Monitor capillary glucose levels 2 hourly if between 3.5 - 7.0 mmol/L.
- They do not require a glucose/insulin infusion as a general rule. There may be rare exceptions:
  - Women who have presented late/with poor control: if glucose levels persistently > 9.0 mmol/L contact the diabetes team for advice about infusion and frequency of monitoring.
  - Women who have been on insulin and develop symptomatic hypoglycaemia. If it is mild, it is generally acceptable to give 3 - 4 glucose tablets to treat, but if recurrent or more significant, the woman may require a glucose infusion.

## **16. Postpartum**

It is important to make sure which type of diabetes the woman has, as this modifies postpartum management.

### **Postpartum diabetes care for type 1 diabetes**

- A postpartum insulin plan should be in the clinical record. If not, contact the diabetes team or physician on call prior to stopping the dextrose/insulin infusion. These women should not be without insulin. Do not give the doses the woman was on the day before delivery, as she should require much reduced doses, less than early pregnancy doses. If she is given too much insulin she is at risk of severe hypoglycaemia. Most women require about two-thirds of their early pregnancy dose.
- The diabetes clinic maintains close contact to help women re-establish their insulin needs and control over the first few weeks postpartum.
- Women should continue testing blood glucose levels before and after meals, and at least once during the night, when up with the baby or at 0200 approximately.
- Consider restarting an ACE inhibitor if woman has been on one prior to pregnancy.
- At discharge ensure they have adequate medication at home, or a prescription if required.
- Women should have an appointment in the diabetes in pregnancy clinic at 6 - 8 weeks postpartum, with a recent HbA1c and other bloods as requested by the physician.
- Appropriate follow-up at a diabetes centre should be arranged.

### **Postpartum diabetes care for GDM or type 2 diabetes**

- All diabetes medication is stopped at delivery, unless specified otherwise by the physician.



- Initial monitoring 2-hourly while nil by mouth if had LSCS and fasting plus two hours post meals when eating. Contact the diabetes team if level > 9.0 mmol/L. After hours, contact the physician on call if > 11.0 mmol/L.
- If levels all acceptable during first 24 hours after delivery, monitoring can be stopped in women who were diet-controlled or on metformin alone during pregnancy.
- For women who had been treated with insulin or have a diagnosis of type 2 diabetes, continue monitoring until instructed to stop by diabetes team. Some women should be restarted on diabetes medications prior to discharge.
- If hyperglycaemia is present postpartum, then metformin may be prescribed. Women who breastfeed may take metformin, recognising a very small amount crosses to the baby but is not thought to have a clinically significant effect. Studies report that glibenclamide and glipizide are not detected in breast milk, so they may also be considered.
- Women with type 2 diabetes or GDM who are subsequently confirmed to have diabetes should have a clinic appointment in the diabetes in pregnancy clinic at 6 - 8 weeks postpartum. (This is usually a virtual follow up appointment so a letter can be sent to the GP. Women are to be seen in clinic if physician requests).
- Some women will require an appointment for obstetric review if there were significant delivery complications or specific contraception through the clinic is planned.
- There is a big emphasis on healthy lifestyle at this stage and referral for Green Prescription
- Ongoing follow-up of recognised type 2 should be organised prior to hospital discharge.

### **Diabetes screening postpartum**

All women who have GDM should have a test to see if they have underlying pre-diabetes or diabetes postpartum. An HbA1c (+/- fasting glucose is now recommended if requested by the physician) at three months postpartum with the result to the GP for follow-up. This is less sensitive than an OGTT, but is associated with improved uptake of testing and hopefully makes it more likely they will continue with ongoing surveillance. This should be handed over to the GP. See [letters](#) for GDM postpartum follow-up letter to GP.

Women who have been identified as having previously unrecognised diabetes during pregnancy should have follow-up testing as felt to be appropriate. Many are likely to be on medication still after delivery, so the HbA1c should be for monitoring control, rather than for diagnosis.

The risk of subsequent diabetes is high after GDM. In studies that have followed up women for < 6 years the risk varied from 3% - 50% and is up to about 80% over 20 year follow-up. At Auckland DHB, 30% of women with GDM have prediabetes or diabetes at the initial postpartum check, highlighting the high risk group that is identified during pregnancy. In Australia, where a lower diagnostic threshold is used to diagnose GDM, 30 - 70% are abnormal within five years. Factors that are associated with an increased risk of subsequent diabetes include high fasting glucose in pregnancy, diagnosis in early pregnancy, need for insulin treatment and obesity. Weight gain after pregnancy and a subsequent pregnancy have been shown to speed up the rate that diabetes appears.

All women who had GDM need 1 - 2 yearly screening for diabetes and other cardiovascular risk factors. An HbA1c measurement is generally recommended annually, depending on the result and women's progress with lifestyle intervention.

### **Recurrence of GDM in next pregnancy**

Women who have GDM in one pregnancy usually (50 - 70%) develop it in a subsequent pregnancy. They may be able to reduce the risk of recurrence by losing weight and maintaining good dietary habits.

### **Contraception**

The contraception plan must be documented on the risk sheet.

Long-acting reversible contraception (LARC) and sterilisation options should be discussed antenatally including the offer of a peripartum procedure as appropriate. It is important that a plan is documented and followed, to avoid missing the opportunity to implement the woman's choice of method.

Contraception should be discussed and arranged without fail after birth, before the patient leaves the hospital. Be aware that in a breastfeeding woman, who is therefore oestrogen deficient, unopposed progesterone does increase insulin resistance. In this situation it may be better to consider alternatives to progesterone only contraception or use it for a short time only. However, this may be the only acceptable choice for some women and better than an unplanned pregnancy.

Postpartum IUCD is performed as soon after birth as possible. For women with risk factors for endometrial hyperplasia and/or cancer, Mirena IUCD is a good option and a referral should be made to gynaecology clinic to discuss this.

## **17. Neonatal**

### **Neonatal hypoglycaemia**

Hypoglycaemia in a neonate is defined as capillary glucose < 2.6 mmol/L.

Auckland DHB recommends that babies are monitored within an hour of birth and pre-feed.

Results should be documented on the neonatal ward chart, which outlines actions to be taken and when to call for neonatal clinician input for an infant with hypoglycaemia.

### **Polycythaemia**

Polycythaemia may be secondary to fetal hypoxia and can lead to hyperbilirubinemia and need for phototherapy.

**Other complications**, such as respiratory distress or birth injury will generally be under the care of the neonatal team.

### **Long-term outcomes**

Offspring of women with diabetes have increased rates of obesity, metabolic syndrome, type 2 diabetes and neurodevelopmental issues, e.g. autism. Follow-up and preventive strategies are important. Breastfeeding should be encouraged whenever possible. Hand-over to the Well Child provider regarding childhood follow-up is recommended. Neonatal follow-up is not routine in this regard (see [associated documents](#) for background paper for further information on complications)

## 18. Resources for midwives caring for women with diabetes

### 18.1 Maternal hypoglycaemia management

This protocol is for **women who are treated with insulin** (or sulphonylureas, e.g. glibenclamide). If a woman is treated with **diet or metformin alone she is not at risk** of hypoglycaemia and does not require treatment.

Firstly, document that the woman does have hypoglycaemia. If she has symptoms, hypoglycaemia should be confirmed with a blood glucose reading:

- In general, capillary glucose measure < 4.0 mmol/L.
- Symptoms, e.g. sweating, dizziness, rapid heart rate, shaking, anxiety, weakness/fatigue, confused, irritability, hunger, pins and needles of lips and tongue, impaired vision, headache (she may have some or all of these symptoms).

Occasionally, women on insulin have hypoglycaemia documented but no symptoms. It should still be treated. Women sometimes lose their awareness of hypoglycaemia (seen more commonly in women with type 1 diabetes). Instead they may present with feeling suddenly very tired or yawning a lot, mild confusion or inability to concentrate, or irritability.

Severe hypoglycaemia is present if the woman is difficult to rouse, or if she is unconscious or fitting. The capillary glucose level is typically in the low 2s or even in the 1s. Severe hypoglycaemia is an emergency and a 777 call should be made, specifying '*adult medical emergency*'.

### Treatment of hypoglycaemia

#### If allowed oral treatment

- If glucose level is 3.0 - 3.9 mmol/L, give 15 – 20 g glucose e.g.:
  - One Hypo-Fit sachet (18 g) or
  - 3 - 4 glucose tablets or
  - 6 - 8 jelly beans or small juice (this is for women who bring their own treatment).
- If glucose levels < 3.0 mmol/L, or woman > 100kg, start with 30 – 40 g glucose:
  - 2 Hypo-Fit sachets or
  - 6 - 8 glucose tablets or
  - 12 - 14 jelly beans or two small juices.
- Repeat blood glucose in 10 - 15 minutes and repeat glucose treatment if necessary until blood glucose > 4.0 mmol/L.
- Once blood glucose above 4.0 mmol/L:

- If she is due to eat a meal, she should have a meal and usual insulin unless the dose is adjusted by doctor.
- If not mealtime, she should have a small carbohydrate snack with protein, e.g.:
  - Crackers x 2 with cheese or
  - Small yoghurt or
  - Glass of milk or
  - One slice of toast/bread.

### If NBM/about to go for LSCS

- If glucose/insulin infusion is **not set up**, give oral Hypo-Fit or glucose tablet treatment as above, but avoid other hypoglycaemia treatments (e.g. avoid jelly beans/fruit juice). **DO NOT** follow up with snack. Instead:
  - If type 1, if hypoglycaemia not resolved or likely to recur, put up glucose/insulin infusion but start only with the glucose and do not start insulin until blood glucose remains above 4 mmol/L for 30 minutes, then start infusion as protocol.
  - If type 1 and woman is using her own pump, she can treat the hypo and suspend her pump for 30 - 60 minutes if she is comfortable to self-manage. Otherwise, put up infusion as above.
  - If type 2, very unlikely to need insulin, so just set up glucose and give bolus as below if glucose level remains or drops again < 4.0 mmol/L.
- If has glucose/insulin infusion running
  - Give 150 mL 10% glucose if capillary glucose 3.0 - 3.9 mmol/L.
  - Give 300 mL 10% glucose if capillary glucose < 3.0 mmol/L.
  - If 300 mL required, also discuss with physician/anaesthetist about ongoing management.

### If unable to swallow and cooperate with oral treatment, i.e. semiconscious/unconscious

Step	Action
1.	Ask a colleague to phone for doctor assistance (call code 777 adult emergency).
2.	If she has a glucose/insulin infusion running, give 300 mL glucose 10% as a rapid infusion (and ensure insulin is not being delivered).
3.	If no IV and semiconscious/unconscious, give glucagon 1 mg IM. This takes 10 minutes to work. <ul style="list-style-type: none"> <li>● Aim to site intravenous Luer in case additional treatment is required.</li> </ul>
4.	Repeat CBG level in 10 minutes to ensure she is recovering, and repeat IV glucose treatment if required and still unable to take oral glucose.
5.	Follow up with snack once she recovers as above, if permitted to eat, or continue glucose insulin infusion, though insulin infusion rates may need to be modified (reduced).

## **18.2 Information required for phone consultation with physician**

If phoning a physician about a woman with diabetes, a logical decision about medication changes may need to be considered. The following information should be at hand to enable the physician to make appropriate decisions:

- Type of diabetes the woman has (e.g. type 1, type 2 or GDM).
- Gestation and reason for admission.
- Fetal condition and growth (especially whether growth restriction).
- Usual medication for diabetes (types of insulin if on insulin, and how and when it is given, whether on metformin, other medications) with doses over the previous 48 hours (check with woman if not documented in her book/diabetes recording sheet).
- Blood glucose levels over the previous 48 hours.
- BMI (from risk sheet) and recent weight.
- Whether the woman is eating or drinking or there are plans for her to be nil by mouth or she is vomiting.
- Whether there are plans to start steroids and when the first dose should be.

When the physician requests a dose by phone, ask for it to be checked by another midwife and repeat doses, insulin type and timing back to physician.

Ensure this is documented in woman's record book and ward insulin plan.

Sometimes it is best for the woman with diabetes to talk directly to the physician. Use common sense and follow up with physician about doses as required.

## **18.3 GDM resources for midwives**

### **Lifestyle advice**

In general, women are advised to follow healthy eating guidelines for pregnant women with the carbohydrate content modified for diabetes. The recommended diet composition is based on the following:

- 15 - 20% of calories from protein.
- < 10% of calories from saturated fat.
- ≤ 10% of calories from polyunsaturated fat.
- 60 - 70% of calories from monosaturated fat and carbohydrate (in general up to 30% fat and approximately 50% carbohydrate).

The proportion of fat and carbohydrate is not clear from the literature. However, a low carbohydrate, high fat diet in animals is associated with more obesity in the offspring so it is reasonable to consider around 50% of calories from complex carbohydrate with low glycaemic index/load. Others suggest a minimum of 170 g carbohydrate daily. Simple sugars should be avoided.

Women are advised to spread their caloric intake through the day, planning three meals with snacks between. Recommendations for total calorie intake are based on the woman's BMI (with a minimum of 1700 cal/day).

Weight gain in pregnancy should be limited, depending on initial BMI. Further detail to assist advice can be found on the National Women's Health web site: click on Health Professionals > Referrals and Information (see [other resources](#)).

Weight reduction during pregnancy is not aimed for. However, some individuals do reduce their weight as a result of healthier eating patterns and there are recent data in obese women with type 2 diabetes that show improved outcomes if weight gain is limited to < 5 kg. In women with a BMI  $\geq$  40 kg/m<sup>2</sup>, it may be appropriate to lose up to 5 kg in pregnancy.

It is not recommended to monitor urine ketones routinely.

Exercise is encouraged during pregnancy, aiming for 30 minutes at least five days a week. Strenuous workouts should be avoided, but walking, swimming and upper body exercises are encouraged.

### **Blood glucose monitoring**

Women diagnosed with GDM are taught to test their blood sugars at home and report them back accurately. It is important to emphasise that honesty is imperative as some women will try to please with acceptable rather than accurate results and this benefits no one.

Accuracy will help the diabetes team to observe trends and advise on appropriate treatment as required.

The woman can phone, fax or email her results to the diabetes midwife, or the midwife will contact her weekly (more often if required). She should also be asked to bring her meter and log book to each clinic appointment. Meters can be downloaded in clinic; this is especially helpful if the clinical picture does not seem to correlate with the reported results.

### **Teaching a woman to test her blood sugars**

- Ensure that the woman is comfortable and the people/person with her is supportive.
- Before entering the room ensure that there is a meter (make sure that staff members know how to set the time and date on the meter and how to recall recent results).
- Also needed is a meter case, finger-pricker pen, spare prickers and test strips that are in date and are compatible to the meter, log book or paper to record results, tissues and meter loan form.
- Once in the room, explain why blood sugar levels are being monitored, this can be explained in a positive way. Put emphasis on the benefits of seeing the effect food and exercise has on blood sugar levels.
- The aim is for the fasting blood glucose to be < 5 mmol/L and the blood glucose to be < 6 - 6.5 mmol/L two hours after the start of each meal. It is important to emphasise that the woman may not achieve these results without pharmacotherapy and she should not starve herself.

- The midwife role is to educate and guide the woman with dietary advice in a non-judgemental way, recognising when treatment is appropriate and facilitating its implementation.
- Women with GDM are taught to test their blood sugars four times a day.
- On waking, it is important to do the test before eating or drinking anything to get accurate results.
- In addition, blood sugars should be tested two hours after the commencement of each meal, make sure the woman knows that she cannot eat or drink anything other than water in that two hour period.
- Show the woman the meter and the strips, making sure she knows how to calibrate the meter as appropriate. Ensure she knows to check the strips for their expiry date.
- Show the woman how to assemble her type of pricker. Inform her that she needs to change her needle every 2 - 3 days.
- Demonstrate the part of the finger that it is best to prick and show her the angle. Explain that the side of the finger is less painful than the pad.
- Ask the woman to demonstrate all that she has been taught washing her hands before pricking her finger; let her know she should be visited the next day to see how she is managing. Ensure that she has signed the loan form and given the money to order some test strips.

See [patient information](#) for GDM patient information.

### Teaching insulin

- Assemble all equipment before commencing:
  - Prescription for insulin and needles to give to woman.
  - Insulin pens and spare needles to give to the woman. Try to give her two different coloured pens if she is commencing both short and intermediate acting insulin.
  - Insulin for the pens the woman should take with her.
  - *'Information for Women needing Insulin in Pregnancy'* (booklet).
  - Either recording sheet or *'Blood Glucose Recording Book'* for recording blood sugar levels.
  - A box of tissues.
- Ensure that the woman is comfortable in the room and ensure the person/people with her are supportive.
- Action of insulin
  - Discuss with the woman the different types (short-acting and intermediate-acting) of insulin and their different actions. Include an explanation about how quickly they peak and how long the background action lasts. Make sure she is aware that she should eat when taking short-acting insulin.
- Administration of insulin
  - Demonstrate how the insulin pen is assembled, how the needles are attached, how to prime the insulin pen, dial the correct dose of insulin and how to make adjustments if the dose is over dialled.

- Show the woman how to check a vial of insulin for expiry date, cracks, and floating particles.
- Demonstrate the areas of the body where insulin can be administered and how to pinch the skin to do so. Remind her to count to ten before withdrawing the needle. Explain that there may be a little bleeding if a small blood vessel is struck with the needle.
- Ask the woman to demonstrate all of the things that have just been shown her including giving herself an injection (no insulin of course).
- Dangers
  - Explain that insulin is safe in the correct doses but can be fatal if misused or in the wrong hands.
  - Explain that needles and spare insulin should be kept away from children and not shared with friends or family members.
- Dosage
  - Ensure that the woman knows what her starting doses of insulin are and that she can correctly dial to the correct dose.
  - Show her on the piece of paper or *Blood Glucose Recording Book* where to write her insulin doses in and where to write adjustments.
  - Ensure the woman is aware that her insulin should be adjusted and this may happen over the phone when a staff member is with her or when the physician has been consulted.
- Storage
  - Ensure that the woman is aware that spare insulin should be stored in the fridge (not freezer) and not stored in the fridge door.
  - Ensure that the insulin pens are not left lying around at home or in a hot car.
- Hypoglycaemia
  - Discuss hypoglycaemia with the woman ensuring that she is aware of all the symptoms and how to treat. Make sure she is aware to follow up with a snack or meal following initial treatment.

Give the woman the '*Information for Women needing Insulin in Pregnancy*' booklet with all the information that has just been given to her, making sure that she has the appropriate phone numbers if she has any questions or concerns. The teaching session should be documented in the clinical record.

It is important that the GP is informed about the woman's diagnosis of GDM and the plan for postpartum follow-up. This is done routinely for all women seen by the diabetes team at ADHB. A second letter informing the GP about postpartum follow-up is sent postnatally, when the woman has been given a laboratory form to do an HbA1c. This letter hands over care to the GP to follow up the 3 months postpartum HbA1c.

## 19. Supporting evidence

- Crowther, C. A., Hiller, J. E., Moss, J. R., McPhee, A. J., Jeffries, W. S., & Robinson, J. S. (2005). Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. *New England Journal of Medicine*, 352(24), 2477-2486.



- Cochrane Training. (n.d.). Grade Approach. Retrieved from: <https://training.cochrane.org/grade-approach>
- HAPO Study Cooperative Research Group. (2008). Hyperglycemia and adverse pregnancy outcomes. *New England Journal of Medicine*, 358(19), 1991-2002.
- Landon, M. B., Spong, C. Y., Thom, E., Carpenter, M. W., Ramin, S. M., Casey, B., et al. (2009). A multicenter, randomized trial of treatment for mild gestational diabetes. *New England Journal of Medicine*, 361(14), 1339-1348.
- Ministry of Health. (2014). *Screening, Diagnosis and Management of Gestational Diabetes in New Zealand: A clinical practice guideline*. Wellington: Ministry of Health.
- Rowan, J. A., Gao, W., Hague, W. M., & McIntyre, H. D. (2010). Glycemia and its relationship to outcomes in the metformin in gestational diabetes trial. *Diabetes Care*, 33(1), 9-16.
- Rowan, J. A., Hague, W. M., Gao, W., Battin, M. R., & Moore, M. P. (2008). Metformin versus insulin for the treatment of gestational diabetes. *New England Journal of Medicine*, 358(19), 2003-2015.
- Rowan J, Rush E, Plank L, Lu J, Obolonkin V, Coat S, Hague W. Metformin in gestational diabetes: the offspring follow up (MiG TOFU): body composition and metabolic outcomes at 7-9 years of age. *BMJ Open Diabetes Res Care* 2018 Apr 13;6(1):e000456. Doi: 10.1136/bmjdr-2017-000456
- Karagiannis, T., Bekiari, E., Manolopoulos, K., Paletas, K., & Tsapas, A. (2010). Gestational diabetes mellitus: why screen and how to diagnose. *Hippokratia*, 14(3), 151.
- Albericos S, Erenbourg A, Hod M et al. GINEXMAL trial BJOG 2016 DOI:10/1111/1471-0528.14389

## 20. Associated documents

### **Auckland DHB policies and guidelines**

- Antenatal Corticosteroids to Improve Neonatal Outcomes
- Fetal Surveillance Policy
- Medication Administration
- Medications – Prescribing

### **Clinical forms**

- CR3138: Maternity Diabetes Insulin Prescription and Blood Glucose Record

### **Patient information**

To access relevant information and resources for women with diabetes in pregnancy, go to the National Women's Health web site, [nationalwomenshealth.adhb.govt.nz](http://nationalwomenshealth.adhb.govt.nz), then click on the tab Health Professionals, go down to Referrals and Information, and click on Diabetes.

Examples of what can be found include:

- Blood glucose testing, including recording sheet

- Gestational Diabetes Mellitus (GDM) – patient information
- Medication options for GDM – patient information
- How to take Metformin – patient information
- Diabetes in Pregnancy – Background Paper

## 21. Disclaimer

No guideline can cover all variations required for specific circumstances. It is the responsibility of the health care practitioners using this Auckland DHB guideline to adapt it for safe use within their own institution, recognise the need for specialist help, and call for it without delay, when an individual patient falls outside of the boundaries of this guideline.

## 22. Corrections and amendments

The next scheduled review of this document is as per the document classification table (page 1). However, if the reader notices any errors or believes that the document should be reviewed **before** the scheduled date, they should contact the owner or [Document Control](#) without delay.