



Forth Valley Diabetes Team
Insulin Pump Workbook
Omnipod 5

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Insulin Pump Therapy

In multiple injection therapy, long acting insulin is used as background (basal) insulin and fast acting (bolus) insulin is used for food.

An insulin pump uses only fast acting insulin to supply the body with insulin continuously. This is made possible by different basal rates and bolus variations delivered by the pump over a 24 hour period.

Hybrid Closed Loop Pump

A hybrid closed-loop system automatically regulates insulin delivery according to your glucose levels, reducing insulin when you are at risk of going low and delivering more insulin when you are at risk of going high. With SmartAdjust™ technology, Omnipod 5 and the Dexcom G6 CGM are in constant communication, enabling automatic insulin adjustments to help improve time in range. When you eat a meal or snack containing carbohydrate, you need to give a bolus dose of insulin by letting the Omnipod 5 controller know your carbohydrate intake prior to eating.

Wearing a pod

Omnipod 5 is a patch (tubeless) pump. The waterproof Pod includes a small, flexible cannula, which is a plastic tube under the skin, and inserts automatically with the push of a button. The pod delivers insulin for up to 3 days and holds up to 200 units of insulin.

A pod can be sited in the same places that an insulin injection can be given:

- Stomach
- Buttock
- Thighs
- Lower back
- Back of arm
- It should be placed 3 inches away from your CGM sensor site.

It is best to avoid:

- Waistbands
- Skin folds
- Scar tissue / lumpy areas
- Areas of lipohypertrophy (fatty lumps)
- Tattoos
- Consider where car seat belts would lie

Other things to consider when changing your pod:

- Wash your hands before changing your pod
- If you use body lotion avoid putting on the area that you wish to use
- Use different sites as lipohypertrophy (lumpy sites) can develop on a pump too
- If you need to shave or wax the area do so 24 hours before you will insert a pod to prevent inserting it into sensitive skin.
- If possible change the pod prior to a meal so you are giving a food bolus soon after.
- You must check your glucose levels 1-2 hours after inserting a new pod so that you know it is working correctly. This means that changing just before bed is not a good idea.

Change the pod:

- At appropriate time intervals, i.e. every 3 days
- If the site is uncomfortable or itchy or the site is red and inflamed
- If you have high glucose and ketone levels and have given a correction dose by pen

Try to check your pod site morning and evening to ensure that there are no problems. This will only take a few seconds.

If you have problems with itchy red sites try spraying with Cavilon 3M 'no sting' barrier spray prior to inserting your pod. This is an alcohol-free liquid barrier film that dries quickly to form a breathable, transparent coating on the skin and is available on prescription from your GP.

Emergency Kit

When you wear an insulin pump, you must be prepared at all times with a backup system that will allow you to give insulin if something goes wrong with your pump.

It is recommended that you should carry the following items when going out:

- Blood glucose meter, finger pricking device and strips.
- Blood ketone meter and test strips
- Spare pod
- Insulin vial
- Mealtime insulin pen and needle (in date). Don't leave the needle attached to the pen or the insulin can crystallise and block the needle. Alternatively you can use a disposable syringe and take insulin from your insulin vial.
- Background insulin pen (if going away for more than 12 hours)
- Treatment for hypoglycaemia
- Emergency contact numbers

Insulin Pump Settings

The system will require to be programmed with your total daily dose of insulin in order for the algorithm to start delivering a basal rate of insulin across a 24 hour period. The system will then learn about individual insulin requirements and constantly adapt. Your pump will also require to be programmed with a basal rate of insulin should it require to revert to manual mode for short periods of time. When delivering a bolus for food, your Omnipod 5 controller will calculate the required bolus based on the following factors; target glucose which can be programmed between 6.1 – 8.3 mmol/l, sensor glucose readings, insulin to carbohydrate ratio, insulin sensitivity factor and insulin duration.

Setting your Basal Rates

In general less insulin is required when using an insulin pump because of the way the insulin is delivered. This can be 20- 30% less than your total daily insulin dose.

Calculating your basal rate:

1. On average, how many units of quick acting/meal time insulin are you injecting in 24 hours?
e.g. 18 units
2. How many units of background insulin are you injecting in 24 hours?
e.g. 22 units
3. Add both together to give your pre pump total daily dose
e.g. 40 units
4. Take 25% off pre pump total daily dose. This is now your total daily pump dose
e.g. 75% of 40 units = 30 units
5. Divide your total daily pump dose by 2 to give your total basal rate in 24 hours
e.g. $30 \div 2 = 15$
6. Divide by 24 to give an hourly basal rate
e.g. $15 \div 24 = 0.625$ units per hour (round down to 0.6 units per hour)

Calculating your insulin to carbohydrate ratio

You should already have an insulin to carbohydrate ratio (ICR). This may need to be altered when you move onto pump therapy. This is a general guide for working out your ICR although your diabetes team may decide to continue your current ICR when you commence pump therapy:

Working out your ICR:

1. Calculate your total daily pump dose (as documented on previous page)
e.g. 30 units
2. Divide this into 400
e.g. $400 \div 30 = 13.3$ round this to 13

For example this would mean you will need approx 1 unit of insulin for every 13g carbohydrate.

My starting insulin to carbohydrate ratio:

I need to take 1 unit of insulin forg of carbohydrate.

Calculating your insulin sensitivity factor (correction factor)

A correction dose is how much 1 unit of insulin will reduce your blood glucose level by.

Working out your correction dose:

This is a general guide and may need to be adjusted

1. Calculate your total daily pump dose
e.g. 30 units
2. Divide this into 130
e.g. $130 \div 30 = 4$

This means that 1 unit of insulin will reduce your blood glucose level by approximately 4mmol.

A more accurate way of working out your correction dose is to use your CGM. When your blood glucose is above target, but is relatively stable, and you have no active insulin on board, take a bolus of 1 unit and see how much this drops your blood glucose by. This will indicate what your correction dose/insulin sensitivity factor will be.

My correction dose is: 1 unit of insulin will reduce my blood glucose bymmol/l.

Calculating insulin pump settings

Calculate pre-pump total daily dose (TDD) =
(This includes both basal and bolus insulin)

Adjustment for pump therapy (-25%):
..... (TDD) x 0.75 = ○ adjusted pump TDD

Anticipated basal 50% of adjusted pump TDD (basal of 40-50% assumes CHO intake 100-200g per day)

Adjusted pump TDD ÷ 2 =

÷24 (hr) = hourly basal rate

Insulin to CHO ratio = $400 \div \text{adjusted pump TDD} = \dots\dots\dots$

Therefore 1 unit of insulin is required for everyg of CHO

Insulin sensitivity = $130 \div \text{adjusted pump TDD} = \dots\dots\dots$

Therefore 1 unit of insulin will reduce your blood glucose by mmol/l

Hypoglycaemia

Hypoglycaemia (blood glucose of less than 4mmol/L) can occur when using an insulin pump for the same reasons as when injecting insulin by pen.

The three most common causes of hypos are:

- Too much insulin.
- Over-estimation of carbohydrate content of food/not finishing meal.
- More physical activity than planned.

Causes Specific to Insulin Pump Therapy:

- Infusing insulin through “lumpy sites” (lipohypertrophy).
- Related to your bolus dose of insulin:
 - Miscalculation of a bolus
 - Over correction of an elevated blood glucose level e.g manual corrections or incorrect ISF setting.
 - Timing of meal bolus – a delayed meal bolus will likely result in the pump increasing insulin and therefore if you then bolus the full amount for your meal it can result in hypoglycaemia

Treatment of hypoglycaemia

Hybrid closed loop systems give additional protection against hypoglycaemia over injections by reducing or suspending insulin delivery in response to falling glucose levels. People using hybrid closed loop systems require less rapid acting carbohydrate to treat hypoglycaemia than those using injections because of this feature of the system. Often half of the previous hypo treatment can be enough.

When treating hypoglycaemia, a useful tool to guide how much rapid acting carbohydrate you might need is to look at the information on your Omnipod 5 controller. If there has been a slow steady fall in glucose without a lot of insulin delivery in the preceding 4 hours (ie. insulin on board from boluses or basal from the algorithm) then you should treat with 4-5g at a time e.g. one jelly baby or soft mint. Frequently this is all that is required for overnight hypoglycaemia as most often there will not have been any recent boluses.

If, however, the glucose is falling rapidly (steeply) and/or you can see that you have a lot of insulin on board then you should treat with 8-10g.

Over treating hypoglycaemia when using this system, will result in increased insulin delivery after the hypo in response to the resulting hyperglycaemia, potentially increasing the risk of further episodes of hypoglycaemia.

The table below gives examples of hypo treatments containing 5-10g of carbohydrate.

Food	5-10g CHO is found in:
Glucose/dextrose tablets	2-3
Pure fruit juice	50-100 ml
Cola/lemonade-type fizzy drink (not diet)	50-100 ml
Jelly Babies	1-2
Jelly Beans	3-6
Fruit Pastilles	2-4

Unlike when you were on injections, when you are using a pump you do not need to give an additional carbohydrate snack when your blood glucose is back above 4mmols/l. If you do eat then you should enter this carbohydrate into your controller and take the insulin for it.

Illness and Diabetic Ketoacidosis (DKA)

When you are ill, your body becomes more resistant to the insulin you are taking so you may require more. In addition, you will produce stress hormones that will cause your glucose levels to rise.

Managing High Blood Glucose Levels when using an Insulin Pump

High glucose levels are managed differently with an insulin pump. With injections or pumps there are several reasons why your glucose levels can rise such as illness, missed insulin, stress or anxiety. Other things to consider when you are using a pump are: -

- Have you eaten carbohydrate foods and have forgotten to bolus?
- Has your POD been in place for longer than 2-3 days?
- Is the cannula site sore or red?
- Is the POD empty or is your pump suspended?

If your glucose levels are 14 mmols/L (in pregnancy 10mmol/L) or above you should do the following: -

- Check your cannula site to ensure that it is ok
- Check for ketones in your blood

You can ask the pump to administer a manual correction bolus if blood glucose is high but be careful when the pump suggests not taking a correction or suggests a smaller one than you might have otherwise taken. This is because the system has calculated that the insulin already given will be sufficient and that any additional insulin will lead to hypoglycaemia.

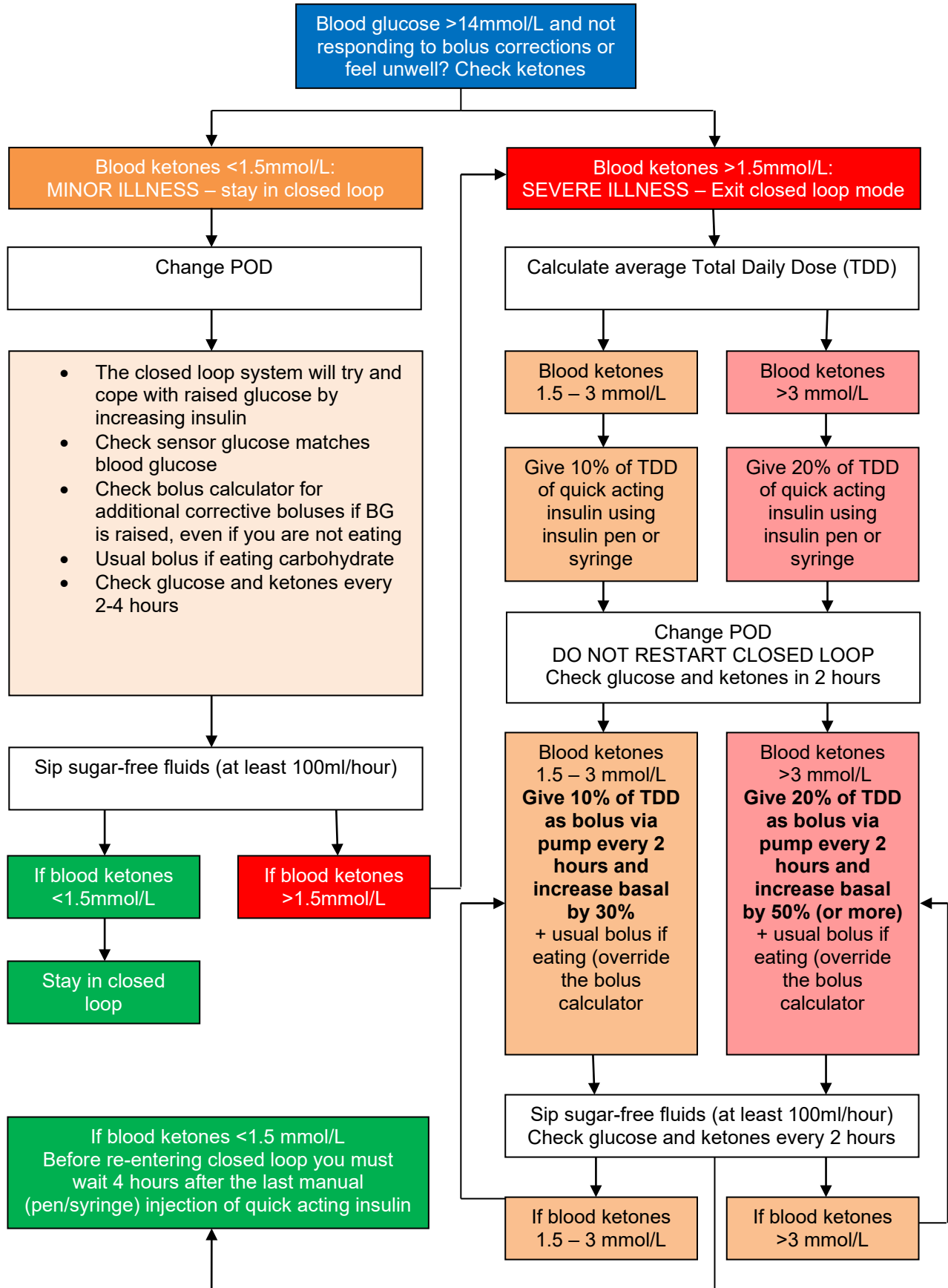
If your ketone levels are above 1.5mmol/L then you must come out of automode and use your pump in manual mode. See over page.

IMPORTANT:

If you have been trying to address hyperglycaemia for more than 4 hours with no improvement contact diabetes team.

If you are vomiting and are unable to keep fluids down, or unable to control your blood glucose or ketones you must contact your GP/Accident and Emergency Dept/NHS 24

Hyperglycaemia and Sick day rules



Delivering a Meal Bolus



Timing of boluses for food is very important, however recommendations are slightly different for a hybrid closed loop system compared with injections. It is even more important to bolus in advance of a meal. If you bolus during or after a meal, there will be a higher chance that you experience post meal hypoglycaemia. This is because the system will have already responded to the rising blood glucose levels by increasing insulin delivery and, with a bolus in addition, you may receive more insulin than is required for the food you have eaten.

We recommend that you try to bolus 10-15 minutes before meals. If you bolus much more in advance than this the result can be hyperglycaemia after meals as the system will reduce insulin delivery in response to falling glucose levels (the opposite of the scenario above).

If a mealtime bolus is missed or delayed:

- 30 – 60 mins after the meal has started give half the bolus dose
- More than 60 mins from the start of the meal – avoid giving the meal time bolus and allow the pump to deal with the raised glucose level

Exercise and Physical Activity



Activity feature – Using the activity feature will temporarily increase the target to 8.3mmol/L. For planned exercise or an increase in physical activity which you know is likely to increase the risk of hypoglycaemia, it is recommended that you switch on the activity feature 60-90 minutes before starting exercise.

If delivering a bolus within 2 hours of planned exercise, consider reducing the bolus. The amount you reduce by will depend on the nature and duration of the planned exercise.

You should avoid 'carb loading' prior to exercise as you may have done on injections. A rise in glucose will cause the pump to increase insulin, increasing the risk of hypoglycaemia during the activity. A gradual and consistent intake of carbohydrate may be necessary, guided by your sensor glucose readings e.g. 10g every 20mins if glucose levels are falling.

Conversion Back on to Insulin Injections

In an emergency situation it may be necessary for you to convert back onto insulin injections.

In case you are unable to recall information from your controller it is recommended that you should always keep a record of your up to date pump settings – you will need your total amount of basal insulin, your insulin to carbohydrate ratio and your correction factor.

How to calculate your starting background dose

Take your total daily dose of basal insulin and add 20% to this amount.

If you take Lantus: take this total amount of insulin

If you take Levemir: divide this amount by two and take that amount twice a day.

How to calculate your food doses

Using your insulin to carbohydrate ratio – take the grams of carbohydrate you are eating and divide by the amount of your ratio.

Eg;

Insulin to carbohydrate ratio is 1:20g

Carbs in meal is 80g so $80/20 = 4$ units of insulin.

If you need to add on a correction:

Insulin sensitivity factor is 1:2mmols/L

Glucose is 10.3 and target is 6mmols – difference in 4.3mmols/l

$4.3/2 = 2$ units

Travel with an Insulin Pump



FAQ's

What preparations do I have to make prior to travelling?

When going on trips, be sure to take extra insulin, pump supplies and an insulin syringe or insulin pen for injections just in case. See the section "Conversion Back On to Insulin Injections" if your insulin pump stops functioning. You should also take your blood testing and ketone monitoring equipment. A good rule of thumb is to take double the amount of supplies that you think you would need.

I'm going on a long haul flight; do I have to make any changes to my pump settings?

Travel across time zones means that you will need to change the clock on your controller when you arrive. You need to make sure your pump knows when you are waking up and going to sleep. Remember to change it back once you are home.

Is there anything else I should do?

- You will need a travel letter from your diabetes team confirming that you use an insulin pump.
- PODS and controllers can safely pass through airport x-ray machines however Dexcom sensors and transmitters should not pass through full body scanners.

Holidays



Extremes of temperature can affect blood glucose levels. If insulin becomes too hot or cold it can stop working, which means that your blood glucose levels will rise very quickly. Heat can also make your insulin work more quickly causing unexpected low blood glucose levels.

FAQ's

Are there any special precautions I need to take?

- If you are wearing your POD on the beach, you will need to keep it out of direct sunlight. You should also avoid exposing your controller to extremes of temperatures therefore try covering with a heavy towel to avoid direct sunlight.
- If you are wearing swimwear think about where you insert your POD. When it is hot, the tape on your POD may not stick as well, especially if your skin is sweaty. You may need to put a second piece of tape over the cannula site. Opsite or Tegaderm can be either bought from a chemist or obtained on prescription from your GP.
- You should remove your POD before you use a sauna, steam room or hot tub. This stops the insulin being affected by the intense heat.
- Your POD is waterproof for up to 60 minutes however your controller is not waterproof.

Hospital Admission

FAQ's

What happens if I have to go into hospital, is there anything I have to do?

Here are some simple guidelines to follow.

- If your admission is planned, inform your Diabetes Team as soon as you know the date for admission. If it is to a different hospital ask them to contact the appropriate team.
- It is easier but not essential if your procedure can be done first thing in the morning.
- The appropriate medical team will advise you about eating and drinking and if you will have to fast. Remind them you have diabetes and ask them to inform the diabetes team that you are in hospital.
- For scheduled surgeries or hospitalization, you should tell the physician/surgeon or hospital staff about your Pod. It may be necessary to remove it for certain procedures or treatments. Remember to replace the basal insulin that was missed while the Pod was removed.
- You may be able to wear your POD throughout the procedure if this is performed under local anaesthetic. It is advisable that you have a venflon (a small cannula) inserted into your hand/arm as a precautionary measure. You may also wish to use the activity feature to reduce the risk of hypoglycaemia during the procedure. This would require to be switched on 1-2 hours before the procedure.
- Ensure that your controller is charged, you have a full POD and that you have a spare POD and insulin.
- The Pod, controller and sensors may be affected by strong radiation or magnetic fields. Before having an X-ray, MRI or CT scan (or any similar test or procedure), remove and dispose of your Pod and sensor and place your controller outside the treatment area.
- If the procedure is carried out under general or spinal anaesthetic intravenous insulin should be commenced and your insulin pump discontinued.
- Make a note of your basal rates in case these are lost from your pump.
- Once you are well enough to manage your pump yourself you can restart your insulin pump.

- When you change back from intravenous insulin onto your insulin pump, the insulin pump and IV insulin should run together for 1 hour before the intravenous infusion is discontinued.

Useful Contacts

If you are experiencing the following issues please contact your insulin pump/Dexcom supplier:

- Faulty pump
- Issues with insulin pump/Dexcom supplies or delivery
- Technical difficulties downloading your pump at home

Omnipod	www.myomnipod.com/en-gb	Tel: 0800 011 6132
Dexcom	www.dexcom.com/en-gb	Tel: 0800 031 5761
		Tech Support 0800 031 5763
Glooko	www.glooko.com	Tel: 020 7795 8191

Urgent Advice:

- Within working hours 9am – 4pm Monday - Friday, please phone 01324 566929
- Out of hours speak to NHS 24 on 111.

Non Urgent Advice:

- Please email fv.diabetespumpserv@nhs.scot

Downloading your pump:

Glooko - Proconnect code - ukforthadu

You may find the answer to your question on our website:

www.forthvalley/diabetes

Non Diabetes Related:

If you have a problem, not related to your Diabetes, please get in touch with your GP or NHS 24 on 111.