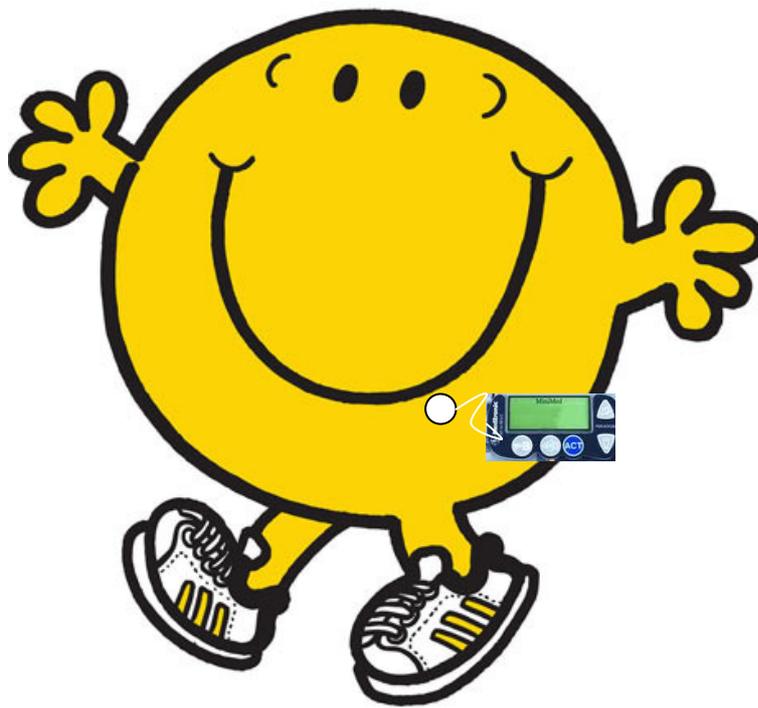


Insulin Pump Therapy

Handheld Record



Highland Paediatric Diabetes Service

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About the Handheld Record

Name _____

This is your personal record for your insulin pump management. It contains important information about using your pump safely, and also records details about your pump, your insulin pump basal rates, what to do in the cases of emergency, and insulin doses to be used if you need to stop using the pump for any reason.

Please take it with you every time you are away from home (on holiday, visiting friends or family) or if you are attending:

- A Diabetes Clinic
- A Diabetes Nurse Review
- A Dietitian Review
- Hospital - if you are unwell

Useful Contact Details

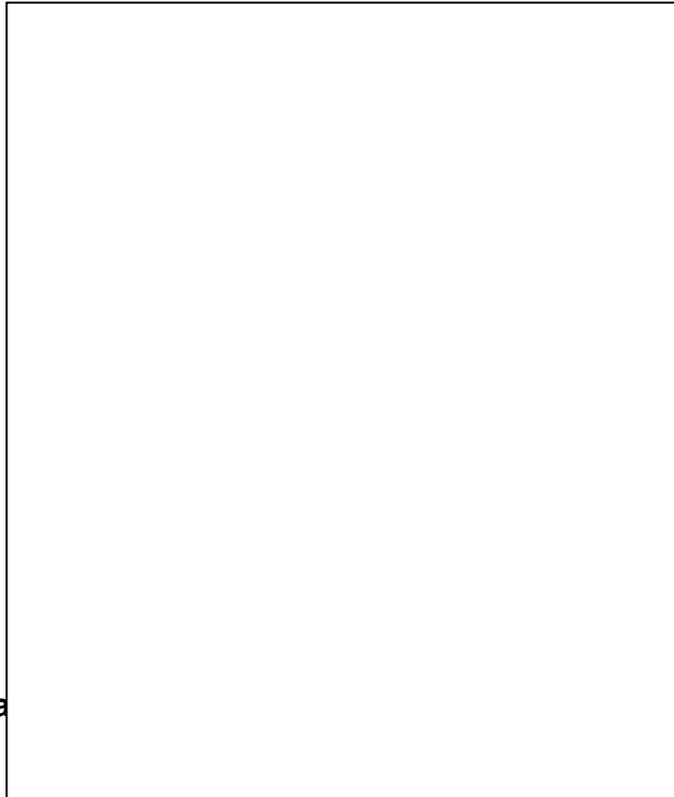
- **Diabetes Nurses**

- **Dietitian**

- **Dr Franklin**

- **Dr Farmer**

- **Out of Hours a**



- **Insulin Pump Helpline**

- Medtronic 01923 205167

24 hour technical helpline for support with button pushing and pump supplies

Insulin Pump Information

Type of Pump	
Manufacturer	
Pump Serial Number	
Date of Pump Start	

Insulin Supplies Information

Customer Service Telephone Number (for ordering supplies)	01923 205167
Type of sets	
Set Order Code	
Size of Reservoirs	
Reservoir Order Code	
Insertion Device (if applicable)	
Insertion Device Order Code (if applicable)	
Insulin vial Name	
Blood sugar meter name	

Insulin Pump Therapy

An insulin pump is a small device which delivers insulin all the time. It delivers insulin into your body through a small cannula (plastic tube) inserted just under the skin. The insulin pump can mimic the pancreas by using fast-acting insulin to give a basal (background) rate. It can be programmed to give different rates across the day. In addition you can press a button to give bolus doses of insulin to cover the carbohydrate in the food that you eat (food bolus) or to give extra insulin to correct a high blood glucose level (correction bolus).

Only fast acting insulin is used in the pump. This means that regular snacks between meals are not required, as long as the basal rate is set correctly throughout the 24 hour period.

Important: because only fast-acting insulin is used in the pump, blood sugars can rise very rapidly if there is any problem with insulin delivery, and can quickly lead to Diabetic Ketoacidosis.

Benefits of Insulin Pump Therapy

The benefits of insulin pump therapy can include

- less frequent severe hypoglycaemia
- improved blood glucose control
- improved HbA1c level
- better quality of life

However, to get the most from the pump and to use the pump safely, it is essential that both the young person (except very young children) and their family are confident in

- using the technical features of the pump
- Carbohydrate Counting to adjust food boluses
- Regular blood glucose testing so that correction doses can be given
- Responding quickly to high blood sugar readings
- Sick day management

Keeping yourself safe on a pump

- Pumps and infusion sets can fail. You must be prepared to give rapid acting insulin by pen without delay. Older children should have a pen available for self-injection. Parents of younger children should have a pen available, and be able to attend within an hour.
- Levemir (background insulin) should also be available for twice daily administration. This will usually be kept at home, but remember to take it with you on holidays and away days. The insulin for backup injections should be in-date. Insulin kept at room temperature should be discarded and replaced after 1 month. If kept in a fridge, it will keep longer – see expiry date on the label.
- Do not settle to sleep unless you are sure the pump is functioning normally. For this reason we advise that you do not routinely change the infusion set in the evening.

Insulin Pump Therapy – Basal Rates

- Basal insulin is given continuously over 24 hours, and provides the background insulin which the body needs.
- It is very important to get the basal rate correct. If it is correct, someone on an insulin pump could go all day without eating and the blood sugars would remain fairly stable.
- The basal rate usually provides between 25-50% of the daily insulin requirement.
- When calculating the basal rate, we take into account that young people usually need 25% less insulin on the pump than they do on injections.

Different Basal Rates

We usually start with 4 or 5 different basal rates for different times of day. These will be adjusted according to your individual needs.

It is possible to set a "temporary basal rate" to cover different situations, for example:

- Strenuous activity
- During the monthly period for girls
- During illness when blood sugar levels may be higher

Insulin to Carbohydrate Ratios

We can specify different insulin to carbohydrate ratios for different times of day. Children often require more insulin per gram of carbohydrate at breakfast time than at other meals. Once programmed, the "bolus wizard" will automatically adjust the recommended bolus dose.

The pump will not automatically take into account other factors which may modify insulin requirement per meal. However, you can manually amend the bolus dose recommended by the pump

- during period time for girls, or during illness (more insulin usually required)
- around physical exercise (less insulin usually required)

Correction Doses [Insulin Sensitivity Factor (ISF)]

A correction dose is insulin given to correct a high blood sugar. The Insulin Sensitivity Factor (ISF) specifies how much one unit of fast-acting insulin will lower the blood glucose. The bolus wizard will aim to bring down the blood glucose to the target (usually set at 6 mmol).

Check a blood sugar 2 hours after giving a correction dose. Use the bolus wizard to determine whether a further correction dose is required. The bolus wizard will take into account the amount of insulin still in the body from the last bolus. This prevents the administration of too much insulin.

Changing Infusion Sets

Frequency of Set Changes

Change the infusion set every 2 days. If a cannula is left in place too long, the infusion site may become infected, or insulin may not be delivered properly, leading to high blood glucose, increasing ketone levels, and Ketoacidosis.

Time of Day

- Change your set when you will need to take a bolus of insulin afterwards, for example before the evening meal. This will allow you to ensure the set is working properly before you go to bed.
- If you have to change your set just before bed, you will need to get up in the night to check a blood glucose level to make sure it is working.

Preparation

- Only remove the old cannula once the new one is up and running and the blood sugar has been stable for at least 2 hours.
- Before changing your set, make sure that you have everything you need.
- Make sure that the insulin is at room temperature to avoid bubbles.

Preventing Infection

- Wash hands before opening any package
- Wash hands after touching the old site
- Take care to avoid touching the ends of the set
- Change sets if pain, redness or discomfort develop over time

Choosing your Site

- Most young people use the lower abdomen. Other possible areas are your buttocks, upper arms and the upper outer areas of thighs.
- Do not site your set where it may get knocked or dislodged, for example under your waistband. Think about any activities you have planned.
- Rotate sites just as you do with injections. The new cannula should be inserted at least 5cm (2 inches) away from the old site.

- Avoid lumpy or heavily used sites

After set insertion

- If there is blood in the tubing, the infusion set must be changed.
- Infusion sites are sometimes painful after insertion. If it is still painful after 1 hour change the set and site.
- Always check blood glucose 2 hours after inserting the set to ensure it is working.

After removing the old set

- Examine the tubing and cannula for kinks, bending or pus. If problems arise regularly, tell the Diabetes Team

Helpful Tips

- If your child experiences irritation from the adhesive tape, try applying Cavilon spray before inserting the cannula. Tea tree cream or Bio-Oil may help relieve irritation persisting after cannula removal.

Blood Glucose Testing

Anyone using an insulin pump **must** test blood sugars regularly. The insulin pump uses only rapid acting insulin, so if the pump fails to deliver insulin (for example if the cannula becomes infected or dislodged, or there is a kink or hole in the tubing), blood sugar will rise quickly, followed by a build up of ketones leading to Ketoacidosis.

Regular blood sugar testing through the day is essential to achieve good blood glucose control and identify problems with insulin delivery. You will need to test your blood glucose 4-6 times each day, usually before meals and snacks. Check an overnight blood sugar at least once each week.

In order to adjust basal rates appropriately, more frequent testing is required when you start on the pump. You will need to test every two hours during the day and every 3 hours overnight. Over time you will learn to adjust basal rates yourself: do extra tests to check the changes are effective.

When unwell test blood sugars at least 4 hourly, including during the night.

Remember to test 2 hours after changing your infusion set.

Targets for Blood Glucose Levels

We usually set the Bolus Wizard to aim for a target of 6 mmol/L when calculating correction doses. With appropriate adjustment of basal rates, regular testing, and use of temporary basal rates after exercise, there should be no need for the blood sugars to regularly run high overnight.

Important!

If you do not test your blood glucose regularly, you are at risk of DKA (Diabetic Ketoacidosis). This is a potentially life threatening condition requiring hospital admission and treatment with intravenous fluids and insulin. If blood sugars are not checked frequently enough to ensure safety, the Diabetes Team will withdraw the pump and restart pen injections.

Hypo (Hypoglycaemia) Management

Hypoglycaemia means low blood glucose (less than 4 mmol/L). This is commonly called 'a Hypo'

Hypo Symptoms

It is important that hypos are recognised quickly. Common signs include:

- Going pale and shaky and unusually quiet
- Becoming aggressive or confused
- Sweating
- Loss of consciousness or (rarely) fits

***If you don't notice any warning signs – please discuss with your diabetes team. You may have 'hypo unawareness'.**

Be alert for the possibility of night time hypos – signs of this may include:

- Fluctuating blood sugars in the morning going from high to low
- Waking up with headaches and feeling confused

Hypos sometimes have no symptoms – we recommend overnight blood glucose testing (2-5am) once each week.

Hypos on an Insulin Pump

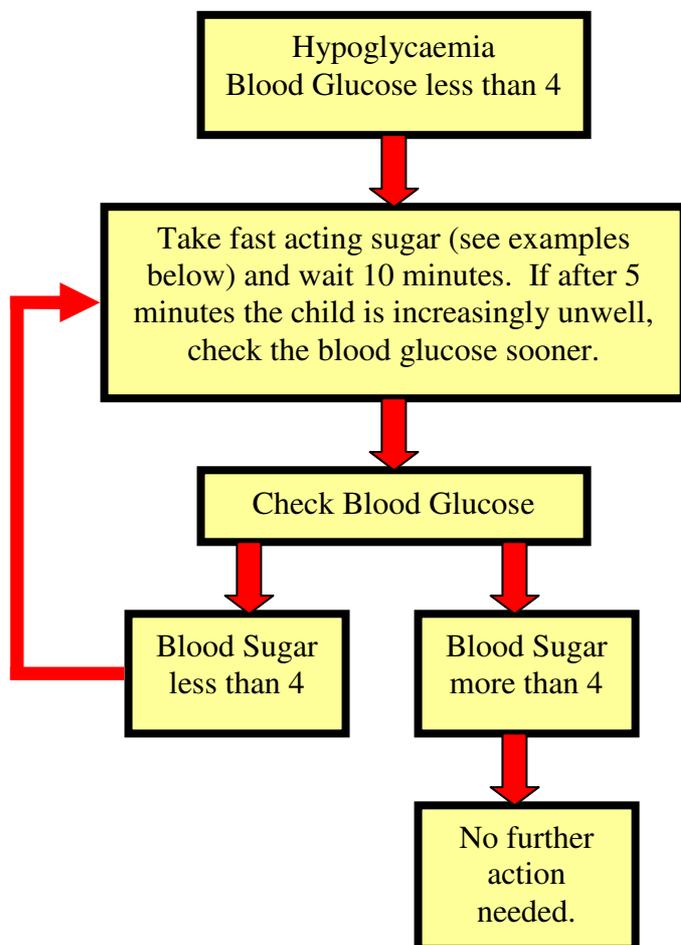
The most common causes are:

- Too much insulin
- Over-estimation of carbohydrate count of food
- More physical activity than planned
- Excessive alcohol

Treatment of hypos

- Follow the plan on the next page
- Do not suspend the insulin pump except in severe hypoglycaemia (unconscious or fitting).
- There is no need to follow the hypo treatment with starchy food.

What If I Am Hypo?



Use **GLUCOSE GEL** if child is unable to swallow.
 Use **GLUCAGON** if child is unconscious or fitting
 If unconscious or fitting – **SUSPEND the PUMP**

	Weight <30kg	Weight 30-50kg	Weight >50kg
Lucozade	60mls or 1/3 of a small glass	90mls or 1/2 a small glass	120 mls or 3/4 of a small glass
Fresh fruit juice or sugary fizzy drink	100 mls or 1/2 of a small glass	150 mls or 3/4 of a small glass	200 mls or 1 small glass
Glucotabs	2-3 tablets	3-4 tablets	5 tablets
Lucozade or Dextro-energy tablets	3-4 tablets	5-6 tablets	7-8 tablets
Fruit Pastilles	4 pastilles	6 pastilles	8 pastilles
Glucose gel (if unco-operative or drowsy)	1 tube	1 1/2 tubes	2 tubes

Preventing hypos on an insulin pump

If hypos occur regularly, follow these tips:

- Count carbohydrate correctly to ensure correct bolus. Always use the bolus wizard for food and correction doses.
- If hypos regularly happen within 3 hours of a meal, adjust the insulin to carbohydrate ratio for that time of day.
- If hypos tend to happen after heavy meals (with unusually large amounts of carbohydrate or fat), use a dual wave bolus.
- Check basal rates as necessary (see below)
- Use a temporary basal rate for exercise (the rate and duration will vary between individuals, and for different kinds of exercise)
- Look for patterns before changing basal rate, insulin to carbohydrate ratio or insulin sensitivity factor.

Choosing a Standard or Dual Wave Bolus

If a meal takes a long time to digest, a standard bolus may result in hypoglycaemia soon after eating, and/or hyperglycaemia for some hours afterwards. If you experience this, a dual wave bolus (where some of the insulin is given "up front", and the remainder over several hours) will be useful. Situations where this is likely to be necessary include:

- Meals with a particularly high carbohydrate content (for example, which require a bolus of 6 units or more)
- High fat meals take longer to be absorbed and cause a slower rise in blood glucose levels. A dual wave bolus will more closely match the rise in blood glucose and help avoid a hypo. Examples of high fat meals include pasta with cheese sauce, pizza, curries and fish and chips.

Identifying whether the basal or bolus rate require adjustment

Your basal rates may be incorrect if you get:

- Hypos at night or 3-5 hours after the last bolus
- Repeated hypo episodes at the same time of day or night

Your Insulin Carbohydrate Ratio (ICR) may be incorrect if you get:

- Hypos within 3 hours of last bolus

The type of bolus may be incorrect if you get:

- hypoglycaemia soon after eating a heavy (high fat or carbohydrate) meal
- hyperglycaemia for many hours after eating a heavy meal

Consider both basal and bolus insulin for

- Exercise, particularly if lasting more than 20-30 minutes (see guidance on page 27)

Management of high blood sugars

Hyperglycaemia means high blood glucose , more than 14 mmol/L. Symptoms may not start until blood sugar levels are much higher.

An insulin pump contains only rapid acting insulin. An interruption in delivery of insulin for any reason will lead to a rapid rise in blood glucose and then ketones. If undetected and/or untreated this will result in Diabetic Ketoacidosis, which requires hospital admission and can be life threatening. It is therefore extremely important to check blood glucose at least 4 times a day to pick up any problems early.

Possible reasons for hyperglycaemia (high blood sugars):

Infusion Set Problems	Insufficient Insulin Delivery	Increased insulin requirements
Inflammation at site	Basal rate too low	Infection or illness
Insertion into hard area	Forgot to give bolus	Growth
Left in for more than 72 hours	Bolus too little for amount of carbohydrate	Stress
Dislodged or blocked	Excessive carbohydrate after a hypo	Reduced exercise
Blood or air bubble in tubing	Rebound following hypo	Hormones
Empty cartridge/reservoir	Pump stopped or forgot to reconnect	Steroids
Leak		
Pump failure		

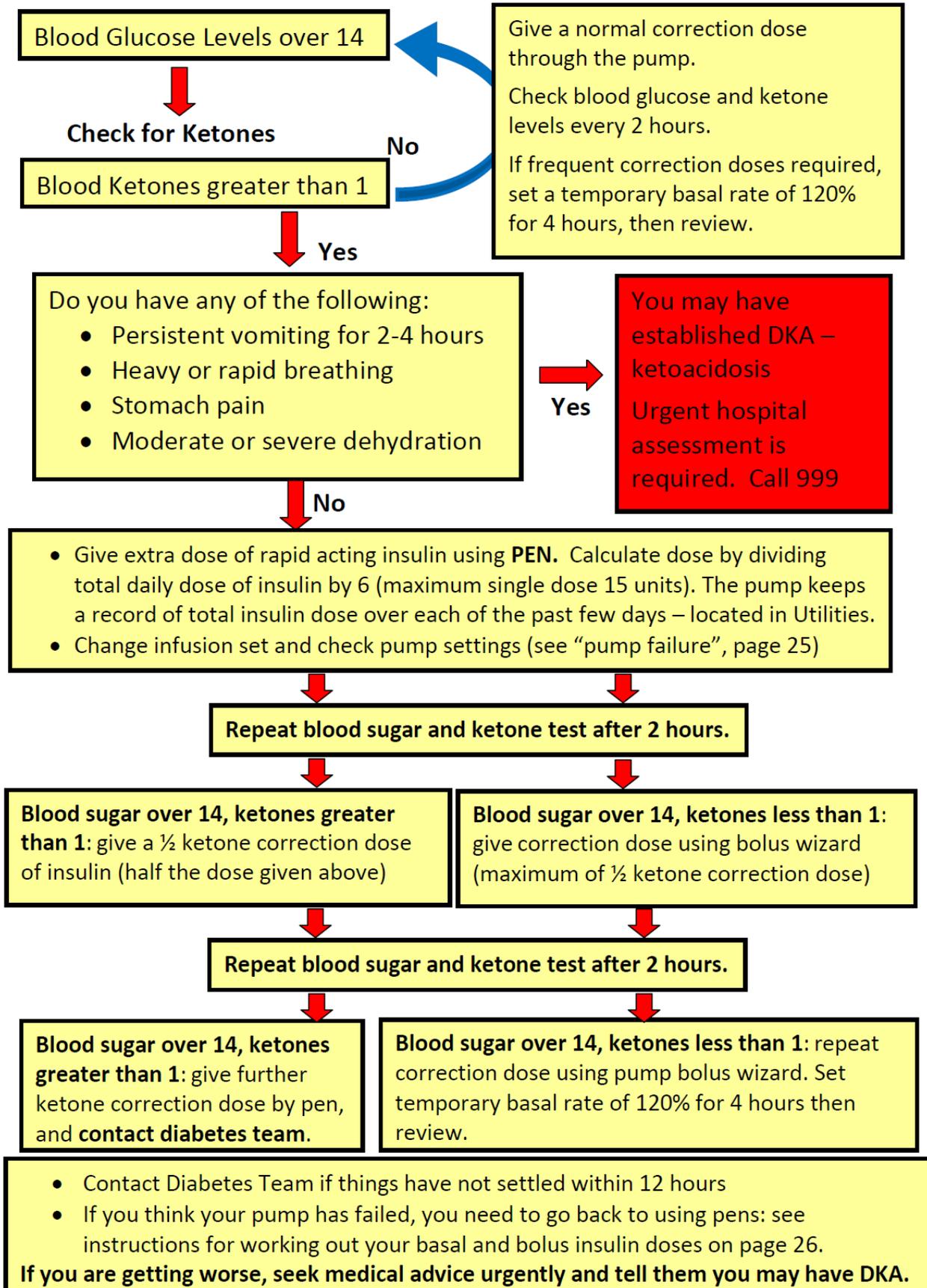
High Blood Sugars and Ketones

If the body does not have sufficient insulin, cells do not have glucose to provide energy so they switch to an alternative source of energy by breaking down fat. The breakdown of fat leads to the development of ketones. As blood glucose and ketone levels rise, the blood becomes acidic. Symptoms include feeling sick and vomiting, stomach pain, drowsiness and heavy breathing. This is known as Diabetic Ketoacidosis (DKA) and requires urgent hospital admission.

To avoid DKA, check blood sugars every 4-6 hours, more often if you are unwell. If blood glucose is above 14 – check for ketones and follow guide below.

If ketones are present give insulin by pen until back under control. More insulin is required to bring blood sugars down when ketones are present.

Diabetic Ketoacidosis (DKA) is dangerous. This guide will tell you when to check for ketones and what to do if you find them



Hospital Admission

Hopefully you will not need to be admitted to hospital, but if you are you need to know the following:

- You (young person and their carers) are the experts on how to work an insulin pump, and will manage the pump while in hospital.
- If your child is not able to look after their pump and diabetes, and you as their carer are not able to stay with them during the admission, your child will be changed to insulin injections by pen during their stay.
- During illness or following injury a temporary basal rate may be required.
- In the event of Ketoacidosis the pump will be removed and the insulin given intravenously.
- If your child is coming into hospital for a minor operation, it may be possible for them to keep their pump on with the agreement of the anaesthetist. You may have to adjust the basal rate, for example to 80-90% from the start of the fasting period. Let your Diabetes Team know well in advance so we can advise you and the anaesthetist.
- If your child needs an emergency operation or a major planned operation, the pump may need to be taken off and an insulin drip started.

Carbohydrate Counting

To get the best results from the pump, you need to count carbohydrates. Accuracy can deteriorate over time. We will offer all pump patients regular refresher sessions with the dietitian.

How to Count Carbs

- **Weigh foods**

- Weigh foods (breakfast cereals, rice, pasta, potatoes) to see how big your usual portion is.
- Do this every few months because your portion sizes are likely to change over time.

- **Use food labels**

- Food labels may tell you how much carbohydrate is in the whole packet.
- Remember to always use the 'total carbohydrate' count on the packet rather than the 'of which sugars'.
- If the figure on a packet only tells you how much carbohydrate is in 100g of the product you will need to:
 - Divide the carbohydrate amount on the packet by 100 giving you the amount of carbohydrate in one gram
 - Multiply this number by the weight of your portion to give you the total amount of carbohydrate for that meal or snack.

For example if eating a packet of crisps:
Packet contains 52g of carbohydrate per 100g,
Packet weighs 40g
 $52 \div 100 = 0.52\text{g}$ carbohydrate in 1g of crisps
 $0.52 \times 40 = 20.8\text{ g}$ carbohydrate in your portion

- **Use nutritional books and phone apps**

- The '*Carbs and Cals*' books and phone apps contain photos of over 2,500 commonly eaten foods, with different portion sizes and details of the amount of carbohydrate in each portion.
- Scottish National Diabetes Research Institute have produced a learning resource for patients about carbohydrate counting
<http://www.diabetesinscotland.org.uk/Publications/9226%20Carbohydrate%20Counting%20the%20Next%20Steps.pdf>

Carbohydrate Counting and your Pump

- Remember to give a bolus of insulin for all Carbohydrate eaten – **Bolus for every Bite!**
- Be as accurate as possible with the counting – do not round up or down.
- Some foods or meals will be digested at different rates. Delayed absorption can be associated with meals which are particularly high in carbohydrate or fat, or foods with low Glycaemic Index (slow release carbohydrate).

It may be useful to keep a food diary and note the effect of different foods on your blood glucose levels. Detailed strategies (such as the use of Dual Wave boluses) can be discussed with the dietitian during your regular reviews.

- Extended or Square Wave Bolus is where the bolus is spread out evenly over an extended period of time (15 mins to 8 hours). It is useful if you are having a long meal time, a buffet, or if you are eating high fat or low GI foods.
- The following can be adjusted on the bolus wizard calculator:
 - Blood glucose targets
 - Insulin to carbohydrate ratios
 - Insulin sensitivity factor (also known as your correction factor)
 - Insulin on board or active insulin
 - Different settings for different times of the day

These settings need to be reviewed regularly, and will change over time as you grow and develop.

When to use a temporary basal rate

Insulin pumps will allow you to make temporary increases or decreases to the basal rate from 1-24 hours and it can be either temporarily increased or decreased.

This can be useful for many reasons, including **illness**, when you can temporarily increase your basal rate if your blood sugars are running persistently high. Most people will change to a temporary basal rate of 120% – 130% for such events.

It can also be useful if you are planning **activity** when you can temporarily decrease your basal rate to prevent hypoglycaemia. How much you reduce by will depend on the type of exercise taken and your level of fitness, but a typical rate would be 70-80%.

It takes 1-2 hours for a change in basal rate to take effect, so plan ahead. Start the temporary basal rate in advance - the duration should include one hour before the exercise, the duration of the exercise and 1-2 hours afterwards (some children may require longer). More detail about insulin adjustment and exercise is given on page 28.

Check blood glucose levels regularly when using a temporary basal rate.

Basal Rate Checks

When blood sugar levels fluctuate, it is often possible to work out from the pattern whether to adjust the Basal Rate or the Insulin Carbohydrate Ratio. Where there are frequent snacks, or when meals are close together, a basal rate check may be required.

The basal rate should keep blood glucose levels in a stable range even when not eating. Testing basal rates requires fasting or delaying a meal.

Tips

- Do not test basal rates if your child is unwell, stressed, or has been doing a lot of activity.
- Begin test when the blood glucose is between 4 and 10 mmol/l. Start 2 hours after eating a meal or snack. Give the usual insulin bolus with that meal. The meal should not include high levels of fat, carbohydrate, or Low Glycaemic Index foods. Use a standard bolus.
- Check blood sugars hourly for the duration of the test (2-3 hourly for overnight tests).
- Do not eat anything or have any carbohydrate containing drinks during the test
- If the blood glucose falls below 4 mmol – treat the hypoglycaemia and stop the test (you have demonstrated that the basal rate is too high).
- If the blood glucose rises above 14 mmol – check ketones, take a correction dose and stop the test (you have demonstrated that the basal rate is too low)
- If the blood glucose rises or falls by over 3mmol during the test, the basal rate should be adjusted accordingly, starting 1-2 hours before the rise or fall.

Advice for Travelling with a Pump

There are a few important things to consider when travelling with an insulin pump. Start planning well in advance.

- Ask your Diabetes Team for a Travel Letter that states you have an insulin pump.
- Some pump companies will lend you a spare pump for the duration of your holiday. This can be organised by calling customer services at least 6 weeks before you leave.
- Ensure that your Travel Insurance covers the insulin pump.
- Take contact details for your pump manufacturers customer services and diabetes team with you. Take this booklet with you – it details what to do in emergencies (hypoglycaemia, hyperglycaemia, ketones and pump failure).
- Pack enough supplies including insulin, pump sets, ketone monitor and blood glucose monitor test strips and lancets. Pack rapid acting insulin, long acting insulin, pens and pen needles in case you have a problem with your pump and need to go back to injections.
- Keep all your insulin supplies in your hand luggage, as the hold luggage will be at sub-zero temperatures which will damage your insulin. Take more than you think you will need, and divide all your supplies evenly between 2 bags of hand luggage in case you have a bag stolen.
- The pump can go through the walk through metal scanner with you, but should not go through the baggage X-Ray machines or a full body scanner. If you are required to remove it, make sure this is for the minimum possible time.
- If you are travelling by plane, you will need to disconnect the Contour Link device from your pump during the flight.
- Insulin is damaged by extremes of temperature. If you are going somewhere hot, cover the pump and tubing so that it is not in direct sunlight. If you disconnect the pump while you are in the pool or sea, keep it in an insulated cool bag. Do not stop or suspend your pump when disconnected as air may enter the tubing. If you are going somewhere very cold (like skiing) make sure the pump and tubing are inside your clothing.
- If your holiday destination is hot or you will be doing extra activity, you may need to use a temporary basal rate to prevent hypoglycaemia. Speak to the Diabetes Team about alternate basal rate patterns.
- Some families prefer to take a 'pump holiday' while on vacation and go back to basal bolus therapy with insulin pens and rapid and long acting insulins. Feel free to discuss with the Diabetes Team.

Travel

If you are flying to a different Time Zones

- If the new time zone is less than 4 hours different, adjust the pump clock on arrival
- If the new time zone is more than 4 hours different, adjust your pump clock by 4 hours on departure, and then gradually adjust further over the next few days
- Give boluses with meals as usual
- Monitor blood glucose levels regularly and correct high and low readings if required.
- Remember to change the clock back when you return home

Most of all – have fun – and send us a postcard to let us know how you get on!

School

One of the Diabetes Nurse Specialists will arrange to go to the school with you to meet the teachers, pupil support assistants and other staff as necessary. They will explain what the pump is, how it works and the differences compared with pen injections. The school will be given guidelines on diabetes and insulin pumps so that they can help you if there is a problem with the pump and immediate action is required.

They will also run through a recommended list of supplies that should be kept in school

- Hypoglycaemia treatment
- Blood glucose and blood ketone monitor supplies
- Spare infusion sets, pump batteries, insulin and insulin pens

Exercise

The pump can be worn for most activities, but should be disconnected for some activities (swimming and contact sports e.g. rugby). After each hour of disconnection, check a blood sugar: if it is rising, reconnect and give a correction bolus. Do not stop or suspend your pump when disconnected as air may enter the tubing.

Activity is often associated with the need for less insulin – this varies a lot between individuals. Your pump gives you the option to decrease the basal rate during and after activity (temporary basal rate). If you are usually active, light exercise such as walking and short bike rides require no adjustment. If you are not usually active, you may have to decrease the basal rate to 70-80% of the usual rate. For more intense activities such as swimming, football, rugby, dance classes, tennis, hiking and sports tournaments, try reducing basal rate by 50% and the bolus dose for the previous meal (if less than 90 minutes before) by 50%. The basal rate should be cut from 1 hour before activity, until 1-2 hours after the activity has ended.

For every hour of above average activity, an extra 10 – 20g of extra carbohydrates will be required (or as much as 15-30g for competitive athletes).

All day activity may need a 50% reduction in the basal rate during the day and 25% reduction that night.

Getting the adjustments right is a matter of trial and error. Record different sporting activities in your log book and monitor how effective your adjustments to basal and bolus insulin have been. Reflecting on this will help you plan for the next activity.

Some sports can result in an adrenaline surge which raises blood sugar levels. If this happens, extra insulin may be needed initially - it can be reduced afterwards.

More information and advice about managing sport when you have diabetes can be found at www.runsweet.com .

Pump Failure

If insulin is not being delivered as required it is usually because of a problem with the infusion set rather than the pump itself.

If the blood sugar readings are unexpectedly high, or failing to respond to correction doses, do the following technical check:

- Check the pump display – is there a reduced temporary basal rate in operation?
- Check the bolus history – have you missed a mealtime bolus?
- Visual check – cannula, insertion site, reservoir and tubing. Run your fingers along the tubing – if there is a leakage, you will be able to smell insulin on your fingers.
- Think: when was the last set change?
- Think: have you changed pump settings recently? If so, check that these have been entered correctly.
- Check battery and insulin level indicators
- Check remote connection (if using remote control)
- Perform pump self-check.

Check for ketones, then follow the plan on page 17. If there are no ketones, give a correction dose via the pump. If you have ketones, use an insulin pen to give a correction dose (1/6 of the usual total daily dose of insulin), then change your pump infusion set and check the pump settings. Recheck blood glucose and ketone levels every 2- 4 hours.

In the event of pump malfunction (rare, but possible) you need to know what to do. The hospital does not keep spare insulin pumps. Contact your pump customer service number (recorded on page 5).

You will need to take insulin injections until your new pump arrives. Always keep a supply of insulin pens; basal or long-acting insulin (Levemir) and fast acting insulin (Novorapid). You can work out how much insulin to take from your total daily insulin dose- follow the dosage calculator on the next page. To find your recent total daily doses, go to the 'Utilities' section on your main screen of the pump, press ACT and daily totals are on that page. Take an average of the last few days, excluding days with an asterisk, as they are incomplete days.

Check blood glucose levels regularly when you have made this change. Dosage adjustments will almost certainly be required.

Returning to basal bolus treatment

If your pump ever fails, you will need to give yourself injections until your new pump arrives. Use this dosage calculator to work out insulin doses.

Average 'Total Daily Dose' (TDD) of insulin administered via the insulin pump	_____ units/24 hrs	
The 'Total Daily Dose' (TDD) of insulin should be split 50:50 into basal and bolus insulin	Basal insulin units (50% of TDD)	Bolus insulin units (50% of TDD)
The calculated basal insulin dose is split into 2 equal doses of Levemir given at 0800 and 2000	Levemir dose for 0800 and 2000	
The bolus doses of insulin should be given according to usual insulin to carbohydrate ratios. [Alternatively you can calculate approximate set doses by splitting the bolus insulin total (50% of the TDD) between the 3 mealtimes]	Insulin to Carbohydrate Ratios for Novorapid bolus doses Breakfast _____ Lunch _____ Tea _____	
Correction doses of Novorapid will be required if blood sugar is > 14 mmols/L How to calculate a correction factor: Divide 100 by the TDD e.g. If 'Total Daily Dose' of insulin is 50 $100/50 = 2$ This means that 1 unit of Novorapid will reduce the blood sugar by 2 mmols/L	Correction Factor 1 unit of Novorapid will reduce the blood sugar by _____ mmols/L Correction doses can be given 4 hourly as needed with or without food Note: When ketones present follow 'DKA is dangerous' flowchart	

Glossary

Basal Rate: rate of continuous background insulin infused

Cannula: a small tube inserted under the skin to deliver insulin– the ‘infusion set’ referred to in this document includes the cannula , the tubing, and the reservoir.

Correction dose: extra insulin given to bring down high blood glucose levels . The size of the correction dose will be determined by the blood glucose level and the Insulin Sensitivity Factor.

Dawn Phenomenon: the natural increase in insulin requirement occurring in the early hours of the morning associated with the body’s natural day/night hormonal rhythm

Diabetic Ketoacidosis or DKA. A potentially life-threatening condition resulting from insufficient insulin in the body to meet basic needs. As ketone levels rise, the blood becomes progressively more acidic. Treatment includes fluids and insulin given by intravenous drip.

Dusk Phenomenon: the natural increase in insulin requirement occurring in the late afternoon associated with the body’s natural day/night hormonal rhythm, usually less pronounced than the dawn phenomenon

Food bolus: a dosage of rapid acting insulin given with meals and snacks

Glycaemic Index (GI): this may range from low to high and refers to how quickly glucose is released from the carbohydrate you have eaten, into the body. Low glycaemic index foods release glucose slowly, while high glycaemic foods release glucose quickly.

HbA1c: an indicator of how well the blood sugar has been controlled over the last 2-3 months

Hyperglycaemia: When blood glucose levels are too high

Hypoglycaemia: When blood glucose levels are too low (under 4 mmol/l) also called a ‘hypo’

Insulin Sensitivity Factor: the fall in blood glucose resulting from 1 extra unit of rapid acting insulin.

Insulin to Carbohydrate Ratio (ICR): the number of grams carbohydrate covered by one unit of insulin (eg 1 unit of insulin per 7g carbohydrate)

Ketoacidosis: see **Diabetic Ketoacidosis above.**

Ketones: These are produced when there is not enough carbohydrate (starvation) or not enough insulin. If ketones are present along with a high blood glucose, the body is seriously short of insulin and additional doses are required to prevent ketoacidosis.

Long Acting Insulin: insulin which acts slowly throughout the day and night to match the normal background level of insulin (e.g. Levemir or Lantus)

Rapid Acting Insulin: Insulin that acts quickly to minimise the rise in blood glucose (sugar) after meals, or to correct a high blood glucose (e.g. Novorapid)

Reservoir: syringe in which insulin is stored in the pump – may also be called cartridge

Temporary Basal Rate: temporary adjustment to the basal rate of insulin, adjusted in response to activity, stress or illness

Useful Websites and Books for Further Reading

Diabetes

www.diabetes.org.uk

www.idf.org.uk

Type 1 Diabetes in Children Adolescents and Young People – How to become an expert in your own diabetes by Ragnar Hanas.

This is a great book and comes highly recommended by your Diabetes Team! It is packed full of information in a straightforward, easy to read style.

Insulin Pumps

<http://www.medtronic-diabetes.com.au/learn-about/diabetes-pump-learning/index.htm#tab0>

www.insulin-pumpers.org.uk

www.input.me.uk

www.childrenwithdiabetes.com/pumps

Pumping Insulin: Everything you need for success on a smart insulin pump by John Walsh and Ruth Roberts. Comprehensive guide book for insulin pump users.

Exercise

www.runsweet.com

Diabetic Athlete's Handbook, Your Guide to Peak Performance by Sheri Colberg

Carbohydrate Counting

Carbs & Cals: A Visual Guide to Carbohydrate & Calorie Counting for People with Diabetes, by Chris Cheyette and Yello Balolia. This is also available as an app for Iphone or Android.

Scottish National Diabetes Research Institute have produced a learning resource for patients about carbohydrate counting

<http://www.diabetesinscotland.org.uk/Publications/9226%20Carbohydrate%20Counting%20the%20Next%20Steps.pdf>

Insulin Pump Accessories

www.diabetes-ezy.com

www.pumpwearinc.com

www.angelbearpumpstuff.com

www.funkypumpers.com

www.pumpfashion.co.uk

Insulin pump settings record sheet

Insulin Pump Settings							Name			
Date										
Time of change										
Basal Rate 1	Time	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	
	Rate									
Basal Rate 2	Time									
	Rate									
Basal Rate 3	Time									
	Rate									
Basal Rate 4	Time									
	Rate									
Basal Rate 5	Time									
	Rate									
Basal Rate 6	Time									
	Rate									
Basal Rate 7	Time									
	Rate									
Basal Rate 8	Time									
	Rate									
Max Basal Rate										
Insulin Carb Ratio 1	Time	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	
	Grams									
Insulin Carb Ratio 2	Time									
	Grams									
Insulin Carb Ratio 3	Time									
	Grams									
Insulin Carb Ratio 4	Time									
	Grams									
Insulin Carb Ratio 5	Time									
	Grams									
Insulin Carb Ratio 6	Time									
	Grams									
Max Bolus										
Correction Factor (ISF) 1	Time	00:00	00:00	00:00	00:00	00:00	00:00	00:00	00:00	
	mmol/u									
Correction Factor (ISF) 2	Time									
	mmol/u									
Correction Factor (ISF) 3	Time									
	mmol/u									
Correction Factor (ISF) 4	Time									
	mmol/u									
Correction Factor (ISF) 5	Time									
	mmol/u									
Correction Factor (ISF) 6	Time									
	mmol/u									

Education Check List

This is a list of important aspects of pump therapy that you need to be confident about to safely use the pump in the first few weeks. It also includes some 'advanced pumping' features that can help you get the most out of your pump over the coming weeks (**A***)

List	Dated and Signed by	
	Patient/Carer	Diabetes Team
Set Time and Date		
Set Basal Rates		
Change Basal Rates		
Set Bolus Calculating Software		
Use Bolus Calculating Software		
Prime Infusion Sets		
Set Changes		
Frequency of Blood Glucose Testing		
Blood Glucose and HbA1c Targets		
Keeping a good Log Book		
High blood glucose Management		
Hypo Management		
Sick Day Rules		
Carbohydrate Counting		
Exercise		
Travel		
School		
Checking basal rates A*		
Alternative bolus Square wave/dual wave A*		