Hybrid Closed-Loop Systems

A Decision Aid

DRAFT Version 1.5, May 2024

Southampton Children's Diabetes Team

SOUTHAMPTON Children's Hospital

What is this decision aid about?

This decision aid is for children and young people with type 1 diabetes and their families. You may have read about insulin pumps, or your diabetes team may have recommended you consider starting this therapy. You might also already have a pump, but would like to know more about other types of pumps available.

This decision aid will give you more information about insulin pumps and hybrid closed-loop (HCL) technology. It will help you reflect on your values around living with diabetes, understand your options, know the pros and cons of each option, then finally allow you to make a decision based on what matters the most to you when managing your diabetes.

It is divided into sections for ease of navigation. You do not have to read the entire content, but can move to sections you find interesting, depending on what you already know and what you would like to know more about.

After reading through this decision aid, you might still have questions. Your diabetes team will help you answer these questions and go through any other points you want to cover before making your decision.

How to use this decision aid?

1 Introduction

2 How does HCL help?

3 Your Values

4 Your Options

5 Your Decision

Useful Links

Click the home icon at any time to go back to the beginning of the decision aid

Click the section titles on the left to navigate between different sections
If this is your first time using this decision aid, we recommend you read through them in sequence using the arrows on the bottom right

Use the arrows to move forward and back between pages

Click here for useful online resources, as well as the sources of the information we used to prepare this decision aid

Introduction

This section gives you a brief introduction to insulin pumps, closed-loop technology, and some photos and videos to get you familiar with what it involves.

It doesn't cover the details of different pump systems we offer. For this, go to section 4.

Introduction

What is hybrid closed-loop (HCL) technology?

Hybrid closed-loop technology involves three things. Click on each one below to find out more.

Or you can click the arrow on the bottom right to skip to the next section.

Insulin pump

Continuous glucose monitor (CGM)

Controller device or smartphone

Introduction

Insulin pump

An insulin pump is a device with a cannula (a small tube) that goes under the skin. It has a small motor that slowly pushes insulin into the body.

There are many different pump types and models, and you can look at those later. Some come with a long tube that connects to the pump, and some are tubeless, which means they stick directly to the skin.

Pumps can be worn wherever you normally inject insulin. Most commonly, this is on the tummy, top of the thighs, top of the buttocks, or back of the arms.

For all pumps, you will need to replace the cannula set every 2-3 days and fill the pump with insulin each time.

Introduction

Continuous glucose monitor (CGM)

A continuous glucose monitor, or CGM, is a sensor that attaches to your skin and measures your glucose levels every 5 minutes. It sends these readings via Bluetooth to your insulin pump, which allows it to decide how much insulin to give.

There are different types of CGM available, but all of them will need replacing at least every 10-14 days.

Some types of CGM can only be placed on the back of your arm. Others can also be placed on your tummy, on top of the thigh, or the lower part of your back.

Introduction

Controller device or smartphone

A 'controller' is the actual device you will use to tell the pump to give a bolus of insulin, such as when you are having a meal or when giving a correction. It will also be the device you use to make decisions involving your pump, such as suspending insulin delivery or making changes to your pump settings.

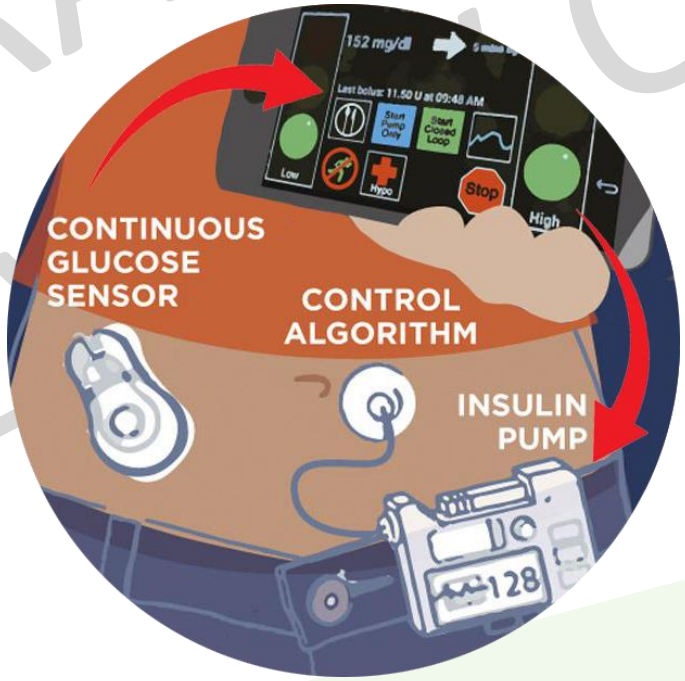
The controller unit differs depending on the pump and HCL system you choose. It can be your own smartphone (via an app), a separate device (which looks similar to a smartphone), or it can be the pump itself (using a touchscreen).

Introduction

How does HCL technology work?

With HCL technology, the devices mentioned can communicate with each other using Bluetooth. The pump knows your glucose reading from your CGM and uses an algorithm to decide how much insulin to give based on this.

As of yet, there is no pump that can decide how much insulin to give with food on its own. Any pump will still rely on you to carb-count and tell it how much insulin to give.



What can HCL do?

It is good to know what HCL can and can't do. This is important so that you can have realistic expectations of what happens when you start using it.

HCL **can** do the following:

- Suspend insulin delivery if glucose is low or about to be low soon
- Give extra insulin at times when glucose is slowly rising
- Allow you to use different 'profiles' for different types of activities (such as exercise)

HCL **cannot** do the following:

- Give a bolus with a meal on its own. You will still have to carb count and use the pump calculator to give a bolus yourself
- Bring glucose down when your glucose is very high or are feeling unwell. Your diabetes team will talk through sick day rules whilst using a pump

Links on this page not yet active!

Online resources

Watch the following video to see what people say about closed loop systems.

Links on this page not yet active!

Online resources

Digibete have developed a series of videos and documents about closed loop systems. Click on the image below to see these resources (requires internet connection).

Hybrid closed-loop systems

https://www.digibete.org/technology-innovation-hybrid-closed-loop-systems/

Understanding diabetes technology

https://www.digibete.org/wp-content/uploads/2022/09/UnderstandingTechPoster4.pdf

Making sense of technology

https://www.digibete.org/wp-content/uploads/2024/01/MakingSenseofTechnology_0501.pdf

How does HCL help?

This section talks a bit about the evidence behind closed-loop technology and how it compares to standard treatment with pen injections. It will give you a quick recap of what we learned from research in this area, and what this means in real life.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

How does HCL help?

In 2021, a large study in England looked at the effect of HCL on diabetes in 251 children and young people. This included children and young people at Southampton Children's Hospital.

The study look at certain outcomes. For each person, it compared before starting HCL and 6 months after using HCL.

Different pumps were used in the study, so the results don't relate to a particular pump or closed-loop system.

How does HCL help?

Click on each point below to see how HCL affected it.
When you are finished, click the arrow on the bottom right for a summary.

HbA1c

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

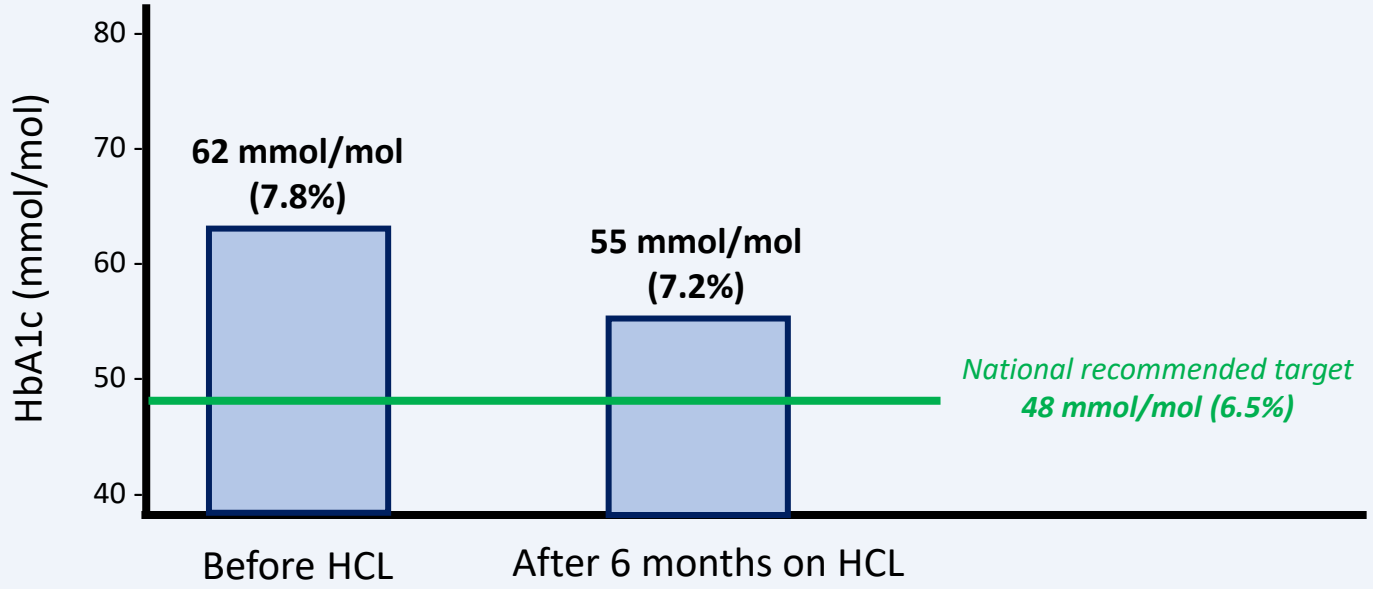
? *What is HbA1c?*

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep



Six months after starting HCL, HbA1c dropped by 7 mmol/mol (0.6%) on average.

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

? *What is HbA1c?*

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep

What is HbA1c?

HbA1c is a measure of your average blood glucose over the last two to three months.

HbA1c is worked out in a different way from the blood glucose levels you are used to measuring. The HbA1c value can be written in 'mmol/mol' or in percentage.

For most children and young people, an ideal level to aim for is **48 mmol/mol (6.5%)**.

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

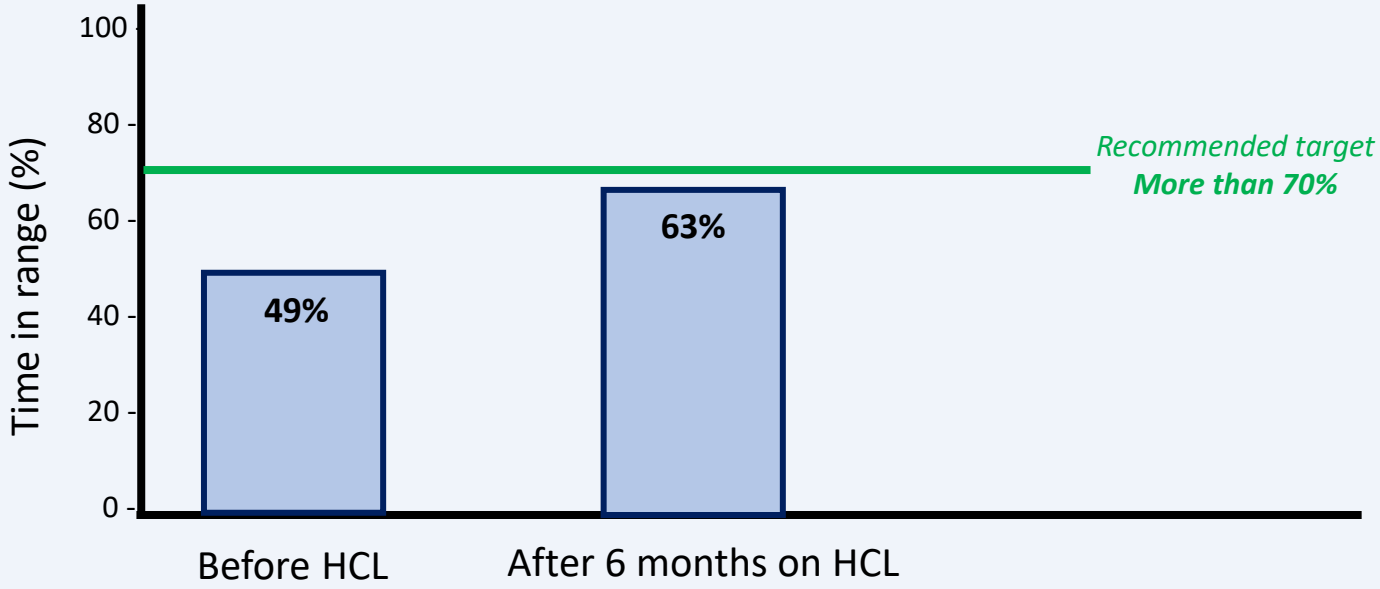
Time in range

? *What is time in range?*

Hypoglycaemia

Fear of hypos

Quality of sleep



Six months after starting HCL, time in range increased by 14%. This means that on average, people using HCL spend around 3 hours 20 minutes more per day in their glucose target range.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

Time in range

? *What is time in range?*

Hypoglycaemia

Fear of hypos

Quality of sleep

What is time in range?

A time in range, or TIR, is how much time of the day your blood glucose is between 4 and 10 mmol/L. It is often expressed as a percentage and taken as an average of the past two weeks.

Time in range is often used as a way to see how steady your blood glucose is. Long periods of highs (above 10 mmol/L) and lows (below 4 mmol/L) can mean that there is room for adjustments.

A time in range of **70% or higher** (which is around 16 hours in a day) is often used as a 'target' to aim for, as long as it is not leading to other problems such as frequent hypos.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

How does HCL help?

Click on each point below to see how HCL affected it.

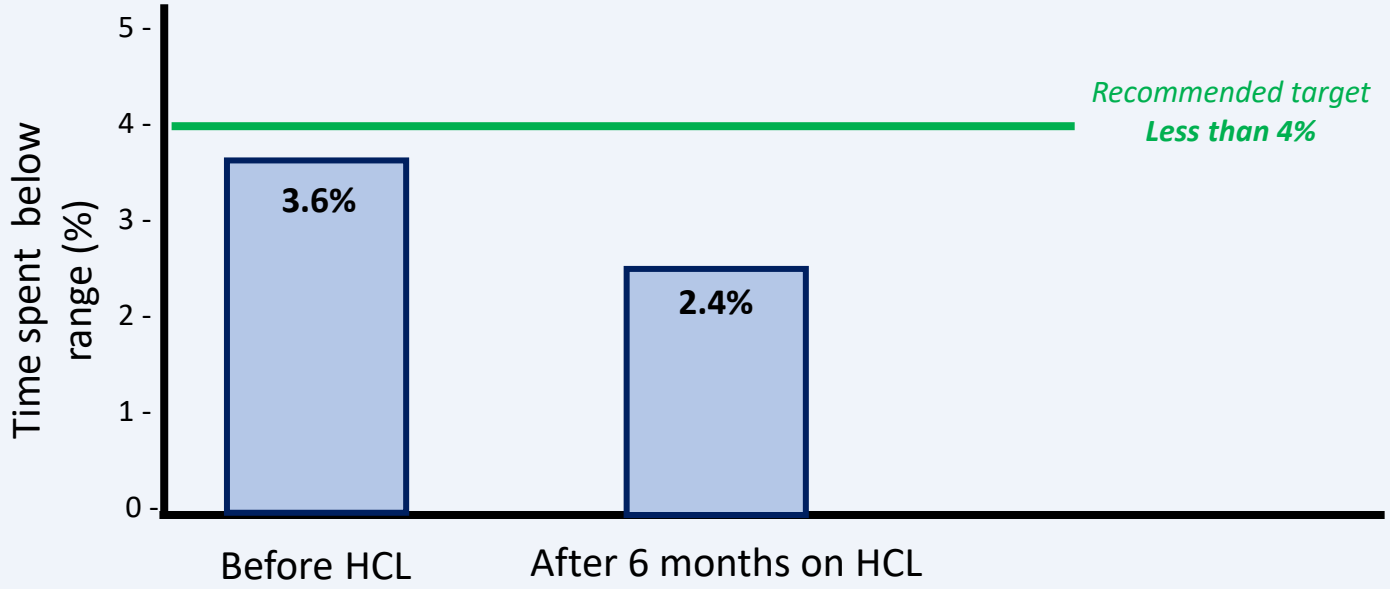
HbA1c

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep



Six months after starting HCL, time below range dropped by 1.2%. This means that on average, people using HCL spend 17 minutes fewer per day in hypoglycaemia (blood glucose below 4 mmol/L).

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep

Children older than 12 years and all parents were asked to fill a questionnaire to know about their fear of hypos. This was filled before starting HCL, and again 6 months after starting.

On average, children and parents reported less worry around hypos after starting HCL.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

How does HCL help?

Click on each point below to see how HCL affected it.

HbA1c

Time in range

Hypoglycaemia

Fear of hypos

Quality of sleep

Children older than 8 years were asked to fill a questionnaire to know about their quality of sleep at night. Parents were also asked to fill a questionnaire to assess their child's sleep disturbance at night. This was filled before starting HCL, and again 6 months after starting.

On average, children and parents reported better quality of sleep after starting HCL. This means that they experienced less sleep disturbance.

How does HCL help?

In summary, using HCL showed great improvement in all the outcomes measured. These include HbA1c, time in range, and frequency of hypoglycaemia.

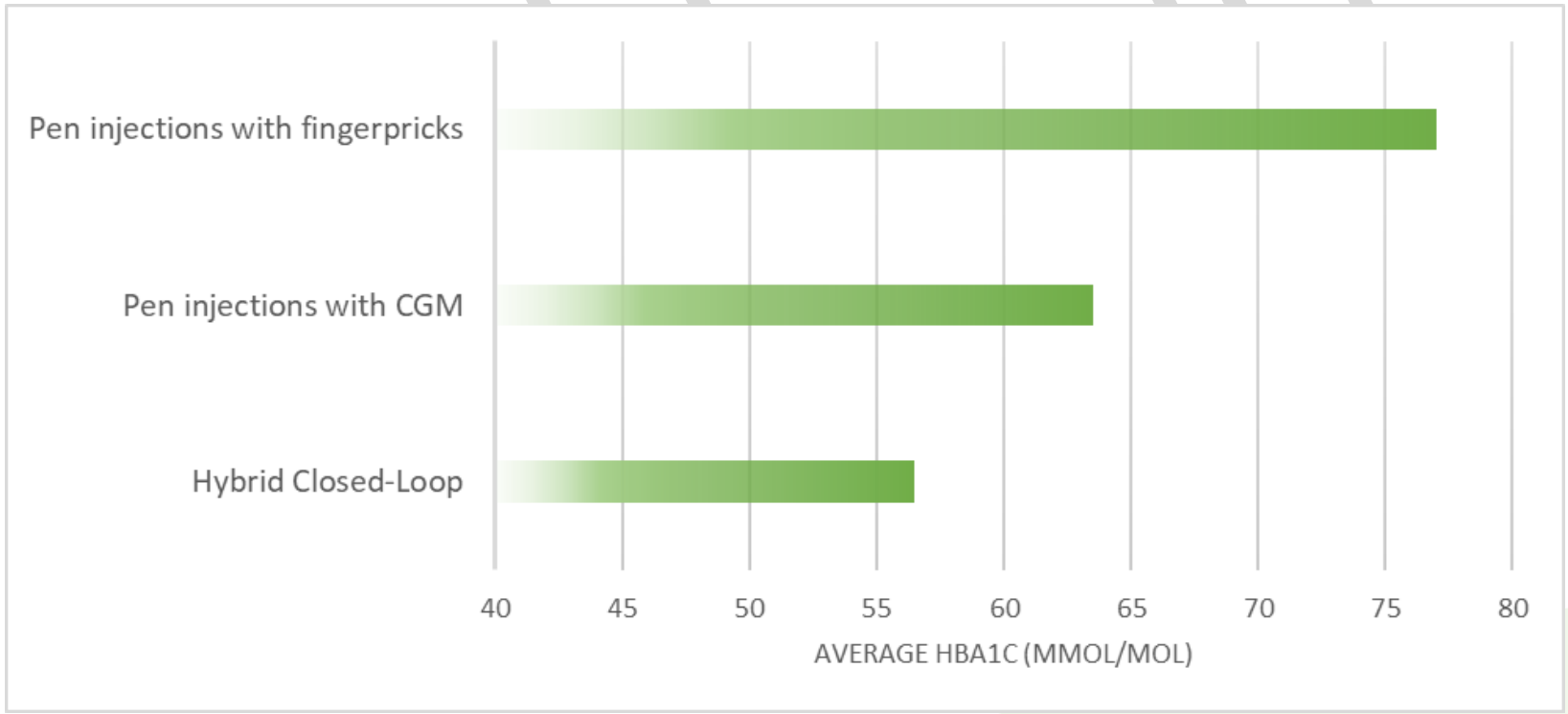
Through questionnaires, the study found that families had less worries around hypoglycaemia and better sleep after using HCL.

As with any study, the results are an average of outcomes from many families. Because every person is different, it does not always mean that you will get the same outcomes. This is why it is important that you consider this together with your own values, as well as the pros and cons of pump therapy, when you are making your decision.

For a look at results specifically from Southampton Children's Hospital, see the next page.

How does HCL help?

Here is how our own children and young people at Southampton hospital did on different types of technology in **2022-2023**.
You can see that using CGM offers better HbA1c results compared to using fingerpricks alone. Adding hybrid closed-loop technology offers even better HbA1c results than CGM alone.



What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.
You can click on each point to find out more.

Pros

- **Improved HbA1c and fewer hypos**
- **No more regular pen injections**
- **No more regular fingerprick tests**

Cons

- **Small risk of DKA if not using the pump appropriately**
- **Always wearing a pump and CGM**

What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.

Improved HbA1c and fewer hypos

As you have seen in the previous section, there is good evidence that most children and young people have better HbA1c and fewer hypos when using HCL.

Is this always the case?

People who rely completely on the pump to 'do the work' for them might not see as much difference. As with any type of treatment, you will get the most benefit when you use it to its full potential.

What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.

No more regular pen injections

The pump will replace both your bolus insulin (such as Novorapid®) and your basal or night-time insulin (such as Lantus® or Tresiba®). All you will need is inserting a new cannula set every three days, and this will deliver all your insulin requirements.

Is this always the case?

There may be situations when the cannula set fails or you find a problem with the pump. At these times, it is important to switch back to pen injections until the problem resolves. Always have a backup of pen injections at home or when you are away from home on long trips.

What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.

No more regular fingerpricks

HCL will come with CGM, which will check your glucose level every 5 minutes. You can use these levels to decide on insulin doses and hypo treatments, without the regular need for fingerpricks.

Is this always the case?

Having a glucose meter is still important as a backup to your CGM. For example, you should do fingerprick check in cases of CGM failure, or if your CGM shows a very high or very low glucose reading.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.

Small risk of DKA if not using the pump appropriately

Using a pump means that you no longer use a basal insulin ('night time' insulin such as Lantus® or Tresiba®). The pump give this basal insulin in small doses every few minutes. This means that if the cannula is bent or dislodged for any reason, glucose can rise quickly and your body may start producing ketones.

How do I manage this?

Make sure to always listen to high alarms, especially where a correction dose is not bringing glucose down. If a correction dose has not worked, you must give a correction using a pen injection and change the pump cannula set.

It is important to check your blood ketones when your glucose level is above 14 mmol/L.

What are the pros and cons of HCL?

Here are the most important pros and cons you should be aware of before starting HCL.

Always wearing a pump and CGM

Using HCL means you will need to be wearing a pump and a CGM almost all the time. It is not suitable to switch back and forth between pump and pen injections, as you will lose many of the advantages of having a pump in the first place.
There are exceptions when you may need to take off the pump, such as when going swimming, but these are for short periods. Generally, you must not take your pump off for longer than one hour at a time, and no longer than 4 hours in total in a 24-hour period.

How do I manage this?

Before starting HCL, it is useful to take a look at different pump and CGM options. You are also allowed to wear a 'dummy pump' for some time to see if this works for you.

What are the pros and cons of HCL?

There are many more points to consider before starting HCL. These are not necessarily a ‘pro’ or a ‘con’, but rather aspects that depend on your personal preferences and values.

The next section talks more about these.

Links on this page not yet active!

Your values

This section will help you to explore your values, your preferences, and what matters most to you before looking at your options and making a decision.

For this section, you should use the short form provided by your diabetes team to look at different values and preferences, and mark down how important each of them is to you.

If you are a parent reading this, it would be particularly useful to involve your child in this section.

When you have considered all the points listed, move to the next section to explore your options.

Click the printer icon if you would like a printable copy of the form.

Your options

This section explores all the pump options available at Southampton Children's Hospital. It will go through each option, what they look like, and the different features they have.

Sometimes, your favourite option might not be suitable for you. This could be for simple reasons such as your age, or for other reasons that your diabetes team can explain in more details. This is why when you are making a decision, it would be good to consider more than one choice that you might like.

Your options

Click on an option to find out more.

T-Slim with Control-IQ

Ypsomed with CampAPS Fx

Medtronic 780G

Omnipod 5

Dana RS with CampAPS Fx

Stay on my current option

Links on this page not yet active!

Your options

T-Slim with Control-IQ

Click the video below to see how Control-IQ technology works:

Click the Digibete icon to go to the T-Slim section of the website: https://www.digibete.org/technology-innovation-tslim/

Your options

T-Slim with Control-IQ

Features:

Pump type	Tubed pump	? *What's this?*
Minimum age to use it	6 years	
Which CGM goes with it?	Dexcom G6 and Dexcom G7	
How do I give a bolus?	Using the pump touchscreen (no app or phone needed)	
How do I charge the pump?	USB cable	
How much insulin can go in the reservoir?	300 units	? *What's this?*

Your options

T-Slim with Control-IQ

Features:

Pump type	
Minimum age to use it	
Which CGM goes with it?	
How do I give a bolus?	
How do I charge the pump?	USB cable
How much insulin can go in the reservoir?	300 units

What is a tubed pump?

A tubed pump is a pump that has visible tubing through which insulin is delivered.
The pump can sit in your pocket or a pouch around your waist. The tubing ends with a cannula, a small plastic tube that sits under the skin.

The pump and tubing can detach and reattach to the cannula when needed (for example, if you are going swimming).

Every 2-3 days, the whole tubing and cannula need to be replaced with new ones.

? *What's this?*

Your options

T-Slim with Control-IQ

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

Insulin reservoir

This is the maximum amount of insulin you can put in a pump at one time.

If your insulin requirements are **more than 100 units per day**, it means you will need to change the cannula set more often than every 3 days.

Regardless of how much insulin is left in the pump at the end of 3 days, you will still need to change the cannula set and refill the pump with fresh insulin.

Your options

T-Slim with Control-IQ

Features:

Is it waterproof?	No. Pump must be detached before swimming or showering.
Compatible smartphone	Not needed. You will still need a smartphone if you want to see glucose level from your Dexcom. The pump also shows your glucose level on its screen.

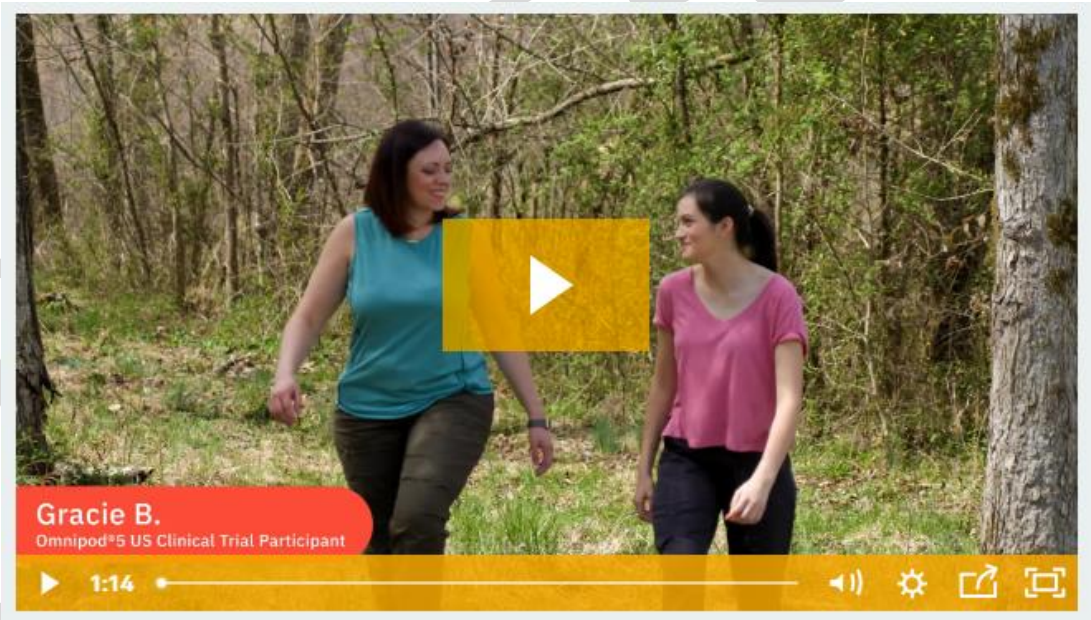
Back to options overview

Links on this page not yet active!

Your options

Omnipod 5

Click the video below to hear a person's experience with Omnipod 5:



Click the Digibete icon to go to the Omnipod section of the website: https://www.digibete.org/technology-innovation-omnipod/

Your options

Omnipod 5

Features:

Pump type	Tubeless pump ? *What's this?*
Minimum age to use it	2 years
Which CGM goes with it?	Dexcom G6 and Libre 2 Plus
How do I give a bolus?	Using a controller ? *What's this?*
How do I charge the pump?	Pump is disposable after use Controller is charged with a USB cable
How much insulin can go in the reservoir?	200 units ? *What's this?*

Your options

Omnipod 5

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir? 200 units

What is a tubeless pump?

A tubeless pump doesn't have any visible tubing. The pump sits directly on the skin, very similar to a CGM device.
The pump still has a cannula, a small plastic tube, which inserts itself under the skin after activation.

Each pump (or pod) is for single use only, and needs to be replaced with a fresh pod every 2-3 days.

? *What's this?*

Your options

Omnipod 5

Features:

Pump type	
Minimum age to use it	
Which CGM goes with it?	
How do I give a bolus?	
How do I charge the pump?	Controller is charged with a USB cable
How much insulin can go in the reservoir?	200 units

What is a controller?

A controller is a device unique to Omnipod. It has the shape and size of a smartphone, and can be used to give insulin with meals and to make adjustments to your pump.

The pump will still work even if the controller is not close to it, but you will still need to carry the controller with you in order to give insulin when you need to.

? *What's this?*

Your options

Omnipod 5

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

Insulin reservoir

This is the maximum amount of insulin you can put in a pump at one time.

If your insulin requirements are **more than 70 units per day**, it means you will need to change the pod more often than every 3 days.

Regardless of how much insulin is left in the pump at the end of 3 days, you will still need to change the pod with a new one and fill it with fresh insulin.

Your options

Omnipod 5

Features:

Is it waterproof?	Yes
Compatible smartphone	Not needed. You control the pump using the controller provided. You will still need a smartphone if you want to see glucose level from your Dexcom or Libre. The controller also shows your glucose level on its screen.

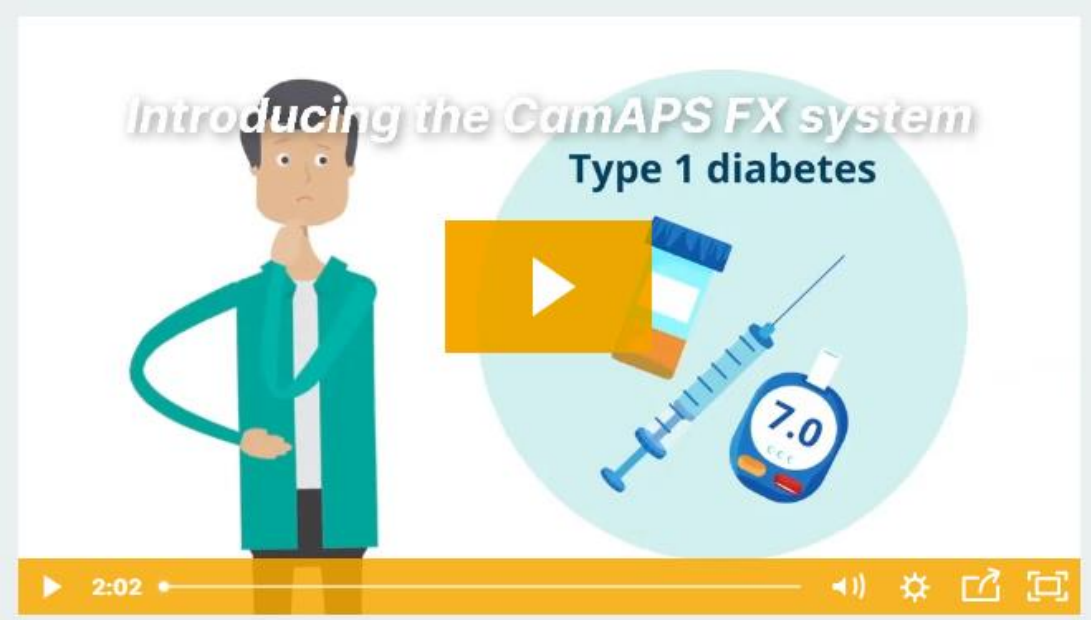
Back to options overview

Links on this page not yet active!

Your options

Ypsomed with CamAPS FX

Click the video below to see how CamAPS FX technology works:



Click the Digibete icon to go to the CamAPS FX section of the website: https://www.digibete.org/resources/technology-innovation-camaps-fx/

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Ypsomed with CamAPS FX

Features:

Pump type	Tubed pump	? What's this?
Minimum age to use it	1 year	
Which CGM goes with it?	Dexcom G6 and Libre 3	
How do I give a bolus?	Using an app installed on your smartphone	
How do I charge the pump?	AAA batteries	
How much insulin can go in the reservoir?	160 units	? What's this?

Your options

Ypsomed with CamAPS FX

Features:

Pump type	
Minimum age to use it	
Which CGM goes with it?	
How do I give a bolus?	
How do I charge the pump?	AAA batteries
How much insulin can go in the reservoir?	160 units

? *What's this?*

What is a tubed pump?

A tubed pump is a pump that has visible tubing through which insulin is delivered.
The pump can sit in your pocket or a pouch around your waist. The tubing ends with a cannula, a small plastic tube that sits under the skin.

The pump and tubing can detach and reattach to the cannula when needed (for example, if you are going swimming).

Every 2-3 days, the whole tubing and cannula need to be replaced with new ones.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Ypsomed with CamAPS FX

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

Insulin reservoir

This is the maximum amount of insulin you can put in a pump at one time.

If your insulin requirements are **more than 50 units per day**, it means you will need to change the cannula set more often than every 3 days.

Regardless of how much insulin is left in the pump at the end of 3 days, you will still need to change the cannula set and refill the pump with fresh insulin.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Ypsomed with CamAPS FX

Features:

Is it waterproof?	No. Pump must be detached before swimming or showering.
Compatible smartphone	Android smartphone only.

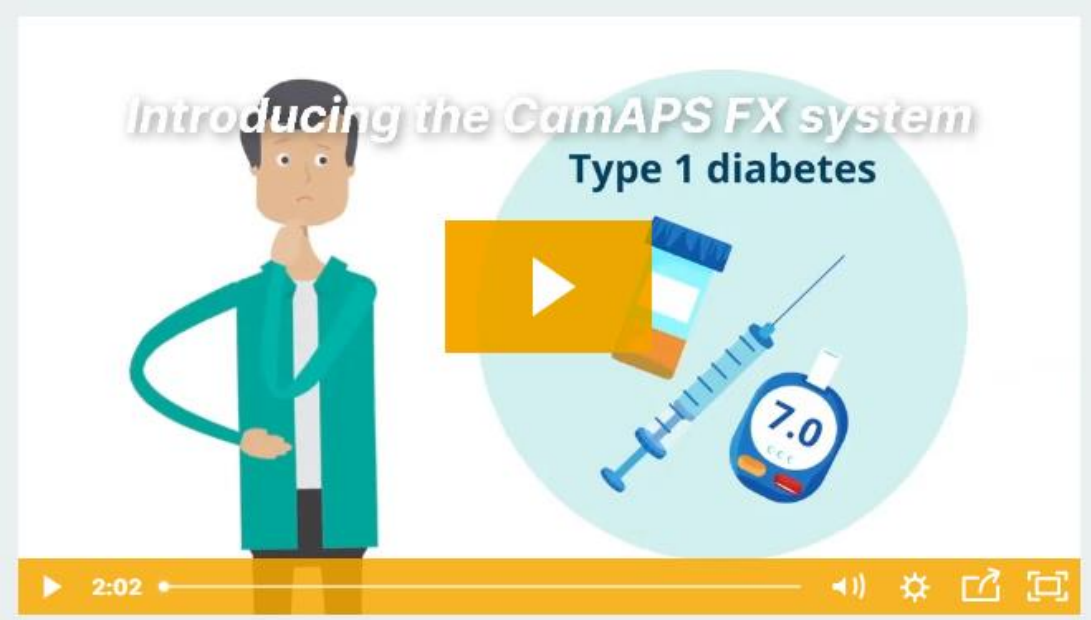
Back to options overview

Links on this page not yet active!

Your options

Dana RS with CamAPS FX

Click the video below to see how CamAPS FX technology works:



Click the Digibete icon to go to the CamAPS FX section of the website: https://www.digibete.org/resources/technology-innovation-camaps-fx/

Your options

Dana RS with CamAPS FX

Features:

Pump type	Tubed pump	? *What's this?*
Minimum age to use it	1 year	
Which CGM goes with it?	Dexcom G6	
How do I give a bolus?	Using an app installed on your smartphone	
How do I charge the pump?	Batteries supplied by manufacturer	
How much insulin can go in the reservoir?	300 units	? *What's this?*

Your options

Dana RS with CamAPS FX

Features:

Pump type	
Minimum age to use it	
Which CGM goes with it?	
How do I give a bolus?	
How do I charge the pump?	AAA batteries
How much insulin can go in the reservoir?	300 units

? *What's this?*

What is a tubed pump?

A tubed pump is a pump that has visible tubing through which insulin is delivered.
The pump can sit in your pocket or a pouch around your waist. The tubing ends with a cannula, a small plastic tube that sits under the skin.

The pump and tubing can detach and reattach to the cannula when needed (for example, if you are going swimming).

Every 2-3 days, the whole tubing and cannula need to be replaced with new ones.

Your options

Dana RS with CamAPS FX

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

Insulin reservoir

This is the maximum amount of insulin you can put in a pump at one time.

If your insulin requirements are **more than 100 units per day**, it means you will need to change the cannula set more often than every 3 days.

Regardless of how much insulin is left in the pump at the end of 3 days, you will still need to change the cannula set and refill the pump with fresh insulin.

Your options

Dana RS with CamAPS FX

Features:

Is it waterproof?	No. Pump must be detached before swimming or showering.
Compatible smartphone	Android smartphone only.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

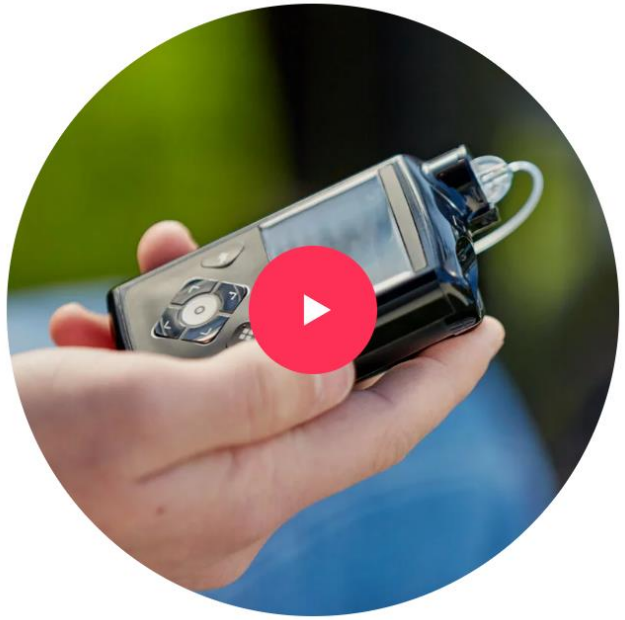
Back to options overview

Links on this page not yet active!

Your options

Medtronic 780G

Click the video below to see how SmartGuard technology



Click the Digibete icon to go to the Medtronic section of the website:
https://www.digibete.org/resources/technology-innovation-medtronic/

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Medtronic 780G

Features:

Pump type	Tubed pump	? What's this?
Minimum age to use it	7 years	
Which CGM goes with it?	Guardian 4 and Simplera	? What's this?
How do I give a bolus?	Using the buttons on the pump (no app or phone needed)	
How do I charge the pump?	AA batteries	
How much insulin can go in the reservoir?	300 units	? What's this?

Your options

Medtronic 780G

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

What is a tubed pump?

A tubed pump is a pump that has visible tubing through which insulin is delivered.
The pump can sit in your pocket or a pouch around your waist. The tubing ends with a cannula, a small plastic tube that sits under the skin.

The pump and tubing can detach and reattach to the cannula when needed (for example, if you are going swimming).

Every 2-3 days, the whole tubing and cannula need to be replaced with new ones.

Medtronic comes with a new type of tubing or infusion set that can be changed every 7 days.

? What's this?

Your options

Medtronic 780G

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

CGMs for Medtronic

CGMs that work with Medtronic are different from those for other pumps.

Both Guardian 4 and Simplera sensors are compatible with Android and iOS smartphones, as well as Apple smartwatches.

These sensors require replacing every **7 days**. A fingerprick blood glucose will be required when entering SmartGuard feature, which is the closed-loop function of the Medtronic pump.

Guardian 4

Simplera

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Medtronic 780G

Features:

Pump type
Minimum age to use it
Which CGM goes with it?
How do I give a bolus?
How do I charge the pump?
How much insulin can go in the reservoir?

Insulin reservoir

This is the maximum amount of insulin you can put in a pump at one time.

If your insulin requirements are **more than 100 units per day**, it means you will need to change the cannula set more often than every 3 days.

Regardless of how much insulin is left in the pump at the end of 3 days (or 7 days, depending on your set), you will still need to change the cannula set and refill the pump with fresh insulin.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

Medtronic 780G

Features:

Is it waterproof?	No. Pump must be detached before swimming or showering.
Compatible smartphone	Not needed. You will still need a smartphone if you want to see glucose level from your sensor. The sensor is compatible with Android and iOS smartphones, and Apple smartwatches. The pump also shows your glucose level on its screen.

Back to options overview

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

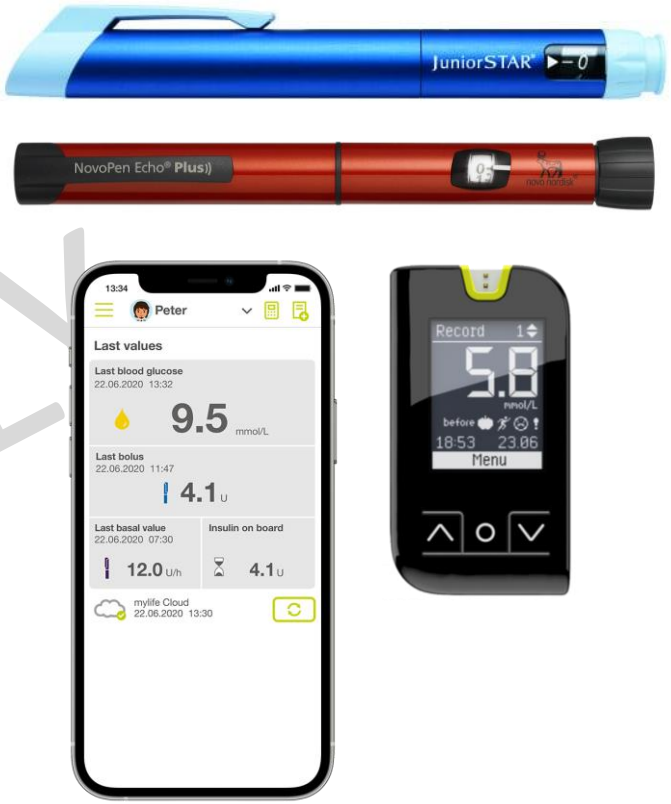
Your options

Stay on my current option

After looking at all the options, you might still be undecided or prefer to stay on your current option.

Your current option might be pen injections or a different pump system not mentioned here. From what you have read so far, you can think about how the pros and cons of what you use currently compare to the other options.

If you are not sure, you can speak with your diabetes team to talk more about these pros and cons before making a decision.



Back to options overview

Your options

Which closed-loop system is the best?

From research studies, all pumps and closed-loop systems gave good outcomes on their effectiveness and safety. All pumps need a similar level of diabetes care.

But each person or family will find an option that works best for them.

The next part is a side-by-side comparison of these systems you have seen so far.

Links on this page not yet active!

Your options

Click each option to learn more

Points to consider	T-Slim	Omnipod 5	Ypsomed with CampAPS Fx	Dana RS with CampAPS Fx	Medtronic 780G
Shape					
Name of HCL algorithm	Control IQ	SmartAdjust	CamAPS Fx	CamAPS Fx	SmartGuard
Pump type	Tubed	Patch (tubeless)	Tubed	Tubed	Tubed
Compatible CGM	Dexcom G6 Dexcom G7	Dexcom G6 Libre 2 Plus	Dexcom G6 Libre 3	Dexcom G6	Guardian 4 Simplera
Minimum age to use	6 years	2 years	1 year	1 year	7 years
How do I give a bolus?	Using the pump	Using a controller device	Using a phone app	Using a phone app	Using the pump
How to charge the pump?	USB cable	Pump is disposable Controller requires USB cable	AAA battery	Company-provided battery	AA battery
Insulin capacity	300 units	200 units	160 units	300 units	300 units

Click here *if you want to see a comparison of more advanced features.*

Links on this page not yet active!

Your options

Click each option to learn more

Points to consider	T-Slim	Omnipod 5	Ypsomed with CampAPS Fx	Dana RS with CampAPS Fx	Medtronic 780G
Shape					
Compatible smartphone	Android or iOS (for CGM, not pump)	Android or iOS (for CGM, not pump)	Android only	Android only	Android or iOS (for CGM, not pump)
Is it waterproof?	No	Yes	No	No	No

Click here *if you want to see a comparison of more advanced features.*

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your options

What's coming up in the future?

Click on the pump images on the right side to learn about upcoming technology.

Mobi

iLet

New types of technology for type 1 diabetes come up frequently.
We will aim to keep you updated whenever we have something new to offer. If you would like to keep updated with what' new nationally, you can visit or subscribe to newsletters from some support groups.

Click on the logos below to go to the group's website:

DIABETES UK
KNOW DIABETES. FIGHT DIABETES.

JDRF IMPROVING LIVES. CURING TYPE 1 DIABETES.

Your options

Tandem Mobi

Mobi is an upcoming pump from Tandem, the same company that makes T-Slim. It will work in a similar way, but is half the size of the T-Slim pump. It doesn't have a touch screen.

The pump will be water resistant and charged through a wireless charger.

This system is still not commercially available or funded in the UK, but is expected to be in the coming years.

Your options

iLet Bionic Pancreas

The iLet Bionic Pancreas is an upcoming closed-loop pump (not yet available in the UK).

It differs from other pumps in that it automates *all* insulin delivery, including basal insulin, as well as meal and correction insulin doses. All you need to do is 'announce' a meal at the start of eating, and the pump will deliver insulin based on your usual needs.

You have the option of making some simple adjustments, such as giving 'more' or 'less' for a certain meal. The pump will learn your insulin needs for meals and adapt this over time. You do not need to announce small snacks.

This system is still not commercially available or funded in the UK, but is expected to be in the coming years.

1 Introduction
2 How does HCL help?
3 Your Values
4 Your Options
5 Your Decision
Useful Links

Your decision

This section will help you check if you are ready to make a decision, and where to find more information.

*To make a decision, you will have to make a **trade-off** – finding a balance between the pros and cons of each option. You can always speak with your diabetes team if you need more information about any of the pros and cons you have read here.*

Your decision

After going through the previous sections and before making a decision, check if you agree with the three statements below. *Click the forward arrow to learn more.*

1. ***I understand what using a closed-loop pump involves.***
2. ***I feel I have received all the information I need to make a decision now.***
3. ***I have considered the commitment to this type of treatment.***

Your decision

1 *I understand what using a closed-loop pump involves.*

It is important to make sure you understand the pros and cons of your options, and have thought about what things matter to you the most when making a choice. Check if you agree with the following statements:

- ❑ I understand how a pump or HCL system is different from pen injections, including the benefits and risks of each.
- ❑ I understand the difference between tubed and tubeless (patch) pumps and where on the body they can be worn.
- ❑ I understand which CGM is compatible with the HCL system I prefer OR I am happy to change my CGM to a compatible type if needed.
- ❑ My current smartphone is compatible with the HCL system I prefer OR I am happy to change my smartphone to a compatible type if needed.
- ❑ I have access to a computer at home OR I can upload my data to a computer when requested by the diabetes.

Your decision

2 *I feel I have received all the information I need to make a decision now.*

There are other ways to find out more before making a decision. We also offer the following:

- **Pump information evening:** attend a 2-hour event with other families (offered every 3 months).
- **Pump trial:** you can try wearing a 'dummy' pump cannula or a patch pump to see how it feels.
- **Individual talk:** one-on-one discussion to go through the options and ask questions.
- **Peer support:** we can connect you with a family or another young person on the same pump you are thinking of. You can also join the Southampton Facebook group, which is led by families of children with type 1 diabetes.
- **Online resources:** we can show you more online resources, such as Digibete.

Your decision

3 *I have considered the commitment to this type of treatment.*

Some families might choose an HCL system, only to find a year later that they or their child now desires a different HCL system. This might be because they have grown and have different preference, or they started a new sport or job which has different requirements. It is important to know that the HCL system you choose cannot be changed for the length of contract, which is usually 4 years. Consider the below points:

- ❑ I understand that once I choose an HCL system, I cannot change it for the length of contract (4 years). I have considered my or my child's needs and how they might change during this time.
- ❑ I understand that if I choose to continue with regular pen injections, I can change my mind and choose to start an HCL system at any point in the future.

Your decision

What do you choose to do?

Think about which treatment is the best option for you or your child at the moment. You do not have to make this decision immediately. You can take some time, discuss it with family, friends, healthcare professionals, and then decide.

- ❑ I feel sure about the best choice for me
- ❑ I know enough about the potential benefits and risks of each option
- ❑ I am clear about which potential benefits and risks matter most to me
- ❑ I have enough support and advice to make a choice

Your decision

Based on the information so far, click on what matches your thoughts at the moment

I have decided to go onto HCL (or continue to use HCL)

I feel unsure what to do

I have decided to remain on regular pen injections

I need more information to make the decision

Links on this page not yet active!

Your decision

Click the printer icon if you would like a printable copy of this pathway.

If you've made your decision to begin HCL therapy, what next?

You will then follow a 'HCL system pathway', and this process will be explained to you by your keyworker. Here is a timeline of what to expect from the start.

CGM Start and Waiting List

- ❑ ***You will be added to the waiting list and your keyworker will keep you updated on the timescale ('wait').***

- ❑ ***Have you completed CGM education?*** **No** → *You will need to complete CGM education programme before the next step (2 weeks to 4 months)*

Yes

- ❑ ***Do you need to change to a compatible CGM?*** **Yes** → *This new CGM will be ordered to your home and an invite sent to you to attend the relevant education programme (2 weeks to 4 months)*

No

Click for pump start

Your decision

If you've made your decision to begin HCL therapy, what next?

Pump Start

- ❑ *Once the CGM education programme is complete, your family's needs will be discussed with you, and you will be invited to either an HCL group start or a 1:1 start (3-6months)*
- ❑ *The pump will be ordered and delivered to your home address. (7-14 days before the HCL start)*
- ❑ *You will receive information via email regarding pre-course content. This includes learning, onboarding, contract, sick day rules and a new insulin prescription.*
- ❑ *Attend a 3-hours HCL group start/education session at UHS – maximum of 4 families. This is led by company representative and diabetes specialist nurse team. Charge your pump/controller before attending and ensure you have all the equipment and insulin with you.*

Click for HCL education

Your decision

If you've made your decision to begin HCL therapy, what next?

The next steps take place after you start using your new pump.

- ❑ ***0-10 Days: remote support via telephone/email/text***
- ❑ ***1-2 Weeks: first follow up in clinic***
- ❑ ***6-8 Weeks: second follow up in clinic***
- ❑ ***Ongoing remote support and education to build knowledge and skills, including advanced modes and troubleshooting***
- ❑ ***3-6 Months: advanced education session***

HCL education continues over the next 4 years. The process will begin again after 3-3½ years.

Your decision

If you've made your decision to remain on pen injections, what next?

We will continue to support you with the therapy you chose.
You can always change your mind later and revisit these options.

Be aware that the rules around eligibility for using HCL are different if you choose to start this as an adult (that is, after turning 18 years old). If you are 18 years old or will soon turn 18, you can ask your diabetes team how this might affect your options.

Back to *your decision*

Find more information

Your decision

You are still unsure or you would like more information first. What next?

You can take your time to think about your options and look at this tool again later. You can also discuss with family, friends, or your diabetes team.
As a reminder, here are the other sources of information we can offer:

- **Pump information evening:** attend a 2-hour event with other families (offered every 3 months).
- **Pump trial:** you can try wearing a 'dummy' pump cannula or a patch pump to see how it feels.
- **Individual talk:** one-on-one discussion to go through the options and ask questions.
- **Peer support:** we can connect you with a family or another young person on the same pump you are thinking of. You can also join the Southampton Facebook group, which is led by families of children with type 1 diabetes.
- **Online resources:** we can show you more online resources, such as Digibete.

Back to *your decision*

You have reached the end of the decision aid tool. Hopefully this has helped you learn more about insulin pumps and hybrid closed loop (HCL) systems, and has helped you think about your values and your options moving forward.

If you have any feedback about this tool, we would love to hear it. You can send us feedback in one of the following ways:

- *By email to: [EMAIL HERE]*
- *By filling this online form: [FORM HERE]*

Check the next section for useful online links and the sources of the information we used to prepare this decision aid.

Useful resources

Find out more about specific pumps and HCL systems:

- CamAPS Fx: *www.camdiab.com* and *www.camdiabtraining.com/*
- T-Slim pump and Control-IQ: *www.tandemdiabetes.com/en-gb/home*
- Omnipod 5: *www.omnipod.com/en-gb*
- Ypsomed pump (works with CamAPS Fx): *www.mylife-diabetescare.com/en-GB/mylife-loop.html*

Digibete Resources:

- Type 1 Technology & Resources:
https://www.digibete.org/type-1-technology-resources/
- Digibete Hybrid Closed Loop Systems:
https://www.digibete.org/technology-innovation-hybrid-closed-loop-systems/
- Making Sense of Diabetes Technology (booklet):
https://www.digibete.org/wp-content/uploads/2024/01/MakingSenseofTechnology_0501.pdf
- Understanding Diabetes Technology (poster):
https://www.digibete.org/wp-content/uploads/2022/09/UnderstandingTechPoster4.pdf

These are the NHS studies about the results of using HCL in young people in the UK:

- *Ng et al. Real world use of hybrid-closed loop in children and young people with type 1 diabetes mellitus – a National Health Service pilot initiative in England. Diabetic Medicine, 2023.*
- *Ng et al. Long-term assessment of the NHS hybrid closed-loop real-world study on glycaemic outcomes, time-in-range, and quality of life in children and young people with type 1 diabetes. BMC Medicine, 2024.*

Developed by
Southampton Children's Diabetes Team
University Hospital Southampton NHS Foundation Trust

http://www.uhs.nhs.uk

May 2024

Southampton Children's Diabetes Team

SOUTHAMPTON Children's Hospital
World class care and research

NHS University Hospital Southampton NHS Foundation Trust