

Type 1 diabetes

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Last updated 26 Apr 2023

✓ Meets Patient's **editorial guidelines**

Est. **15 min** reading time

Type 1 diabetes is the type of diabetes that typically develops in children and in young adults. In type 1 diabetes the body stops making insulin and the blood sugar (glucose) level goes very high. Treatment to control the blood glucose level is with insulin injections and a healthy diet. Other treatments aim to reduce the risk of complications. They include reducing blood pressure if it is high and advice to lead a healthy lifestyle.

At a glance

- Type 1 diabetes happens when the pancreas stops making insulin, causing high blood sugar levels.
- Symptoms often include increased thirst, frequent urination, tiredness, and weight loss.
- It usually develops quickly in children or young adults.
- Diagnosis is confirmed with a blood test measuring glucose levels.
- Treatment involves insulin injections and a healthy diet.
- Regular monitoring of blood sugar levels helps manage the condition.
- Untreated type 1 diabetes can lead to serious, life-threatening complications.

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What is type 1 diabetes?

Diabetes mellitus (just called diabetes from now on) occurs when the level of sugar (glucose) in the blood becomes higher than normal. There are two main types of diabetes. These are called type 1 diabetes and **type 2 diabetes**.

Type 1 diabetes usually first develops in children or young adults. In the UK about 1 in 300 people develop type 1 diabetes at some stage.

With type 1 diabetes the illness usually develops quite quickly, over days or weeks, as the pancreas stops making insulin. It is treated with insulin injections and a healthy diet (see below).

Type 1 diabetes symptoms

The symptoms that usually occur when you first develop type 1 diabetes are:

- You are very thirsty a lot of the time.
- You pass a lot of urine.
- Tiredness, weight loss and feeling generally unwell.

The above symptoms tend to develop quite quickly, over a few days or weeks. After treatment is started, the symptoms soon settle and go. However, **without treatment**, the blood sugar (glucose) level becomes very high and acids form in the bloodstream (ketoacidosis). If this persists you will become lacking in fluid in the body (dehydrated) and are likely to lapse into a coma and die. (The reason you make a lot of urine and become thirsty is because glucose leaks into your urine, which pulls out extra water through the kidneys.)

How is type 1 diabetes diagnosed?

A simple dipstick test can detect sugar (glucose) in a sample of urine. This may suggest the diagnosis of type 1 diabetes. However, the only way to confirm the diagnosis is to have a blood test to look at the **level of glucose in your blood**.



What causes type 1 diabetes?

Type 1 diabetes occurs when your blood glucose (sugar) level is too high because your pancreas can't make insulin. This happens because some cells and chemicals in your blood attack and destroy the cells in your pancreas. It is not known exactly why the insulin producing cells in the pancreas are attacked, but it may be triggered by certain infections.

Is type 1 diabetes inherited?

Although type 1 diabetes is not an inherited disease, there is a genetic factor. A first-degree relative (sister, brother, son, daughter) of someone with type 1 diabetes has about a 1 in 16 chance of developing type 1 diabetes. This is higher than the chance of the general population, which is about 1 in 300. This is probably because certain people are more prone to developing autoimmune diseases such as diabetes, and this is due to their genetic make-up, which is inherited.

Why does the pancreas stop making insulin?

In most cases, type 1 diabetes is thought to be an autoimmune disease. The immune system normally makes antibodies to attack germs called bacteria and viruses, and also other germs. In autoimmune diseases the immune system makes antibodies against part or parts of the body.

If you have type 1 diabetes you make antibodies that attach to the beta cells in the pancreas. These are thought to destroy the cells that make insulin. It is thought that something triggers the immune system to make these antibodies. The trigger is not known but a popular theory is that a virus triggers the immune system to make these antibodies.

Rarely, type 1 diabetes is due to other causes. For example, severe inflammation of the pancreas, or surgical removal of the pancreas for various reasons.

Complications of type 1 diabetes

Very high blood glucose level

If you are not treated, or use too little insulin, a very high blood sugar (glucose) level can develop quite quickly – over several days. If left untreated this causes lack of fluid in the body (dehydration), drowsiness, and serious illness which can be life-



threatening. A very high blood glucose level sometimes develops if you have other illnesses such as any infections. In these situations you may need to adjust the dose of insulin to keep your blood glucose level normal.

Long-term complications

If the blood glucose level is higher than normal, over a long period of time, it can have a damaging effect on the blood vessels. Even a mildly raised glucose level which does not cause any symptoms in the short term can affect the blood vessels in the long term. This may lead to some of the following complications (often years after diabetes is first diagnosed):

- **Furring or 'hardening' of the arteries (atheroma)** which can cause problems such as **angina, heart attacks, stroke** and poor circulation.
- **Eye problems** which can affect vision. This is due to damage to the small arteries of the retina at the back of the eye.
- **Kidney damage** which sometimes develops into kidney failure.
- **Nerve damage.**
- **Foot problems.** These are due to poor circulation and nerve damage.
- **Impotence.** Again, this is due to poor circulation and nerve damage.
- Other rare problems.

The type and severity of long-term complications vary from case to case. You may not develop any at all. In general, the nearer your blood glucose level is to normal, the less your risk of developing complications. Your risk of developing complications is also reduced if you deal with any other risk factors that you may have, such as high blood pressure.

It has been found that people with type 1 diabetes are more at risk of periodontitis. This is a condition that destroys the tissues supporting your teeth. Untreated, this could lead to tooth loss. Gingivitis which is an inflammation of the gums can lead to periodontitis and further severe gum conditions if left untreated.

At your annual review, your doctor will remind you to have checks with your dentist. If you do have periodontitis, managing this illness can improve blood sugar control. Your dentist may see you more regularly to ensure this condition is managed



Treatment of complications

Too much insulin can make the blood glucose level go too low (**hypoglycaemia**, sometimes called a 'hypo'). This can cause you to feel sweaty, confused and unwell; you may lapse into a coma. Emergency treatment of hypoglycaemia is with sugar, sweet drinks, or a glucagon injection (a hormone which has the opposite effect to insulin). Then you should eat a starchy snack such as a sandwich.

Type 1 diabetes treatment

Although diabetes cannot be cured, it can be treated successfully.

If a high blood sugar (glucose) level is brought down to a normal or near-normal level, your symptoms will ease and you are likely to feel well again. However, you still have some risk of complications in the long term if your blood glucose level remains even mildly high – even if you have no symptoms in the short term.

Studies have shown that people who have better glucose control have fewer complications (such as heart disease or eye problems) compared with those people who have poorer control of their glucose level.

Therefore, the main aims of treatment are:

- To keep your blood glucose level as near to normal as possible.
- To reduce any other risk factors which may increase your risk of developing complications. In particular, to reduce your blood pressure if it is high and to lead a healthy lifestyle.
- To detect any complications as early as possible. Treatment can prevent or delay some complications from becoming worse.

Treatment aim 1 – keeping your blood glucose level near normal

How is the blood glucose level monitored?

It is likely you will need to monitor your blood sugar (glucose) levels by using a monitor at home. If you check your blood glucose level, ideally you should aim to keep the level between 4 and 7 mmol/L before meals and less than 9 mmol/L two hours after meals.



It may be best to measure your blood glucose level at the following times:

- At different times in the day.
- After a meal.
- During and after vigorous sport or exercise.
- If you think you are having an episode of low blood glucose (hypoglycaemia).
- If you are unwell with another illness (for example, a cold or an infection).

Continuous glucose monitoring for all adults with type 1 diabetes

The National Institute for Health and Care Excellence (NICE) has updated its guidance for people with type 1 diabetes. It recommends that all adults with type 1 diabetes should be offered a continuous glucose monitoring (CGM) device.

There are two types of CGM. Both involve wearing a tiny sensor inserted under your skin, usually on your tummy or arm. This sensor measures the glucose found in the fluid between the cells. The sensor tests glucose every few minutes. A transmitter sends the information to a monitor wirelessly. This allows you to have a much better idea of what your glucose levels are and whether they are going up or down.

Using CGM will mean you do not have to use finger-prick testing as often to monitor your blood glucose. Using CGM can help you keep your glucose closer to normal and reduce the risk of hypos.

Your diabetes specialist care team should discuss the options with you in detail and help you decide on, and use, a device.

Another blood test is called HbA1c. This test measures a part of the red blood cells. Glucose in the blood attaches to part of the red blood cells. This part can be measured and gives a good indication of your blood glucose control over the previous 1–3 months. This test is usually done regularly by your doctor or nurse. Ideally, the aim is to maintain your HbA1c to less than 48 mmol/mol (6.5%). However, this may not always be possible to achieve and your target level of HbA1c should be agreed between you and your doctor.

Insulin

To stay well and healthy you will need **insulin injections** for the rest of your life. Your doctor or diabetes nurse will give a lot of advice and instruction on how and when to



rather than taken as tablets. There are various types of insulin. The type or types of insulin advised will be tailored to your needs.

The **six main types of insulin** are:

- **Rapid-acting analogue** – can be injected just before, with or after food. It tends to last between 2 and 5 hours and only lasts long enough for the meal at which it is taken.
- **Long-acting analogue** – is usually injected once a day to provide background insulin lasting approximately 24 hours.
- **Short-acting insulin** – should be injected 15–30 minutes before a meal, to cover the rise in blood glucose levels that occurs after eating. It has a peak action of 2–6 hours and can last for up to 8 hours.
- **Medium-acting and long-acting insulin** – are taken once or twice a day to provide background insulin or in combination with short-acting insulins/rapid-acting analogues. Their peak activity is between 4 and 12 hours and can last up to 30 hours.
- **Mixed insulin** – is a combination of medium-acting and short-acting insulin.
- **Mixed analogue** – is a combination of medium-acting insulin and rapid-acting analogue.

Most people take 2–4 injections of insulin each day. The type and amount of insulin you need may also vary each day, depending on what you eat and the amount of exercise you do.

New types of insulin have become available called **biosimilar insulins** ('biosimilars'). These are biological copies of original insulins. They are cheaper than original insulins and therefore free up NHS resources to be used for other services that patients need. Your doctor may wish to discuss biosimilars with you. If you are well controlled on an existing insulin there is no need to change. However, if you jointly agree that changing to a biosimilar is appropriate, you will need to monitor your blood glucose more closely to make sure that good control is achieved.



Insulin pumps

Insulin pump therapy continually infuses insulin into the layer of tissue just beneath the skin (the subcutaneous tissue). Insulin pumps work by delivering a varied dose of fast-acting insulin continually throughout the day and night, at a rate that is pre-set according to your needs.

An insulin pump involves a lot of work and requires a high level of motivation from the person using it. These pumps are not suitable for everyone with type 1 diabetes. Your doctor will be able to discuss this with you in more detail.

Editor's note

Dr Krishna Vakharia, 29th January 2024

NICE has recommended hybrid closed loop (HCL) systems for managing blood glucose levels in type 1 diabetes. These are insulin pumps that automatically deliver the background insulin and vary the dose delivered by reading your CGM sensor and calculating the dose required. This means it reduces the burden for you to continuously monitor your blood glucose and work out how much insulin is needed. However, you would still need to manually calculate requirements at certain times such as meal times.

Currently, these can only be used under certain conditions and criteria. Your doctor will be able to discuss with you whether these would be beneficial for you.

For further reading on this – take a look at the further reading section.

Alternatives to injecting insulin

There has been plenty of research done in recent years to develop ways to administer insulin other than by injection. These have included insulin nasal and oral sprays, patches, tablets and inhalers. After many years of work, some of the methods being researched are showing a degree of success. However, it will be some time before any of these devices will be available to people with diabetes in the UK.



Healthy diet

You should **eat a healthy diet**. This diet is the same that is recommended for everyone. The idea that you need special foods if you have diabetes is a myth. Diabetic foods still raise blood glucose levels, contain just as much fat and calories and are usually more expensive than non-diabetic foods.

Basically, you should aim to eat a diet low salt and sugar and **high in fibre** and good fats and with plenty of vegetables. Fruit, though good for you, should be limited due to their high sugar content. However, you will need to know how to balance the right amount of insulin for the amount of food that you eat when living with type 1 diabetes. Therefore, you will normally be referred to a dietician for detailed advice.

The Dose Adjustment for Normal Eating and Exercise (DAFNE) programme is designed for people with type 1 diabetes. The programme provides information to show you how to manage your insulin doses to allow for a varied diet and for when you exercise.

Balancing insulin and diet, and monitoring blood glucose levels

Monitoring your blood glucose level will help you to adjust the amount of insulin and food according to the level and your daily routine.

Treatment aim 2 – to reduce other risk factors

You are less likely to develop complications of diabetes if you reduce any other risk factors. Everyone should aim to cut out preventable risk factors but people with diabetes have even more of a reason to do so.

Keep your blood pressure down

It is very important to have your blood pressure checked regularly. The combination of high blood pressure and diabetes is a particularly high risk factor for complications. Even mildly raised blood pressure should be treated if you have diabetes. Medication, often with two or even three different medicines, may be needed to keep your blood pressure down. **See the separate leaflet called Diabetes and High Blood Pressure.**



If you smoke – now is the time to stop

Smoking is a high risk factor for complications. You should see your practice nurse or attend a smoking cessation clinic if you have difficulty **stopping smoking**. If necessary, medication or nicotine replacement therapy (nicotine gum, etc) may help you to stop.

Do some physical activity regularly

Regular physical activity also reduces the risk of some complications such as heart and blood vessel disease. If you are able, a minimum of 30 minutes' brisk walking at least five times a week is advised. Anything more vigorous is even better – for example, swimming, cycling, jogging, dancing. Ideally you should do an activity that gets you at least mildly out of breath and mildly sweaty. You can spread the activity over the day (for example, two 15-minute spells per day of brisk walking, cycling, dancing, etc).

Other medication

Depending on your age and how long you have had diabetes, you may be advised to take a **medicine to lower your cholesterol level**. This will help to lower the risk of developing some complications such as **heart disease** and stroke.

Try to lose weight if you are overweight or obese

Excess weight is also a risk factor for heart and blood vessel disease. Getting to a perfect weight is often unrealistic. However, if you are overweight, **losing some weight** will help.

Some of these lifestyle issues may not seem to be relevant at first to young children who are diagnosed as having diabetes. However, as children grow, a healthy lifestyle should be greatly encouraged for the long-term benefits. **See the separate leaflet called Cardiovascular Disease (Atheroma)**.



Treatment aim 3 – to detect and treat any complications

Most GP surgeries and hospitals have special diabetes clinics. Doctors, nurses, dieticians, specialists in foot care (podiatrists – previously called chiropodists), specialists in eye health (optometrists), and other healthcare workers all play a role in giving advice and checking on progress. Regular checks may include:

- Checking levels of blood sugar (glucose), HbA1c, cholesterol and blood pressure.
- Ongoing advice on diet and lifestyle.
- Checking for early signs of complications – for example:
 - Eye checks:
 - Guidance from the National Institute for Health and Care Excellence (NICE) recommends that if you are diagnosed with type 1 diabetes as an adult, your GP should refer you straightaway to the local NHS eye screening service so a specialist can detect problems with the retina (a possible complication of diabetes) which can often be prevented from becoming worse.
 - If your eyesight suddenly becomes significantly worse, you should consult your GP or diabetes team promptly for referral to a specialist eye clinic.
 - Increased pressure in the eye (glaucoma) is also more common in people with diabetes, and can usually be treated. **See the separate leaflet called Diabetic Retinopathy.**
 - Urine testing – these include testing for protein in the urine, which may indicate early kidney problems. **See the separate leaflet called Diabetic Kidney Disease.**
 - Foot checks – to help to prevent foot ulcers. **See the separate leaflet called Diabetes, Foot Care and Foot Ulcers.**
 - Tests for the sensation in your legs to detect early nerve damage. See the separate leaflets called **Diabetic Neuropathy** and **Diabetic Amyotrophy**.



- Blood tests – these include checks on kidney function, and other general tests. They also include checks for some autoimmune diseases which are more common in people with diabetes. For example, **coeliac disease** and thyroid disorders are more common than average in people with type 1 diabetes.

It is important to have regular checks, as some complications, particularly if detected early, can be treated or prevented from becoming worse.

Immunisation

You should be **immunised against flu** (each autumn) and against **infection from pneumococcal germs (bacteria)** (just given once). These infections can be particularly unpleasant if you have diabetes.

Frequently asked questions

What is the difference between type 1 and type 2 diabetes?

There are two main types of diabetes: type 1 and type 2. Type 1 diabetes typically develops quickly, over days or weeks, as the pancreas stops making insulin. It usually first appears in children or young adults. The article focuses on type 1 diabetes, where insulin injections and a healthy diet are crucial for management.

How quickly do the symptoms of type 1 diabetes usually appear?

The symptoms of type 1 diabetes tend to develop quite quickly, usually over a few days or weeks. Once treatment begins, these symptoms typically subside. However, without treatment, the blood sugar level can become very high, leading to serious complications like ketoacidosis, dehydration, coma, and even death.

Can type 1 diabetes be cured?

No, type 1 diabetes cannot be cured. However, it can be treated successfully to manage blood sugar levels and reduce symptoms. Treatment involves insulin



to normal as possible and prevent long-term complications.

Are there any alternative ways to take insulin besides injections?

While insulin injections are currently the standard treatment in the UK, research has been exploring other administration methods such as nasal and oral sprays, patches, tablets, and inhalers. Some of these methods show promise, but it will be some time before they become available to patients in the UK.

What is the DAFNE programme and how does it help people with type 1 diabetes?

The DAFNE (Dose Adjustment for Normal Eating and Exercise) programme is specifically designed for individuals with type 1 diabetes. It provides guidance on how to adjust insulin doses to accommodate a varied diet and physical activity, helping people better manage their condition in daily life.

Why is it important for people with type 1 diabetes to get vaccinated against flu and pneumococcal infections?

It is recommended that people with type 1 diabetes get immunised against flu annually and against pneumococcal germs once. These infections can be particularly severe and unpleasant for individuals with diabetes, making vaccination an important preventative measure.

These questions and answers have been generated from the information in this article.

Further reading and references

- **Management of diabetes** [\[PDF\]](http://www.sign.ac.uk/assets/sign116.pdf) (<http://www.sign.ac.uk/assets/sign116.pdf>); Scottish Intercollegiate Guidelines Network – SIGN (March 2010 – updated November 2017)



- **Type 1 diabetes in adults: diagnosis and management** [\[link\]](https://www.nice.org.uk/guidance/ng17) (<https://www.nice.org.uk/guidance/ng17>); NICE Guidelines (August 2015 – last updated August 2022)
- **Diabetes (type 1 and type 2) in children and young people: diagnosis and management** [\[link\]](https://www.nice.org.uk/guidance/ng18) (<https://www.nice.org.uk/guidance/ng18>); NICE Guidelines (Aug 2015 – updated May 2023)
- **Information prescriptions – living well** [\[link\]](https://www.diabetes.org.uk/guide-to-diabetes/managing-your-diabetes/information-prescriptions) (<https://www.diabetes.org.uk/guide-to-diabetes/managing-your-diabetes/information-prescriptions>); Diabetes UK
- **Type 1 diabetes in adults** [\[link\]](https://www.nice.org.uk/guidance/qs208) (<https://www.nice.org.uk/guidance/qs208>); NICE Quality standard, March 2023
- **Diabetes – type 1** [\[link\]](https://cks.nice.org.uk/topics/diabetes-type-1/) (<https://cks.nice.org.uk/topics/diabetes-type-1/>); NICE CKS, December 2024 (UK access only)

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• Next review due: 19 Apr 2028

• 26 Apr 2023 | Latest version

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