

### In this article...

- Why type 2 diabetes develops and its prevalence
- The effect on a person's health and wellbeing
- How rising numbers of people with type 2 diabetes affect the health service

# Type 2 diabetes: causes, diagnosis and impact on health and wellbeing

## Key points

**Globally, diabetes claimed the lives of 6.7 million people in 2021**

**In the UK, 1 in 16 adults has diabetes and most of these have type 2 diabetes**

**The incidence of diabetes has reached epidemic proportions globally and nationally**

**It is predicted that there will be 5.5 million people in the UK with diabetes by 2030 if action is not taken**

**Type 2 diabetes shortens lives and impairs health, but is often preventable**

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**Abstract** Many people in the UK are living with diabetes, and most have type 2 diabetes. The prevalence of type 2 diabetes is rising nationally and globally in line with growing obesity levels. It is important that nurses are aware of why type 2 diabetes develops and how it can be prevented, put into remission and treated. This article, the first in a series of three on type 2 diabetes, considers the prevalence of diabetes and how the condition affects health and wellbeing.

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In the UK >5 million people are estimated to have diabetes; most have type 2 diabetes mellitus (T2DM), which is generally preventable (Diabetes UK, nd). Diabetes increases the risk of developing long-term conditions, some of which – such as blindness and amputation – are life changing. This article will consider the prevalence of T2DM and how it affects a person's health and wellbeing.

## What is T2DM?

Diabetes has been defined as “a chronic, metabolic disease characterised by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves” (World Health Organization (WHO), nd). T2DM is the most common type and occurs when the body becomes resistant to, or does not produce enough, insulin. T2DM mainly occurs in adults and over the past 30 years global prevalence has risen dramatically (WHO, nd).

By contrast, type 1 diabetes, once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin by itself (WHO, nd).

## Why does T2DM occur?

Blood glucose is regulated by the pancreas, which has digestive and glucose regulation functions. Located in the curve of the duodenum (Fig 1), which is the first section of the small intestine, the pancreas measures 12.5-15cm (Tortora and Derrickson, 2017). It consists of a head, a body and a tail.

The pancreas is made up of two types of cells:

- Those with an exocrine function related to digestion;
- Those with an endocrine function related to glucose regulation.

Most of the pancreas comprises clusters, which are called acinar cells or acini. The acini produce digestive enzymes. Scattered throughout the pancreas are endocrine cells, known as pancreatic islets; these are also called islets of Langerhans. There are thought to be around 1-2 million islets of Langerhans in the pancreas (Tortora and Derrickson, 2017). Each islet is composed of five different endocrine cell types:

- Alpha;
- Beta;
- Delta;
- Epsilon;
- Gamma.

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These secrete at least five hormones respectively, including:

- Glucagon;
- Insulin;
- Amylin;
- Somatostatin;
- Ghrelin;
- Pancreatic polypeptide (PP) (El Sayed and Mukherjee, 2023; Tortora and Derrickson, 2017).

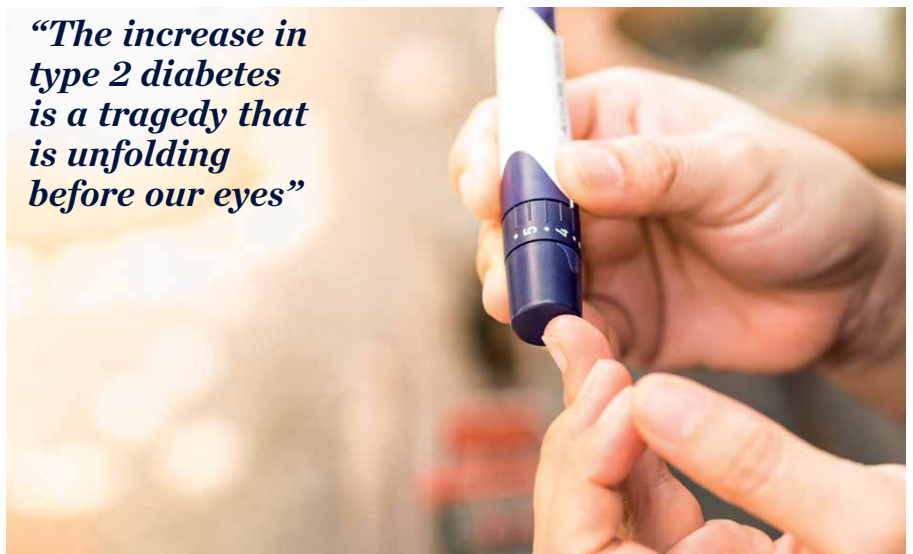
The interactions of pancreatic hormones are complex and not yet fully understood (El Sayed and Mukherjee, 2023; Tortora and Derrickson, 2017). Table 1 explains their function.

The main hormones responsible for regulating blood glucose are insulin and glucagon. Insulin is secreted from the beta cells in the pancreas. It maintains glucose homeostasis so blood glucose remains within a narrow healthy range.

Insulin lowers blood sugar. Normally, when we eat, levels of glucose in the blood rise and insulin is produced and released directly into the bloodstream. Insulin binds to insulin receptors and this triggers the movement of glucose transporter type 4 – often abbreviated to GLUT4 – inside the cells. This enables cells in the body to use glucose and convert it to energy (Taylor and Knight, 2021).

When the body has enough energy, the liver takes glucose and stores it as glycogen. The liver can store up to 5% of its mass as glycogen. When the liver has reached its

*“The increase in type 2 diabetes is a tragedy that is unfolding before our eyes”*



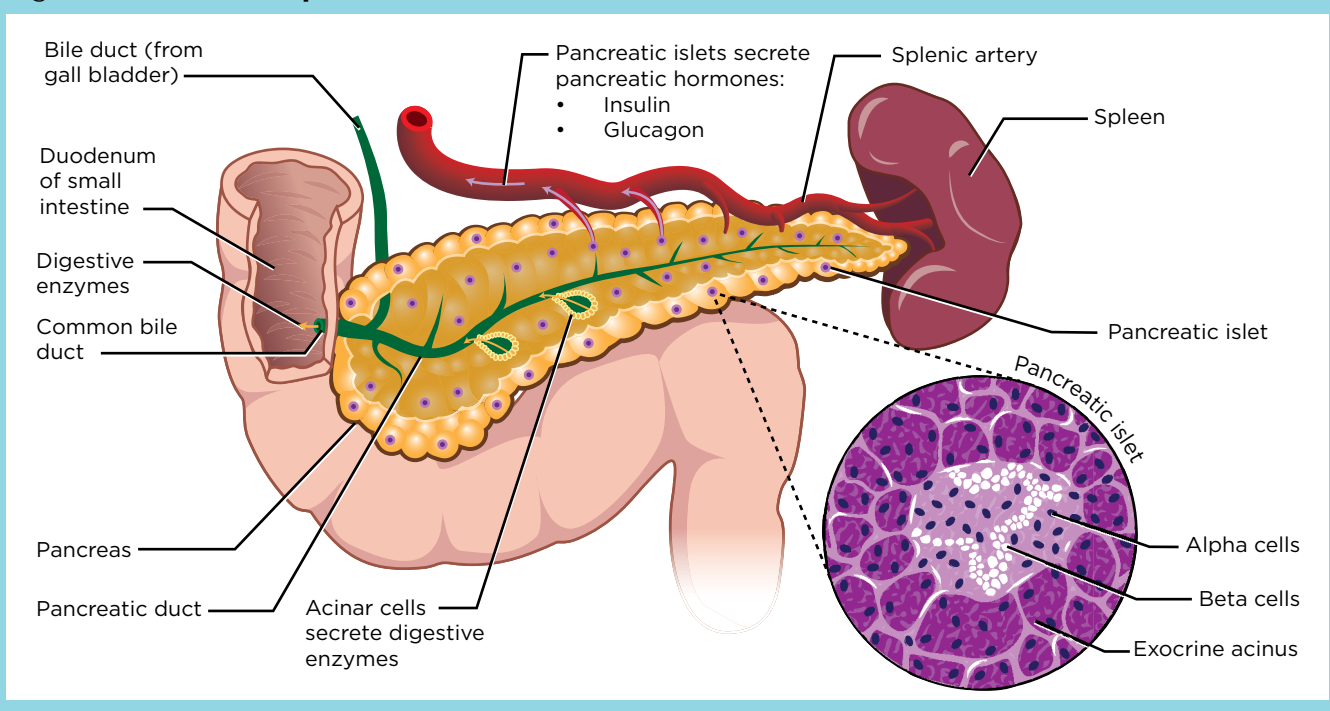
storage capacity, insulin signals fat cells to take up glucose to be stored as triglycerides (El Sayed and Mukherjee, 2023; Tortora and Derrickson, 2017). Glucagon is secreted from the alpha cells of the pancreas and stimulates the release of glycogen stored in the liver. This raises blood glucose (Tortora and Derrickson, 2017).

T2DM is a progressive disease characterised by elevated blood glucose levels. Blood glucose levels are elevated because of a decline in beta-cell function. This may be accompanied by reduced insulin sensitivity – this is known as insulin resistance (Heo and Choi, 2019).

### How common is diabetes?

Over the past 80 years, the number of people in the UK with diabetes has risen from 200,000 to an estimated 5 million (Diabetes UK, nd). Globally, 537 million people have diabetes (International Diabetes Federation (IDF), 2021). In 2021, 6.7 million people died of diabetes globally, which equates to one person every five seconds; the condition is one of the top causes of premature death (IDF, 2021). In the UK in 2021, 13.6 million people were at increased risk of T2DM, and the number of people with a diabetes diagnosis is expected to rise to 5.5 million by 2030 (Diabetes UK, nd).

Fig 1. Structure of the pancreas



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Table 1. Islets of Langerhans: hormones secreted and their function

Endocrine cell type	Hormone secreted	Function
Alpha	● Glucagon	● Raises blood glucose level
Beta	● Insulin ● Amylin	● Insulin and amylin are released at the same time ● Insulin lowers blood-glucose level ● Amylin: ● Inhibits secretion of glucagon ● Slows the emptying of stomach contents ● Helps regulate blood pressure ● Stimulates the satiety centre of the brain to limit food consumption
Delta	● Somatostatin	● Inhibits the secretion of multiple hormones, including growth hormone, insulin, glucagon, gastrin, vasoactive intestinal peptide and thyroid-stimulating hormone
Epsilon	● Ghrelin	● Inhibits the secretion of insulin via paracrine interaction between delta cells and beta cells of the islets of the pancreas ● Stimulates appetite and growth hormone secretion
Gamma	● Pancreatic polypeptide	● Inhibits somatostatin secretion and secretion of digestive enzymes ● Blocks ghrelin function, reduces appetite and induces feelings of satiety (that is, feeling full)

Source: Adapted from El Sayed and Mukherjee (2023) and Tortora and Derrickson (2017)

WHO (2020) states that diabetes is defined as an HbA<sub>1c</sub> of >48mmol/mol. HbA<sub>1c</sub> levels indicate average blood glucose levels over time and, the higher the HbA<sub>1c</sub>, the greater the risk of developing diabetes-related complications. Table 3 illustrates how HbA<sub>1c</sub> correlates with average blood glucose levels (Diabetes.co.uk, 2023a).

### How diabetes affects health and wellbeing

People with undiagnosed, or poorly managed, diabetes can feel very unwell. High blood glucose levels cause a lack of energy and increased risk of tissue damage. Diabetes can affect a person's life and that of their family. A person with poorly managed diabetes may not appreciate how unwell they are until diabetes control improves: symptoms can develop slowly and they may think it is normal to lack stamina and tire easily.

T2DM was once a disease that affected middle-aged and older people, but it is now affecting many younger adults and children (Romieu et al, 2017; Kao and Sabin, 2016). People who develop T2DM aged <40 years are more likely to experience rapid deterioration in pancreatic function and have a greater incidence of adverse outcomes (Magliano et al, 2020).

Undiagnosed diabetes, or that which is poorly managed, is associated with premature death (Harding et al, 2016). Diabetes can also lead to problems with vision and circulation, and increases the risk of:

- Heart disease;
- Stroke;
- Dementia;
- Nerve damage;

### Diagnosing diabetes

National Institute for Health and Care Excellence (NICE) (2023) guidance recommends testing for diabetes if a person presents with persistent hyperglycaemia and has clinical features of diabetes. Table 2 provides a full overview of these features, which include:

- Polydipsia (excessive thirst);
- Polyuria (increased urine output);
- Polyphagia (increased appetite accompanied by weight loss);
- Tiredness and irritability;
- Poor wound healing (NICE, 2023).

An HbA<sub>1c</sub> blood test is commonly used to diagnose or monitor diabetes (London Diabetes Clinical Network, 2018). HbA<sub>1c</sub> measures glycated haemoglobin. When haemoglobin – the protein in red blood cells that transports oxygen – attaches to glucose in the blood, the process is known as glycation. An HbA<sub>1c</sub> test measures the amount of glucose attached to the haemoglobin over a two-to-three-month period, as this is how long the blood cells typically last in the body (MedlinePlus, 2022).

An HbA<sub>1c</sub> test is not recommended for:

- People with a disease affecting haemoglobin, such as sickle cell disease;

- People with chronic kidney disease;
- People on haemodialysis;
- Pregnant women.

In such cases a different test, glycated albumin, may be used (Zendjabil, 2020).

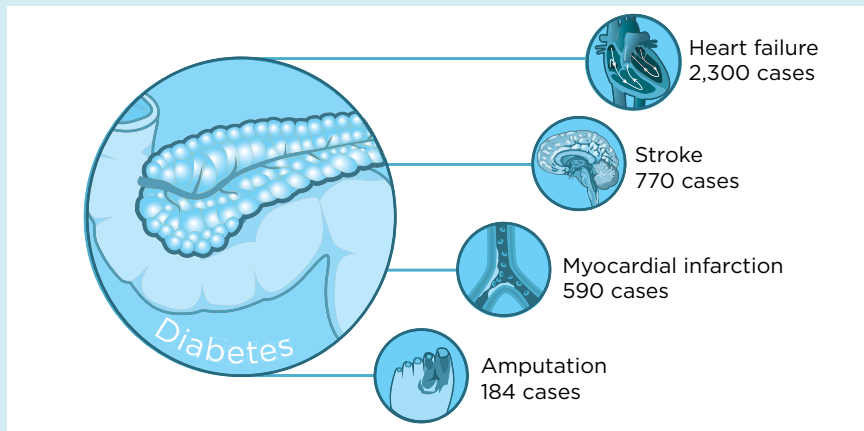
Table 2. Clinical features of diabetes

Symptom	Reason
Polyuria (increased urine output)	The body tries to reduce sugar levels by passing more urine
Polydipsia (excessive thirst)	The person drinks more to replace lost fluid
Polyphagia (increased appetite, accompanied by weight loss)	The body is unable to use glucose effectively and the person feels hungry
Tiredness and irritability	The process that converts glucose into adenosine triphosphate and provides energy to the cells is affected. High blood sugar prevents the body drawing on reserves of glycogen in the liver
Fungal infection	High sugar levels in blood and tissues increase infection risks
Poor wound healing	High sugar levels affect the circulation and slow wound healing
Deterioration of vision	High sugar levels have a negative effect on vision

Source: Nazarko (2016)

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Fig 2. Associated conditions



Approximate number of cases that diabetes leads to each week in the UK  
Data has been taken from Diabetes UK (nd)

- Sexual difficulties (Diabetes.co.uk, 2023b). The main complications of diabetes are:
- Microvascular disease affecting the eyes, nerves and kidneys;
- Macrovascular disease, leading to cardiovascular disease, cerebrovascular disease and lower-extremity artery disease (Chawla et al, 2016).

Every week, diabetes leads to 184 amputations, >770 strokes, 590 heart attacks and 2,300 cases of heart failure in the UK (Diabetes UK, nd) (Fig 2).

### How diabetes affects the health service

People with diabetes are admitted to hospital more often than the general population, especially as emergencies, and stay, on average, longer as inpatients (Dhatariya et al, 2020). Diabetes is thought to cost the NHS £10bn per year – around 10% of the NHS budget (NHS England, 2022); the money is often spent treating the complications of an avoidable disease.

T2DM can have a profound effect on a person's health and increases the risk of renal failure, heart attack, stroke, dementia, loss of vision and limb amputation. This topic will be covered in detail in the next article in this series.

The increase in T2DM is a tragedy that is unfolding before our eyes. It is a preventable

Table 3. HbA1c and blood-glucose levels

HbA1c (mmol/mol)	Average blood glucose (mmol/L)
119	18
108	17
97	15
86	13
75	12
64	10
53	8
42	7
31	5

Source: Diabetes.co.uk (2023a)

global pandemic that unnecessarily claims the lives of many people: to put it into context, in 2021, 6.7 million people died of diabetes (IDF, 2021), while Covid-19, over several years, has claimed more than 6.95 million lives so far (as of 6 September 2023) (WHO, 2023). We must begin to apply the same level of effort to reducing the number of lives lost and marred by T2DM as we do to preventing Covid-19.

### Conclusion

Most people in the UK who have diabetes have T2DM, and the number with this type of diabetes is rising year on year. People with T2DM may experience a life marred by ill health. The NHS is struggling to provide care to ever-increasing numbers of people with T2DM but it does not have to be this way. We can work with people to reduce the risks of T2DM and induce remission if diabetes occurs. **NT**

- The next article in this series will discuss how we can work with people to reduce the risk of T2DM and how it is possible to induce remission through diet and exercise

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### Resources

Go to [www.diabetes.co.uk/hba1c-to-blood-sugar-level-converter.html](http://www.diabetes.co.uk/hba1c-to-blood-sugar-level-converter.html) to access a calculator that can be used to:

- Convert HbA1c levels to blood-glucose levels
- Provide an average blood glucose level