# CONTINUOUS GLUCOSE MONITORING SYSTEMS FOR TYPE 1, MONOGENIC AND PANCREATOGENIC DIABETES MELLITUS

ACE agency for care effectiveness

## WHAT IS TYPE 1 DIABETES?

**Insulin** is a hormone produced by the pancreas. It is essential for helping a type of sugar from food, called **glucose**, to enter cells in the body so it can be used as energy or stored for later use. **Type 1** diabetes is an **autoimmune** condition where the body's immune system destroys insulin-producing cells in the pancreas, causing a lack of insulin which leads to **high levels** of glucose in the blood.[1]

The most common symptoms of **high** blood glucose include blurred vision, passing large amounts of urine, needing to urinate often, feeling thirsty all the time, feeling very tired, and losing weight without trying.[1,2]

### COMMON SYMPTOMS OF HIGH BLOOD GLUCOSE

- Feeling thirsty all the time
- Losing weight without trying
- Blurred vision
- Needing to urinate often
- Feeling very tired
- Feeling hungry all the time

## WHAT ARE MONOGENIC AND PANCREATOGENIC DIABETES MELLITUS?

### Monogenic diabetes mellitus

This form of diabetes is caused by a change (mutation) in a single gene that affects how the body produces or regulates insulin causing high blood glucose levels. Symptoms usually appear at a young age, and the condition may be known by other names, including **neonatal diabetes** (starting in infancy) and **maturity-onset diabetes of the young** (MODY), which typically appears in adolescence or early adulthood.

The specific gene affected influences when symptoms begin, how severe they are, and the most appropriate treatment, so the condition can vary widely between individuals.

### Pancreatogenic diabetes mellitus

This type of diabetes develops when the **pancreas** becomes damaged or is surgically removed. Because the pancreas produces insulin, these problems can reduce how much insulin the body has, which can cause blood glucose levels to rise.

## PREVENTING HEALTH COMPLICATIONS

Over time, high blood glucose levels can damage nerves and blood vessels, causing serious health complications including heart disease, stroke, chronic kidney disease, nerve damage, and eye problems. Maintaining your blood glucose in the healthy range can reduce your risk of developing these health complications. You can do this by:

- **monitoring** your blood glucose levels regularly at least 4 times per day with a finger-prick and a **glucose meter** or continuous glucose monitoring (**CGM**) system,
- matching the insulin dose to your carbohydrate (**"carb"**) intake,
- giving yourself **insulin** using injections or an insulin pump,
- **regularly** seeing your doctor for check-ups, and
- learning **self-management** skills from your diabetes healthcare team to better manage your condition.

### MANAGING BLOOD GLUCOSE LEVELS[3]

**Regular checking** of your blood glucose level with:

- Blood glucose meter
- CGM system

**Insulin** treatment:

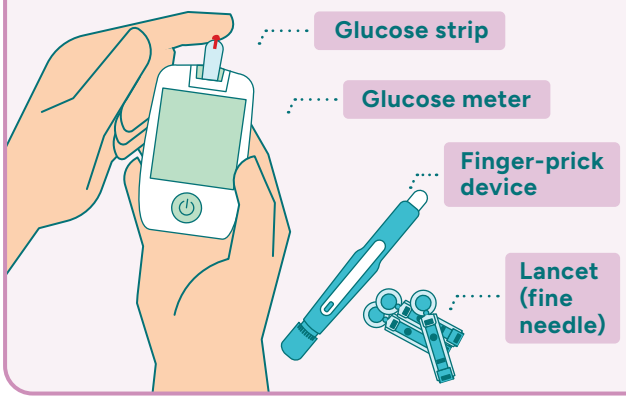
- Insulin pen
- Insulin pump

## MANAGING BLOOD GLUCOSE LEVELS

People with **type 1 diabetes** check their blood glucose levels **regularly** and take insulin to help keep their levels in a healthy range. Some people with **monogenic diabetes** or **pancreatogenic diabetes** may also need to do this. Doctors also use a test called haemoglobin A1c (**HbA1c**) every few months to measure a person's **average blood glucose level over time** and check how well their diabetes is being managed.

## SELF-MONITORING BLOOD GLUCOSE LEVELS

### FINGER-PRICK AND A GLUCOSE METER




#### What is this device?

Commonly used by people with diabetes to monitor their blood glucose levels at different times of the day.

#### What items are included?

Items include lancets, finger-prick device, glucose strips and a glucose meter.

#### How is it used?

A fine needle called a lancet is loaded into a finger-prick device, which is used to pierce the skin. A drop of blood is placed on a glucose strip and blood glucose levels are read using a glucose meter.

#### What are the differences in use between brands?

Different brands are available but they are generally used in the same way.

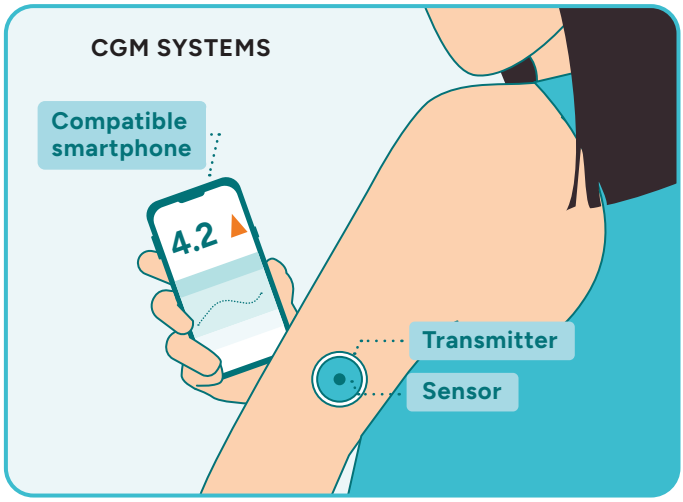
#### BENEFITS

- ✓ Accurate
- ✓ More affordable than CGM systems
- ✓ Easy to use with practice

#### LIMITATIONS

- ✗ Only know the blood glucose level at the point of testing so you need to check throughout the day to track changes
- ✗ Pain from finger-pricking
- ✗ Might be hard to find a suitable space to check blood glucose levels

### CGM SYSTEMS




#### What is this device?

A CGM system is a **wearable** technology used to monitor glucose levels under the skin throughout the day and night.

#### What items are included?

Main items include a glucose sensor with or without a transmitter, receiver or smartphone application.

#### How is it used?

An **applicator** is used to insert a **sensor** that measures glucose levels under the skin and wirelessly sends the readings to a small recording device (**receiver**) or a **smartphone** to display the readings and trends.

#### What are the differences in use between brands?

Different brands are available and they are categorised into 2 types depending on how they work:

- **Real-time:** automatically sends glucose readings to the user via a **transmitter** and provides **alerts** if glucose levels are outside the set target range.
- **Intermittently-scanned:** requires users to manually scan the sensor before they can see their readings and trends.

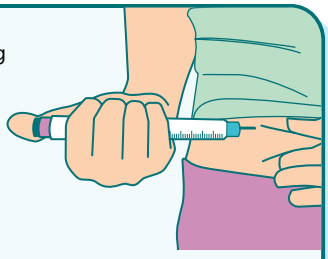
#### BENEFITS

- ✓ Automatically measures glucose levels every few minutes, allowing you to easily see how your glucose level is changing without the pain of finger-pricking
- ✓ Data trends allow you to understand the effects of food and activities on your blood glucose level
- ✓ Convenient and easy to use

#### LIMITATIONS

- ✗ CGM systems measure the amount of glucose in the fluid under the skin, which will take a few minutes to match the level in the blood. If your CGM system's alerts and readings do not match your symptoms or expectations, you may have to use finger-prick and a glucose meter to check your blood glucose levels
- ✗ Skin allergy or irritation from the sensor patch
- ✗ More costly than glucose meters as sensors and transmitters need to be replaced regularly

## INSULIN TREATMENT



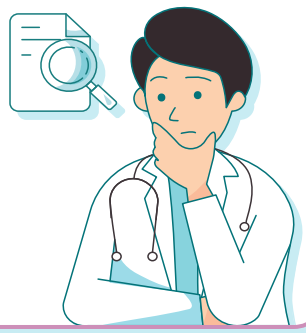
People with type 1 diabetes need to decide when and how much insulin to give themselves by considering their blood glucose **reading**, the amount of carbs in their food, and their current and upcoming physical **activities**. Depending on their condition, some people with monogenic or pancreatogenic diabetes mellitus may need to do this too.

If a person gives themselves **too little** insulin, their blood glucose could rise above their target level. Prolonged high blood glucose causes a **high HbA1c** result, which indicates a higher risk of developing long-term complications.

If a person gives themselves **too much** insulin for the amount of carbs they are eating, their blood glucose will become low (also known as hypoglycaemia or "**hypo**"). Onset can be **fast** and it can be dangerous, especially when it occurs during sleep or to people who do not know what is happening, such as a young child. People who have had hypos before **may not** have obvious symptoms of low blood glucose, making them **unaware** that they are having a hypo.[4]

## WHAT DOES THE EVIDENCE FROM CLINICAL STUDIES SAY ABOUT BLOOD GLUCOSE MONITORING DEVICES?

**ACE reviewed all available clinical evidence and received expert advice from doctors and patients about self-monitoring of blood glucose levels by finger-pricking and CGM systems.[5]**



**CGM systems** are likely to be **better** than self-monitoring blood glucose by finger-pricking for **certain** children and adults with type 1, monogenic or pancreatogenic diabetes mellitus to:

- increase the amount of **time** that their glucose level is within a **target** range
- reduce **hypos**
- improve **HbA1c** levels

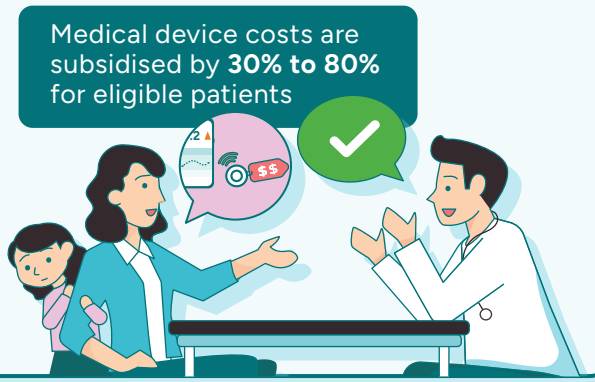
## SUBSIDISED CGM SYSTEMS ARE AVAILABLE

CGM systems are **subsidised** for children and adults with type 1, monogenic or pancreatogenic diabetes mellitus who:

- have frequent, unpredictable, severe or night-time hypo,
- are unable to recognise or communicate symptoms of hypo, or
- have high HbA1c levels

despite **regularly** monitoring their blood glucose levels by finger-pricking and using insulin as best as they can.

Subsidy only applies to **certain models and accessories** that are **prescribed** by a doctor in a **public** healthcare institution. Scan the QR code to learn more.[5]




## KEY MESSAGES

**Subsidised CGM systems** are available for children and adults with **type 1, monogenic** or **pancreatogenic diabetes mellitus** who meet certain clinical criteria when prescribed by a doctor in a public healthcare institution.

Discuss with your **doctor** which blood glucose self-monitoring device is suitable for you by considering your medical history, preferences, and any affordability concerns. You can also speak to a **medical social worker** if you need further financial assistance for any treatment, or you can reach out to **local patient support groups**[6] if you want to meet with people with diabetes and share your experiences.


Sources
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2. www.cdc.gov/diabetes/about/index.html
3. www.healthhub.sg/programmes/diabetes-hub
4. www.healthhub.sg/programmes/diabetes-hub/hypoglycaemia
5. ACE Technology Guidance on *Continuous glucose monitoring systems for children and adults with type 1 diabetes mellitus, monogenic diabetes or pancreatogenic diabetes,* 2025
6. typeOne.sg




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