How to initiate and support continuous glucose monitoring

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What and why

- Eligibility for the use of continuous glucose monitoring (CGM), which includes both real-time and intermittently scanned, is increasing as national organisations such as NICE update their guidelines.
- This is based on the evidence of significant benefits of CGM use in people with diabetes, including increased time spent in target glucose range, improved quality of life and reduced risk of hospital admissions for severe hypoglycaemia and diabetic ketoacidosis.[1,2]
- Accessibility to CGM is now widening to include persons who may have all their diabetes reviews delivered in primary care. As clinicians, it is important that we seek to enable timely and appropriate initiation of CGM, offer support to those in our care and try to mitigate inequitable access.
- This guide gives an overview of CGM for healthcare professionals working within primary care and signposts to further resources and reading.

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What is CGM?

- Both real-time CGM (rtCGM) and intermittently scanned CGM (isCGM) are methods of measuring glucose levels via interstitial fluid (fluid between cells), without the need for routine capillary blood glucose testing.
- rtCGM records glucose levels continuously throughout the day and night, providing both real-time and predictive glucose data. A small sensor is worn, usually on the arm or abdomen, which inputs interstitial glucose data continually via a transmitter or via bluetooth to the wearer's smartphone.
- People using a reader without their device linked to a transmitter (e.g. isCGM not linked to a smartphone) will still need to scan their sensor. To obtain sufficient data for a complete glucose profile, the sensor must be scanned at least every 8 hours although data is enhanced from six scans a day or more.
- There are various CGM systems available, some of which work with insulin pumps or enable closed-loop systems and which are only available via the NHS supply chain through specialist secondary care services. However, as of August 2023, three devices are available via NHS prescription (FP10): see **Table 1**.
- Although other CGM devices are available, or will be in the future, this guide focuses primarily on the FreeStyle Libre and Dexcom ONE, as these devices are more commonly available to primary care.

Table 1. CGM systems available via NHS prescription.[3]

	FreeStyle Libre 2	Dexcom ONE	GlucoRx AiDEX
Type of CGM	isCGM/ rtCGM*	rtCGM	rtCGM
Sensor life	14 days	10 days	14 days
Transmitter life	n/a	3 months	4 years
New sensor warm-up time	1 hour	2 hours	1 hour
Calibration required	No	No	No

*The FreeStyle Libre 2 functions as rtCGM when paired with the LibreLink app on a smartphone and as isCGM (requiring manual scanning) when used with the Libre Reader device.

Potential benefits

- Reduction in fingerprick testing.
- Trend arrows can aid safe and effective adjustments in treatment to avoid hypo- and hyperglycaemia.
- Alarms can be set to alert the user to potential hypo- and hyperglycaemic events.
- Patterns in glucose variation can be identified.
- Easier and less invasive identification of night-time hypos.
- Can enhance self-management and user engagement.
- Carers and parents can access readings and data.
- Generates a full 24-hour glycaemic picture (for isCGM, sensor must be scanned at least every 8 hours to achieve this).
- Studies show increased time in glucose target range, and potentially improved HbA_{1c}, reducing the risk of long-term diabetes complications.[1]
- Positive impact on quality of life.[1]
- Data can be uploaded to share online with healthcare professionals through compatible systems (subject to local data-sharing agreements), enabling potentially more effective consultations and also remote reviews.
- Apps enable the sensors to be scanned with smartphones/ smartwatches.
- Studies in people with type 1 diabetes show cost-effectiveness compared with fingerprick testing.[1]
- Larger text displays and spoken glucose readings are possible for those with visual impairment.

Possible disadvantages

- Data overload can confuse or worry some users.
- Interstitial fluid glucose time lag; thus, a fingerprick test is required in periods of rapidly changing glucose levels.
- CGM should not be prescribed without an individual being able to use capillary blood glucose monitoring when needed (See **Need to Know** section).
- Possible sensor problems relating to skin irritation or adhesive failure.
- Group 2 drivers still need to check capillary blood glucose levels for driving.[4]

References can be found in the online version of this article.

GP: references to be updated online

Who is eligible?

England and Wales (see NICE NG3, NG17, NG18, NG28; and Health Technology Wales guidance 004-2)

- All adults with type 1 diabetes.
  - Pregnancy: rtCGM preferred unless unable to use or clear preference for isCGM is expressed.*
- All children and young people with type 1 diabetes (rtCGM preferred unless unable to use or clear preference for isCGM is expressed).*
- For adults with type 2 diabetes on multiple daily insulin injections, offer isCGM (or rtCGM if available for same or lower cost)* if any of the following apply:
  - Recurrent hypoglycaemia or severe hypoglycaemia (see ***Box 1***).
  - Impaired hypoglycaemia awareness (see ***Box 1***).
  - A condition or disability (including a learning disability or cognitive impairment) that means the user cannot self-monitor capillary blood glucose but could use an isCGM device (or have it scanned for them).
  - User would otherwise be advised to self-monitor capillary glucose at least 8 times a day.
- Consider rtCGM* for pregnant women who are on insulin therapy but do not have type 1 diabetes if:
  - Problematic severe hypoglycaemia (with or without impaired awareness of hypoglycaemia).
  - Unstable blood glucose levels that are causing concern despite efforts to optimise glycaemic control.

Scotland (see https://bit.ly/3S4mi1G)

Scottish Health Technologies Group. *Freestyle Libre Flash Glucose Monitoring Advice Statement*.

Northern Ireland (see https://bit.ly/2NkbQEL)

(Currently under review) For people living with type 1 diabetes there is a list of things to take into account before granting a 3–6-month trial. Following the trial, improvements in management are reviewed before a decision is made on an annual prescription.

***Note: The FreeStyle Libre 2 now functions as rtCGM if used with a smartphone.**

Box 1. Assessing hypoglycaemia

- For more information on hypoglycaemia, including useful questions to determine occurrence, see *How to prevent, identify and manage hypoglycaemia in adults with diabetes*
- Validated questionnaires such as the Clarke, Gold and Pedersen tools are useful methods to assess impaired hypoglycaemia awareness. However, they have not been validated in people with type 2 diabetes, and they may (particularly the Gold score) underestimate impaired hypoglycaemia awareness in type 2 diabetes.[5] **These tools should not override clinical judgement when evaluating the benefits of CGM for an individual with diabetes.**

Need to know

Blood glucose vs interstitial fluid

- Blood glucose and interstitial glucose levels are closely related but not identical.
- The glucose measured by the FreeStyle Libre 2 system lags behind capillary readings by 2.4 minutes in adults and 2.1 minutes in children.[6] For other CGM, the lag depends on the device used; the Dexcom ONE has a time lag of around 4 minutes.[7]
- Therefore, in times of rapidly changing blood glucose levels (e.g. after eating or exercise), or when there are symptoms of hypoglycaemia, a fingerprick blood glucose measurement is indicated.

Fingerprick testing

People using CGM will still need access to fingerprick testing for the following circumstances:

- In times of rapidly changing glucose levels.
- When symptoms do not match the sensor reading.
- Group 2 drivers (e.g. large lorries and buses).
- In case of CGM system failure.

People with type 1 diabetes will also still need access to a means of testing for ketones.

Driving

- CGM can be used for glucose monitoring for group 1 (car and motorcycle) drivers (drivers must pull over to scan if using isCGM). However, fingerprick glucose equipment must be carried and used to confirm blood glucose levels when:
  - Glucose level reads ≤4.0 mmol/L.
  - Symptoms of hypoglycaemia are experienced, or the CGM reading is inconsistent with the symptoms being experienced.
- Group 2 drivers still need to use fingerprick testing for driving. For further information, see *How to assess fitness to drive*
- In the Republic of Ireland, advice is to use blood glucose monitoring: https://bit.ly/2QH5Aca

Travel

- Take spare equipment.
- Check with individual manufacturers' guidance on use with airport scanners.
- Check with individual airlines about use in flight.

Discarding of sensors

This should be via an appropriately sized sharps bin.

Use in water

Users can bathe, swim and shower with the sensors in place.

Initiation: Top tips

- Shared decision making to identify the most appropriate device (consider the person's preference, benefits/drawbacks of alerts and alarms, ability to share data with family and carers, potential issues with scanning/dexterity, and cost).
- Download the device's compatible mobile app for use with a smart device, prior to fitting. If a smart device is not available, arrange for a compatible reader before fitting.
- See manufacturers' specific guidance on how to apply the sensor and, where relevant, transmitter (links: Libre | Dexcom ONE).
- Advise on warm-up time for the sensor (see ***Table 1*** on page 1).
- Set low and high alarms (refer to individual device user guides) based on individualised target glycaemic range.
- Signpost the user and/or their family and carers to appropriate education to enable self-management (see **Resources** list).
- Provide information on future need for capillary glucose testing, driving, etc. (see **Need to know** section).
- Consider linking to the device's cloud-based system (depending on local data-sharing guidelines) so that data can be shared from the person's own account to the healthcare professional's clinic account, to allow for remote review/consultations.
  - Ensure the person understands when the data will be reviewed, and that CGM does not mean a professional will be viewing/monitoring their data continuously outside of consultations.
- Arrange for timely review/follow-up.

What information/data does CGM provide?

- Current **interstitial glucose level (A)**.
- **Trend arrows** show the direction glucose is heading and the rate of change **(B)**.
- **Daily patterns (C)**.
- **Low-glucose events (D)**.
- Time spent in the target glucose range: **Time in Range (TIR)** – see ***Box 2***.[8]
  - ➤ Increasing TIR reduces the risk of microvascular complications.[9]
- The user can also add **notes on food, exercise and insulin doses (E)**.
- **Ambulatory glucose profile (F)**.
  - ➤ For more information, see *Quick guide: Interpreting CGM data*

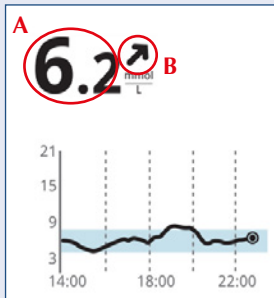


Image source: FreeStyle Libre

Glucose trend arrow meanings

- ↑ Increasing quickly (>0.11 mmol/L/min)
- ↗ Increasing slowly (0.06–0.11 mmol/L/min)
- → Stable (<0.06 mmol/L/min)
- ↘ Decreasing slowly (0.06–0.11 mmol/L/min)
- ↓ Decreasing quickly (>0.11 mmol/L/min)

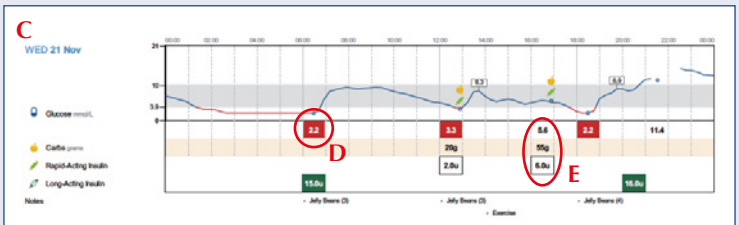


Image source: FreeStyle LibreView

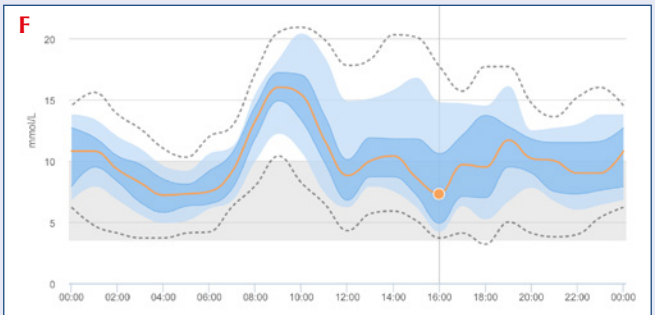


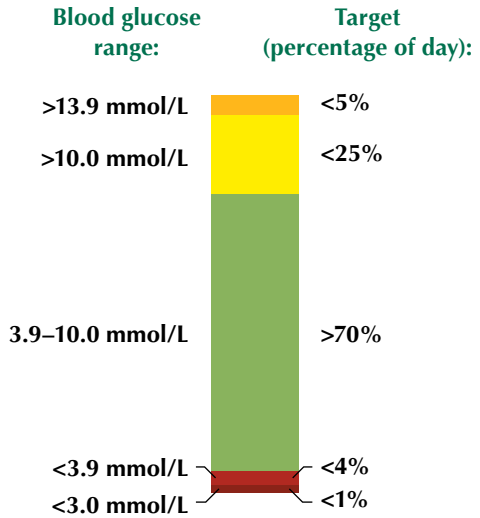
Image source: Dexcom Clarity

Box 2. Time in Range (TIR)

Overall goal (type 1 and 2 diabetes):
Aim for >70% of the day with
Time In Range (3.9–10.0 mmol/L)

Priority 1:
Minimise **Time Below Range (<3.9 mmol/L)**

Priority 2:
Then minimise **Time Above Range (>10.0 mmol/L)**



Note: Other targets are recommended in cases of frailty or pregnancy

Data review: Top tips

- Respect the person's data and avoid negative language: see *How to find the ideal words in consultations*
- For data interpretation, see *Quick guide: Interpreting CGM data*
- Common areas causing variability and/or reduced TIR include:
  - ➤ Limited sensor glucose data (insufficient isCGM scanning).
  - ➤ Unsuitable TIR targets.
  - ➤ Inappropriate alarm/alert settings.
  - ➤ Incorrect timing of insulin.
  - ➤ Incorrect dose of insulin.
  - ➤ Under-reacting to glucose levels.
  - ➤ Over-reacting to glucose levels.
  - ➤ Overtreating hypoglycaemia.
  - ➤ Poor injection technique to include injecting into areas of lipohypertrophy.
- For information of appropriate insulin management, see *The Six Steps to Insulin Safety* e-Learning module.
- For information on appropriate injection technique, visit Injection Technique Matters

Resources

For healthcare professionals:

- Diabetes technology Network
- Leicester Diabetes Centre/ EDEN: *Implementing Glucose Sensing in Primary Care* e-Learning modules

Manufacturers' resources:

- Abbott FreeStyle Libre
- Dexcom ONE
- GlucoRx AiDEX