# CONTINUOUS GLUCOSE SELF-MONITORING IN DIABETES GUIDELINE

<table>
<tr><th colspan="3">GENERAL OVERVIEW OF GLUCOSE SELF-MONITORING METHODS</th></tr>
<tr><th>Finger prick glucose testing</th><th colspan="2">Continuous glucose monitoring (CGM)</th></tr>
<tr><td rowspan="2">Choice from current local formulary (type 2DM & obstetrics)<br><br>COMPONENTS = blood glucose meter & finger prick device + matching blood glucose testing strips & lancets</td><td>isCGM</td><td>rtCGM</td></tr>
<tr><td>requires user to intermittently scan (is) to send and display the glucose values from last 8hrs, also known as “flash”CGM<br><br>i.e. Freestyle Libre 2 (14-days sensor)<br><br>COMPONENTS of isCGM = sensor + reader (via mobile app or reader device)<br><br>NB. Freestyle Libre 3 is a rtCGM and is not available for initiation or prescribing within primary care</td><td>automatically sends and displays the glucose values in real time (rt), some may be directly linked with insulin pump into hybrid closed-loop system or suspend function<br><br>i.e. Dexcom (10-days sensor & 3-months transmitter), Enlite, Freestyle Libre 3, Glucomen Day, GlucoRx Aidex, Guardian, TouchCare Nano<br><br>COMPONENTS of rtCGM = sensor (may require separate transmitter) + reader (via mobile app, reader device or insulin pump)</td></tr>
<tr><td>Measures glucose level in capillary blood</td><td colspan="2">The CGM systems measure glucose in interstitial fluid. The lag time between changes in blood glucose and interstitial fluid glucose may impair accuracy and reliability of CGM during rapidly changing blood glucose levels.</td></tr>
</table>

**Tip:** Continuous glucose monitoring (CGM) should be offered as the 1st line method of glucose monitoring for patients with type 1 diabetes and only those patients with type 2 or gestational diabetes who are on insulin multiple daily injections (MDI) or insulin pump requiring blood glucose testing more than 8x a day.

## LOCAL PATHWAY FOR CGM INITIATION (isCGM or rtCGM)

**INITIATION**

- specialist diabetes consultant
- diabetes specialist nurse
- diabetes specialist dietitian
- diabetes specialist midwife
- primary care clinician with special interest, training and experience in diabetes

upon referral from primary care team

**ONGOING REVIEW**

- initial review at 3 months and 6 months, then every 6-12 months **with the initiating specialist team or clinician**
- following each review a clinical letter to be shared with primary care prescriber detailing ongoing glucose targets and management plan

**ONGOING PRESCRIBING**

- initiating clinican to provide **ONE SENSOR (10-14 days supply)** when requesting ongoing prescribing from primary care
- transferred to primary care with details of individual monitoring targets, management plan and date/time frame of the next planned review with the initiating team (specialist)/clinician

# Type 2 Diabetes

**Glucose monitoring advice for patients with type 2 DM depends on clinical management, treatment, and clinical presentation.**
Initiation and ongoing monitoring review to be provided by specialist diabetes team or primary care clinicians with special interest, training, and experience in diabetes

<table>
<tr><th>DIET + LIFESTYLE CONTROLLED</th><th>ORAL THERAPY & NON-INSULIN INJECTABLES</th><th colspan="2">INSULIN</th></tr>
<tr><td rowspan="3">✗<br>Routine glucose monitoring not recommended</td><td>(in monotherapy or combination)<br>- metformin<br>- SGLT2 inhibitors (flozins)<br>- GLP-1 agonists<br>- pioglitazone<br>- DPP-4 inhibitors (gliptins)</td><td colspan="2">✓<br>Offer routine glucose monitoring</td></tr>
<tr><td rowspan="2">✗<br>Routine glucose monitoring not recommended<br><br>UNLESS:<br>▪ on oral meds linked to risk of hypo (SULFONYLUREAS: gliclazide, glimepiride, glipizide, tolbutamide or MEGLITINIDES: repaglinide, nateglinide) -<br>provide DVLA testing advice<br>▪ episodes of hypo/ suspected hypo<br>▪ pregnant or planning<br><br>✓<br>Offer capillary blood glucose</td><td>If testing requirements up to 8x day<br>⇩<br>offer<br>CAPILLARY blood glucose TESTING<br>with a glucose monitor from the current agreed local formulary</td><td>▪ testing requirements of 8x day or more<br>▪ recurrent/ severe hypo<br>▪ hypo unawareness<br>▪ medical condition/ dissability so patient unable to self monitor or requires carrer input (i.e. learning disability, cognitive impairment)<br>⇩<br>Offer isCGM (“flash”) i.e. Freestyle Libre 2<br>Consider rtCGM only if same/lower NHS cost</td></tr>
<tr><td>In addition patients to be provided with blood glucose monitor, corresponding testing strips and lancets for CGM calibration and back up (especially while driving as advised by DVLA).<br>The testing strips and lancets should be available to patients on repeat prescription and provided on “when required” basis.</td></tr>
<tr><td colspan="2">When starting oral/iv corticosteroids consider short term glucose self monitoring followed by treatment review.</td><td colspan="2">Lorry and bus drivers (Group 2 drivers) on insulin require frequent blood glucose capillary testing while driving in a professional capacity (CGM systems are not permitted as evidence by DVLA for Group 2 drivers).</td></tr>
</table>

# Type 1 Diabetes

**CGM is the preferred method and should be offered for routine glucose monitoring to all patients with DM type 1 on insulin**

Initiation and ongoing monitoring review to be provided by specialist diabetes team upon referral or primary care clinicians with special interest/expertise

<table>
<tr><td colspan="2">ON INSULIN MULTIPLE DAILY INJECTIONS<br>Based on patient's preferences and system functionality, offer a choice of:</td><td colspan="2">ON INSULIN PUMP<br>Based on patient's preferences and system functionality, offer a choice of:</td></tr>
<tr><td>rtCGM<br>i.e. Dexcom One, GlucoMen Day, GlucoRx AiDEX</td><td>isCGM<br>i.e. Freestyle Libre 2</td><td>rtCGM<br>choice is predominantly based on compatibility with the pump (i.e. integration into hybrid closed-loop delivery system, or "suspend" function)</td><td rowspan="2">isCGM<br>no direct/real time pump integration<br>i.e. Freestyle Libre 2</td></tr>
<tr><td colspan="2">The CGM systems listed above are available for prescribing in primary care, therefore are suggested 1st line choice for patients with type 1 diabetes on MDI, who do not require integration with an insulin pump</td><td>Some rtCGM systems are not available for prescribing in primary care and are only accessible via NHS Supply chain/IFR generated by the diabetes specialist team<br>i.e. Freestyle Libre 3, Dexcom G6 & G7, Guardian 3 &4, Enlite, TouchCare Nano</td></tr>
<tr><td colspan="4">In addition patients to be provided with capillary blood glucose monitor, corresponding testing strips and lancets for CGM calibration and back up (especially while driving as advised by DVLA). The testing strips and lancets should be available to patients on repeat prescription and provided on "when required" basis. Lorry and bus drivers (Group 2 drivers) on insulin require frequent blood glucose capillary testing while driving in a professional capacity (CGM systems are not permitted by DVLA for professional drivers i.e. Group 2 drivers).</td></tr>
</table>

**IF PATIENT UNABLE/DOES NOT WISH TO USE CGM**

**Self-monitoring of capillary blood glucose – to be offered as 2nd line**

- Blood glucose (BG) to be measured minimum of 4x day – before each meal and at bedtime (minimum Rx qty 200 strips/28 days)
- Advise to measure BG up to 10x day (minimum Rx qty 300 ~~250~~ strips/28 days) when:
  - Target HbA1c not reached
  - Frequent hypos or impaired hypo awareness
  - During illness
  - Before, during and after sport
  - During/planning pregnancy or breastfeeding
- Enable additional BG testing if necessary (could be more than 10x day) due to:
  - Lifestyle (i.e. lorry/bus drivers, undertaking high risk activities, high risk occupation, travelling)
  - Impaired hypo awareness

| |
|---|
| - Professional bus/lorry drivers (Group 2 drivers) on insulin require 2-hourly capillary blood glucose testing while driving in a professional capacity (DVLA) |
| Where a patient has no preference/request for a specific blood glucose monitor (due to functionality/connectivity) offer any glucose monitor from the current agreed local formulary (most cost effective testing strips and lancets) |

## GESTATIONAL DIABETES AND DIABETES IN PREGNANCY

**Glucose monitoring advice depends on clinical presentation and treatment**

Initiation and ongoing monitoring review to be provided by specialist joint diabetes and antenatal care team upon referral

<table>
<tr><td rowspan="2">DIET + LIFESTYLE CONTROLLED</td><td rowspan="2">ORAL THERAPY (METFORMIN) AND/OR SINGLE DOSE INTERMEDIATE OR LONG-ACTING INSULIN</td><td colspan="2">INSULIN MULTIPLE DAILY INJECTIONS</td></tr>
<tr><td>type 1 DM</td><td>type 2 DM or gestational diabetes</td></tr>
<tr><td colspan="2">DM type 2 or gestational diabetes</td><td rowspan="4">offer rtCGM as 1st line<br>(preferably with insulin pump)<br>⇩<br>If patient unable to use or has preference offer isCGM (“flash”) system as 2nd line choice i.e. Freestyle Libre 2<br>⇩<br>If patient unable to use or has preference offer 3rd line capillary blood glucose testing.<br>Testing advice: fasting, pre-meal, 1 hr post-meal and at bedtime daily</td><td>If testing requirements up to 8x day<br>⇩<br>offer CAPILLARY BLOOD GLUCOSE TESTING with a glucose monitor from the agreed current local formulary<br>Testing advice: fasting, pre-meal, 1 hr post-meal and at bedtime daily</td></tr>
<tr><td colspan="2" rowspan="3">offer CAPILLARY BLOOD GLUCOSE TESTING with a glucose monitor from the current agreed local formulary<br>Testing advice: fasting and 1-hr post meal daily</td><td>For patients presenting with:<br>▪ testing requirements of 8x day or more<br>▪ recurrent/ severe hypo<br>▪ hypo unavareness<br>▪ medical condition/ dissability so patient unable to self monitor or requires carrer input (i.e. learning disability, cognitive impairment)<br>⇩<br>offer isCGM (“flash”) system as 1st line i.e. Freestyle Libre 2</td></tr>
<tr><td>Consider rtCGM only if severe hypo or unstable BG levels despite efforts and only for a total duration of 12 months including pre-conceptual period, pregnancy, and the immediate post-partum period.</td></tr>
</table>

## GLUCOSE MONITORING TARGETS

| | |
|---|---|
| **type 1 DM** | - fasting on waking 5-7 mmol/L<br>- Before meals 4-7 mmol/L<br>- After meals (at least 90min after eating) 5-9 mmol/L<br><br>Target HbA1C ≤ 48 mmol/mol (6.5%) but needs to be individualised for each patient according to clinical presentation. |
| **type 2 DM** | Target HbA1C ≤ 48 mmol/mol (6.5%) for patients managed by lifestyle & diet ± single drug not linked to risk of hypo.<br><br>Target HbA1C ≤ 53 mmol/mol for patients managed with drugs associated with the risk of hypo (sulfonylureas, meglitinides).<br><br>If HbA1C ≥ 58 mmol/mol and managed with a single drug → reinforce diet & lifestyle advice + assess drug adherence and if appropriate intensify the treatment<br><br>Target HbA1C needs to be individualised for each patient according to clinical presentation i.e. consider:<br>- life expectancy<br>- significant comorbidities<br>- risk of hypo unawareness<br>- risk of or history of falls<br>- skilled tasks i.e. driving or operating machinery |
| **pregnant patients with any form of diabetes** | - fasting ≤ 5.3 mmol/L<br>- 1 hour after meals ≤ 7.8 mmol/L<br>- 2 hours after meals ≤ 6.4 mmol/L<br>- If on insulin, to maintain BG level above 4 mmol/L<br><br>Target HbA1C for pre-existing diabetes ≤ 48 mmol/mol (6.5%) |

## SUMMARY OF DVLA GLUCOSE MONITORING REQUIREMENTS

- CGM (isCGM i.e. “flash” and rtCGM) is suitable for glucose monitoring for driving purposes for Group 1 drivers, but not for Group 2 (bus and lorry) drivers who require capillary blood glucose monitoring (may be prescribed in addition to CGM).
- Patients using CGM for routine blood glucose monitoring are to be provided with capillary blood glucose monitor, corresponding testing strips and lancets for CGM calibration and back up especially while driving – GB meter to be carried in the vehicle. The testing strips and lancets should be available to patients on repeat prescription and provided on “when required” basis.
- Group 1 drivers on insulin are advised to check glucose levels up to 2 hours before the start of the journey, 2 hours afterwards and then every 2 hours while driving – CGM is regarded by DVLA as suitable for this purpose.
- Group 1 drivers on oral meds linked to risk of hypo (sulfonylureas, meglinitides) are advised to check glucose levels up to 2 hours before the start of the journey, 2 hours afterwards and then every 2 hours while driving. Therefore, ~~may~~ require capillary BG monitoring and prescription for testing strips and lancets on “when required” basis.
- Group 2 drivers (bus and lorry) on insulin, sulfonylurea or meglitinide require regular capillary blood glucose monitoring at least twice a day including on non-driving days and, are advised to check glucose levels up to 2 hours before the start of the journey, 2 hours afterwards and then every 2 hours while driving – CGM is not suitable for this purpose. The BG monitor must hold 3 months of readings.

**REFERENCE RESOURCES:**

Assessing fitness to drive: a guide for medical professionals, DVLA guidance, published: May 2022, http://www.gov.uk/dvla/fitnesstodrive

Diabetes in pregnancy: management from preconception to the postnatal period, NICE guideline NG3, published: 25 February 2015, https://www.nice.org.uk/guidance/ng3

Type 1 diabetes in adults: diagnosis and management, NICE guideline NG17, published: 26 August 2015, https://www.nice.org.uk/guidance/ng17

Type 2 diabetes in adults: management, NICE guideline NG28, Published: 2 December 2015, https://www.nice.org.uk/guidance/ng28