Inpatient use of

Continuous Glucose Monitors

**Summary Guideline**

**Jan 2024**

**Inpatient use of Continuous Glucose Monitors – Short Guideline**

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For more information contact:  
Health Improvement Unit, Queensland Diabetes Clinical Network, Department of Health, GPO Box 48, Brisbane QLD 4001, email [QldDiabetesNetwork@health.qld.gov.au](mailto:QldDiabetesNetwork@health.qld.gov.au).

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# General

Continuous Glucose Monitors (CGM) are devices used by people living with diabetes (PwD) as part of routine insulin treated diabetes management in the community. Intermittently scanned CGM (isCGM) and real-time CGM (rtCGM) measure interstitial glucose via a filament that sits under the skin within the subcutaneous tissue. PwD may also have configured customisable alerts to notify them of hypoglycaemia or hyperglycaemia.

Throughout this guideline both rtCGM and isCGM are collectively referred to as CGM. CGM sensors are typically placed on the abdomen or upper arm with each sensor-life between 7-14 days. Although, no CGM device is currently approved by the Therapeutic Goods Administration for inpatient use, in certain clinical circumstances, it may be beneficial for CGM use to continue in hospital(1). More information regarding individual types of available CGM can be found in the accompanying supporting documentation.

# Scope

This summary guideline aims to outline the following for adults living with diabetes using CGM whilst hospitalised at Queensland Health acute care facilities:

* Scenarios suitable for continued wear and interpretation of CGM
* Scenarios in which wear and use of CGM is not recommended
* Recommended clinical workflow for PwD and clinical staff caring for those using CGM

This guideline **does not** provide guidance on the following:

* Initiation of CGM for hospitalised PwD
* Insulin pump including CGM connected insulin pumps
* Self-management of diabetes in hospital
* Routine care of diabetes in hospital
* People without diabetes who are using CGM

# Definitions

The guidelines refer to both ‘wearing’ a CGM and ‘using’ a CGM, which may be appropriate in different clinical contexts.

**Wear** – The PwD continues to wear their CGM. Associated alerts and alarms may inform need to perform additional point of care capillary blood glucose (POC CBG) checks, but CGM values are otherwise not utilised by the clinical team.

**Use** –The PwD continues to wear their CGM and utilises CGM readings in conjunction with POC CBG monitoring to inform glucose management in hospital.

# Clinical Scenarios

#### Potential suitable candidates for continued wear and use of CGM in hospital

#### Existing users of CGM who can continue to self-manage and interpret their CGM whilst hospitalised

An existing CGM user can continue to wear and use their CGM whilst hospitalised in clinically appropriate scenarios. CGM values should be reviewed and entered into the medical record at the clinically appropriate interval (ie. Before meals, 2100 and 0200) consistent with standard POC CBG monitoring protocols. Confirmatory POC CBG may be required in clinical scenarios detailed below.

**Contraindications for continued CGM use**

**PwD who cannot self-manage or cannot access an appropriate carer/guardian to manage and interpret the CGM on their behalf.**

This includes the following clinical scenarios:

* PwD unable to wear CGM safely (eg. extensive skin condition)
* PwD unable to scan isCGM (Freestyle Libre 2)
* PwD unable to access a suitable reader device (phone or CGM reader), including during any invasive procedure.
* PwD unable to safely alert clinical staff in setting of hypoglycaemia and or hyperglycaemia alarms
* PwD unable to replace CGM sensors when required.

**Clinical situations in which accuracy of CGM may be significantly compromised.**

This includes, but is not limited to the following clinical scenarios:

* Critically unwell patients
* Haemodialysis or peritoneal dialysis
* During surgery or other invasive procedures
* Hyperglycaemic emergencies (Diabetic Ketoacidosis and Hyperglycaemic Hyperosmolar Syndrome)

Standard POC CBG monitoring at clinically appropriate intervals should replace CGM whilst use is contraindicated. PwD may continue to wear the CGM if safe to do so and no requirement to remove CGM (see below).

**CGM devices should be removed in the below scenarios**

* Magnetic Resonance Imaging (MRI)
* Computed Tomography (CT) scan
* Direct Current Cardioversion / Cardiac Arrest
* CGM sited within anticipated surgical or diathermy field
* Extensive skin condition
* CGM user is unable to self-manage the CGM within the remaining lifespan of the current sensor
* CGM user is unable to self-manage the CGM for an anticipated significant period of time

Ideally, the CGM user should remove their own CGM device. If they are unable to do so, clinical staff should remove, label and store the device securely.

## POC capillary blood glucose levels

**Point of care capillary blood glucose levels (POC CBG) are required in addition to CGM measures in the following scenarios**

* Confirmatory POC CBG at standard timing is recommended if the PwD is not able and/or suitable to self-manage their diabetes, including self adjustment of insulin whilst hospitalised.
* Suspected Hypoglycaemia
  + If CGM detects hypoglycaemia (<4.0mmol/L) or if the PwD reports symptoms of hypoglycaemia.
  + Capillary POC CBG should be rechecked every 10-15 minutes until resolution of hypoglycemia.
  + Treatment of hypoglycaemia is as per standard Queensland Health protocols.
* Hyperglycaemia
  + If CGM detects persistent hyperglycaemia >16mmol/L
* Clinical scenarios in which CGM glucose values may be inaccurate, including:
  + Exposure to potentially interfering medications (Table 1)
  + Rapid fluid shifts (eg. Ascites drainage)
  + Poor tissue perfusion (eg. Hypotension or hypothermia)
  + Rapid glucose changes (eg after exercise stress test or physiotherapy exercises)
  + Any other situation where there is concern regarding accuracy of the CGM value.
* CGM has been inactive for a period of time due to contraindication (eg. if PwD undergoing surgical procedure)
* CGM utilised requires regular calibration (Medtronic Guardian 3)

Additionally, intermittent POC CBG to confirm the accuracy of CGM readings may be performed to inform treatment decisions.

**CGM readings are deemed inaccurate if the following criteria are met**

* **CGM value >5.6mmol/L: ≥20% absolute difference between CGM and fingerstick**
* **CGM value ≤5.6mmol/L: >1.1mmol/L absolute difference between CGM and fingerstick**

If CGM readings are identified to be inaccurate, more frequent POC CBG is recommended. The CGM user should attempt calibration if able. If inaccuracy is persistent, the CGM sensor could be replaced OR standard POC CBG should be utilised. Further information regarding troubleshooting is available on the accompanying clinical staff information sheet.

|  |  |  |
| --- | --- | --- |
| **Medication** | **CGM device** | **Effect** |
| Paracetamol >4g / day  Paracetamol – any dose | Dexcom G6  Medtronic Guardian 3  Medtronic Guardian 4 | CGM values may be higher than actual glucose  CGM values may be higher than actual glucose |
| Alcohol | Medtronic Guardian 3\* | CGM values may be higher than actual glucose |
| Ascorbic acid (vitamin C), >500 mg/day | Freestyle Libre 2 | CGM values may be higher than actual glucose |
| Hydroxyurea | Dexcom G6, Medtronic Guardian 3\* | CGM values may be higher than actual glucose |

Table 1. Potentially interfering medications

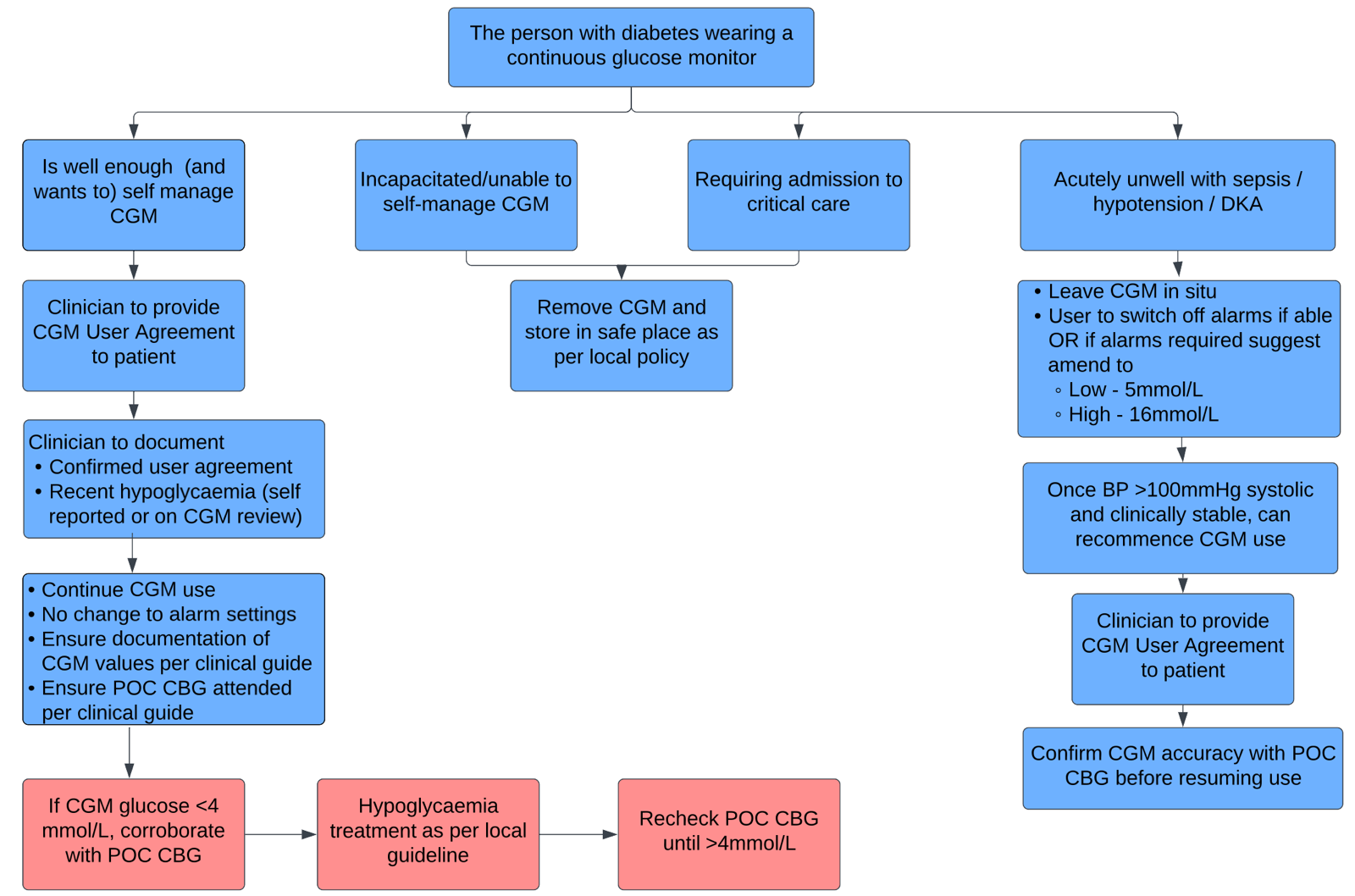
\*Note, Medtronic Guardian 4 is new to market with limited post-marketing testing performed to date

## Specific complex clinical scenarios

* Kidney disease:
  + PwD and chronic kidney disease (non-dialysis) may continue to use CGM. Insertion of CGM into areas of oedema should be avoided.
  + POC CBG are required for those managed with haemodialysis or peritoneal dialysis.
* Peri-operative:
  + Insulin infusions: Hourly capillary POC CBG should be performed to guide titration rather than CGM values.
  + CGM use is not recommended intra and post-operatively whilst PwD is unable to self-manage and interpret the CGM device.
  + CGM devices can remain in situ if deemed appropriate by the anaesthetic and surgical team.
  + CGM devices should be sited away from the surgical site, diathermy pads or any sites that are likely to be subject to compression (eg. abdomen in a prone patient or underneath blood pressure cuff
  + Confirmatory POC CBG should be performed following invasive procedures to confirm accuracy prior to resumption of CGM use. Minor procedures are less likely to impact accuracy.
* Pregnancy:
  + Insulin infusions: Hourly capillary POC CBG should be performed to guide titration rather than CGM values.
  + Labour/Caesarian section: CGM can be used during labour at the discretion of the obstetrician/physician. Recommendations for Caesarean section are as per perioperative section as above. The CGM sensor should be sited away from the abdomen or surgical site.
* Medical Imaging:
  + CGM may be worn during X-ray and angiography. Lead shield protection could be utilised.
  + Confirmatory POC CBG should be performed following any exposure to X-rays or CT to confirm accuracy.
* Palliative Care:
  + Consider therapeutic aim and potential psychological stressors of continuation or cessation of CGM. CGM is likely to be less accurate with decreased tissue perfusion. Where possible, document patient wishes in advance.

**Responsibilities of clinical staff**

* Identification and recognition the PwD is wearing a CGM
* Clinician to confirm suitability to continue to wear and use CGM device
* Clinician to provide the user agreement
* Clinician to document acknowledgement of CGM user agreement and history of hypoglycaemia
* Nursing staff to document CGM values within POC CBG field within the medical record. A comment identifying that the measure was from a CGM device is required.
* Nursing staff to perform appropriate confirmatory POC CBG testing as per above recommendations.
* Clinician to identify requirement to remove CGM in appropriate clinical scenarios.

**Recommended Clinician Workflow**

**Recommended documentation required once CGM user identified**

Standardised documentation by clinical staff will identify that PwD and clinical staff are aware of the recommendations within this clinical guide. Documenting history of hypoglycaemia assists in determining whether any recorded hypoglycaemic events are ‘acquired’, an important metric for safety and quality of inpatient diabetes care. It is recommended the following is documented:

*PwD is currently using a CGM device. They have been provided and acknowledged the CGM user agreement outlining responsibilities for the CGM user and clinical staff.*

*There is NO history of recent or severe hypoglycaemia (< 3mmol/L or requiring third party assistance) as reported by patient OR on CGM download*

*OR There IS a history of recent or severe hypoglycaemia (< 3mmol/L or requiring third party assistance) as reported by patient OR CGM download*

**Responsibilities for CGM user**

* To provide all required CGM consumables
* To self-manage the CGM device
* CGM use to alert the care team if hypoglycaemia/hyperglycaemia related alarms
  + There is no requirement to adjust existing alarm settings, however CGM users could consider a low alarm set at 4-5mmol/L and a high alarm set at 16mmol/L.

**Additional documentation (link)**

* Full guideline with supporting evidence
* Basic CGM information for clinical staff
* Patient agreement outlining responsibilities for CGM use in hospital.

# References

1. Korytkowski MT, Muniyappa R, Antinori-Lent K, Donihi AC, Drincic AT, Hirsch IB, et al. Management of Hyperglycemia in Hospitalized Adult Patients in Non-Critical Care Settings: An Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab. 2022;107(8):2101-28.