The East of England
Priorities Advisory Committee
A function of PrescQIPP

GUIDANCE STATEMENT

Continuous glucose monitoring (CGM) in adults age 19 and older

PAC recommendations

Summary of criteria recommended for funding. All recommendations apply to patients with type 1 diabetes mellitus (T1DM) only.

1. Adults who have more than one episode a year of severe hypoglycaemia resulting in temporary cognitive impairment requiring external assistance for recovery, despite optimisation of diabetes care, defined as:
   - Severe hypoglycaemia requiring the assistance of another person to administer carbohydrates, glucagon, or take other corrective actions.
2. Adults with persistent hypoglycaemia unawareness (see a and b below) with disabling hypoglycaemia (see c below), despite optimised diabetes care or where the person is unable to communicate symptoms of hypoglycaemia with disabling hypoglycaemia (see c below).

   a. Score ≥4 on the Clarke hypoglycaemia unawareness questionnaire OR score ≥4 on the Gold hypoglycaemia unawareness Likert scale

   b. Evidence of incidentally detected hypoglycaemia episodes from downloaded blood glucose monitoring data/significant hypoglycaemia lasting >15 minutes confirmed by diagnostic CGM or downloaded blood glucose monitoring data, that occurred during the waking day which the patients were unaware of or unable to communicate for example, because of cognitive or neurological disabilities.

   c. Disabling hypoglycaemia is defined as repeated and unpredictable episodes of hypoglycaemia that results in persistent anxiety about recurrence and is associated with a significant adverse effect on quality of life. Disabling hypoglycaemia is associated with one or more of the following features:
   - High frequency of blood glucose testing (≥8 tests per day)
   - High frequency of blood glucose testing during night that disturbs sleep
   - Persistent efforts to maintain high blood glucose levels in excess of the recommended maximum target in order to avoid hypoglycaemic episodes, that adversely affect metabolic control.
3. Routine funding for any other patients is considered a low priority and is not recommended.
4. Short term use of CGM for diagnostic purposes is included within the National Tariff and should not be separately funded.
5. The use of CGM will be audited and these recommendations will be reviewed after one year.

Background

Continuous glucose monitoring (CGM) with alarms

The technology

CGM devices consist of three key components:[1]

- A subcutaneous sensor that measures interstitial glucose levels
- A transmitter that sends readings to a display device
- A display device that shows interstitial glucose levels. This might be a separate hand held device (known as "standalone" CGM) or a pump (known as an "integrated system")

All CGM devices have an alarm function to alert the patient to episodes of hypoglycaemia. Integrated devices are capable of suspending insulin infusion when blood glucose (BG) falls below a pre-set level or suspend insulin infusion when hypoglycaemia is predicted from interstitial glucose readings. A summary of device features can be seen in appendix 1.

CGM systems require calibration using finger-prick blood glucose testing a minimum of twice a day. Finger-prick testing using a blood glucose meter is still required during times of rapidly changing glucose levels when interstitial fluid glucose levels may not accurately reflect blood glucose levels (i.e. acute illness such as influenza, diarrhoea and vomiting), or if hypoglycaemia or impending hypoglycaemia is reported, or the symptoms do not match the system readings.[2]

All devices require a minimum level of expertise and understanding on how to use them, interpret readings and take appropriate action, and require a commitment from the patient/carer to use appropriately and therefore not all devices may be suitable for all patients.[2,3]

Intermittent interstitial glucose monitoring (iGM) or Flash Glucose Scanning systems (FGS) e.g. Freestyle Libre® currently does not alarm if glucose levels are high or low.[4] The use of iGM/FGS e.g. Freestyle Libre® is not considered in this document.

NICE guidance

The 2015 NICE guideline [NG17] for diagnosis and management of T1DM in adults does not recommend routine use of real time CGM in adults, but states that CGM may be considered in certain patients.[5]

- Consider real time CGM for adults with T1DM who are willing to commit to using it at least 70% of the time and to calibrate it as needed, and who have any of the following despite optimised use of insulin therapy and conventional blood glucose monitoring:
  - More than one episode a year of severe hypoglycaemia with no obviously preventable precipitating cause.
  - Complete loss of awareness of hypoglycaemia.
  - Frequent (more than two episodes a week) asymptomatic hypoglycaemia that is causing problems with daily activities.
  - Extreme fear of hypoglycaemia.
  - Hyperglycaemia (HbA1c level of 75 mmol/mol [9%] or higher) that persists despite testing at least ten times a day. Continue real time CGM only if HbA1c can be sustained at or below 53 mmol/mol (7%) and/or there has been a fall in HbA1c of 27 mmol/mol (2.5%) or more.
- For adults with T1DM who are having real time CGM, use the principles of flexible insulin therapy with either a multiple daily injection insulin regimen or continuous subcutaneous insulin infusion (CSII or insulin pump) therapy.

Real-time CGM should be provided by a centre with expertise in its use, as part of strategies to optimise a person's HbA1c levels and reduce the frequency of hypoglycaemic episodes.

The NICE Guidance Development Group concluded that current data do not support the routine use of CGM and that while there is some evidence of clinical benefit, this is not compelling and it is not currently a cost-effective intervention.[5]

The NICE guideline [NG3] for diabetes in pregnancy: management from preconception to the postnatal period, states:[6]

- Do not offer CGM routinely to pregnant women with diabetes.
- Consider CGM for pregnant women on insulin therapy:
  - Who have problematic severe hypoglycaemia (with or without impaired awareness of hypoglycaemia) or
  - Who have unstable blood glucose levels (to minimise variability) or
  - To gain information about variability in blood glucose levels.

NICE Diagnostic Guidance (DG21) makes the following recommendations on the use of the MiniMed Paradigm Veo:[2]

The MiniMed Paradigm Veo system is recommended as an option for managing blood glucose levels in people with type 1 diabetes only if:

- They have episodes of disabling hypoglycaemia despite optimal management with continuous subcutaneous insulin infusion and
- The company arranges to collect, analyse and publish data on the use of the MiniMed Paradigm Veo system.

The MiniMed Paradigm Veo system should be used under the supervision of a trained multidisciplinary team who are experienced in continuous subcutaneous insulin infusion and CGM for managing T1DM only if the person or their carer:

- Agrees to use the sensors for at least 70% of the time
- Understands how to use it and is physically able to use the system and
- Agrees to use the system while having a structured education programme on diet and lifestyle, and counselling.

People who start to use the MiniMed Paradigm Veo system should only continue to use it if they have a decrease in the number of hypoglycaemic episodes that is sustained. Appropriate targets for such improvements should be set.

NICE DG21 does not support the routine use of the Animas Vibe and Dexcom G4 Platinum CGM systems.[2] The NICE Medtech Innovation Briefing (MIB51) reviews the MiniMed 640G system (Medtronic) system but makes no specific recommendations on its use.[7] However, experience of using the technologies is developing, and feedback from East of England (EoE) clinicians is that in practice, all these systems are in use with good outcomes for patients. CGM technologies are developing quickly with more devices coming on to the market. This document does not seek to recommend a particular device. Since writing this document, Medtronic have launched the MiniMed 670G closed loop integrated insulin pump/CGM system. This document does not look at the place of this new technology in therapy.

The high cost of CGM devices and consumables prohibits the routine commissioning of CGM for all groups of patients for who NICE recommend CGM should be considered. PAC have worked with clinicians in the EoE to identify patient groups to which the provision of this treatment should be targeted. PAC supports use in patients in the priority patient groups specified in this document. Use in other patient groups, including use in pregnancy, is currently considered a low priority for funding.

The NHS Long Term Plan published in January 2019 states that by 2020/21, all pregnant women with T1DM will be offered CGM, helping to improve neonatal outcomes.[5] At the time of writing, no details

were available on funding arrangements to support the implementation of this service development. These recommendations will be reviewed when more information is available.

General funding recommendations

CGM must be initiated and managed by a consultant-led specialist diabetes team.

Funding approval including treatment aims, continuation and stopping criteria must be agreed with the Commissioner before commencement of treatment – see individual criteria below.

Funding should be provided for an initial period of six months and reviewed every 12 months.

Funding should be continued where there is evidence of:

- Achievement of treatment goals specified for each criteria below.
- Evidence for need for continuation of treatment e.g. evidence of continued hypoglycaemia unawareness as agreed with Commissioner prior to commencement of treatment.

Funding for treatment should be discontinued where:

- Patient/carers are unable to cope with sensor/managing technology despite intensive support by the diabetic team.
- Failure to wear the sensor >70% of the time.[2]
- Failure to achieve treatment goals specified for each criteria.

Diabetes teams must ensure that:

- The motivation of the patient and their ability to manage the technology appropriately has been assessed.
- Patients are given education and training in the use of the CGM.

Before commencing treatment, clinicians must agree a contract with the patient agreeing the treatment aims and terms of use e.g. agree to use the sensors for at least 70% of the time, and confirming that they understand that:

- Funding for treatment will be withdrawn if treatment aims are not met or the technology is not used as per the agreed treatment plan.
- The need for ongoing CGM will be reviewed and that it will be discontinued at an appropriate time.

Teams must submit data on use of CGM annually to commissioners for the purposes of audit of the use of CGM technology.

PAC recommendations and rationale

Recommendation 1

Adults who have more than one episode a year of severe hypoglycaemia resulting in cognitive impairment requiring external assistance for recovery, despite optimisation of diabetes care, defined as:[9]

- Severe hypoglycaemia requiring the assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions.

Rationale

Severe hypoglycaemic episodes often cause significant adverse events such as seizures, and can result in permanent structural changes in the brain.

Additionally, anxiety about the recurrence following a severe hypoglycaemic event leads to high frequency of blood glucose testing (≥8 tests per day) including testing during the night that disturbs

sleep which is associated with a significant adverse effect on quality of life, and persistent efforts to maintain high blood glucose levels in excess of the recommended maximum target in order to avoid hypoglycaemic episodes, that adversely affect metabolic control.

Treatment aims

- Reduction in the number of hypoglycaemic events
- Achievement and maintenance of target HbA1c agreed by the Diabetes Team
- Reduce blood glucose variability
- Improve quality of life

Entry criteria

More than one episode a year of severe hypoglycaemia requiring the assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions despite optimised diabetes care.

Review and stopping criteria

- Review at six months and subsequently every 12 months against treatment aims and compliance criteria.
- Three month trial without CGM after three years treatment. Need for continued treatment assessed against criteria for funding CGM and Flash Glucose Scanning systems.

Recommendation 2

Adults with persistent hypoglycaemia unawareness (see a and b below) with disabling hypoglycaemia (see d below), despite optimised diabetes care, or where the person is unable to communicate symptoms of hypoglycaemia with disabling hypoglycaemia (see c below).

a) Score ≥4 on the Clarke hypoglycaemia unawareness questionnaire OR score ≥4 on the Gold hypoglycaemia unawareness Likert scale

b) Evidence of incidentally detected hypoglycaemia episodes from downloaded blood glucose monitoring data/significant hypoglycaemia lasting >15 minutes confirmed by diagnostic CGM or downloaded blood glucose monitoring data, that occurred during the waking day which the patients were unaware of or unable to communicate for example, because of cognitive or neurological disabilities.[10]

c) Disabling hypoglycaemia is defined as repeated and unpredictable hypoglycaemia that results in persistent anxiety about recurrence and is associated with a significant adverse effect on quality of life.[11] Disabling hypoglycaemia is associated with one or more of the following features:

- High frequency of blood glucose testing (≥8 tests per day).
- High frequency of blood glucose testing during night that disturbs sleep.
- Persistent efforts to maintain high blood glucose levels in excess of the recommended maximum target in order to avoid hypoglycaemic episodes, that adversely affect metabolic control.

Rationale

The occurrence of frequent and unpredictable hypoglycaemia in people who are hypoglycaemia unaware or unable to communicate symptoms of hypoglycaemia has significant consequences on the care of the person, and for their quality of life and that of their family/carers. Patients are also anxious about occurrence of severe hypoglycaemia.

The unpredictable nature of hypoglycaemia results in the need for frequent blood glucose testing (≥8 times a day) and often testing during the night or while the person would otherwise be asleep. This has a significant negative impact on the quality of life of the person and the family/carers. The fear of severe hypos lead patients to maintain glucose levels at higher than recommended in order to reduce the risk of hypos, which results in poor control of HbA1c levels and increased risk of long term complications.

People with persistent hypoglycaemia unawareness or where the person is unable to communicate symptoms of hypoglycaemia require a glucose monitoring system with alarms to alert them or their family/carers to a hypoglycaemic event. Flash glucose monitoring does not currently have an alarm and is not a suitable technology for this group of patients.

Treatment aims

- Reduction in the number of hypoglycaemic events
- Achievement and maintenance of target HbA1c agreed by the Diabetes Team
- Reduce blood glucose variability
- Improve quality of life

Entry criteria

- Evidence of incidentally detected hypoglycaemia episodes from downloaded blood glucose data/significant hypoglycaemia lasting >15 minutes confirmed by diagnostic CGM or downloaded blood glucose data, that occurred during the waking day which the patients were unaware of or unable to communicate

AND

- Score ≥4 on the Clarke hypoglycaemia unawareness questionnaire OR score ≥4 or the Gold hypoglycaemia unawareness Likert scale

AND

- Frequent blood glucose testing (≥8 times per day) that is clinically appropriate on the recommendation of the diabetes specialist team, confirmed by data download from the blood glucose testing meter.

Review and stopping criteria

- Review at six months and subsequently every 12 months against treatment aims and compliance criteria.
- Three month trial without CGM after three years treatment. Need for continued treatment assessed against criteria for funding CGM and Flash Glucose Scanning systems.

Cost impact assessment

Cost impact estimates have been based on a range of devices that are currently used in practice, using current known EoE contract prices or list prices. This document does not seek to recommend a particular device.

Patient number estimates are based on audit data from the North West London Collaboration of Clinical Commissioning Group's policy implemented in November 2016.[3,12]

The North West London policy patient criteria differ slightly from PAC recommended criteria and also include use in patients with poorly controlled HbA1c. Overall the criteria are similar and likely to relate to the same magnitude of patients, however patient numbers and estimated cost impact is indicative only. Audit data collected from implementation of the North West London policy indicates that 1.4 patients per 100,000 total population are eligible for CGM under their policy.

Patient numbers

Extrapolating from the North West London audit data on implementation of a policy for funding for similar patient criteria, it is estimated that 1.4 patients per 100,000 total CCG population would be eligible for CGM under the criteria set out in recommendations 1 and 2 of this document.

Cost impact estimate per 100,000 population

System	Cost per 100,000 population per year
Medtronic Guardian2 Link transmitter and Enlite sensor	£5,311
Medtronic Minilink system	£5,032
Dexcom G6 stand-alone system	£3,423

All adults with T1DM are advised to perform blood glucose testing a minimum of four times per day; pre meals to calculate bolus doses of insulin, and before bed time.

Additional tests are required to confirm a result indicating hypoglycaemia, where the result does not match symptoms and during times of illness.

It is estimated that most adults who are managed using insulin pumps blood glucose test on average five times per day. The use of CGM would see a drop in number of blood glucose tests to approximately four tests per day, representing a modest cost saving.

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Document history

PAC approval date	14 January 2019
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Consultation process	PAC members East of England clinicians
QA process	Katie Smith. Senior Clinical Pharmacist PrescQIPP. 27th February 2019

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Appendix 1: Assessment against Ethical and Commissioning Principles

Treatment assessed

Continuous Glucose Monitoring (CGM) for adults

East of England Priorities Advisory Committee Recommendation

- CGM is recommended for patients with Type 1 diabetes mellitus (T1DM) who fulfil one or more of the following criteria:
  - » Adults who have more than one episode a year of severe hypoglycaemia resulting in temporary cognitive impairment requiring external assistance for recovery, despite optimisation of diabetes care, defined as: Severe hypoglycaemia requiring the assistance of another person to administer carbohydrates, glucagon, or take other corrective actions.
  - » Adults with persistent hypoglycaemia unawareness with disabling hypoglycaemia, despite optimised diabetes care or where the person is unable to communicate symptoms of hypoglycaemia with disabling hypoglycaemia.
  - » Routine funding for any other patients is considered a low priority and is not recommended.

Clinical effectiveness

There is limited data on the long term outcomes of using CGM in terms of fewer complications and reduced emergency admissions.

Cost effectiveness

Cost effectiveness of the use of CGM has yet to be established. More data on the cost-effectiveness of CGM is required.

Equity

No issues identified.

Needs of the community

The needs of the community are considered to be low as well established and accurate methods of monitoring glucose exist.

Need for healthcare (incorporates patient choice and exceptional need)

CGM is an emerging technology. It may address issues for those patients who are unable to recognise or communicate the symptoms of hypoglycaemia.

Policy drivers

NICE recommends the use of CGM as an option in certain circumstances, but it is not recommended for routine use.

Disinvestment

CGM is currently a high cost technology and routine funding would require disinvestment in other areas of healthcare provision.

Appendix 1: Summary of available CGM devices[13,14,15]

	CGM component	Insulin pump capable of integration	Key features	Average annual cost[1]	Evidence/NICE review
Integrated pumps with CGM	Medtronic MiniLink transmitter and Enlite sensor	Paradigm Veo (Medtronic)	• Alarm • Suspends insulin infusion if BG < lower limit	**£3,594	NICE DG21:[2] Recommended as option with conditions
	Medtronic Guardian 2 Link transmitter and Enlite sensor	MiniMed 640G*	• Alarm • Suspends insulin infusion if BG predicted to go < lower limit • Allows dose of insulin to be very small	**£3,794	No NICE guidance issued. NICE Medtech innovation briefing (MIB51)[7]
	A6 TouchCare CGM System	A6 TouchCare® (Medtrum)	• Alarm • Fully integrated system with low glucose suspend (LGS) and predictive LGS mechanism • CGM can be used as a standalone system	Not yet known	No NICE guidance issued.
Stand-alone CGM devices	Dexcom G4 Platinum	N/A	• Alarm	***£3,185 (+ receiver £350)	NICE DG21:[2] Insufficient evidence to support routine use as an integrated system for use with insulin pumps.Not considered by NICE as a stand-alone devices.
	Dexcom G5 mobile	N/A	• Alarm	***£3,065 (+ receiver £275)	
	Dexcom G6	N/A	• Alarm	***£2,445 (+ receiver £275)	Not considered by NICE
	Eversense XL CGM system (Roche)	N/A	• Alarm	Not yet known	Not considered by NICE

*Since writing this document, Medtronic have launched the MiniMed 670G closed loop integrated insulin pump/CGM system. This document does not look at the place of this new technology in therapy.
**Based on East of England contract prices June 2018
***List prices provided by Dexcom June 2018 (NB may be eligible for up to 24% bulk purchase discount)