MEDICAL POLICY

Diabetes: Continuous Glucose Monitors (CGM)
(All Lines of Business Except Medicare)

Effective Date: 8/1/2019

Section: DME
Policy No.: 207

Technology Assessment Committee Approved Date:
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Medical Policy Committee Approved Date: 8/01; 8/02; 11/03; 7/04; 6/05; 3/07; 7/07; 1/08; 5/08; 11/09; 12/10; 8/11; 6/13; 2/15; 4/15; 2/16; 5/17; 8/17; 12/17; 1/18; 6/18; 10/18; 8/19

Medical Officer Date

See Policy CPT/HCPCS CODE section below for any prior authorization requirements

SCOPE:

Providence Health Plan, Providence Health Assurance, Providence Plan Partners, and Ayin Health Solutions as applicable (referred to individually as “Company” and collectively as “Companies”).

APPLIES TO:

All lines of business except Medicare

BENEFIT APPLICATION

Medicaid Members

Oregon: Services requested for Oregon Health Plan (OHP) members follow the OHP Prioritized List and Oregon Administrative Rules (OARs) as the primary resource for coverage determinations. Medical policy criteria below may be applied when there are no criteria available in the OARs and the OHP Prioritized List.

POLICY CRITERIA

Note:

- This policy does not apply to patients under the age of 2 years for whom long-term CGM use may be considered medically necessary and covered.

- This policy does not address “closed-loop” or “automated insulin delivery” systems which are now defined by the U.S. Federal Drug Administration as artificial pancreas device systems. Please see the Providence Health Plan, Diabetes: Artificial Pancreas policy, listed in the Policy Cross References section below.

- This policy does not address the FreeStyle Libre Flash™ or Dexcom G5/G6 for personal, long-term use. The FreeStyle Libre Flash and Dexcom G5/G6 is addressed in the Providence
Health Plan Pharmacy Policy: Continuous Glucose Monitors for Personal Use (Non-professional). If approved, this device will be made available at the member’s pharmacy at applicable durable medical equipment cost-share.

Short-Term Continuous Glucose Monitor and Related Accessories and Supplies

I. Professional short-term continuous glucose monitoring (CGM) devices and related accessories and supplies may be considered medically necessary and covered for individuals with type 1 or type 2 diabetes when all of the following criteria (A.-D.) are met:
   A. The device has been FDA approved for diagnostic, short-term purposes; and
   B. The device is to be used for a time frame between 3 to 14 consecutive days; and
   C. Documented history of inadequate glycemic control despite compliance with frequent self-monitoring (4 or more fingersticks per day) and has either of the following problems controlling blood glucose level:
      1. Documented hypoglycemia unawareness; or
      2. Documented recurring episodes (two or more events) of clinically significant hypoglycemia (less than 54 mg/dl) or fasting hyperglycemia (greater than 150 mg/dl); and
   D. No more than two monitoring sessions within a 12 month period.

II. Use of a short-term CGM device and related accessories and supplies are considered not medically necessary and not covered when the above criterion I. is not met.

Long-Term Continuous Glucose Monitor and Related Accessories and Supplies (Initial Use)

III. Personal long-term FDA-approved CGM devices and related accessories and supplies may be considered medically necessary and covered when an individual undergoes the completion of a diabetes self-management education program and any one of the following criteria (A. or B. or C.) are met:

   A. Adults (25 years or older) with type 1 diabetes who meet both of the following criteria (1. and 2.):
      1. Documented history of inadequate glycemic control, as indicated by both of the following:
         a. Compliance with frequent self-monitoring (4 or more fingersticks per day); and
         b. Either insulin injections (3 or more times per day) or a medically necessary insulin pump are used for maintenance of blood sugar control; and
      2. Any of the following criteria is met:
         a. HbA1c measurements of 7.0% and greater; or
b. Recurring episodes (two or more events) of clinically significant hypoglycemia (less than 54 mg/dl).

B. Individuals (2* to 24 years of age) with type 1 diabetes who meet both of the following criteria:
   1. Documented history of inadequate glycemic control, as indicated by both of the following:
      a. Compliance with frequent self-monitoring (4 or more fingersticks per day); and
      b. Either insulin injections (3 or more times per day) or a medically necessary insulin pump are used for maintenance of blood sugar control; and
   2. Any of the following criteria is met:
      a. Recurring episodes (two or more events within a 30 day period) of clinically significant hypoglycemia (less than 54 mg/dl), including suspected episodes (e.g., nocturnal); or
      b. Impaired awareness or the inability to communicate hypoglycemia.

C. Pregnant individuals with pre-gestational type 1 or type 2 diabetes who meet both of the following criteria (1. and 2.) during the course of their pregnancy:
   1. Documented history of inadequate glycemic control, as indicated by both of the following:
      a. Compliance with frequent self-monitoring (4 or more fingersticks per day); and
      b. Either insulin injections (3 or more times per day) or a medically necessary insulin pump are used for maintenance of blood sugar control; and
   2. Recurring episodes (two or more events) of any one of the following:
      a. Clinically significant hypoglycemia (less than 54 mg/dl), including suspected episodes (e.g., nocturnal); or
      b. Fasting hyperglycemia (greater than 150 mg/dl).

IV. Use of a long-term CGM device and related accessories and supplies are considered not medically necessary and not covered when the above criterion III. is not met, including but not limited to:
   A. Type 1 diabetics not on insulin or taking only basal or bid insulin
   B. As a convenience item

V. Use of a long-term CGM device and related accessories and supplies are considered investigational and not covered in all other situations, including but not limited to:
   *Note: This policy does not apply to patients under the age of 2 year for whom long-term CGM use may be considered medically necessary and covered.
   A. Non-pregnant adults with type 2 diabetes
   B. Individuals with gestational diabetes mellitus (GDM)
C. Children with type 2 diabetes  
D. Individuals with compliance issues  

VI. Use of CGM devices with an implantable sensor (e.g., Eversense™ by Senseonics™) is considered investigational and is not covered for all indications.

Continued Coverage of Related Accessories and Supplies  

VII. Continued coverage of related accessories and supplies for a long-term CGM device may be considered medically necessary and is covered during the period of covered use of the CGM device.

Upgrade/Replacement of CGM Systems  

VIII. An upgrade or replacement of an existing CGM system may be considered medically necessary and covered when both of the following criteria (A. and B.) are met:  

A. Documentation that one or more of the device components meet all of the following criteria (1.-3.):  
   1. Are no longer functional; and  
   2. Are not under warranty; and  
   3. Cannot be repaired; and  
B. Evidence of an evaluation by the health care provider managing the diabetes within the last six months that includes a recommendation supporting continued use of a continuous glucose monitor.

IX. Upgrade or replacement of an existing CGM system is considered not medically necessary and not covered when criterion VIII. above is not met.

Enhancements/Optional Accessories  

X. Enhancements or optional accessories for CGMs via smartphones, tablets, wrist-watches and computers are considered convenience items and therefore are not medically necessary and are not covered, including, but not limited to:  

A. Mobile Apps (e.g., Dexcom Share2 App, Dexcom Follow, Dexcom CLARITY® Reports App, MiniMed Connect)  
B. Diabetes management software (e.g., Dexcom CLARITY®, FreeStyle CoPilot Health Management System, Medtronic CareLink® system)  
C. Remote glucose monitoring devices (e.g., mySentry)  
D. Hypoglycemic wristband alarm (e.g., Diabetes Sentry™)
BILLING GUIDELINES

Based on CPT code descriptions, limits have been placed on the following codes:

- A cumulative total of 365 disposable, invasive sensors (CPT: A9276) are eligible for reimbursement per calendar year.
- A cumulative total of 12 requests for supply allowance for therapeutic CGMs (CPT: K0553) are eligible for reimbursement per calendar year.

**Freestyle Libre Flash™**

This policy does not address the FreeStyle Libre Flash for personal long-term use. The FreeStyle Libre Flash is addressed in the Providence Health Plan Pharmacy Policy: Continuous Glucose Monitors for Personal Use (Non-professional): FreeStyle Libre™. If approved, this device will be made available at the member’s pharmacy at applicable durable medical equipment cost-share. Requests for medical claims will be denied to rebill through pharmacy.

**CPT/HCPCS CODES**

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<th>All Lines of Business except Medicare</th>
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<tr>
<td><strong>Prior Authorization Required</strong></td>
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<tr>
<td>A9276 Sensor; invasive (e.g., subcutaneous), disposable, for use with interstitial continuous glucose monitoring system, one unit = 1 day supply</td>
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<tr>
<td>A9277 Transmitter; external, for use with interstitial continuous glucose monitoring system</td>
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<tr>
<td>A9278 Receiver (monitor); external, for use with interstitial continuous glucose monitoring system</td>
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<tr>
<td>K0553 Supply allowance for therapeutic continuous glucose monitor (CGM), includes all supplies and accessories, 1 unit of service = 1 month’s supply</td>
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<tr>
<td>K0554 Receiver (monitor), dedicated, for use with therapeutic continuous glucose monitor system</td>
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<tr>
<td>S1030 Continuous noninvasive glucose monitoring device, purchase (for physician interpretation of data, use cpt code)</td>
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<tr>
<td>S1031 Continuous noninvasive glucose monitoring device, rental, including sensor, sensor replacement, and download to monitor (for physician interpretation of data, use cpt code)</td>
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Diabetes Mellitus

Patients with poorly controlled diabetes mellitus (DM; or simply referred to as diabetes) are at risk for numerous acute and chronic complications. Common long-term complications due to elevated blood glucose include cardiovascular disease, kidney damage, eye disease, and nerve damage. Pregnant women with poorly controlled diabetes are at higher risk for maternal and neonatal complications. Extremely elevated blood glucose levels may lead to diabetic ketoacidosis and other potentially life-threatening conditions. Conversely, overly aggressive treatment of diabetes may lead to life-threatening hypoglycemia, especially among patients with comorbidities who are unaware of the signs and symptoms of hypoglycemia.¹

Continuous Glucose Monitoring

Continuous glucose monitoring (CGM) systems are devices that measure glucose levels in interstitial fluid at frequent predetermined intervals. CGM systems are designed to obtain information regarding daily patterns in glucose levels that, when evaluated in real time or reviewed retrospectively, can guide...
adjustments to therapy, with the goal of improving overall glycemic control. Devices which are used for short periods (3-14 days) where data is sent to the physician, are referred to as professional devices. CGMs designed for individual use and monitoring for longer period are referred to as long-term CGMs.

Glucose measurements provided during continuous monitoring by traditional “nontherapeutic” devices are not intended to replace standard self-monitoring of blood glucose (SMBG) obtained using fingerstick blood samples. However, CGMs are considered an adjunct to SMBG, alerting the patient to the need for self-monitoring. Newer generation CGM devices, that are intended to replace SMBG, defined by the centers for Medicare & Medicaid as “therapeutic” devices, are currently being developed. To date, two “therapeutic” devices have been approved by the U.S. Food & Drug Administration.

CGM devices typically consist of a disposable sensor, a transmitter, and a monitor. The subcutaneous insertion of the glucose sensor (usually in the abdomen) allows the measurement of interstitial fluid glucose as it diffuses from capillaries to cells, using either enzymatic (glucose oxidase reaction) or microdialysis technology. Interstitial glucose levels generally have good agreement with arterial glucose levels, although there can be significant variation for a small number of individuals. Each sensor can continuously measure glucose for up to seven days, providing real-time data every 1 to 10 minutes. Currently available CGM devices provide either historic (retrospective) data or real-time data. CGM systems also have out-of-range alarms and “trend alarms” that are designed to warn the patient of impending hypo- or hyperglycemia. There are three types of CGM devices currently on the market, which are described below:

**Professional/Short Term CGMs:**
Professional CGMs are purchased by healthcare providers and are prescribed to an individual to use over a short period of time (between 3-14 days depending on the device) to record and store glucose data for diagnostic purposes. The individual returns to the physician’s office where the data can be analyzed and used to prescribe an appropriate insulin regimen. These devices may be indicated for use either as an adjunctive device to complement standard home blood glucose monitoring devices, or device which replaces the need to standard home blood glucose monitoring devices.

**Personal/Long-term CGMs:**
Personal CGMs are purchased by individuals and provide retrospective or real-time glucose values that allow users to track patterns and possibly identify episodes of low and high blood glucose levels. The data can be downloaded to personal computers or mobile phones using custom software and stored for historical analysis. The devices may alert the user if a glucose level falls below or rises above a preset/default values. These devices may be indicated for use either as an adjunctive device to complement standard home blood glucose monitoring devices, or device which replaces the need to standard home blood glucose monitoring devices.

**Implantable glucose sensors:**
These new devices are intended for long term use (90 days) and include a sensor which is implanted subcutaneously in the upper arm to measure glucose. The measurement is then relayed to a transmitter. The data can be downloaded to personal computers or mobile phones using custom...
software. These devices are indicated for use as an adjunctive device to complement, not replace, information obtained from standard home blood glucose monitoring devices. Currently there are no devices that have received FDA approval.

**Table 1. Examples of FDA-Approved Continuous Glucose Monitors**

<table>
<thead>
<tr>
<th>Professional Short-term CGM Devices</th>
<th>Indications</th>
<th>Contraindications</th>
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</table>
| **DexCom G4 PLATINUM Professional**<sup>2</sup> | Diabetes mellitus (type 1 or type 2)  
Requires a prescription.  
Sensors can be worn up to 7 days.  
An adjunctive device to complement, not replace, information obtained from standard home glucose monitoring devices  
Detection of episodes of hyperglycemia and hypoglycemia. | Use in critically ill patients.  
Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scan, or diathermy treatment.  
Taking medications with acetaminophen. |
| **FreeStyle Libre Pro Flash**<sup>3</sup> | Diabetes mellitus (type 1 or type 2)  
Requires a prescription.  
Sensors can be worn up to 14 days.  
Does not require user calibration with blood glucose values.  
Detection of episodes of hyperglycemia and hypoglycemia. | Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scan, or diathermy treatment.  
Has NOT been approved for pregnant individuals. |
| **iPro®2**<sup>4</sup> (to be used with either the Enlite sensor or Sof-Sensor) | Diabetes mellitus (type 1 or type 2)  
Requires a prescription.  
Prevents data viewing by patients in real time.  
Enlite sensors can be worn up to 6 days. Sof-sensors may be worn up to 3 days.  
An adjunctive device to complement, not replace, information obtained from | None known. |
Providence Health Plans Medical Policy

Diabetes: Continuous Glucose Monitors (CGM)
(All Lines of Business Except Medicare)

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Personal Long-term CGM Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Manufacturer</th>
<th>Age Restriction</th>
<th>Indications</th>
<th>Contraindications</th>
</tr>
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</table>
| FreeStyle Libre Flash* (therapeutic) | Abbott | 18 years and older | • Diabetes mellitus (type 1 or type 2)  
• Requires a prescription.  
• Sensors can be worn up to 10 days.  
• Replaces fingerstick blood glucose testing for diabetes treatment decisions. | • MRI, (CT) scan, or diathermy treatment.  
• Has NOT been approved for pregnant individuals or persons on dialysis.  
• Not recommended for critically-ill population. |
| Guardian Connect ⁵ (Not therapeutic) | Medtronic MiniMed | 14 to 75 years of age | • Diabetes mellitus (type 1 or type 2)  
• Requires a prescription.  
• For continuous or periodic monitoring of glucose levels  
• Provides real-time glucose values and trends through a Guardian Connect app installed on a compatible consumer electronic mobile device. | • People who are unwilling or unable to perform a minimum of two meter blood glucose tests per day  
• People who are unable or unwilling to maintain contact with their healthcare professional.  
• Patients with insufficient vision or hearing to allow recognition of the alerts generated by the Guardian Connect app. |

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Review of Evidence

A review of the ECRI, Hayes, Cochrane, and PubMed databases was conducted regarding the use of interstitial continuous glucose monitors for the management of diabetes mellitus. Below is a summary of the available evidence identified through June of 2017.
**Diabetes: Continuous Glucose Monitors (CGM)**

(All Lines of Business Except Medicare)

**Adults with Type 1 Diabetes**

*Systematic Reviews*

- In 2017, Benkhadra et al. published a systematic review that evaluated real-time (rt) CGM in type 1 diabetics, including 11 RCTs with moderate- to low-risk of bias published through January of 2015.\(^6\) Primary outcomes assessed were HbA1c, time spent in hypoglycemia and number of hypoglycemic episodes. Meta-analysis results found that in adult patients (>15 years of age) the use of rt-CGM was associated with a statistically significant reduction in HbA1c (-0.276; 95% CI: -0.465 to -0.087, p<0.001). There was no statistically significant difference in time spent in hypoglycemia or the number of hypoglycemic episodes in any age group.

- In 2015, Hayes published a review of continuous glucose monitoring systems for various patient populations including adults with type 1 diabetes, which included 23 RCTS published through July of 2015.\(^1\) Six of the included RCTs evaluated CGM as an adjunct to SMBG versus SMBG alone in adults with type 1 diabetes, with three studies that included only adults and three studies that enrolled both adult and pediatric patients but reported separate analyses for adult patients. Two RCTs found that constant use of CGM for six months was associated with statistically significant improvements in HbA1c levels. However, two RCTs found that constant use of CGM for three or six months did not significantly improvement HbA1c. Despite somewhat inconsistent findings, the review rated the use of CGM in adults with type 1 diabetes as “A”, for the use of CGM in patients who have not achieved adequate glycemic control despite frequent SMBG. The review concluded that between the highly consistent findings that CGM was beneficial in studies in which data for children and adults were combined, and some positive findings concerning the benefits of CGM in studies of only adult patients with type 1 diabetes, that CGM use in this population has some proven benefit.

- In 2012, Langendam et al. published a Cochrane review that compared CGM with conventional SMBG in patients of all ages with type 1 diabetes, including 22 RCTs published through May 2011.\(^7\) The primary objective outcomes assessed were changes in HbA1c, number of episodes of severe hypoglycemia, number of episodes with mild hypoglycemia and number of ketoacidotic events. The meta-analyses showed that, across all age groups, CGM provided a benefit for patients who started on CGM plus continuous subcutaneous insulin infusion (CSII) via pump compared with patients using multiple daily injections (MDI) and SMBG. However, this analysis analyzed pediatric and adults patients together and had very high heterogeneity between studies (I\(^2\) =84%), limiting its applicability to only the adult population. In the adults only analyses, after 3 months, four of the five RCTs reported significantly greater decrease in HbA1c level for patients using CGM compared with SMBG. Of the RCTS with 6-12 month follow-up, three of the four RCTs also reported significantly greater decrease in HbA1c level for patients using CGM compared with SMBG. Five RCTs reported hypoglycemic measures as outcomes, but only one found a significant decrease in hypoglycemic measures in the CGM group compared to the SMBG group (-16.60% time; 95% CI: -
Three RCTs reported hyperglycemic events and three reported ketoacidotic events, but none of these studies found significant differences in either outcome between groups.

Randomized Controlled Trials (RCTs)

Since the publication of the systematic reviews described above, there have been several RCTs published that assessed the use of CGM in type 1 diabetic adults. These RCTs are described below.

- In 2015, New et al. published a 100-day, prospective, multicenter trial including adults (>18 years of age) with type 1 or type 2 diabetes on MDI or CSII (>6 months) with HbA1c values of 7–11%, who performed SMBG an average of 2–7 times per day. Overall, 126 type one diabetics were split between three groups (n=42 patients per group): CGM with alarms, CGM without alarms and SMBG. Approximately one third of the patients were using CSII for insulin administration and two thirds were using MDI. The only outcome where type 1 diabetic patients were analyzed separately from type 2 patients was the time spent outside a glucose target. Type 1 diabetics using CGM with alarm spent significantly less time outside of their targeted glucose range than those using SMBG (-1.3 hrs/day difference; 95% CI: -2.52 to -0.28; p=0.0149) but the difference between the CGM with no alarm and the SMBG group was not significant. Separate analyses for type 1 and type 2 diabetics regarding the use if CSII versus MDI were not performed.

- In 2017, Beck et al. published the results of a multicenter RCT that included 158 adults with type 1 diabetes who were using MDI and had hemoglobin A1c (HbA1c) levels of 7.5% to 9.9% who were randomly assigned 2:1 to CGM (n = 105) or SMBG (n = 53). The primary outcome measure was the difference in change in HbA1c level from baseline to 24 weeks and secondary measures included hypoglycemia at less than 70 mg/dL. Mean HbA1c reduction from baseline was significantly improved in the CGM group (1.1% at 12 weeks and 1.0% at 24 weeks) compared to the SMBG group (0.5% and 0.4%) (p < 0.001). At 24 weeks, the adjusted treatment-group difference in mean change in HbA1c level from baseline was -0.6% (95% CI, -0.8% to -0.3%; p < 0.001). Median duration of hypoglycemia at less than <70 mg/dL was 43 min/d (IQR, 27-69) in the CGM group versus 80 min/d (IQR, 36-111) in the control group (p = 0.002).

- In 2017, Lind et al. published a multicenter open-label crossover RCT that included 161 individuals with type 1 diabetes and HbA1c of at least 7.5% treated with MDI. Participants were randomized to receive treatment for 26 weeks, separated by a washout period of 17 weeks and the difference in HbA1c between weeks 26 and 69 was analyzed. A total of 142 participants were analyzed at follow-up and mean HbA1c was 7.92% during CGM use and 8.35% during SMBG (mean difference, -0.43% [95% CI, -0.57% to -0.29%]; p < 0.001).

Section Summary

As demonstrated by the review of the systematic reviews and randomized trials noted above, the use of CGM devices for adults with type 1 diabetes, lack of glycemic control, and other specific indications has been established as standard of care. Therefore, the remaining evidence review will focus on the potentially experimental and investigational uses of CGMS.
Pregnant Women

Systematic Reviews

- In 2013, Voormolen et al. published a systematic review that evaluated the efficacy of CGM compared with SMBG in pregnant women with type 1 or type 2 diabetes or gestational diabetes (GDM) in studies identified up to February 2013. Two moderately-sized RCTs were included that employed retrospective CGM (n=46 T1D and 25 T2D, and n=73 GDM) and two RCTs which employed real-time CGM (n=123 T1D and 31 T2D, and n=25 T1D). Due to heterogeneity between studies, meta-analyses were not possible. One small RCT on retrospective CGM showed a significant reduction in third-trimester HbA1c compared with SMBG (mean 5.8% versus 6.4%; p=0.007) and a significant reduction in neonatal macrosomia (35% versus 60%; odds ratio [OR], 0.36; 95% CI, 0.13 to 0.98; p=0.05). A second RCT on real-time CGM reported that the use of CGM did not significantly improve any of the outcomes measured, including glycemic control (reported as HbA1c or severe hypoglycemia), neonatal macrosomia, preeclampsia, cesarean delivery, and neonatal hypoglycemia.

- In 2015 Hayes published a systematic review which included a review of the evidence for the use of CGM in pregnant women. This review included three RCTs that evaluated CGM as an adjunct to SMBG versus SMBG. However, all three studies addressed different clinical situations. One large RCT enrolled 154 women with pre-pregnancy type 1 diabetes and found that CGM was not associated with significant improvement in glycemic control, decreased pregnancy complication rates, or any of the neonatal outcomes assessed. A second RCT enrolled 73 women diagnosed with gestational diabetes (GDM) and found that CGM improved identification of women who required insulin and/or metformin (31% monitored with CGM versus 8% monitored by SMBG, p=0.0149) but the use of CGM was not associated with better maternal or neonatal outcomes. The third RCT enrolled 71 women who had pre-pregnancy type 1 or type 2 diabetes and found that use of CGM was associated with statistically significant decrease in mean HbA1c (5.8% in the CGM group versus 6.4% in the SMBG group, p=0.007), and marginally significant decreases in mean birth weight (effect size 0.7 SD, 95% confidence interval 0.0 to 1.3; p=0.05), and risk of macrosomia (OR 0.36; 95% CI: 0.13 to 0.98, p=0.05). All three of the included studies were limited by lack of blinding and post-partum follow-up and small sample numbers for some of the outcomes assessed. The review concluded that additional well-designed studies of CGM are needed to determine the efficacy and clinical utility of CGM in pregnant women who have gestational, type 1, or type 2 diabetes.

- In 2017, Moy et al. published an update to their 2014 Cochrane review comparing several techniques of blood glucose monitoring and their impact on maternal and infant outcomes among pregnant women with pre-existing type I or type 2 diabetes, including two RCTS comparing CGM versus standard monitoring (N=225 women). All of the RCTs included in this review had been
included in the previous Hayes review, described above. The review reported no statistical
differences in pre-eclampsia (RR 1.37, 95% CI 0.52 to 3.59), caesarean section (average RR 1.00, 95% CI 0.65 to 1.54) and large-for-gestational age (average RR 0.89, 95% CI 0.41 to 1.92) outcomes
between groups. In the 2008 Murphy RCT (n=71), mean maternal HbA1c (as the measure of
glycemic control) was lower for women in the CGM group (mean difference of -0.60 %, 95% CI -0.91 to -0.29).\textsuperscript{11} The review reported that there was insufficient evidence to assess perinatal mortality and there were no significant differences for preterm birth (< 37 weeks' gestation). One RCT was
determined to be of low quality and the other RCT was deemed very low quality and had a very high
degree of statistical heterogeneity for a number of outcomes due to large CI's crossing the line of no
effect and small sample sizes for a number of outcomes. The review concluded that there is no
glucose monitoring technique that is superior to any other technique among pregnant women with
pre-existing type 1 or type 2 diabetes, and additional large well-designed RCTs are required to
inform choices of glucose monitoring techniques.

**Randomized Controlled Trials (RCTs)**

Since the systematic reviews described above, only one RCT was identified that evaluated the use of
CGM in pregnant women. This RCT is described below.

- In 2016, Wei et al. published an RCT that investigated the effects of CGM on maternal and neonatal outcomes in 106 women with gestational diabetes mellitus (GDM).\textsuperscript{13} Women were randomly
allocated to the antenatal care plus CGM group or the self-monitoring blood glucose (SMBG) group. There were no significant differences in prenatal or obstetric outcomes (e.g., caesarean delivery rate, Apgar score, macrosomia or neonatal hypoglycemia) between the CGM and SMBG groups. The lack of difference between groups was attributed to small sample size. HbA1C levels were not significantly different between groups. Only two maternal outcomes were found to be significantly different between groups: the proportion of GDM women with excessive gestational weight gain was lower in the CGM group than in the SMBG group (33.3% vs. 56.4%, \(p = 0.039\)), and women who initiated CGMs earlier gained less weight (\(p = 0.017\)). Limitations of the trial included missing clinical data throughout the trial as well as at 6-weeks post-partum, small sample size. The investigators stated that larger follow-up studies were needed to determine if CGM improves maternal and neonatal outcomes in patients with GDM.

**Section Summary**

The evidence regarding the use of CGMs in pregnant women with pre-gestational diabetes has
limitations. Studies have recruited different patient populations, assessing a combination of type 1
and/or type 2 diabetic women. Only one of the two RCTs involving pre-gestational type 1 and type 2 diabetics found that use of CGM was associated with statistically significant improvements in maternal glycemia and some neonatal outcomes. Despite these limitations, there is a relatively high risk of adverse maternal and neonatal outcomes associated with poorly controlled overt diabetes. According to the CDC,\textsuperscript{14} blood sugar that is not well controlled in a pregnant woman with type 1 or type 2 diabetes may increase comorbidity risks, including but not limited to: birth defects, large-for-gestational-age
There is a paucity of evidence regarding the use of CGMs in pregnant women who develop gestational diabetes mellitus (GDM). Studies have addressed different clinical situations. One RCT reported that CGM use in women with GDM was better able to predict women who would require antidiabetic therapies but did not find any improvement in maternal and neonatal outcomes. The second RCT assessed a large number of maternal and neonatal outcomes and the only significant outcome reported was a reduction in excessive maternal weight gain in the CGM group. In addition, according to the CDC, GDM has a short duration, as it usually develops during the middle of pregnancy, and can often be controlled through eating healthy foods and regular exercise. At this time, the efficacy of CGM use for women who develop GDM has not been established.

**Type-1 Diabetes in Children and Adolescents**

**Systematic Reviews**

- In 2012, Yeh et al. published a systematic review evaluating, in part, the comparative effectiveness of self-monitoring of blood glucose (SMBG) and real-time CGM (rt-CGM), including five RCTs which reported data separately for younger age groups (N=434 children <18 years). Although one small cross-over trial reported that use of CGM was associated with a statistically significant improvement in mean HbA1c (mean difference −0.46%; 95% CI −0.26% to −0.66%; p < 0.001) in 72 pediatric patients, the remaining four moderately-sized RCTs did not find a significant decrease in HbA1c levels with the use of rt-CGMs. In the pooled analysis, there were significant differences in change from baseline HbA1c level whether SMBG or rt-CGM was used.

- In 2013, Poolsup et al. published a meta-analysis to assess the effect of CGM on glycemic control in type 1 diabetic children in RCTs identified up to May 2013 that were ≥ 8 weeks in duration, and that reported HbA1c outcomes. Ten RCTs (N= 817, children ≤ 18 years old with type 1 diabetes). Of the 10 studies included, seven were of high quality, and three of low quality. Among the pediatric type 1 diabetics, CGM did not reduce HbA1c to a greater degree than SMBG (mean difference, −0.13%; 95% CI, −0.38% to 0.11%; p=0.27). The reviewers found significant heterogeneity among the included studies (I²=71%) likely due to several factors including: heterogeneity in study sample size (range, 11 to 156 patients), differences in frequency and duration of CGM use, differences in the intervention period, and the intervention used.

- In 2014, Matsuda and Brennan published a systematic review that evaluated the efficacy of CGM for adolescents (aged 12 to 18 years) with type 1 diabetes compared to SMBG alone, including RCTs from 2002 through 2012 that reported the number of hypoglycemic episodes (blood glucose <70 mg/dL) and HbA1c levels. Only two moderately-sized multicenter RCTs (n= 40, 45) were included. Although no heterogeneity between studies was detected, there were differences in the length of diagnosis of subjects at baseline, which can impact HbA1c values. Reduction in HbA1c from baseline to 26 weeks in both studies was not significantly different between groups (mean difference =
−0.11; 95% CI, −0.61 to 0.39; p=0.674). Therefore, CGM was not significantly more effective than SMBG in adolescent patients for controlling HbA1c. The review concluded that more evaluation is needed of the efficacy of CGM in the adolescent population.

- In 2015, Hayes published a systematic review which included a review of the evidence for the use of CGM in pediatric patients with type 1 diabetes. This review included six RCTs that evaluated CGM as an adjunct to SMBG versus SMBG alone, all of which had been included in the previous review, described above. Three of the included studies enrolled only pediatric patients and three studies enrolled pediatric and adult patients but reported results separately for pediatric patients. Overall, results of these studies suggest that the use of CGM does not improve glycemic control or provides only limited improvement. Five of the six included studies were RCTs, which found that constant or nearly constant use of CGM as an adjunct to SMBG did not significantly improve mean HbA1c levels compared with use of SMBG alone. The sixth included study was a small cross-over trial by Battelino, described above. Although one of the RCTs reported that use of CGM was associated with statistically significant reductions in severe hypoglycemia in pediatric patients, this finding was not replicated in the three other RCTs which reported hypoglycemia as an outcome. The review concluded that additional well-designed studies of CGM were needed to determine the efficacy of CGM in pediatric patients who have type 1 diabetes, giving the use of this device a “C” rating due to inconsistent findings in this population.

Section Summary

The evidence for the use of CGM in children with type 1 diabetes is conflicting. Trials that have recruited mixed diabetic populations (adults and children), report improved glycemia control in children when analyzed separately form adults. However, trials that have focused solely on children and adolescents report that the use of CGM does not improve glycemic control in children and adolescent diabetic patients despite constant or near-constant use. In addition, the impact of CGM use by compliant children and adolescents on long-term health outcomes is lacking. Despite conflicting results and limited evidence of improved health outcomes, poorly controlled diabetes in children can lead to numerous adverse outcomes in this population. According to the American Diabetes Association, children are less able or unable to recognize or articulately their hypoglycemia, and lack of glycemic control in children can have adverse effects on brain development and function. In addition to neurological vulnerability, poor management of glycemic control in children can impact their growth and sexual maturity.

Type-2 Diabetes in Children, Adolescents, and Adults

Systematic Reviews

- In the 2013, Poolsup et al. meta-analysis described above, the reviewers also assessed the effect of CGM on glycemic control in type 2 diabetic adults in RCTs identified up to May 2013 that were ≥ 8 weeks in duration, and that reported HbA1c outcomes. Four RCTs (N=161 adults ≥ 18 years of age with type 2 diabetes) were included, two of which were of high quality and two of low quality.
In a pooled analysis of retrospective and real-time (rt) CGMs, CGM was significantly more efficacious than SMBG in terms of HbA1c reduction (mean difference, −0.31%; 95% CI, −0.6% to −0.02%; \( p=0.04 \)). However, sub-group analyses identified that retrospective CGM was not superior to SMBG. Studies sizes were of moderate size, ranging from 25 to 100 patients). The only benefit was from rt-CGM. There was no heterogeneity (I²=0%) between the included studies, although there were variations in terms of study quality, frequency and duration of CGM use, and interventions.

- In 2015, Hayes published a systematic review which included a review of the evidence for the use of CGM in adult patients with type 2 diabetes.\(^1\) This review included five RCTs that evaluated CGM as an adjunct to SMBG versus SMBG. In the three RCTs in which the CGM was used constantly, one study (n=100) reported significant improvement in mean HbA1c with the use of CGM (\( p<0.001 \)) in an adjusted analysis, but the other two RCTs (n=50 and 92) did not find significant improvements in HbA1c with the use of the device. Limitations of these RCTs included: significant differences in baseline characteristics between groups, no blinding reported and short-term (<1 year) follow-up. However, the two included small RCTs (n=52 and 65) in which CGM was used intermittently (two or three 3-day sessions over 2-3 months) both reported that CGM was associated with statistically significant improvements in mean HbA1c. All included studies suffered from small sample size, limited follow-up, and some degree of industry support. The review concluded that additional studies were needed to determine whether CGM is beneficial in this diabetic population, giving the use of this device in type 2 diabetic adults a “C” rating due to inconsistent findings and a rating of “D2” for type 2 diabetic children due to a paucity of evidence concerning use of CGM in this population.

- The systematic review conducted to formulate the 2017 National Institute for Health and Care Excellence (NICE) guidelines on management of type 2 diabetes in adults (aged 18 and over), included two small RCTs (N=165) of insulin-dependent patients with mean baseline HbA1c levels between 8.3% - 8.9%.\(^2\) The studies had very different follow-up periods (12 weeks and 52 weeks) and were deemed to be of low and very low quality. The meta-analysis showed an overall significant and clinically important reduction in HbA1c levels in people on insulin in the CGM group compared to those on SMBG alone up to 12 months. However, between the two trials there were conflicting results reported for this outcome. The review concluded there was still uncertainty regarding the effectiveness of CGM in this population.

Randomized Controlled Trials (RCTs)

- In 2016, Sato et al. published a small RCT which assessed the effect of treatment guidance based on data from a CGM device on glycemic control in 34 patients with insulin-dependent type 2 diabetes.\(^3\) The intervention group received treatment guidance based on the CGM data, while the control group received advice based on SMBG and glycosylated hemoglobin (HbA1c) levels. At eight months, there was no significant difference in the change from baseline of HbA1c between the two groups. There was also no significant difference in the change from baseline in the Diabetes Treatment Satisfaction Questionnaire score between the two groups. The authors concluded that treatment guidance using retrospective CGM data was not effective for improving glycemic control.
and therapeutic satisfaction in Japanese patients with type 2 diabetes, but further studies that include larger populations are needed to confirm the present findings.

Section Summary

The evidence for the use of CGM in patients with type 2 diabetes consists of several small- to medium-sized RCTS and three systematic reviews of these RCTs. The RCTs of CGM in adults with type 2 diabetes have published conflicting results. The published RCTs are heterogeneous in terms of sample size, frequency and duration of CGM use, the intervention period, intervention used, and quality. There is a paucity of evidence on the use of CGM in children and adolescents with type 2 diabetes. At this time, the efficacy of CGM use for type 2 diabetics, of any age, has not been established. In addition, evidence is needed to determine if CGM improves long-term health outcomes, such as avoidance of long-term diabetic complications, in this patient population.

Implantable Long-term CGMs

Nonrandomized Studies

- In 2015, Dehennis et al. published a small multicenter study which assessed the accuracy of glucose measurement by the Senseonics’ Eversense® CGM system compared to measurements obtained by venous blood, including 24 adults (between the ages of 18 and 65) with insulin-dependent type 1 or type 2 diabetes. Twenty two of the twenty four (92%) sensors reported glucose continuously for 90 days, and the mean absolute relative difference (MARD) for all 24 sensors was 11.4 ± 2.7% compared to venous reference glucose values. There was no significant difference in glucose values detected by the CGM compared to standard blood glucose monitoring throughout the 90-day study, nor was there a significant difference between the two methods at low (<70mg/dL) or high >180mg/dL glucose levels. No serious adverse events were noted. The authors concluded that the study showed successful in-clinic and home use of the Senseonics CGM system over 90 days in subjects with diabetes mellitus.

- In 2017, Kropff et al. published the results of a uncontrolled multicenter observational trial which assessed the accuracy and longevity of the implantable Eversense CGM in the PRECISE study, including 71 adults (18 years and older) with type 1 and type 2 diabetes. The participants were followed for 180 days to test the accuracy of the implanted CGM. The mean absolute relative difference (MARD) for venous reference glucose values >4.2 mmol/L over the study duration was 11.1% (95% CI 10.5, 11.7). However, device performance in the hypoglycemic range (≤75 mg/dL) significantly less than the overall performance (21.7 vs. 11.6% MARD; p< 0.001). A Kaplan-Meier analysis for sensor survival estimated that 100, 82, and 40% of sensors were functional through day 45, day 90, and day 180, respectively. The authors noted that participants with type 2 diabetes and participants of non-Caucasian descent were underrepresented in this study; limiting the applicability of the results to a wider population.
CLINICAL PRACTICE GUIDELINES

American Diabetes Association (ADA)

The 2017, the ADA “Standards of Medical Care in Diabetes” evidence-based guidelines recommended the following regarding the use of CGMs for people with diabetes mellitus:

- When used properly, CGM in conjunction with intensive insulin regimens (defined as (multiple-dose insulin or insulin pump therapy) is a useful tool to lower A1C in selected adults (aged 25 years) with type 1 diabetes. Level of Evidence = A (Clear evidence from well-conducted adequately powered RCTs)
- Although the evidence for A1C lowering is less strong in children, teens, and adolescents, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. Level of Evidence = B (Supportive evidence from well-conducted cohort studies and case series)
- CGM may be a useful tool in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. Level of Evidence = C (evidence from poorly controlled or uncontrolled studies; or conflicting evidence with the majority of evidence supporting the recommendation)
- Given the variable adherence to CGM, assess individual readiness for continuing CGM use prior to prescribing. Level of Evidence = E (expert consensus)
- When prescribing CGM, robust diabetes education, training, and support are required for optimal CGM implementation and ongoing use. Level of Evidence = E (expert consensus)

Endocrine Society

The 2016 Endocrine Society evidence-based clinical practice guideline on “Continuous Subcutaneous Insulin Infusion Therapy and Continuous Glucose Monitoring in Adults” recommended the following regarding the use of CGMs for people with diabetes mellitus:

- Real-time CGM is recommended for adults with well-controlled DM1 and for adults with DM1 who have HbA1c levels above target. Patients should be willing and able to use a CGM device on a nearly daily basis.
- Short-term use of real time CGM is suggested for adult patients with DM2 who have HbA1c levels greater or equal to 7% and are both willing and able to use a CGM device.
- Education, training, and ongoing support to help achieve and maintain individualized glycemic goals are suggested for adults with diabetes using CGM.

National Institute for Health and Care Excellence (NICE)
The 2016 NICE guideline “Type 1 Diabetes in Adults: Diagnosis and Management” was based on a systematic review of the evidence and recommended the following regarding the use of CGMs for people with type 1 diabetes:

- Routine use of real time (rt) CGM in adults with type 1 diabetes is not recommended.
- Consider rt- CGM for adults with type 1 diabetes who are willing to commit to using it at least 70% of the time and calibrate it as needed, and who have at least one of the following (despite optimized use of insulin therapy and conventional blood glucose monitoring): more than one episode a year of severe hypoglycemia that has no obviously preventable cause; complete hypoglycemia unawareness; frequent asymptomatic hypoglycemia that interferes with daily activities; extreme fear of hypoglycemia; or hyperglycemia that persists despite frequent testing (but only continue CGM if HbA1c can be sustained at 7% or below, or if there has been a fall in HbA1c of 2.5% or more).
- For adults with type 1 diabetes using CGM, insulin therapy should be applied with either multiple daily injections of insulin or continuous subcutaneous insulin infusion therapy.

The 2017 NICE guideline “Type 2 Diabetes in Adults: Management” did not recommend the use of CGMs for people with type 2 diabetes due to a lack of high quality RCTs and conflicting evidence. The panel stated that there is still uncertainty regarding the effectiveness of continuous glucose monitoring.

American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE)

In 2016, the AACE and ACE published a joint consensus statement on “Outpatient Glucose Monitoring” recommended the following regarding the use of CGMs for people with diabetes mellitus:

- CGM is recommended for adults and children with type 1 diabetes, particularly for individuals with a history of severe hypoglycemia and hypoglycemia unawareness, and to assist in correcting hyperglycemia in patients not within target range for blood glucose level.
- Before CGM use, patients should have knowledge of the basics of sensor insertion, calibration, and real-time data interpretation. More in-depth training and more frequent follow-up is recommended for CGM users who are children.
- Current evidence is limited for CGM use for patients with type 2 diabetes who are receiving insulin or sulfonylureas; trials assessing the use of CGM for these patients are ongoing.
- No recommendation was provided regarding the use of CGM for persons with type 2 diabetes who have a low risk of hypoglycemia.
- The benefits of CGM in pregnant individuals with preexisting diabetes are unclear; and additional studies are needed. CGM should primarily be considered a teaching tool when used during pregnancy, and should be used to evaluate peak postprandial blood glucose, fine-tune insulin dosing, and identify foods associated with blood glucose fluctuations.
- Additionally, CGM can be used as a supplement to blood glucose monitoring during pregnancy, in particular for monitoring nocturnal hypoglycemia or hyperglycemia and postprandial hyperglycemia.
Children and Adolescent Patients

*International Society for Pediatric and Adolescent Diabetes (ISPAD)*

The 2014 ISPAD evidence–based clinical practice consensus guideline, “Assessment and Monitoring of Glycemic Control in Children and Adolescents with Diabetes”\(^{28}\) recommended the following regarding the use of CGMs for children with diabetes mellitus:

- CGM may particularly benefit individuals with hypoglycemic unawareness because CGM devices can be set to alert patients when glucose is below a specified range or when glucose falls at a rapid rate. However, it is currently recommended that CGM values are confirmed by SMBG for real-time adjustments of insulin dosing.

*National Institute for Health and Care Excellence (NICE)*

The 2015 NICE guideline, “Diabetes (Type 1 and Type 2) in Children and Young People: Diagnosis and Management”\(^{29}\) recommended the following regarding the use of CGMs for children with diabetes mellitus:

- Offer ongoing real-time (rt)-CGM monitoring with alarms to children and young people with type 1 diabetes who have at least one of the following: frequent severe hypoglycemia, impaired awareness of hypoglycemia associated with adverse consequences (e.g., seizures or anxiety), or inability to recognize or communicate about symptoms of hypoglycemia.
- Consider ongoing rt-CGM for neonates, infants, and preschool children; children and young people who undertake high levels of physical activity; and children and young people who have comorbidities (i.e., anorexia nervosa) or who are receiving treatment (e.g., corticosteroids) that impedes control of blood glucose levels.
- Consider intermittent CGM to improve blood glucose control in children and young people who have hyperglycemia that persists despite insulin adjustment and additional support.

Pregnant Women

*National Institute for Health and Care Excellence (NICE)*

The NICE 2015 guideline, “Diabetes in Pregnancy: Management from Preconception to the Postnatal Period”\(^{30}\) recommended the following regarding the use of CGMs for pregnant individuals with diabetes:

- CGM should not be offered routinely to pregnant women with diabetes.
- Consider CGM for pregnant women on insulin therapy who either have severe hypoglycemia or unstable blood glucose levels, or to gain information about changes in blood glucose levels.

*Endocrine Society*
The 2013 Endocrine Society evidence-based clinical practice guideline on “Diabetes and Pregnancy” suggested that CGM be used during pregnancy for women with overt or gestational diabetes when SMBG is not sufficient to assess glycemic control. The society deemed this a weak recommendation due to low quality evidence. The society stated that “although there is a paucity of literature on continuous glucose monitoring use during pregnancy, there is evidence that in gestational diabetes, it will detect clinically meaningful hypoglycemia and postprandial hyperglycemia that may go unrecognized by self-monitoring of blood glucose”.

INSTRUCTIONS FOR USE

Company Medical Policies serve as guidance for the administration of plan benefits. Medical policies do not constitute medical advice nor a guarantee of coverage. Company Medical Policies are reviewed annually and are based upon published, peer-reviewed scientific evidence and evidence-based clinical practice guidelines that are available as of the last policy update. The Companies reserve the right to determine the application of Medical Policies and make revisions to Medical Policies at any time. Providers will be given at least 60-days’ notice of policy changes that are restrictive in nature.

The scope and availability of all plan benefits are determined in accordance with the applicable coverage agreement. Any conflict or variance between the terms of the coverage agreement and Company Medical Policy will be resolved in favor of the coverage agreement.

REGULATORY STATUS

Mental Health Parity Statement

Coverage decisions are made on the basis of individualized determinations of medical necessity and the experimental or investigational character of the treatment in the individual case.

MEDICAL POLICY CROSS REFERENCES

- Diabetes: Artificial Pancreas Devices and Other Integrated Systems (All Lines of Business Except Medicare), DME112
- Diabetes: Artificial Pancreas Devices and Other Integrated Systems (Medicare Only), DME397
- Diabetes: Blood Glucose Monitor and Supplies, DME206
- Diabetes: Continuous Glucose Monitors (Medicare Only), DME392
- Diabetes: Insulin Pumps (External and Implanted), DME208

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(All Lines of Business Except Medicare) |
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