Continuous or Intermittent Monitoring of Glucose in Interstitial Fluid

Policy # 00019
Original Effective Date: 03/25/2002
Current Effective Date: 06/20/2016

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the “Company”), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

When Services May Be Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:

- Benefits are available in the member’s contract/certificate, and
- Medical necessity criteria and guidelines are met.

72 Hour Glucose Monitoring
Based on review of available data, the Company may consider 72 hour continuous glucose monitoring (CGM) in the interstitial fluid using an implantable sensor as a technique of diabetic monitoring to be eligible for coverage.

Patient Selection Criteria
Coverage eligibility for 72 hour continuous glucose monitoring (CGM) in the interstitial fluid using an implantable sensor as a technique of diabetic monitoring will be considered when the following patient selection criteria are met:

- Insulin dependent diabetic; AND
  - Inadequate glycemic control as evidenced by unexplained hypoglycemic episodes, hypoglycemic unawareness, suspected postprandial hyperglycemia or recurrent ketoacidosis; OR,
  - Prior to insulin pump initiation to determine basal insulin levels.

Note: Monitoring would be for 72 consecutive hours, and approved for a maximum of 2 times per year.

Chronic Continuous Glucose Monitoring
Based on review of available data, the Company may consider chronic continuous monitoring of glucose levels in interstitial fluid, including real-time monitoring, as a technique of diabetic monitoring to be eligible for coverage.

Patient Selection Criterion
Coverage eligibility for chronic continuous monitoring of glucose levels in interstitial fluid, including real-time monitoring, as a technique of diabetic monitoring will be considered when the following patient selection criterion is met:

- Insulin dependent diabetics requiring 3 or more insulin injections per day or are on an insulin pump with recurrent unexplained severe symptomatic hypoglycemia for whom hypoglycemia puts the patients or others at risk.

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When Services Are Considered Investigational

Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

Based on review of available data, the Company considers other uses of continuous monitoring of glucose levels in interstitial fluid, including real-time monitoring, as a technique of diabetic monitoring to be investigational.*

Based on review of available data, the Company considers the use of continuous monitoring of glucose in the interstitial fluid when patient selection criteria is not met to be investigational.*

Background/Overview

Tight glucose control in patients with diabetes has been associated with improved outcomes. Several devices are available to measure glucose levels automatically and frequently (e.g., every 5 to 10 minutes). The devices measure glucose in the interstitial fluid and are approved as adjuncts to traditional self-monitoring of blood glucose (SMBG) levels.

The advent of blood glucose monitors for use by patients in the home over 20 years ago revolutionized the management of diabetes. Using fingersticks, patients could monitor their blood glucose level both to determine the adequacy of hyperglycemia control and to evaluate hypoglycemic episodes. Tight diabetic control, defined as a strategy involving frequent glucose checks and a target hemoglobin A1c (HgA1c) in the range of 7%, is now considered standard of care for diabetic patients. Randomized controlled trials (RCTs) of tight control have demonstrated benefits for type I diabetics in decreasing microvascular complications. The impact of tight control on type II diabetics and on macrovascular complications such as stroke or myocardial infarction (MI) is less certain.

However, tight glucose control requires multiple measurements of blood glucose each day (i.e., before meals and at bedtime), a commitment that some patients may be unwilling or unable to meet. In addition, the goal of tight glucose control has to be balanced with an associated risk of hypoglycemia. An additional limitation of periodic self-measurements of blood glucose is that glucose values are seen in isolation, and trends in glucose levels are undetected. For example, while a diabetic patient’s fasting blood glucose level might be within normal values, hyperglycemia might be undetected postprandially, leading to elevated HgA1c values.

Recently, measurements of glucose in interstitial fluid have been developed as a technique of automatically measuring glucose values throughout the day, producing data that show the trends in glucose measurements, in contrast to the isolated glucose measurements of the traditional blood glucose measurements. Although devices measure glucose in interstitial fluid on a periodic rather than a continuous basis, this type of monitoring is referred to as continuous glucose monitoring (CGM).

Several devices have received FDA approval. The first 2 approved devices were the Continuous Glucose Monitoring System (CGMS®) (MinMed), which uses an implanted temporary sensor in the subcutaneous tissues, and the GlucoWatch G2™ Biographer, an external device worn like a wristwatch that measures...
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Glucose in interstitial fluid extracted through the skin with an electric current (referred to as reverse iontophoresis).

Additional devices that have subsequently been approved include those for pediatric use and those with more advanced software, more frequent measurements of glucose levels, more sophisticated alarm systems, etc. Devices initially measured interstitial glucose every 5 to 10 minutes and, with currently available devices, the time intervals at which interstitial glucose is measured ranges from every 1 to 2 minutes to 5 minutes. While CGMs potentially eliminate or decrease the number of required daily fingersticks, it should be noted that, according to the FDA labeling, monitors are not intended to be an alternative to traditional self-monitoring of blood glucose levels but rather provide adjunct monitoring, supplying additional information on glucose trends that are not available from self-monitoring. In addition, it is important to note that devices may be used intermittently, eg, time periods of 72 hours, or on a long-term basis.

In addition to stand-alone CGMs, several insulin pump systems have included a built-in CGM. This policy addresses continuous glucose monitoring devices, not the insulin pump portion of these systems.

FDA or Other Governmental Regulatory Approval

U.S. Food and Drug Administration (FDA)

Several continuous glucose monitoring systems have been approved by the FDA through the premarket approval process:

- The Continuous Glucose Monitoring System (CGMS) (MiniMed) in 1999 (approved for 3-day use in a physician's office).
- The GlucoWatch G2 Biographer in 2001. Of note, neither the GlucoWatch nor the autosensors have been available after July 31, 2008.
- The Guardian®-RT (Real-Time) CGMS (Medtronic, MiniMed) in July 2005. (MiniMed was purchased by Medtronic).
- The DexCom® STS CGMS system (DexCom) was approved by the FDA in March 2006.
- The Paradigm™ REAL-Time System (Medtronic, MiniMed) was approved by the FDA in 2006. This system integrates a continuous glucose monitor with a Paradigm insulin pump. The second generation integrated system is called the MiniMed Paradigm Revel System.
- The FreeStyle Navigator® CGM System (Abbott) was approved in March 2008.
- The DexCom G4 Platinum (DexCom) CGM was approved for use in adults 18 years and older in October 2012. The device can be worn for up to 7 days. In February 2014, FDA expanded use of the Dexcom Platinum CGM to include patients with diabetes, age 2 to 17 years old.

Centers for Medicare and Medicaid Services (CMS)

A 2006 national coverage determination (NCD) stated that home blood glucose monitors are covered for patients meeting the following criteria:

- The patient has been diagnosed with diabetes;
- The patient’s physician states that the patient is capable of using the device appropriately; and
- The device is designed for home use.
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The NCD did not specifically mention continuous versus intermittent use of home blood glucose monitors.

Rationale/Source
This policy is updated regularly with searches of the MEDLINE database. A TEC Assessment was published in 2003. The most recent literature review was performed through November 11, 2014. Following is a summary of the key literature to date:

Continuous Glucose Monitoring Systems
Most of the following discussion focuses on the clinical utility of CGM systems. That is, their ability to provide either additional information on glucose levels, leading to improved glucose control or to improve the morbidity/mortality associated with clinically significant severe and acute hypoglycemic or hyperglycemic events. Because diabetic control encompasses numerous variables including the diabetic regimen and patient self-management, RCTs are important to isolate the contribution of interstitial glucose measurements to the overall diabetic management. Data on patients with type 1 diabetes and type 2 diabetes are discussed separately.

Type 1 Diabetes
Several meta-analyses of RCTs have been published; they have focused on slightly different populations, eg, age and/or type of diabetes, and different study designs, eg, by length of follow-up. Two 2011 meta-analyses included studies on adults and/or children. The study by Gandhi et al identified studies conducted among patients with type 1 and/or type 2 diabetes and stratified findings by type of diabetes. The investigators identified 19 RCTs evaluating CGM interventions lasting at least 8 weeks and conducted in the outpatient setting. Mean baseline HbA1c was at least 7.0% in all studies but included one in which the mean baseline HbA1c was 6.4%. Overall, compared with self-monitoring of blood glucose, CGM was associated with a statistically significant reduction in mean HbA1c (weighted mean difference [WMD], -0.27%; 95% confidence interval [CI], -0.44% to -0.10%). When stratified by age and type of diabetes, there was a statistically significant reduction in HbA1c in adults with type 1 diabetes and adults with type 2 diabetes, but not in studies of children and adolescents with type 1 diabetes.

Another 2011 meta-analysis of RCTs on CGM included trials conducted in adults and children with type 1 diabetes who were on an intensive insulin regimen (studies of type 2 diabetes were not included). This meta-analysis required a minimum of 12 weeks of follow-up in the studies (as compared with at least 8 weeks in the Gandhi meta-analysis). Studies compared CGM with self-monitored blood glucose (SMBG); there was no restriction related to type of CGM device, but the CGM readings had to be used to adjust insulin dose or modify diet. A total of 14 RCTs met eligibility criteria. In a pooled analysis, there was a statistically significant reduction in HbA1c with CGM compared with SMBG (WMD, -0.26%; 95% CI, -0.34% to -0.19%). In a subgroup analysis by age, there were significant reductions in HbA1c with CGM in studies of adults (n=5) (WMD, -0.33; 95% CI, -0.46 to -0.20) and in studies with children and/or adolescents (n=8) (WMD, -0.25; 95% CI, -0.43 to -0.08).

Two 2012 meta-analyses evaluating the efficacy of CGM in patients with type 1 diabetes had similar findings: overall, use of CGM to result in significantly greater reductions in HbA1c compared with SMBG. Most recently, a 2013 systematic review by Poolsup et al included RCTs that compared CGM with SMBG,
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had interventions lasting at last 8 weeks, and reported HbA1c as an outcome. For type 1 diabetes, only studies in children were included. Ten RCTs including pediatric patients with type 1 diabetes met inclusion criteria and were included in a meta-analysis. Overall, the investigators did not find that CGM had a significantly greater impact on HbA1c than SMBG. The pooled estimate of the difference in HbA1c between groups was -0.13% (95% CI, -0.38% to 0.11%). In a subgroup analysis by approach to CGM, devices that provided data retrospectively (retrospective CGM) did not result in better glucose control than SMBG (5 studies; pooled mean difference, -0.05%; 95% CI, 0.46% to 0.35%). However, real-time CGM was superior to SMBG in terms of improving glycemic control (5 studies; pooled mean difference, 0.18%; 95% CI, 0.35% to 0.02%).

Representative RCTs follow.

In 2008, the Juvenile Diabetes Research Foundation (JDRF) published results of a study that randomly assigned 322 adults and children with type 1 diabetes to CGM or self-(home) monitoring. With HbA1c as the primary outcome measure, there was a significant difference among patients 25 years of age or older that favored continuous monitoring (mean HbA1c difference, 0.53%), while the difference between groups was not statistically significant for those ages 15 to 24 years or 8 to 14 years. The population in this study had relatively well-controlled diabetes in that entry criterion was glycated Hb of 7% to 10%, but approximately 70% had levels between 7% and 8%; in addition, more than 70% of patients were using an insulin pump. No significant differences were noted in rates of hypoglycemic events, but the study was likely not sufficiently large to detect potential differences. The authors also reported that monitor use was greatest in those patients ages 25 or older, the group in which 83% of patients used the monitor 6 or more days per week. The investigators also conducted a nonblinded single-arm 6-month extension to the randomized trial in which patients in the control group were offered a CGM device. A total of 214 of 219 (98%) in the control group participated in the extension. This included 80 (37%) who were at least 25 years old, 73 (34%) who were 15- to 24-year old, and 61 (29%) who were 8- to 14-year old. The mean HbA1c level at the time of initiation of CGM use was 7.4±0.7%. Patients were instructed to use the device on a daily basis. Among the 154 patients with baseline A1c at least 7%, there was a significant decrease in A1c 6 months after initiating device use in the older age group (mean change in A1c, -0.4% ±0.5%; p<0.001). HbA1c did not decrease significantly in the 15- to 24-year-olds (0.01%±0.7%, p=0.95) or in the 8- to 14-year-olds (0.02±0.7%, p=0.85). Greater decrease in HbA1c was associated with more frequent use of the CGM device (p=0.001, adjusted for age group). Frequency of device use tended to decrease over time, with less of a decrease in the older age group. At month 6, median use of CGM devices was 6.5 days per week among the older age group, 3.3 days among the 15- to 24-year-olds, and 3.7 days per week among the children. During the 6-month extension, the rate of severe hypoglycemic events was 15 per 100 person-years of follow-up.

An additional randomized trial by JDRD, published in 2009, studied the potential benefits of CGM in the management of adults and children with well-controlled type 1 diabetes. In this study, 129 adults and children with intensively treated type 1 diabetes (age range, 8-69 years) and HbA1c less than 7.0% were randomly assigned to either continuous or standard glucose monitoring for 26 weeks. The main study outcomes were time with glucose level at or below 70 mg/dL, HbA1c level, and severe hypoglycemic events. At 26 weeks, biochemical hypoglycemia (≤70 mg/dL) was less frequent in the CGM group than in
the control group (median, 54 vs 91 min/d, respectively), but the difference was not statistically significant (p=0.16). Time out of range (≤70 or >180 mg/dL) was significantly lower in the CGM group than in the control group (377 vs 491 min/d, respectively, p=0.003). There was a significant treatment group difference favoring the CGM group in mean HbA1c at 26 weeks adjusted for baseline values. One or more severe hypoglycemic events occurred in 10% and 11% of the 2 groups, respectively (p=NS). The authors concluded that the weight of evidence suggests that CGM is beneficial for individuals with type 1 diabetes who have already achieved excellent control with HbA1c of less than 7.0%. This is a relatively small study. In addition, the clinical significance of some of these findings is not certain. Some of the patients in this group would likely meet policy statements for use of CGM.

The MITRE trial, published by Newman et al in 2009, was conducted to evaluate whether the additional information provided by use of minimally invasive glucose monitors resulted in improved glucose control in patients with poorly controlled insulin-requiring diabetes. This was a 4-arm RCT conducted at secondary care diabetes clinics in 4 hospitals in England. In this study, 404 people aged older than 18 years, with insulin-treated diabetes mellitus (types 1 or 2) for at least 6 months, who were receiving 2 or more injections of insulin daily, were eligible. Most participants, 57%, had type 1 diabetes, 41% had type 2 diabetes, and 2% were classified as “other.” Participants had 2 HbA1c values of at least 7.5% in the 15 months before entry and were randomized to 1 of 4 groups. Two groups received minimally invasive glucose monitoring devices (GlucoWatch Biographer or MiniMed Continuous Glucose Monitoring System, CGMS). Intermittent CGM was used, ie, monitoring was performed over several days at various points in the study. These groups were compared with an attention control group (standard treatment with nurse feedback sessions at the same frequency as those in the device groups) and a standard control group (reflecting common practice in the clinical management of diabetes). Change in HbA1c from baseline to 3, 6, 12, and 18 months was the primary indicator of short- to long-term efficacy in this study. At 18 months, all groups demonstrated a decline in HbA1c levels from baseline. Mean percentage changes in HbA1c were -1.4 for the GlucoWatch group, -4.2 for the CGMS group, -5.1 for the attention control group, and -4.9 for the standard care control group. In the intention-to-treat analysis, no significant differences were found between any of the groups at any of the assessment times. There was no evidence that the additional information provided by the devices resulted in any change in the number or nature of treatment recommendations offered by the nurses. Use and acceptability indicated a decline in use of both devices, which was most marked in the GlucoWatch group by 18 months (20% still using GlucoWatch vs 57% still using the CGMS). In this study of unselected patients, use of CGMs (CGMS on an intermittent basis) did not lead to improved clinical outcomes.

In 2011, Mauras et al published an analysis from the Diabetes Research in Children Network (DirecNet) Study Group that evaluated CGM in the management of young children aged 4 to younger than 10 years with type 1 diabetes. A total of 146 children (mean age, 7.5 years) were randomized to CGM or usual care. At baseline, 30 children (42%) had an HbA1c of at least 8%. The primary outcome was clinical success, as defined as reduction in HbA1c by at least 0.5% without the occurrence of severe hypoglycemia at 26 weeks. Clinical success was attained by 19% in the CGM group and 28% in the usual care group (p=0.17). Mean change in HbA1c, a secondary outcome, did not differ significantly between groups (-0.1 in each group, p=0.79).
Section Summary
There are numerous RCTs and several systematic reviews of RCTs evaluating CGM in patients with type 1 diabetes. Systematic reviews generally found that CGM use resulted in improved glycemic control for adults with type 1 diabetes and for children with type 1 diabetes who used real-time CGM devices.

Type 2 Diabetes
Two of the systematic reviews previously described in the section on type 1 diabetes also reported on the efficacy of CGM in patients with type 2 diabetes. Gandhi et al identified 3 RCTs that included patients with type 2 diabetes (one of these included patients with either type of diabetes). There was a mixture of patients with type 2 diabetes who did and did not require insulin. In a meta-analysis of the 3 trials, there was a statistically significant reduction in HbA1c with CGM compared with SMBG in adults with type 2 diabetes (WMD, -0.70; 95% CI, -1.14 to -0.27). In 2013, Poolsup et al conducted a meta-analysis of 4 trials conducted with adults with type 2 diabetes. In a pooled analysis, CGM had greater efficacy in terms of HbA1c than usual care. The pooled mean difference in HbA1c was -0.31% (95% CI, -0.6 to 0.02, p=0.04). Because of a lack of statistical heterogeneity among studies, subgroup analyses (eg, by type of CGM device) were not performed. However, there were some differences among studies; 1 used retrospective CGM and 2 used real-time CGM. Also, there was variability in the frequency of CGM use, making it difficult to determine the optimal frequency of use.

A representative study included in the 2013 meta-analysis evaluated intermittent use of a CGM device in 100 patients with type 2 diabetes who did not use prandial insulin. Eligible participants were 18 or older, had type 2 diabetes for at least 3 months, and had an initial HbA1c of at least 7% but not more than 12%. The study compared real-time continuous monitoring with the DexCom device used for four 2-week cycles (2 weeks on/1 week off) with SMBG. The primary efficacy outcome was mean change in HbA1c. The mean decline from baseline in HbA1c in the CGM versus the SMBG group was 1.0% versus 0.5% at 12 weeks, 1.2% versus 0.5% at 24 weeks, 0.8% versus 0.5% at 38 weeks, and 0.8% versus 0.2% at 1 year, respectively. Over the course of the study, the reduction in HbA1c was significantly greater than in the SMBG group (p=0.04). After adjusting for potential confounding variables including age, sex, baseline therapy, and whether the individual started taking insulin during the study, the difference between groups over time remained statistically significant (p<0.001).

Section Summary
There are fewer RCTs on CGM in patients with type 2 diabetes than for patients with type 1 diabetes. Systematic reviews that included 3 to 4 RCTs found that there was variability in the intervention, eg, type of CGM device, frequency of use and patient populations, eg, adults and/or children. Although systematic reviews have found a statistically significant benefit of CGM in terms of glycemic control, the small number of RCTs and variability among interventions makes it difficult to identify an optimal approach to CGM use or subgroup of type 2 diabetes patients who might benefit.

Pregnant Women with Diabetes
In 2013, Voormolen et al published a systematic review of the literature on CGM during pregnancy. The authors identified 11 relevant studies (ie, published in peer-review journals and evaluating the utility of CGM in pregnancy). Two of the studies were RCTs. The 11 studies included a total of 534 women; the largest
study was an RCT that had 154 participants. Seven of the studies used retrospective CGM, and the remaining 4 studies used real-time CGM. The authors did not pool study findings; they concluded that evidence is limited on the efficacy of CGM during pregnancy. The 2 published RCTs are described next:

The larger RCT was published by in 2013 by Secher et al in Denmark. The investigators randomized 154 women to real-time CGM in addition to routine pregnancy care (n=79) or routine pregnancy care alone (n=75). There were 123 women with type 1 diabetes and 31 with type 2 diabetes. Patients in the CGM group were instructed to use the CGM device for 6 days before each of 5 study visits and were encouraged to use the devices continuously. Participants in both groups were instructed to perform 8 daily self-monitored plasma glucose measurements for 6 days before each visit. Baseline mean HbA1c was 6.6% in the CGM group and 6.8% in the routine care group. The 154 pregnancies resulted in 149 live births and 5 miscarriages. The prevalence of large-for-gestational age infants (at least 90th percentile), the primary study outcome, was 45% in the CGM group and 34% in the routine care group. The difference between groups was not statistically significant (p=0.19). In addition, no statistically significant differences were found between groups for secondary outcomes, including the prevalence of preterm delivery and the prevalence of severe neonatal hypoglycemia. Women in this study had low baseline HbA1c, which might help explain the lack of impact of CGM on outcomes. Other factors potentially contributing to the negative findings include the intensive SMBG routine in both groups and the relatively low compliance rate (64%) in the CGM group with the instruction of use the CGM devices for 6 days before each of 5 study visits.

In 2008, Murphy et al in the U.K. randomized 71 pregnant women with type 1 (n=46) or type 2 (n=25) diabetes to CGM or usual care. The intervention consisted of up to 7 days of CGM at intervals of 4 to 6 weeks between 8 and 32 weeks of gestation. In addition to CGM, the women were advised to measure blood glucose levels at least 7 times a day. Baseline HbA1c was 7.2% (SD=0.9) in the CGM group and 7.4% (SD=1.5) in the usual care group. The primary study outcome was maternal glycemic control during the second and third trimesters. Mean HbA1c levels were consistently lower in the intervention arm, but differences between groups were not statistically significant at any time point. For example, between 28 and 32 weeks’ gestation, mean HbA1c levels were 6.1% (SD=0.60) in the CGM group and 6.4% (SD=0.8) in the usual care group (p=0.10). The prevalence of large-for-gestational age infants (at least 90th percentile) was a secondary outcome. Thirty-seven (35%) infants in the CGM group were large-for-gestational age compared with 18 of 30 (60%) in the usual care group. The odds ratio for reduced risk of a large-for-gestational age infant with CGM was 0.36 (95% CI, 0.13 to 0.98; p=0.05).

Neither RCT found a statistically significant difference in their primary outcome. The Murphy study found a borderline statistically significantly lower rate of large-for-gestational age infants in women who used CGM while pregnant. Taken together, 2 published RCTs on CGM in pregnancy do not provide strong evidence that routine CGM during pregnancy is beneficial. However, it is difficult to draw definitive conclusions from this limited evidence.

Other Diabetic Subgroups
CGM has been proposed for specific diabetic subgroups such as patients with poor diabetic control, as evidenced by recurrent hypoglycemia, hypoglycemia unawareness, postprandial hyperglycemia, and/or recurrent diabetic ketoacidosis. For these groups, CGM provides different types of information than single
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glucose measurements, such as trends in glucose and rates of change. There is only anecdotal evidence for the efficacy of this approach; there is no high-quality evidence available to evaluate the impact of this approach on health outcomes.

Continuous Glucose Monitoring Systems Integrated With an Insulin Pump

Technology is now available that allows linkage between a CGM device and an insulin pump. In a randomized study of 132 adults and children from France reported in 2009, Raccah et al reported improved HbA1c levels (change in A1c of 0.96% vs 0.55%, respectively) in patients who were fully protocol compliant for use of an insulin pump integrated with CGMS compared with those using a pump with standard glucose self-monitoring. In 2012, Battelino et al published findings of a multicenter crossover study conducted in several European countries that included 153 children and adults with type 1 diabetes. The study used the MiniMed Paradigm REAL-Time system, which integrates a CGM device and an insulin pump system. Patients were randomized to use of the system for 6 months with the sensor on and 6 months with the sensor off, in random order, with a washout period of 4 months between interventions. Baseline HbA1c ranged from 7.5% to 9.5%. After treatment, mean HbA1c was 8.04% in the sensor on arm and 8.47% in the sensor off arm. The mean difference in HbA1c between groups was -0.43% (95% CI, -0.32% to -0.55%; p<0.001). Neither of the above trials was blinded, and neither compared continuous with intermittent use of the CGM.

Physician Specialty Society and Academic Medical Center Input

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted. In response to requests, input was received from 1 physician specialty society and 4 academic medical centers. Those providing input concurred that this technique, particularly intermittent glucose monitoring, was helpful in a subset of patients with diabetes. Reviewers commented that this monitoring can improve diabetes care by reducing glucose levels (and improving HbA1c) and/or by reducing episodes of hypoglycemia. Reviewers believed that there was persuasive information from case reports to demonstrate the positive impact of intermittent glucose monitoring.

Summary of Evidence

The available studies demonstrate that glucose monitoring may improve glucose control in type 1 diabetic patients. However, the data on the impact of long-term continuous glucose monitoring are still limited. Studies such as that of the Juvenile Diabetes Research Foundation suggest that more frequent use of CGMs may result in better outcomes, but this finding is not consistent across all available studies. In addition, the magnitude of effect is modest, suggesting that either the efficacy is of a small magnitude or that only a subset of patients benefit from this type of monitoring. Thus, the impact of CGM use on glucose control for the general diabetic population is uncertain, and CGM is considered investigational for the purpose of improving glucose control in the general diabetic population.

Continuous glucose monitoring provides more data points on glucose levels and also provides information about trends. This additional information is most likely to benefit subgroups of diabetic patients, ie, those patients with type 1 diabetes who do not have adequate control, including episodes of hypoglycemia,
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Despite use of current best practices including multiple (>4) daily checks of blood glucose and use of an insulin pump. Based on the available data and supported by strong clinical input, intermittent, ie, 72-hour, glucose monitoring may be considered medically necessary in those whose type 1 diabetes is poorly controlled, despite use of best practices.

Using a rationale similar to that just noted for intermittent monitoring, continuous monitoring can also be used in diabetic subpopulations. Continuous glucose monitoring may be considered medically necessary to provide additional data for management of those who have recurrent, unexplained, severe hypoglycemia that puts the patient or others at risk, despite use of current best practices.

The available literature suggests that CGM systems may improve glycemic control in patients with type 2 diabetes, but too few studies have focused on this population, and it is not clear what subset of patients with type 2 diabetes might benefit from intermittent or continuous glucose monitoring. Due to the limited evidence, use of CGM systems in patients with type 2 diabetes is considered investigational.

References
2. Blue Cross and Blue Shield Technology Evaluation Center (TEC). Use of Intermittent or Continuous Interstitial Fluid Glucose Monitoring in Patients with Diabetes Mellitus. TEC Assessments. 2003; Volume 18, Tab 16.
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03/21/2002 Medical Policy Committee review
03/25/2002 Managed Care Advisory Council approval
06/24/2002 Format revision. No substance change to policy.
01/29/2004 Medical Director Review
02/17/2004 Medical Policy Committee review. Format revision. No substance change to policy.
02/23/2004 Managed Care Advisory Council approval
02/01/2006 Medical Director review
02/23/2006 Quality Care Advisory Council approval
07/07/2006 Format revision, including addition of FDA and or other governmental regulatory approval and rationale/source. Coverage eligibility unchanged
03/14/2007 Medical Director review
03/21/2007 Medical Policy Committee approval. Real time monitoring added to policy statement. Coverage eligibility unchanged.
05/07/2008 Medical Director review
05/21/2008 Medical Policy Committee approval. 72 hour continuous glucose monitoring now eligible for coverage with criteria. The word “Continuous” was removed from the title.
12/03/2008 Medical Director review
12/17/2008 Medical Policy Committee approval. Separated criteria into type I and type II diabetes in the 72 Hour Glucose Monitoring coverage section. Added, “Type II diabetes in patients who are insulin dependent requiring three or more insulin injections per day.” to the 72 Hour Glucose Monitoring coverage section. Adopted BCBSA format, title and coverage for chronic continuous glucose monitoring as follows: Based on review of available data, the Company may consider continuous monitoring of glucose levels in interstitial fluid, including real-time monitoring, as a technique of diabetic monitoring, in the following situations to be eligible for coverage:

- Patients with type 1 diabetes on an insulin pump with recurrent unexplained severe symptomatic hypoglycemia for whom hypoglycemia puts the patients or others at risk; or
- Pregnant type 1 diabetics, when recurrent hypoglycemia cannot be resolved.

11/04/2010 Medical Policy Committee approval
11/16/2010 Medical Policy Implementation Committee approval. No change to coverage.
11/03/2011 Medical Policy Committee approval
11/16/2011 Medical Policy Implementation Committee approval. No change to coverage. Rationale rewritten.
03/01/2012 Medical Policy Committee approval
03/21/2012 Medical Policy Implementation Committee approval. Under the 72 hour glucose monitoring section, “Type 1” was removed and “as evidenced by four or more documented blood glucose checks per
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day with fasting blood glucose levels often greater than or equal to 150 and/or hypoglycemic levels of less than or equal to 50 for at least a month" was also removed from patient selection criteria.

09/06/2012 Medical Policy Committee approval
09/19/2012 Medical Policy Implementation Committee approval. Patient Selection Criteria for both 72 hour and chronic continuous glucose monitoring revised.
03/07/2013 Medical Policy Committee review
03/20/2013 Medical Policy Implementation Committee approval. Added "requiring 3 or more insulin injections per day or are" to the first bullet for Chronic Continuous Glucose Monitoring criteria.
06/05/2014 Medical Policy Committee review
06/18/2014 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
06/04/2015 Medical Policy Committee review
06/17/2015 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
08/03/2015 Coding update: ICD10 Diagnosis code section added; ICD9 Procedure code section removed.
06/02/2016 Medical Policy Committee review
06/20/2016 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
10/01/2016 Coding update
01/01/2017 Coding update: Removing ICD-9 Diagnosis Codes and CPT coding update
07/01/2017 Coding update
Next Scheduled Review Date: 06/2017

Coding
The five character codes included in the Blue Cross Blue Shield of Louisiana Medical Policy Coverage Guidelines are obtained from Current Procedural Terminology (CPT®), copyright 2015 by the American Medical Association (AMA). CPT is developed by the AMA as a listing of descriptive terms and five character identifying codes and modifiers for reporting medical services and procedures performed by physician.

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CPT is a registered trademark of the American Medical Association.

Codes used to identify services associated with this policy may include (but may not be limited to) the following:

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<th>Code Type</th>
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<tr>
<td>CPT</td>
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<td>New codes eff 1/1/17: 0446T, 0447T, 0448T</td>
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<tr>
<td>HCPCS</td>
<td>A9276, A9277, A9278, E0784, S1030, S1031, S1034, S1035, S1036, S1037</td>
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<td></td>
<td>New codes eff 7/1/17: K0553, K0554</td>
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<td>ICD-10 Diagnosis</td>
<td>E08.3211-E08.3219 E08.3291-E08.3299 E08.3311-E08.3399 E08.3411-E08.3499</td>
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Continuous or Intermittent Monitoring of Glucose in Interstitial Fluid

Policy # 00019  
Original Effective Date: 03/25/2002  
Current Effective Date: 06/20/2016

<table>
<thead>
<tr>
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<td>E11.00-E11.9</td>
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</tr>
</tbody>
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*Investigational – A medical treatment, procedure, drug, device, or biological product is Investigational if the effectiveness has not been clearly tested and it has not been incorporated into standard medical practice. Any determination we make that a medical treatment, procedure, drug, device, or biological product is Investigational will be based on a consideration of the following:

A. Whether the medical treatment, procedure, drug, device, or biological product can be lawfully marketed without approval of the U.S. FDA and whether such approval has been granted at the time the medical treatment, procedure, drug, device, or biological product is sought to be furnished; or
B. Whether the medical treatment, procedure, drug, device, or biological product requires further studies or clinical trials to determine its maximum tolerated dose, toxicity, safety, effectiveness, or effectiveness as compared with the standard means of treatment or diagnosis, must improve health outcomes, according to the consensus of opinion among experts as shown by reliable evidence, including:
   1. Consultation with the Blue Cross and Blue Shield Association technology assessment program (TEC) or other nonaffiliated technology evaluation center(s);
   2. Credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community; or
   3. Reference to federal regulations.

**Medically Necessary (or "Medical Necessity") - Health care services, treatment, procedures, equipment, drugs, devices, items or supplies that a Provider, exercising prudent clinical judgment, would provide to a patient for the purpose of preventing, evaluating, diagnosing or treating an illness, injury, disease or its symptoms, and that are:

A. In accordance with nationally accepted standards of medical practice;
B. Clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and
C. Not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent treatment or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.

For these purposes, "nationally accepted standards of medical practice" means standards that are based on credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community, Physician Specialty Society recommendations and the views of Physicians practicing in relevant clinical areas and any other relevant factors.
Continuous or Intermittent Monitoring of Glucose in Interstitial Fluid

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