# BEST PRACTICES IN: Continuous Glucose Monitoring in Patients With Insulin-Requiring Type 2 Diabetes

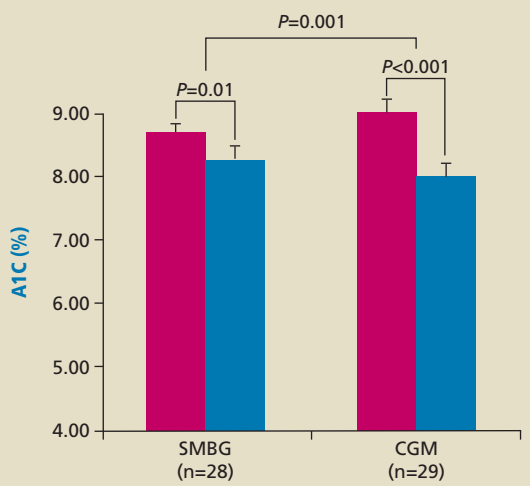
Continuous glucose monitoring (CGM) displays trends in glucose levels over time rather than the isolated data time points produced by self-monitoring of blood glucose (SMBG) levels. It measures glucose levels in interstitial fluid space using a sensor that can be worn from 3 to 7 days, depending on the device.[1-3] This enables patients and providers to see where glycemic excursions might be occurring and address them through changes in diet, exercise, or therapy. CGM is currently approved by the US Food and Drug Administration as adjunctive to SMBG, and SMBG should be used for treatment decisions.

In adults ≥25 years old with type 1 diabetes (T1D) and baseline glycated hemoglobin levels (A1C) ≥7.0%, virtually daily CGM use for 6 months led to significantly greater A1C reductions from baseline compared to a group randomized to conventional monitoring with a home blood glucose meter ($P<0.001$).[4] During a further 6-month-long, nonrandomized follow-up, A1C improvement was maintained with significantly increased time per day spent in the desired glucose range (71–180 mg/dL) ($P=0.02$, difference from baseline to 12 months).[5]

## Benefits of CGM in Individuals With Type 2 Diabetes (T2D)

Fewer randomized data are available about the use of CGM in individuals with T2D than in those with T1D. Some findings, though not all, support benefits similar to those reported in patients with T1D. One randomized, prospective, 3-month-long study compared intermittent CGM use (3 days/month) to SMBG use (≥4 times weekly) in 57 patients with poorly controlled T2D (A1C, 8%–10%). Investigators reported greater reductions in A1C (**Figure**) compared to those reported with SMBG. Glycemic variability and postprandial glucose levels improved significantly compared to baseline in the CGM group.[6] The authors concluded that awareness of blood glucose levels led patients to modify their diet and exercise patterns in order to reduce glycemic excursions.

**Figure. Difference in A1C Change, Baseline to 12 Weeks, CGM vs SMBG**




Difference (mean ± SD) in the change in glycated hemoglobin (A1C) levels from baseline to the 12-week follow-up examination between the self-monitoring blood glucose (SMBG) and continuous glucose monitoring (CGM) system groups. Red bars, baseline A1C; blue bars, A1C 12 weeks later. Source: Yoo et al.[6] Used with permission.

The results from this study are consistent with my clinical experience. Some of my insulin-requiring patients with T2D—particularly those on intensive insulin regimens—wear the CGM device continuously. These patients use real-time CGM data to help predict and prevent hypoglycemia, as well as to react to pre- and postprandial glucose trends. I find the ability to download the CGM data extremely helpful for retrospective analysis of patterns and therapeutics responses.

**Preventing hypoglycemia.** In my opinion, a major benefit of CGM in individuals with T2D is to empower both patients and clinicians to prevent hypoglycemia. Symptomatic, severe hypoglycemia (defined as blood glucose levels <50 mg/dL or symptoms that resolved with treatment and required assistance from another person or medical assistance) has been associated with increased risk of death in patients with T2D plus cardiovascular disease (CVD) or evidence of subclinical CVD plus two additional cardiovascular risk factors.[7] The American Diabetes Association (ADA), the American Heart Association, and the American College of Cardiology Foundation have published a scientific/position statement urging providers to be vigilant about preventing severe hypoglycemia in patients with advanced disease.[8]

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I view CGM as a valuable tool to help prevent hypoglycemia; it alerts the patient and the clinician to triggers for hypoglycemia so that these can be addressed and avoided. A patient recently reported to me that he cut short a walk upon seeing that his glucose level was 126 mg/dL and falling. His glucose level was 80 mg/dL when he returned home. The patient indicated that he would have continued walking if he had not observed the CGM reading.

## T2D Patient Types Who May Especially Benefit From CGM

**The patient with hypoglycemic unawareness.** Without CGM use, patients may not necessarily know when hypoglycemia is developing or occurring. Consensus guidelines suggest patients with hypoglycemic unawareness or frequent episodes of severe hypoglycemia as candidates for CGM.[9] An abstract at the recent ADA meeting revealed that nearly two thirds (20/33) of older patients (n=33; mean age, 75 years; 91% using insulin; 77% had T2D) monitored with CGM for 3 days had at least 1 hypoglycemic episode during that time period, lasting an average of 53 minutes.[10] CGM data, to which the patients were blinded, revealed an average of 3.85 hypoglycemic episodes per patient. Virtually all episodes were undetected by fingerstick measures or by symptoms. This illustrates the problem of hypoglycemic unawareness in the older, insulin-dependent patient.

**The patient with persistently elevated A1C levels.** CGM data can reveal reasons for high A1C levels that have resisted all efforts at improvement. One of my older, highly insulin-resistant, insulin-requiring patients with T2D regularly had a morning SMBG measurement in the normal range (~100 mg/dL), but his A1C level was high (~8.0%). He wears a sensor for 3 days every month to provide me with more data about where to target our efforts.

The CGM data have shown me that he sometimes skips lunch, is active during the day, and then consumes a high-carbohydrate dinner. He is hyperglycemic all night, but his glucose levels gradually fall so that he reaches the target range by morning. We instructed him to take rapid-acting insulin 30 minutes prior to his evening meal if his blood glucose is >120 mg/dL, and counseled him to reduce his carbohydrate intake at dinner. His glucose levels rose more quickly than the rapid-acting insulin could work if his insulin was given immediately before the meal.

**The patient with reasonable glycemic control but activity-limiting glycemic variability.** An 80-year-old patient with brittle T2D has acceptable A1C levels but is fearful of taking walks because he worries that the exercise may induce hypoglycemia or hyperglycemia. He has difficulty with carbohydrate counting. It is easier for him to respond to sensor data than to count carbohydrates.

## Reimbursement

Coverage is increasingly widespread for both personal and professional CGM through commercial insurance plans, although generally not available on Medicare and sometimes only available for patients with T1D. Current procedural terminology (CPT) codes exist for the setup and training of CGM (95250) and for provider interpretation of CGM data (95251). It is best to check with payers as to the specific criteria for CGM use and frequency with which these codes can be billed. With documentation that severe hypoglycemia has occurred (ie, requiring the assistance of another person to recover, particularly if paramedics were summoned), insurers typically reimburse for CGM. With the benefits shown by the continuous clinical data provided by CGM, insurance coverage for this technology will most likely improve.

## Summary

CGM is a useful tool for a wide variety of patients. CGM does not replace fingerstick glucose values but can fill in the "holes" between home glucose monitoring measurements, enabling patients in real time and providers retrospectively to analyze the data.

From my perspective, everyone with diabetes on an intensive insulin regimen should wear a CGM device, for their own day-to-day benefit as well as to provide me with data upon which to make therapeutic decisions. However, these devices do have their technical drawbacks, can be cumbersome to wear, and are not appealing to all patients. Additionally, alarms and data interpretation can be overwhelming. But this is just the beginning of a technology that stands to markedly improve our ability to provide safe and effective diabetes care to those on insulin therapy. The tools should improve, our ability to teach patients how to use the devices in real time and our skills at retrospective data interpretation should all continue to advance, and hopefully data will emerge to prove the value of this technology for patients with diabetes.

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