

# Self-Monitoring of Blood Glucose: An Underutilized Tool

Geralyn R. Spollett, MSN, ANP-CS, CDE

Imagine trying to bake a cake without knowing the temperature of the oven or trying to judge how much gas is left in the car's tank during a long trip without a gas gauge. Although it would not be impossible to do these tasks without the proper measurement tools, it would take much more time and you wouldn't have the information you need to solve any problems that occur.

Similarly, during previous generations, people with diabetes, working only with urine testing or retrospective laboratory glucose results, had limited information on which to base day-to-day self-care decisions.

The advent of self-monitoring of blood glucose (SMBG) in the late 1970s gave people with diabetes a valuable tool for self-management. No longer dependent on inconvenient laboratory diagnostics or inaccurate urine testing, patients now had accurate glucose values within minutes, using a hand-held meter and a small drop of blood. Having access to blood glucose values whenever they choose to perform the test enables patients to improve their glycemic control, preventing acute and chronic complications.

## Controversies in SMBG

The frequency for performing SMBG varies depending on the needs of each patient. Insulin-using patients (with type 1 or type 2 diabetes) are advised to perform SMBG three or more times daily.<sup>1</sup> Most practitioners agree on the relevance of glucose monitor-

ing in this group. There has been much controversy about the efficacy of SMBG among patients who do not use insulin. However, guidelines for these patients with type 2 diabetes are vague, and no specific frequency is recommended.

When first developed, this innovation in diabetes care held such promise: it would encourage a new level of patient-provider collaboration, empower patients to become more active participants in their own care, and act as a personal guide for trouble-shooting glucose control issues related to diet, physical activity, travel, and other lifestyle changes.

Unfortunately, SMBG has fallen far short of achieving its promise. Why? Saudek et al.<sup>2</sup> reviewed many SMBG trials and concluded that the trials "support the conclusion that SMBG, if effectively translated into action, improves glycemia." Prescribing SMBG without an educational link so that patients can effectively use the information they gain had no effect on A1C values.

Surely, for some patients, seeing their glucose results and associating changes in food and activity with their glucose levels gives them insight into their metabolism. But for too many others, SMBG is a "tattletale" that tells when patients "cheat" on their diet, or a "report card" that signifies when they have failed to closely follow their diabetes care plan. Unfortunately, a tool that was designed to improve and individualize care has, in many

instances, become a barrier, another problem to overcome.

Operating a meter has become easier. Today's meters feature smaller devices with larger screens and pictorial screen prompts for each step. Performing SMBG involves fewer steps, offers faster results, requires no calibrations or codes, and needs only tiny blood samples. There are now easy-to-use lancing devices, sharper and finer lancets, and capillary action strips. Meters now have large memories, averaging capabilities, markers for various events, prompts for hyper- and hypoglycemia values, and capabilities for computer downloading and interfacing with insulin pumps.

However, technology is only as useful as the knowledge and motivation of those who possess it. These innovative features mean little if patients do not use their meter or understand how their results can be used to make a significant difference in their own self-management.

## Helping Patients Use SMBG

The American Association of Diabetes Educators (AADE) position statement "Self-Monitoring of Blood Glucose: Benefits and Utilization"<sup>3</sup> offers both the educational components for meter use (the steps for meter care and usage) and a list of the roles and responsibilities of health care providers in teaching SMBG. One of those responsibilities is "to provide education in making appropriate therapy adjustments utilizing the

results.<sup>23</sup> The statement also calls on the diabetes health care community to promote and adopt standardized SMBG education.

The dilemma is that there is no research demonstrating or supporting the best method for educating patients about SMBG to improve glycemic control and reach targets.

In many instances, once patients learn the technical aspects of meter use and the times to perform SMBG, the educational process comes to a halt. Although the educational components of SMBG and meter use as defined by the AADE position statement are integral to the use of this tool, without continuing instruction on the translation of SMBG results into action, the opportunity to improve self-management is limited. If SMBG is to be a problem-solving tool, it must move beyond the mere reporting of glucose levels to the application of these data in retrospective and prospective analysis of lifestyle behaviors and medication usage.

Based on teaching and learning principles that have been applied to other areas of skill acquisition in diabetes management, it is logical to approach the use of SMBG in a step-wise manner, building on each successive task to achieve greater independence, as outlined in Table 1 and discussed in more detail below.

**Presenting SMBG as a tool**

Tools allow those who use them to complete a task or achieve an outcome more easily. It is important to present SMBG as an important tool for achieving glycemic control. Clinicians need to teach patients that SMBG gives valuable information that allows patients the freedom to make changes that best suit their lifestyle. SMBG not only helps to individualize care, but also allows patients to assess what works or does not work in their own self-management. It can

**Table 1. A Step-Wise Approach to SMBG Education**

1. Discuss the importance of SMBG as a tool that guides care decisions and helps analyze problems in maintaining glucose control, not as a judgment.
2. Establish mutually agreed upon glucose goals tailored to individual patients' needs and discuss which testing times will give patients the best information to make self-care decisions. Collaborate with patients to select one or two times during the day to regularly monitor glucose, comparing their values to their target glucose levels and noting possible indications for self-adjustment. Work with patients to create an action plan for improving glycemic control based on their glucose meter data. Establish plans for recording data in a format that will be most useful to patients. Encourage and support patients' efforts to problem solve and make necessary changes.
3. Follow up with patients within a short time frame to reinforce their self-care behaviors.
4. Review glucose logs with patients and focus on both positive changes they have made and areas of concern indicated by their SMBG results.
5. Discuss with patients how they will handle glucose results that do not appear to reflect their efforts at self-management.

also be a safety tool, helping to assess signs and symptoms of hyper- and hypoglycemia.

**Determining monitoring times**

Patients need to understand the action of their prescribed medications and how specific times for glucose monitoring can assist in evaluating their medications' effects. Knowing the time frame for increases in post-meal glucose levels helps patients see that postprandial SMBG can provide valuable data about the effects of the size and content of their meals. Giving guidance to patients about using SMBG to assess the effects of physical activity or exercise on glucose control demonstrates the importance of exercise in controlling type 2 diabetes and becomes crucial to safe exercise programs for patients who use insulin.

**Individualizing monitoring times**

For newly diagnosed people with diabetes, a recommendation to perform SMBG before each meal and at bedtime can seem daunting. Although such a regimen may be helpful for providers in adjusting therapy, it is overwhelming for patients and can

create anxiety and confusion when its purpose and results are not fully explained. It is far better to limit testing times and discuss how those times relate to therapy and affect decision-making.

If more intensive testing is needed, try to limit the time period to the time necessary to adequately evaluate and treat the problem. The more stable a patient's physical activity, medication dosages, and meal schedule are, the fewer testing times are needed. However, during periods when schedules change or lifestyle transitions occur, it may be necessary to increase monitoring to guide appropriate therapeutic decisions.

**Relating action to results**

If patients realize early on that the glucose results they obtain from SMBG play a vital part in making therapeutic changes, the process has validity for them. Outlining appropriate action based on SMBG results and empowering patients to act accordingly supports the concepts of patient-provider collaboration and self-care management. Guidelines for data analysis and related actions

should be specific, and directions should be clearly written for home use, enabling patients to feel confident in proceeding independently. When patients achieve a successful outcome, it reinforces self-efficacy.

Patients should be taught how to look for patterns in their SMBG data: times when the high or low results tend to cluster, indicating a recurring problem. The urge to impulsively respond to a high or low result without putting it into the context of the day's events may cause dramatic glycemic shifts and not successfully address the underlying problem. If patients see results that consistently fall outside their target range during a 3-day period when no changes in their meal plan, medications, or activity have occurred, then they should make adjustments according to the agreed upon action plan.

Data management of glucose results can take many forms, including written logbooks or diaries and periodic meter memory downloads. The best method is the one that an individual patient feels will be most effective for him or her. Often, the way in which data are organized is crucial to decision making. Patients may need to experiment with different methods before deciding on the one that works best for them.

A color-coded system is one method that helps some patients recognize glucose patterns. The first step is to agree on a target glucose range. SMBG results that are above the range are colored with a pink highlighter pen; those below the range are highlighted yellow; and those within the range are colored green. The colors relate to those of a traffic light: pink means Stop Hyperglycemia, yellow means Use Caution because results are too low, and green means Go, You're in the Target Range. The clustering of any

one color at a particular time of day is not a judgment of patients' efforts, but rather indicates that they need to review that time frame for possible issues and action steps to achieve their self-management targets.

#### **Following up**

Whether by telephone, e-mail, or an office visit, providers need to contact patients shortly after their initial education session on SMBG to offer continuing support. Helping patients make changes based on SMBG supports the formation of new behaviors essential to self-management. Keep in mind that working to achieve targets can be frustrating, particularly when patients have endeavored to make positive changes, and their results do not reflect this.

#### **Reviewing logs**

During subsequent office appointments, providers have many opportunities to educate patients about how to use their SMBG results to improve glycemic control. Sitting side by side so that the log is visible to both parties, patients and providers can analyze glucose readings focusing on positive factors (such as target attainment at the fasting time) and problematic results (such as higher post-supper readings). Start by asking patients what they see and have learned from SMBG. You might be surprised what you learn from their insights that will then lead to individualized solutions to problems.

This is also an ideal time to educate patients about the questions they should ask themselves when reviewing their SMBG results:

- Did I eat or drink anything that may have affected the glucose result?
- Did I skip or delay a meal, causing a change in my blood glucose?
- Did I take my medication or insulin as prescribed?

- Did I change my exercise level?
- Did I feel ill or stressed or start a new medication?
- Was there a change in my schedule that could have altered my glucose?

All of these recommendations seem very simple and direct, but they take time to implement. As with any skill acquisition, learning to use a glucose meter and SMBG results for self-management requires guidance and support. Providers need to move from seeing SMBG as a report of glucose levels that helps in prescribing medication to viewing it as an integral tool that allows for adaptability and flexibility in self-management.

If SMBG has not fulfilled its early promise as a tool that supports self-management and patient-provider collaboration, it is the lack of education on its use, rather than the tool itself, that bears the blame.

When patients ask their providers, "What are you looking at when you see my numbers?," the window of opportunity flies open, and the providers then have the chance to make what patients may see as an onerous task into a meaningful, life-changing practice.

#### **REFERENCES**

<sup>1</sup>American Diabetes Association: Standards of medical care in diabetes. *Diabetes Care* 32 (Suppl. 1):S13–S61, 2009

<sup>2</sup>Saudek CD, Derr RL, Kalyani RR: Assessing glycemia in diabetes using self-monitoring blood glucose and hemoglobin A<sub>1c</sub>. *JAMA* 295:1688–1697, 2006

<sup>3</sup>Austin MM, Haas L, Johnson T, Parkin CG, Parkin CL, Spollett G, Volpone MT: Self-monitoring of blood glucose: benefits and utilization. *Diabetes Educ* 32:835–847, 2006

---

*Geralyn R. Spollett, MSN, ANP-CS, CDE, is the associate director and nurse practitioner at the Yale Diabetes Center, Yale School of Medicine, New Haven, Conn.*