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*The Diabetes Educator* 2006; 32; 835

DOI: 10.1177/0145721706295873

The online version of this article can be found at:

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# AADE POSITION STATEMENT

## Self-monitoring of Blood Glucose: Benefits and Utilization

**S**elf-monitoring of blood glucose (SMBG) has revolutionized diabetes care by providing individuals with diabetes the ability to measure their own blood glucose levels at any time. Individuals with diabetes can use this information to respond appropriately to their glucose levels, resulting in improved overall glycemic control. Two large landmark, randomized clinical trials, the Diabetes Control and Complications Trial<sup>1</sup> and the United Kingdom Prospective Diabetes Study<sup>2,3</sup> confirmed the benefits of tight glycemic control in all patients with diabetes. These studies demonstrated that hyperglycemia significantly increases the risk for the long-term microvascular complications of diabetes (retinopathy, nephropathy, and neuropathy disease). Other studies have shown that glycemic control reduces the risk of macrovascular complications.<sup>4</sup>

Although large clinical trials have yet to be conducted to assess the impact of SMBG on diabetes outcomes, recommendations for use of SMBG in patients with type 1 diabetes are clearly defined.<sup>5,6</sup> In type 2 diabetes, Schwedes et al<sup>7</sup> showed that meal-related SMBG within a structured counseling program improves A1C levels. More recently, a large epidemiologic study by Martin et al, which followed 3268 patients for approximately 6.5 years, showed that SMBG was associated with decreased diabetes-related morbidity and all-cause mortality in type 2 diabetes; this association was even seen in the subgroup of patients who were not receiving insulin therapy.<sup>8</sup> Research has also shown that SMBG assists in controlling glucose levels and preventing adverse outcomes in pregnancy and preconception planning.<sup>9-12</sup> Furthermore, SMBG is an integral component of the American Association of Diabetes Educators (AADE) 7<sup>TM</sup> Self-care Behaviors<sup>13</sup> and is widely regarded as a valuable tool to help individuals with

This is an official position statement of the American Association of Diabetes Educators (AADE). AADE is dedicated to advancing the role of the diabetes educator and improving quality of diabetes education and care.

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AADE Board approval: May 2006

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DOI: 10.1177/0145721706295873

diabetes understand the impact of foods, medications, and activities on their glucose levels.<sup>14-16</sup>

The following statement presents the recommendations of the AADE on the use of SMBG by individuals with diabetes:

Health care professionals providing diabetes care and education should encourage and support the use of SMBG in all individuals with diabetes. Safe and appropriate blood glucose-monitoring methods need to be taught, including self-management skills that incorporate and use the data obtained from blood glucose monitoring for an individualized program of self-care.

## Overview

All health care providers need to encourage individuals with diabetes to use SMBG. All persons with diabetes using insulin and/or oral agents can benefit from SMBG use.<sup>7,8,17</sup> Individuals managing their diabetes through meal planning and physical activity may also benefit from SMBG by having objective data to evaluate the impact of lifestyle changes on diabetes control,<sup>7,8,18</sup> as well as providing important data to guide the patient and health care team during intercurrent illness; however, this benefit has been largely unstudied in randomized controlled trials in this population. A large epidemiologic study of 24 312 patients in a managed care organization showed that frequent monitoring of blood glucose was associated with clinically and statistically better glycemic control regardless of therapy.<sup>18</sup>

SMBG can be used by individuals with diabetes to avoid acute complications and increase safety in the following situations, among others:

- symptoms of hypoglycemia/hyperglycemia;
- hypoglycemia unawareness;
- periods of illness, postsurgery, or posttransplant;
- exercise;
- gastroparesis;
- adjustment of diabetes medications;
- evaluation of effects of other medication therapies (eg, steroids);
- preconception planning; and
- pregnancy.

## Benefits and Use of SMBG

SMBG is integral to diabetes self-management and offers the potential for increased patient learning and

enables patients to take an active role in their care. Active patient involvement can facilitate achievement of glycemic goals.<sup>5,6</sup>

SMBG is a tool that guides glycemic management strategies and has the potential to improve problem-solving and decision-making skills for both the person with diabetes and his or her health care provider. SMBG can promote improved understanding of the impact of foods, physical activity, and medications on blood glucose levels. It can facilitate more timely adjustment of therapeutic regimens, thereby supporting flexibility in meal planning, physical activity, and insulin/oral agent administration. SMBG has been shown to improve glycemic control in individuals with type 1 and type 2 diabetes<sup>7,8,17</sup> and improve overall health and sense of well-being.<sup>19</sup> SMBG is particularly important in pregnancy, where it has been shown that intensive glycemic control significantly benefits fetal outcomes.<sup>9-12</sup>

As a safeguard against the acute complications of diabetes, SMBG provides a method for quickly detecting the occurrence of hypoglycemia and hyperglycemia. This quick detection enables individuals with diabetes to respond rapidly to treat or prevent these potential emergencies. This ability can be particularly valuable for individuals with hypoglycemic unawareness.

In persons with type 1 diabetes, SMBG is used in conjunction with ketone monitoring if blood glucose levels are greater than 300 mg/dL (16.5 mmol/L) and during illness or stress.<sup>20</sup> During pregnancy, ketone testing is also advised for early detection of ketosis, which may adversely affect behavior and intellectual development in the offspring.<sup>21</sup>

## Skill Sets Required for SMBG

Accurate monitoring requires careful training regardless of the method or device used. Return demonstration by the patient is a critical aspect of this instruction. Technological advances continue to reduce potential sources of user errors in monitoring. However, the need for verification of SMBG skills remains of utmost importance.<sup>22</sup> Basic SMBG education should cover the following steps<sup>23</sup>:

- operation of the meter including calibration,
- obtaining an adequate blood sample for monitoring,
- use of attendant supplies such as control solutions,
- care and storage of devices and supplies,
- disposal of sharps,
- documentation of results, and
- use of results.

Pages 837-843 are not included in this document since they were product advertisement in this issue of The Diabetes Educator Journal.

## Alternate Site Testing

Alternate-site testing allows individuals to obtain blood from sites other than the finger and is available on many meters. However, caution needs to be used with alternate-site testing. It has been shown that significant variations in blood glucose levels exist between samples obtained from finger sticks and alternate sites (ie, forearm) when blood glucose levels are changing rapidly.<sup>24,25</sup> It is therefore recommended that patients obtain blood samples from either the fingertips or base of the thumb. Studies have shown a strong correlation between glucose levels obtained from the base of the thumb and those obtained from finger sticks.<sup>26,27</sup> When the finger is used, always obtain the blood sample from the sides of the finger where there is increased blood flow and fewer nerve endings.<sup>28</sup>

## Responsibility of the Health Care Professional

All health care professionals who intervene in the management and education of people with diabetes require a working knowledge of SMBG tools and procedures. Individualized education in day-to-day management skills using the data obtained from SMBG need to be taught by the health care professional and include the following<sup>19,22</sup>:

- assistance in selecting a glucose-monitoring system best suited to the individual's situation, taking into account potential physical and financial barriers;
- instruction in accurately performing SMBG and recording glucose values;
- discussion and selection of mutually agreeable individualized glycemic target goals;
- education in making appropriate adjustments in diabetes regimen by using the results;
- periodic reassessment of user technique and data use; and
- disposal of sharps and infection control.

Health care professionals need to provide individualized recommendations in the timing of monitoring (eg, morning, bedtime, before or after meals), the frequency of monitoring, appropriate use of alternate-site testing, sites for different situations, glycemic goals, and appropriate steps to be taken if goals are not achieved.<sup>29</sup> The actions to be taken will depend on the needs and decision-making skills of each individual. Ideally, written instructions for meal planning, physical activity, medication adjustment and management of hypoglycemia, hyperglycemia, and sick

days will be provided. SMBG recommendations need to be flexible and individualized based on the individual's glycemic goals and current status. The instructions must also include when and whom to call for assistance with self-management issues.

## Effective Use of SMBG

The optimal impact of SMBG is achieved only when data obtained through monitoring is consistently applied in an individualized program of monitoring, assessment, reassessment, problem solving, and decision making to facilitate self-care.

There are numerous guidelines regarding the frequency of checking blood glucose levels based on type of diabetes and therapeutic modalities.<sup>30</sup> However, it is important to individualize SMBG regimens to address individual needs. Furthermore, health care professionals will need to modify SMBG regimens to accommodate therapeutic and lifestyle changes.

The goals of self-care management can best be achieved when there is a mutual review of the data by the health care professional and the individual with diabetes.

The diabetes health care professional needs to review the monitoring program and data with the patient on a periodic basis. A randomized, controlled trial, which followed 199 subjects for 6 months, showed that use of educational materials that target SMBG use significantly increased monitoring frequency and improved glycemic control.<sup>31</sup>

To assist the self-care process, many monitoring systems feature a memory function that can store and recall the date, time, and glucose value for each blood glucose check and can interface with computers. Although this feature provides patients and health care professionals with the ability to quickly review large amounts of data in a comprehensive manner, it does not replace the use of logbooks. However, data management systems that allow users to input data such as glucose levels, hypoglycemic episodes, exercise, medications, and carbohydrate intake can also be useful. Periodic review of glucose values within the context of these factors and events facilitates timely adjustments in lifestyle or medication between scheduled medical visits.

## Summary

The full potential of SMBG can be realized only when persons with diabetes appropriately apply the data provided by their monitoring to the other components of

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their overall plan of diabetes self-care. Accurate data from SMBG can be used to prevent or respond early to the acute complications of diabetes and prevent or delay the long-term complications. It is imperative that SMBG data are accurate. Accurate monitoring requires careful training regardless of the equipment used. Health care professionals play a key role in ensuring that SMBG is accurate and used appropriately. The AADE supports the use of SMBG as a vital tool to achieve glycemic goals and promote self-care for individuals with diabetes.

## Development of This Document

This position statement was developed by a multidisciplinary task force of the AADE. The following members were selected for their expertise, professional discipline, and geographical location to ensure a broad representation of perspectives and practices.

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