AADE POSITION STATEMENT

The American Association of Diabetes Educators Position Statement: Self-Monitoring of Blood Glucose Using Glucose Meters in the Management of Type 2 Diabetes

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Introduction

Effective management of type 2 diabetes is contingent on numerous factors and behaviors. Among the AADE7 Self-Care Behaviors™ (healthy eating, being active, monitoring, taking medications, problem solving, reducing risks, and healthy coping), self-monitoring of blood glucose (SMBG) can be a key component of the treatment regimen.[1] Large clinical trials have demonstrated that glycemic control, as assessed by hemoglobin A1C (A1C) levels (which reflect blood glucose levels over a three-month period), reduces the microvascular changes that lead to severe diabetes-related complications.[2-4] Current evidence also suggests that post-prandial hyperglycemia can be a risk factor for the development of both microvascular and macrovascular disease leading to cardiovascular risk.[5-7] Individualized approaches to A1C control are especially important for the adult with type 2 diabetes.[8]

SMBG is an important complement to the measurement of A1C levels because it provides the person with diabetes immediate information about their blood glucose levels. Unlike A1C monitoring, SMBG provides the person with diabetes a means to distinguish fasting, preprandial, and postprandial blood glucose levels.[9] By delivering information on a person's current blood glucose level, SMBG allows the person with diabetes to monitor the immediate effects of food, physical activity, and medications on glycemic control.[9] To be useful, SMBG must be integrated into the diabetes self-management plan in a personalized way so that results are meaningful to the individual.[10, 11] The diabetes educator has the skills and training required to instruct the person with diabetes on the goals and techniques of SMBG, and more importantly, on how to evaluate and use the data to improve glycemic control.

Background

SMBG refers both to the act of checking (or testing) blood glucose levels with a blood glucose meter and utilizing the results to make lifestyle and treatment regimen decisions. The results from SMBG can be used by the person with diabetes to make necessary changes to self-care behaviors, to collaborate with their healthcare provider on a routine basis for feedback, or to analyze data and identify potential action plans. Unfortunately, some people with diabetes may not understand how to utilize SMBG results in the above-described ways. Thus, there is a need to remedy this through diabetes education.

While the benefits of SMBG have been demonstrated in persons with type 1 diabetes and persons with type 2 diabetes who are treated with insulin, outcomes of studies assessing the effects of SMBG in persons with type 2 diabetes who are not treated with insulin have revealed inconsistent results. A Cochrane review of randomized controlled trials published in 2012 concluded that there was no substantial evidence of a beneficial effect of SMBG in people with type 2 diabetes not treated with insulin.[12] A subsequent review published in 2013 criticized the Cochrane review for excluding many studies and drawing conclusions from only a small number of studies; trials reviewed in the 2013 paper associated SMBG with major and significant decreases in A1C in persons with type 2 diabetes not treated with insulin.[6] These inconsistent findings may be due to differing study design elements or other factors, e.g., the implementation of intensive care in both the SMBG and control groups.

A limitation of some trials included in the Cochrane review analysis[12] was the lack of information on modification of behavior or treatment in response to the blood glucose level readings.[5, 6] In contrast, a consensus report found that high quality efficacy data from randomized controlled trials which used a structured approach (a defined monitoring regimen where results were used to make pharmaceutical or lifestyle adjustments) demonstrated efficacy of SMBG in non-insulin treated type 2 diabetes.[10] Similarly, in the Structured Testing Program study (N=483), appropriate use of structured SMBG significantly improved glycemic control and facilitated more timely/aggressive treatment changes in non-insulin treated type 2 diabetes without decreasing general well-being.[13]

While SMBG may not be appropriate for all people with type 2 diabetes who are not treated with insulin, it is a useful tool for many. People with diabetes who use SMBG can benefit from being

able to identify the relationship between nutrition, physical activity, and current blood glucose levels, interpret the results, and make changes.[14] These individuals can expect to see improvement in diabetes management or prevention of complications and hospitalizations.[15]

Beyond improving clinical outcomes, SMBG data can improve quality of life.[16] Most people with diabetes believe that using SMBG has beneficial health outcomes, and those who received training in the interpretation of SMBG results experienced fewer negative feelings about SMBG compared to those who relied on providers to interpret their results.[16, 17] However, it must also be acknowledged that many factors (e.g., pain, socioeconomic status, and social support) can be barriers to self-monitoring behavior.[17]

People with type 2 diabetes with proper training are able to use SMBG to predict future episodes of hypoglycemia.[18] People with diabetes who inject insulin can be shown how to titrate their insulin dosage based on SMBG values to achieve improved glycemic control while minimizing acute episodes of hypoglycemia.[19] Symptoms of hypoglycemia may not be recognized by young children or their parents and adults with hypoglycemia unawareness. SMBG is particularly valuable in these populations.[20]

SMBG also has an important place in the management of diabetes in pregnant women, i.e., gestational diabetes. The American Diabetes Association recommends SMBG before and after meals and occasionally at night time for optimal results in pregnant women with pre-existing diabetes.[21] Similarly, the National Institute for Health and Clinical Excellence clinical guidelines advise pregnant women with diabetes to check fasting and one-hour post-prandial blood glucose levels after every meal during pregnancy. Those who are taking insulin are also encouraged to check their blood glucose before going to bed at night.[22]

Role of the Diabetes Educator

1. **Assess meter and monitoring technique.** Accuracy of SMBG results are meter- and user-dependent. The diabetes educator should periodically assess the accuracy and appropriateness of the blood glucose meter being used, as well as the monitoring technique. The accuracy of these instruments is affected by individual and environmental variables, including hematocrit, hypotension, hypoxia, hypertriglyceridemia, concomitant drugs, as well as temperature and humidity.[23] The diabetes educator can assist in selecting meters that will be accurate under the conditions they will be used. To effectively recommend and train on meter use, the educator

must understand insurance coverage and cost of equipment, and personalize education based on the individual's monitoring needs and resources. If SMBG is simply prescribed without education, people with diabetes are less likely to take advantage of the feedback that SMBG provides about their immediate response to medication, lifestyle behaviors, stress and illness. Clinical trials have demonstrated that those trained in using SMBG were more likely to adhere to instructions regarding meal planning, because they observed the immediate effects of their food intake on blood glucose levels.[14]

2. **Recommend frequency of SMBG.** The diabetes educator should help determine the optimal frequency of blood glucose testing based on medication regimen, level of glycemic control, and the individual's specific needs and goals.[24] Diabetes educators also educate people with diabetes on when to perform SMBG in other situations such as illness, periods of stress or trauma, and initiation of new medications that can affect blood glucose levels.

3. **Interpret results and recommend action.** The diabetes educator should educate people on how to interpret their SMBG results and make appropriate adjustments to their medication, diet, and physical activity in accordance with the diabetes educator's scope of practice.[24] The diabetes educator is able to help people with diabetes optimize use of SMBG by teaching pattern management and problem solving skills while reviewing high or low blood glucose results with the individual.[25] All people with diabetes should be taught to know the goals of SMBG, their own blood glucose goals (at different times of the day) as well as their A1C goal. In addition, diabetes educators should compare blood glucose records with the A1C to identify possible causes if they don't match.[26, 27] Furthermore, they should understand how these are linked and how the achievement of these goals is related to their treatment plan, particularly their diabetes medication regimen.

4. **Tailor instruction based on individual needs.** The diabetes educator should be able to identify which individuals have the ability and the resolve to learn how to respond to the data in terms of lifestyle and treatment adjustment since not all people with diabetes benefit equally from SMBG.[28] The effectiveness of diabetes self-management education also varies with age, with children having less capacity to implement SMBG or interpret blood glucose results.[29] Thus, diabetes educators should engage in a process of individualized, continuing education

regarding self-management and SMBG to maintain optimal metabolic control through the years.[27]

Cognitive and physical factors can also affect the capacity to understand and implement SMBG; persons with low cognitive function are more likely to require assistance in performing all diabetes self-care tasks.[30] People with diabetes and poor dexterity or vision along with older adults may require additional guidance about adaptation, special counseling or specific meter selection.[31]

5. **Identify and address barriers.** Barriers to SMBG can include cost, pain, inconvenience, forgetfulness/distraction, poor understanding of SMBG usefulness, disappointment in the results, psychosocial factors such as emotional distress, lack of support or low self-esteem, language, limited literacy and numeracy skills, and physical or cognitive issues.[32, 33] The issues around pain and inconvenience may be larger in the patient's perception than in reality.[34] As to cost, people with diabetes whose SMBG supplies are covered by insurance were found to have lower A1C levels than those without insurance coverage.[35]

6. **Recommend mechanisms for communication and ongoing support.** The diabetes educator should evaluate an individual's primary support network and, if needed, provide additional support and encouragement.[36] Individuals with diabetes whose support persons were depressed, had low self-esteem, or low levels of optimism, were less likely to perform SMBG.[36] Diabetes educators have an important role in helping to facilitate communications between people with diabetes and their healthcare provider(s) to ensure the SMBG results are shared and discussed, and that action is taken when warranted.

AADE Maintains the Following Positions

- Diabetes educators must be able to educate people with diabetes about how to use SMBG to obtain, interpret, and take action on accurate data safely, efficiently, and effectively.
- Diabetes education should provide people with diabetes insight about how to take advantage of the immediate feedback SMBG provides to better manage their blood glucose levels.
- SMBG readings are to be used in clinical decision-making by every member of the individual's healthcare team. Diabetes self-management education must include

instruction on recognizing blood glucose levels that are out of the target range and taking the appropriate action steps in response to such readings.

- In appropriate cases where barriers such as cognitive limitations impede effective use of SMBG, diabetes educators and people with type 2 diabetes should collaborate in the regular performance of SMBG, individualized to the person's needs and abilities.
- Diabetes educators need to be appropriately informed so that they can refer people with diabetes to community resources that help overcome barriers such as cost and limited access to diabetes education.

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