

# What Primary Care Providers Can Do to Address Barriers to Self-Monitoring of Blood Glucose

William A. Fisher, PhD, Deborah H. Cornman, PhD, Taylor Kohut, MSc, Holly Schachner, MD, and Patricia Stenger, RN, CDE

**S**elf-monitoring of blood glucose (SMBG) can be instrumental in achieving glycemic control in individuals with type 1<sup>1,2</sup> or type 2<sup>3-8</sup> diabetes. SMBG can help people with diabetes understand the effects of food and exercise on blood glucose and assist them to make healthy choices; provide insights to patients and clinicians concerning the effectiveness of therapies; and provide direction in efforts to achieve and maintain glycemic control.<sup>5,9-11</sup>

SMBG will be most effective in improving glycemic control among individuals with diabetes who have learned appropriate self-management actions to take on the basis of SMBG results and who undertake such actions consistently.<sup>2,5</sup> Despite the substantial potential benefits of SMBG, however, adherence to recommended frequency and patterns of self-monitoring is suboptimal and inconsistent among many individuals with diabetes.<sup>5,9-11</sup>

A fundamental goal of the clinical management of diabetes involves facilitating diabetes self-care practices that lead to positive health outcomes.<sup>12</sup> SMBG is seen as a tool that can provide useful information to patients and health care providers (HCPs), assisting patients to become active self-managers and HCPs to make timely and informed treatment adjustments to optimize therapy and improve metabolic outcomes.<sup>13</sup> The International Diabetes Federation supports this concept in the first recommendation of its Guideline

on Self-Monitoring of Blood Glucose in Non-Insulin-Treated Type 2 Diabetes, which states, “SMBG should be used only when individuals with diabetes (and/or their caregivers) and/or their HCPs have the knowledge, skills, and willingness to incorporate SMBG monitoring and therapy adjustment into their diabetes care plan in order to attain agreed treatment goals.”<sup>14</sup>

The aim of SMBG is to facilitate timely clinical interventions to achieve or maintain blood glucose within an acceptable target range and to assist individuals with diabetes in making informed decisions about their daily diabetes-related choices. Toward these ends, medical guidelines recommend that testing frequency and timing be individualized. After first establishing an agreed-upon target range for each patient, clinicians need to consider the individual therapeutic approach and develop a plan for meaningful testing—in the context of the individual therapeutic approach—that can answer specific questions, reinforce identified health-promoting behaviors, and help both themselves and their patients understand the impact of interventions and choices.

Schnell et al.<sup>15</sup> recently suggested less intensive or more intensive schemes for testing based on variables such as the treatment approach, the risk of hypoglycemia, and the quality of an individual’s metabolic control. To optimize the benefit of SMBG to both patients

and clinicians, the level of implementation of SMBG and a structured approach to testing should be individualized and informative to both patients and clinicians and should aim to encourage patient self-efficacy. An illustration of how individualized patterns of SMBG can be informative to patients and clinicians is provided in Table 1.

Findings of recent research based on the Information–Motivation–Behavioral Skills model of health behavior<sup>16-18</sup> have identified significant SMBG information gaps, SMBG motivational obstacles, and SMBG behavioral-skills limitations that may act as obstacles to self-monitoring practice among individuals with type 1 or type 2 diabetes.<sup>19</sup> These SMBG information deficits, motivational obstacles, and behavioral-skills limitations appear to be consequential; individuals with diabetes who were less informed, less motivated, and less skilled with respect to SMBG reported significantly less frequent self-monitoring.<sup>19</sup> Information, motivation, and behavioral-skills obstacles to SMBG represent significant challenges for primary care providers and individuals with diabetes in establishing and maintaining diabetes self-care behaviors that lead to positive health outcomes.<sup>12</sup>

With the aim of realizing the potential benefits of SMBG, a considerable amount of research has been conducted to identify effective methods for encouraging self-mon-

**Table 1. Two Illustrations of How Individualized SMBG Testing Can Be Informative to Patients and Clinicians**

**Illustration 1:**

This patient's A1C is 8.3%, which is higher than one would expect based on the blood glucose values shown below (in mg/dl). Given that the values are mostly in the target range, many clinicians might discharge the patient from his appointment, saying, "Keep up the good work." However, some investigative SMBG could provide insights to both the patient and the clinician to enable better diabetes decisions.

	8:00 a.m.	10:00 a.m.	Noon	3:00 p.m.	6:00 p.m.	9:00 p.m.
Monday	83			107		
Tuesday	97					88
Wednesday					94	
Thursday						
Friday	87					
Saturday						
Sunday	61		89			

What if the patient was asked to perform SMBG twice a day, but at specific times, to learn how food and exercise may affect his blood glucose level? For the next week, the patient was asked to carry out SMBG before and 2 hours after breakfast for several days, with results shown below.

	8:00 a.m.	10:00 a.m.	Noon	3:00 p.m.	6:00 p.m.	9:00 p.m.	Notes
Monday	83	253					Eggs & oatmeal
Tuesday	97						
Wednesday							
Thursday	87	194					Eggs & oatmeal
Friday							
Saturday		132					Eggs
Sunday	61	118					Eggs

The patient excitedly called the office on Monday to say that he learned from looking at his SMBG log that his breakfast on the weekend helped to keep his blood glucose values in his target range (70–140 mg/dl before meals and < 180 mg/dl after meals). With an A1C of 8.3% (not at the goal of < 7%) and postprandial blood glucose values above the target range, the clinician should encourage less carbohydrate intake for breakfast on weekdays. If the postprandial hyperglycemia is persistent, the clinician could consider adding a medication that addresses postprandial hyperglycemia to the patient's metformin therapy.

*continued on p. 36*

itoring adherence. Meta-analysis indicates that a diversity of interventions may have positive effects on SMBG knowledge, frequency, and accuracy.<sup>20</sup> Individual intervention trials that include provision of an SMBG device and education,<sup>21</sup> a blood glucose "owner's manual,"<sup>22</sup> and stages-of-change<sup>23</sup> and motiva-

tional interviewing<sup>24–28</sup> interventions all have shown positive effects on SMBG frequency and, often, on A1C levels. Although the research literature demonstrates that interventions may be effective in facilitating SMBG and achieving improved glycemic control, the implementation of effective interventions by busy clini-

cians seeing patients with diabetes in time- and resource-limited settings remains a challenge.

In a clinical reality that is often overburdened, interventions that are brief and effective at strengthening SMBG adherence may be of considerable utility, and motivational interviewing represents one such

**Table 1. Two Illustrations of How Individualized SMBG Testing Can Be Informative to Patients and Clinicians, *continued* from p. 35**

**Illustration 2:**

We now consider a patient who eats a large bedtime snack every night because of his fear of having low blood glucose overnight. The clinician asks the patient to continue with SMBG twice a day, 3–4 days per week, but asks the patient to test at 9:00 p.m. and at midnight, as shown below.

	8:00 a.m.	10:00 a.m.	Noon	3:00 p.m.	6:00 p.m.	9:00 p.m.	Midnight
Monday						107	224
Tuesday							
Wednesday						124	233
Thursday							
Friday						112	198
Saturday							182
Sunday						89	

Both patient and clinician are likely to learn from this pattern of SMBG. This patient eats a large snack at bedtime and did not know that it made his blood glucose values rise above his target levels. The clinician learned that he might be able to lower the patient's insulin sensitizer (metformin) dose if the patient is able to limit his bedtime snacking.

potentially effective diabetes management strategy. Suggestions for selectively implementing a motivational interviewing approach to strengthen SMBG adherence, when indicated, follow and may prove useful for clinicians who have limited time and require brief but effective counseling techniques.

Ideally, this approach would be implemented by all members of the diabetes care team. However, this article focuses on the use of motivational interviewing by individual clinicians.

**A Primary Care Approach to Identifying and Addressing Information, Motivation, and Behavioral-Skills Barriers to SMBG**

Motivational interviewing is a patient-centered but clinician-directed approach to enhancing individual patients' intrinsic motivation for health behavior change by exploring and resolving their ambivalence about making such change. The motivational interviewing approach consists of a set of empirically supported communication techniques

that are designed to produce rapid, internally motivated improvements in health behavior practices.<sup>24–33</sup> It has been adapted for use in brief clinical encounters to address a wide variety of health behaviors,<sup>32–35</sup> including diabetes self-management,<sup>24–28</sup> and may be employed in efforts to strengthen SMBG utilization in the diabetes care setting.

According to Miller and Rollnick, the originators of this approach, “The strategies of Motivational Interviewing are more persuasive than coercive, more supportive than argumentative . . . . The overall goal is to increase the patient's intrinsic motivation, so that change arises from within rather than being imposed from without. When this approach is done properly, it is the patient who presents the arguments for change, rather than the clinician.”<sup>32</sup>

A fundamental principle of motivational interviewing involves the understanding that patients are the foremost experts—and clinicians' primary assets—in

understanding what it would take for them to improve their motivation and capability to improve their diabetes self-management practices. As described by one diabetes care clinician, “I learned that I should not solely rely on my perspectives and instincts . . . . The patient is the expert on himself or herself, and I am the expert on diabetes . . . . It is my job to bring the expertise together.”<sup>36</sup>

The role of clinicians is to help individuals with diabetes to explore where they want to go with respect to SMBG adherence and what it would take for them to get there. The approach is directive; clinicians manage the counseling process aimed at identifying and addressing barriers to SMBG adherence. It is also patient-centered, seeking to elicit and reinforce patient-generated motivation and patient-generated strategies for change.

Several core principles of motivational interviewing are relevant to encouraging self-generated change and strengthening adherence to

SMBG. Described in more detail below, these include the development of discrepancy, embracing ambivalence, supporting patient self-efficacy, expressing empathy, and “rolling with resistance.”

1. Development of discrepancy.

This principle emphasizes that clinicians can assist patients in exploring the gap between their current self-management practices and their broader health goals. In other words, in clinician-patient encounters, clinicians can pose the question of whether patients’ current SMBG practices are consistent with achievement of their valued long-term health objectives.

2. Embracing ambivalence. This principle acknowledges that many patients are ambivalent about making health behavior changes and encourages clinician-patient interaction to explore patients’ ambivalence about change.

Allowing patients to discuss their perceptions of the costs of SMBG adherence and the benefits of suboptimal adherence can quite paradoxically serve as a catalyst for positive behavior change.

3. Support for self-efficacy. This principle encourages clinician-patient interactions that strengthen patients’ perceptions that they are capable of achieving realistic health behavior-change goals and that healthy outcomes are possible.

4. Expression of empathy. The motivational interviewing approach is empathic and nonjudgmental and uses reflective listening to convey an understanding of patients’ feelings and perspective without judging or blaming.

5. “Rolling with resistance.” Resistance—when patients are in denial or argue with their clinician, or simply refuse to talk—is often related to how the clinician and patient are interacting, and it can be made worse (for example, by

clinician threats) or diminished (by avoiding confrontation), depending on the clinician’s response.

Patient resistance is a signal that clinicians and patients are not at the same place and can indicate that clinicians are pushing patients beyond where they are ready to go. Rather than viewing resistance as a problem, clinicians can view it as a signal to change how they interact with patients.

It is to be emphasized that motivational interviewing is a counseling approach, not a set of fixed techniques to be employed mechanically. Following are some steps that clinicians may adopt in selective use of this approach to strengthen SMBG and diabetes self-management in patients for whom this may be indicated.

**Step 1: Set the agenda.**

Embodying the patient-centered, empathic, nonjudgmental, but directive approach to health behavior change, clinicians first set the agenda for a brief discussion. Asking for permission to have this discussion (e.g., “If it is okay with you, I’d like to talk about how you are doing with your diabetes.”) demonstrates respect for patients, gives them a sense of control, can lessen defensiveness, and can increase engagement.

**Step 2: Assess patients’ SMBG self-management: how are they doing with respect to blood glucose testing?**

Acknowledging that diabetes self-management is challenging (e.g., “A lot of my patients find it difficult to test on a regular basis. How has testing been going for you?”) helps to create an environment in which it is safe for patients to admit imperfection and increases the likelihood that patients will be honest and forthcoming.

**Step 3: Reinforce success and prevent relapse, or choose a self-management practice to address.**

If self-management is proceeding well, praise patients and discuss strategies to prevent relapse. Relapse prevention involves asking patients about situations in which they have had difficulty practicing SMBG and discussing how they have dealt with these situations in the past and how they could avoid or manage these situations in the future. If patients are struggling with one or more diabetes self-care challenges, ask them which challenge they would like to focus on (e.g., “Would you like to talk about testing or exercise?”). This helps ensure that patients’ behavior change efforts are relevant and that there is sufficient time to adequately address at least one issue. It is essential that both clinicians and patients provide input, but the decision of what, if anything, to focus on is the patients’ prerogative.

**Step 4: Rate importance.**

Motivational interviewing provides a means for understanding whether patients’ obstacles to SMBG adherence involve information deficits (e.g., lack of knowledge of the importance of structured testing to understand the impact of food choices on post-meal blood glucose variations), motivational obstacles (e.g., the feeling that testing is painful and time-consuming), or behavioral skills limitations (e.g., the use of poor technique to get an adequate blood drop).<sup>19</sup>

Identifying specific obstacles to SMBG adherence starts with assessing the importance to patients of undertaking SMBG as recommended. Patients who rate SMBG as unimportant may be indicating that they lack information about the importance of self-monitoring (e.g., “Why should I test after a meal? I don’t know what that tells

me.”), or they may endorse beliefs that deter testing (e.g., “My body tells me—without testing—whether my blood glucose is high or low.”).<sup>19</sup> To explore patients’ perceptions of the importance of testing, clinicians can say something such as, “I want to understand better how you feel about testing, so I’d like to ask you a couple of questions. On a scale of 1 to 10, where 1 is ‘not at all important’ and 10 is ‘very important,’ how important is it to you to test both before and after one of your meals, for say 3 days per week?”

#### **Step 5: Rate confidence.**

Understanding patient barriers to SMBG adherence also involves assessing patients’ confidence that they are capable of adhering to SMBG. Patients who are not confident in this regard may be indicating that they lack the required motivation to self-monitor or that they lack the behavioral skills necessary to do so. Patients may experience SMBG as a punishing event that they have no motivation to endure (e.g., “It’s painful and time-consuming.”), or they may lack the skills required to remember to test, to keep their meter handy, or to use it correctly.<sup>19</sup> To explore patients’ confidence that they are capable of undertaking SMBG at a recommended frequency and pattern, clinicians can say something such as, “Again using a 10-point scale, where 1 is ‘not at all confident’ and 10 is ‘very confident,’ how confident are you that you could test both before and after one of your meals, 3 days per week?”

#### **Step 6: Decide whether to focus on importance or confidence.**

The next step is to decide whether to work on improving a patient’s perceived importance or confidence in relation to recommended SMBG practice. In general, if importance ratings are low (e.g., < 7), it is worth-

while to work on helping patients strengthen their understanding of the importance of testing, regardless of their confidence rating. (If testing is not important to them, their confidence about testing is not likely to matter.) If importance ratings are  $\geq 7$ , clinicians can work on whichever rating—importance or confidence—is lower. If both importance and confidence are rated 10 and patients are still not consistently testing, clinicians can proceed directly to identifying barriers to testing and developing strategies with patients about how to overcome those barriers.

#### **Step 7: Identify patients’ specific barriers to SMBG and explore strategies that might help to overcome these barriers.**

Once clinicians have decided whether to focus on importance or confidence, two questions can help clarify patients’ specific barriers to SMBG and what patients believe might help strengthen their practice of SMBG.

First, ask, “You said you were a [number] on importance (or confidence). Why did you give yourself a [number] and not a lower score?” This paradoxical question is important because it can elicit self-motivating “change statements” that emphasize the importance of testing or strengthen patients’ confidence in testing. Patients’ responses to this question often also provide insights into their strengths and resources (e.g., “I said 6, not lower, for importance, because I know blood glucose is important, but I’m just not convinced I have to test myself that often” or “I gave a 5 for confidence and not lower, because I do manage to test during the week, but on the weekends, I can’t seem to remember to do it.”).

Next, clinicians can ask, “What would it take [or “What would have to happen”] for the importance of testing before and after one meal

three times a week to increase from a 6 to an 8 or 9?” or “What would it take [or “What would have to happen”] for your confidence in testing before and after one meal three times a week to increase from a 5 to a 7 or 8?” This question exploits the fact that patients are the experts in what would be required for them to regard testing as important or to be confident in their capability to test as recommended. Note that it is recommended to frame the “What would it take?” question in relation to a score a couple of points higher than that given by patients. Clinicians are well aware that change is generally a progressive process and not an all-at-once occurrence.

Responses to the “What would it take?” question will often provide concrete direction for clinician-patient discussion of how to achieve increases in patients’ perceived importance or confidence in testing. Once conditions for increasing importance or confidence in testing are identified, clinicians and patients can work together on specific strategies for change.

#### **Step 8: Negotiate an achievable behavior change goal.**

After discussing importance or confidence and patient-generated (or, if necessary, clinician-suggested) strategies for strengthening importance or confidence, clinicians and patients can negotiate an achievable SMBG behavior change or maintenance goal. It is more important for the goal to be achievable than for it to represent perfection; building on success across time is essential.

#### **Step 9: Follow up through subsequent clinical contacts.**

If patients report success with respect to the SMBG behavior change or maintenance goal that has been negotiated, clinicians may reinforce that success, discuss challenges that

have emerged, and actively work with patients on relapse-prevention strategies. Clinicians and patients may then negotiate maintenance of change or a more challenging goal for the future. If patients have experienced difficulty achieving their negotiated goal, clinicians and patients can discuss alternative means for achieving the same goal or develop a strategy for a different, more easily achieved goal for the future.

Figure 1 presents a summary of the steps involved in a motivational interviewing approach to SMBG adherence. Table 2 presents a case study that illustrates a motivational interviewing approach to SMBG adherence.

### Conclusions

Motivational interviewing approaches to diabetes self-management have become increasingly popular, and research support for their effectiveness is accumulating.<sup>24-28</sup> Findings from research indicate that people with type 1 or type 2 diabetes, even of long duration, who have had diabetes education and who test relatively frequently, often still have SMBG information, motivation, and behavioral skills gaps that may impede optimal self-monitoring. In this article, we have suggested an adaptation of motivational interviewing that may prove helpful to clinicians when working with patients who are struggling to follow essential aspects of diabetes self-management.

### Relevance for clinicians

Most clinicians encounter patients who are struggling to manage their diabetes. Even veteran patients may have SMBG information gaps, motivational obstacles, and behavioral skills limitations that interfere with self-monitoring practice. Using motivational interviewing approaches, selectively and when indicated, to rapidly identify and address SMBG

barriers may be an effective addition to busy clinicians' armamentarium in the time- and resource-limited reality of diabetes care.

The American Diabetes Association Standards of Medical Care in Diabetes<sup>37</sup> emphasizes behavior change as a prominent management focus. With clinicians' assistance, patients can make significant improvements in achieving A1C, blood pressure, and lipid targets.

In settings in which access to diabetes education may be limited, a positive impact can nonetheless be made by employing techniques

utilized in more formal diabetes education programs. There is a continuing need to convey the knowledge necessary for patients to understand their individual diabetes-management needs, the motivation to act on this information adherently and over the long term, and the behavioral skills necessary to carry out treatment recommendations effectively.<sup>19</sup> It is anticipated that clinicians' implementation of evidence-based self-management behavior change strategies will stimulate further advances in patient health status in future years.

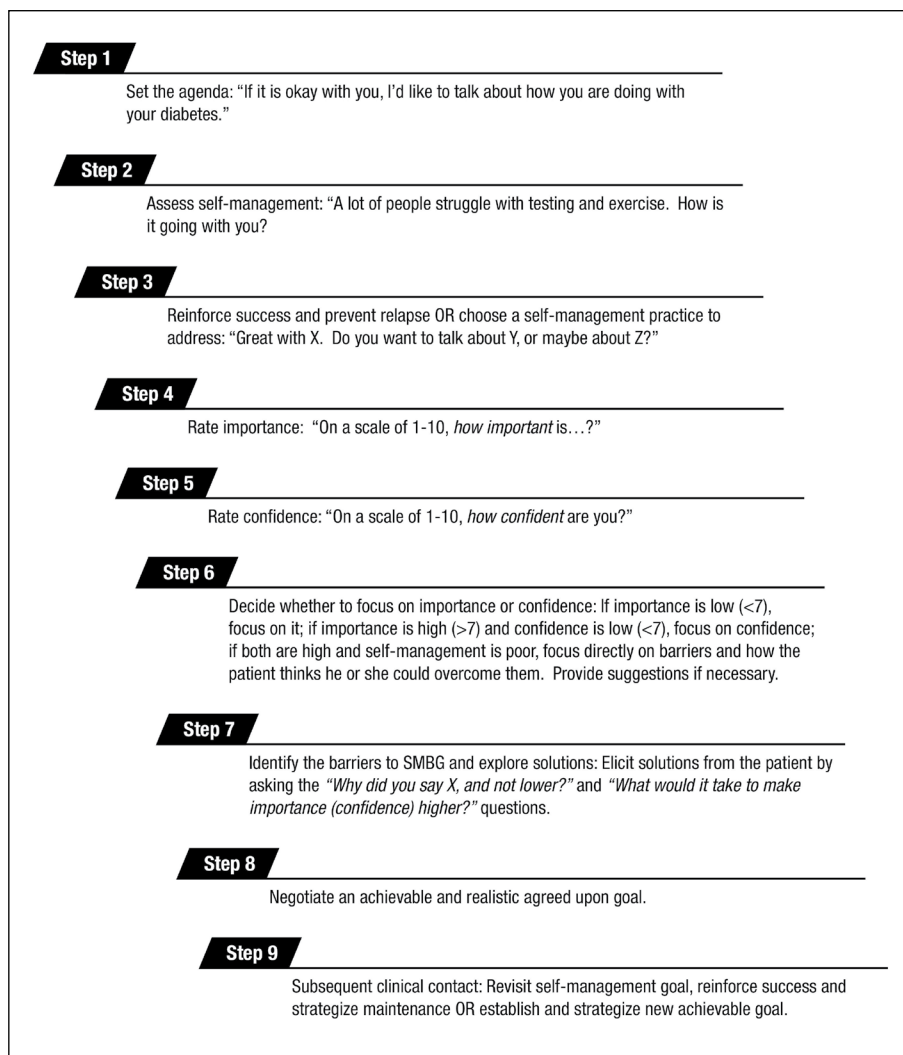


Figure 1. Steps in a motivational interviewing approach to strengthening SMBG.

**Table 2. Motivational Interviewing Approach Case Study: S.R.**

S.R. is a 58-year-old mid-level administrator at an insurance company. He has had type 2 diabetes for 6 years, and both of his parents had diabetes and died in their 60s from complications. His clinical picture includes:

- BMI: 29 kg/m<sup>2</sup>
- A1C: 8.3%
- Fasting blood glucose: 110 mg/dl
- Blood pressure: 128/78 mmHg
- Total cholesterol: 190 mg/dl
- LDL cholesterol: 130 mg/dl
- HDL cholesterol: 35 mg/dl
- Triglycerides: 207 mg/dl
- Treatment regimen: Metformin and nateglinide
- Activity level: cycles on weekends, recently started lunchtime walks
- Testing regimen: SMBG once or twice daily, several days a week (most often before breakfast and before bed)
- Diet: tries to “eat right”

Review of his SMBG record book reveals that his fasting blood glucose levels are generally in his target range. The following interview is an example of how a clinician could use the motivational interviewing approach in helping S.R. with SMBG implementation and health status improvement.

Motivational Interviewing Steps	Sample Script
Step 1: Set the agenda.	<p><b>Clinician:</b> “If it is okay with you, I would like to talk about how you are managing your diabetes at home.”</p> <p><b>SR:</b> “Sure.”</p>
Step 2: Assess SMBG self-management.	<p><b>Clinician:</b> “A lot of people struggle with meal planning, exercise, and testing. How are you doing?”</p> <p><b>SR:</b> “I walk at lunchtime, and I bicycle on weekends. I try to eat right, and when I test, the numbers are okay. I really don’t understand why my A1C is still up. It’s frustrating.”</p>
Step 3: Choose a self-management action.	<p><b>Clinician:</b> “You’re doing well with your exercise. Great! I can understand that you might be frustrated that your A1C is not where you’d like it to be. We can talk about your meal plan or about how testing is going. Which would you like to focus on?”</p> <p><b>SR:</b> “Actually, I’d like to talk about testing. I am testing once or twice a day, and my results are always fine.”</p> <p><b>Clinician:</b> “Do you test at any particular times?”</p> <p><b>SR:</b> “Whenever I get to it. All over the place.”</p>
Step 4: Rate importance.	<p><b>Clinician:</b> “I’d like to understand a little better how you feel about testing. On a scale of 1 to 10, where 1 is ‘not at all important’ and 10 is ‘very important,’ how important is it to you to test, say, both before and after breakfast, a few days per week?”</p> <p><b>SR:</b> “Oh, maybe a 5.”</p>
Step 5: Rate confidence.	<p><b>Clinician:</b> “And using the 10-point scale, where 1 is ‘not at all confident,’ and 10 is ‘very confident,’ how confident are you that you could test, say, both before and after breakfast for a few days per week?”</p> <p><b>SR:</b> “8. I already test twice a day, anyway, most days.”</p>

*continued on p. 41*

**Table 2. Motivational Interviewing Approach Case Study: S.R., continued from p. 40**

<p>Step 6: Decide whether to focus on importance or confidence; and Step 7: Identify barriers to importance and confidence and options for overcoming them.</p>	<p><b>Clinician:</b> “Okay, you said the importance of testing both before and after breakfast for a few days is 5. Why did you say 5 and not, say, 3 or 4?”  <b>SR:</b> “I am just not convinced that testing before and after breakfast would help me. I test now, and my A1C is high.”  <b>Clinician:</b> “What would have to happen for you to rate the importance of testing before and after breakfast a 7 or an 8?”  <b>SR:</b> “I’d have to believe that testing before and after breakfast could actually help me bring down my A1C.”</p>
<p>Step 8: Negotiate an achievable goal.</p>	<p><b>Clinician:</b> “Okay, let me explain. Blood glucose goes up when you eat. Testing before and after breakfast will help us better understand what happens to your blood glucose in response to your breakfast food choices. Maybe we just need to change some foods around. Would you be willing to see what testing before and after breakfast, twice a week, tells us? Does that make sense?”  <b>SR:</b> “I guess so. If it gives me feedback so I could avoid foods that send my glucose high, it might be worth it.”  <b>Clinician:</b> “Great. When you test, write down what you’ve had for breakfast, so we can do a little detective work on what you’re eating and where your blood glucose levels go. Call me at the end of the week, and we’ll work on figuring this out, okay? Do you have any questions?”</p>
<p>Step 9: Follow up through subsequent clinical contact.</p>	<p><b>SR:</b> “Hi, it’s S.R., and I am calling with my blood glucose levels.”  <b>Clinician:</b> “Were you able to test before and after breakfast and write down what you ate?”  <b>SR:</b> “I didn’t think I would learn anything, but I did. I eat oatmeal every day, and it turns out that my wife makes me a double portion on weekends when I cycle, and that makes my blood glucose go up. Now on days when I cycle, I eat a regular portion of oatmeal and an egg. I’m not hungry and my after-breakfast blood glucose is lower.”  <b>Clinician:</b> “Excellent detective work. Now, would you like to try seeing what lunch does?”</p>

**ACKNOWLEDGMENTS**

Development of this article was supported by Bayer HealthCare LLC, Diabetes Care. Technical editorial assistance was provided by Bo Choi, PhD, of MedErgy and was funded by Bayer HealthCare LLC, Diabetes Care.

**REFERENCES**

<sup>1</sup>DCCT Research Group: The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 329:977–986, 1993

<sup>2</sup>Hirsch IB, Bode BW, Childs BP, Close KL, Fisher WA, Gavin JR, Ginsberg BH, Raine CH, Verderese CA: Self-monitoring of blood glucose (SMBG) in insulin- and non-insulin-using adults with diabetes: consensus recommendations for improving SMBG accuracy, utilization, and research. *Diabetes Technol Ther* 10:419–439, 2008

<sup>3</sup>McAndrew L, Schneider SH, Burns E, Leventhal H: Does patient blood glucose monitoring improve diabetes control? A systematic review of the literature. *Diabetes Educ* 33:991–1011, 2007

<sup>4</sup>Welschen LMC, Bloemendal E, Nijpels G, Dekker JM, Heine RJ, Stalman WA, Bouter LM: Self-monitoring of blood glucose in patients with type 2 diabetes who are not using insulin: a systematic review. *Diabetes Care* 28:1510–1517, 2005

<sup>5</sup>Grava MB: Self-monitoring of blood glucose as part of a multi-component therapy among non-insulin requiring type 2 diabetes patients: a meta-analysis (1966–2004). *Curr Med Res Opin* 21:173–184, 2005

<sup>6</sup>Boutati EI, Raptis SA: Self-monitoring of blood glucose as part of the integral care of type 2 diabetes. *Diabetes Care* 32(Suppl. 2):S205–S210, 2009

<sup>7</sup>Bergenstal R, Bode B, Tamler R, Trencle D, Stenger P, Schachner H, Kohut T, Fisher WA: Advanced meter features improve postprandial and paired blood glucose testing in individuals with diabetes: results of the Actions with Contour blood glucose meter and behaviors in frequent Testers (ACT) study. *Diabetes Tech Ther* 14:851–857, 2012

<sup>8</sup>Guerci B, Drouin P, Grange V, Bougneres P, Fontaine P, Kerlan V, Passa P, Thivolet C, Vialettes B, Charbonnel B: Self-monitoring of blood glucose significantly improves metabolic control in patients with type 2 diabetes mellitus: the Auto-Surveillance Intervention Active (ASIA) study. *Diabetes Metab* 29:587–594, 2003

<sup>9</sup>Centers for Disease Control and Prevention: Self-monitoring of blood glucose among adults with diabetes—United States, 1997–2006. *MMWR Morb Mortal Wkly Rep* 56:1133–1137, 2007

<sup>10</sup>Karter AJ, Ferrara A, Darbinian JA, Ackerson LM, Selby JV: Self-monitoring of blood glucose: language and financial barriers in a managed care population with diabetes. *Diabetes Care* 23:477–483, 2000

<sup>11</sup>Vincze G, Barner JC, Lopez D: Factors associated with adherence to self-monitoring of blood glucose among persons with diabetes. *Diabetes Educ* 30:112–125, 2004

<sup>12</sup>Parkin CG, Hinnen D, Campbell RK, Geil P, Tetrack DL, Polonsky WH: Effective



use of paired testing in type 2 diabetes: practical applications in clinical practice. *Diabetes Educ* 35:915–927, 2009

<sup>13</sup>Barnett AH, Krentz AJ, Strojek K, Sieradzki J, Azizi F, Embong M, Imamoglu S, Perusicova J, Uliciansky V, Winkler G: The efficacy of self-monitoring of blood glucose in the management of patients with type 2 diabetes treated with a gliclazide modified release-based regimen: a multicentre, randomized, parallel-group, 6-month evaluation (DINAMIC 1 study). *Diabetes Obes Metab* 10:1239–1247, 2008

<sup>14</sup>International Diabetes Federation: Guideline on self-monitoring of blood glucose in non-insulin treated type 2 diabetes, 2009 [article online]. Available from [http://www.idf.org/webdata/docs/SMBG\\_EN2.pdf](http://www.idf.org/webdata/docs/SMBG_EN2.pdf). Accessed 27 May 2011

<sup>15</sup>Schnell O, Alawi H, Battelino T, Ceriello A, Diem P, Felton A, Grzeszczak W, Harno K, Kempler P, Satman I, Verges B: Addressing schemes of self-monitoring of blood glucose in type 2 diabetes: a European perspective and expert recommendation. *Diabetes Technol Ther* 13:959–965, 2011

<sup>16</sup>Fisher JD, Fisher WA, Shuper P: The information-motivation-behavioral skills model of HIV preventive behavior. In *Emerging Theories in Health Promotion Practice and Research*. 2nd ed. DiClemente RJ, Crosby RA, Kegler MC, Eds. San Francisco, Jossey-Bass, 2009, p. 22–63

<sup>17</sup>Fisher WA, Fisher JD, Harmon J: The information-motivation-behavioral skills model: a general social psychological approach to understanding and promoting health behavior. In *Social Psychological Foundations of Health and Illness*. Suls J, Wallton K, Eds. London, Blackwell, 2003, p. 82–106

<sup>18</sup>Fisher WA, Schachner H: Self-monitoring of blood glucose in diabetic children and adolescents: barriers, behaviors, and the search for solutions. *US Endocrinol* 4:2–5, 2009

<sup>19</sup>Fisher WA, Kohut T, Schachner H, Stenger P: Understanding self-monitoring of blood glucose among individuals with type 1 and type 2 diabetes: an information-motivation-behavioral skills analysis. *Diabetes Educ* 37:85–94, 2011

<sup>20</sup>Norris SL, Engelgau MM, Narayan KM: Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes Care* 24:561–587, 2001

<sup>21</sup>Siebolds M, Gaedeke O, Schwedes U: Self-monitoring of blood glucose: psychological aspects relevant to changes in HbA1c in type 2 diabetic patients treated with diet or diet plus oral antidiabetic medication. *Patient Educ Couns* 62:104–110, 2006

<sup>22</sup>Moreland EC, Volkening LK, Lawlor MT, Chalmers KA, Anderson BJ, Laffel LM:

Use of a blood glucose monitoring manual to enhance monitoring adherence in adults with diabetes: a randomized controlled trial. *Arch Intern Med* 166:689–695, 2006

<sup>23</sup>Jones H, Edwards L, Vallis TM, Ruggiero L, Rossi SR, Rossi JS, Greene G, Prochaska JO, Zinman B: Changes in diabetes self-care behaviors make a difference in glycemic control: the Diabetes Stages of Change (DiSC) study. *Diabetes Care* 26:732–737, 2003

<sup>24</sup>Smith DE, Heckemeyer CM, Kratt PP, Mason DA: Motivational interviewing to improve adherence to a behavioral weight-control program for older obese women with NIDDM: a pilot study. *Diabetes Care* 20:52–54, 1997

<sup>25</sup>Knight KM, McGowan L, Dickens C, Bundy C: A systematic review of motivational interviewing in physical health care settings. *Br J Health Psychol* 11:319–332, 2006

<sup>26</sup>Ismail K, Winkley K, Rabe-Hesketh S: Systematic review and meta-analysis of randomised controlled trials of psychological interventions to improve glycaemic control in patients with type 2 diabetes. *Lancet* 363:1589–1597, 2004

<sup>27</sup>Alam R, Sturt J, Lall R, Winkley K: An updated meta-analysis to assess the effectiveness of psychological interventions delivered by psychological specialists and generalist clinicians on glycaemic control and on psychological status. *Patient Educ Couns* 75:25–36, 2009

<sup>28</sup>Burke BL, Arkowitz H, Menchola M: The efficacy of motivational interviewing: a meta-analysis of controlled clinical trials. *J Consult Clin Psychol* 71:843–861, 2003

<sup>29</sup>Channon S, Smith VJ, Gregory JW: A pilot study of motivational interviewing in adolescents with diabetes. *Arch Dis Child* 88:680–683, 2003

<sup>30</sup>Channon SJ, Huws-Thomas MV, Rollnick S, Hood K, Cannings-John RL, Rogers C, Gregory JW: A multicenter randomized controlled trial of motivational interviewing in teenagers with diabetes. *Diabetes Care* 30:1390–1395, 2007

<sup>31</sup>Burke B, Arkowitz H, Dunn C: The efficacy of motivational interviewing. In *Motivational Interviewing: Preparing People for Change*. Miller WR, Rollnick S, Eds. New York, Guilford, 2002, p. 217–250

<sup>32</sup>Miller WR, Rollnick S: *Motivational Interviewing: Preparing People to Change Addictive Behavior*. New York, Guilford Press, 1991

<sup>33</sup>Miller WR, Rollnick S: *Motivational Interviewing: Preparing People for Change*. New York, Guilford Press, 2002

<sup>34</sup>University of Connecticut Center for Health, Intervention, and Prevention: Options intervention protocol manual: a

step-by-step guide to risk reduction counseling with PLWHA [article online], 2007. Available from <http://www.chip.uconn.edu/chipweb/documents/interventions/Options%20intervention%20protocol%20manual.pdf>. Accessed 27 May 2011

<sup>35</sup>Treasure J: Motivational interviewing. *Adv Psychiatr Treat* 10:331–337, 2004

<sup>36</sup>Marrero D (Ed.): *1,000 Years of Diabetes Wisdom: Inspiration and Insight the World's Leading Diabetes Professionals Gained From Their Patients*. Alexandria, Va., American Diabetes Association, 2008

<sup>37</sup>American Diabetes Association: Standards of medical care in diabetes—2011. *Diabetes Care* 34(Suppl. 1):S11–S61, 2011

---

*William A. Fisher, PhD, is a distinguished professor in the Department of Psychology and the Department of Obstetrics and Gynaecology of the University of Western Ontario in London, Ontario, Canada. Deborah H. Cornman, PhD, is the associate director of the Center for Health, Intervention, and Prevention at the University of Connecticut in Storrs. Taylor Kohut, MSc, is a doctoral candidate in the Department of Psychology at the University of Western Ontario. Holly Schachner, MD, is the senior director of Medical Affairs and Patricia Stenger, RN, CDE, is director of medical communications at Bayer HealthCare LLC, Diabetes Care in Tarrytown, N.Y.*

**Note of disclosure:** Dr. Fisher has received research support and speaker and consulting fees from Bayer HealthCare LLC, Diabetes Care, which provided funding for the development of this article. Mr. Kohut has received research support from and Dr. Schachner and Ms. Stenger are employees of Bayer HealthCare LLC, Diabetes Care.