

Chapter

5

**APPROACHES FOR THE
NEWLY DIAGNOSED PATIENT**

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During the initial evaluation of a patient newly diagnosed with diabetes, the first step is to assess the patient's current state of health, as well as the risk of complications. A comprehensive initial evaluation may take place over several visits. This evaluation should include the following approach.^{1,2}

INITIAL EVALUATION***Comprehensive History***

Obtaining a comprehensive history of the patient is the first step. This includes:

- ▲ Information on diabetes severity, duration, and symptoms
- ▲ Family history, including diabetes, endocrine disorders, atherosclerosis, hypertension, and dyslipidemia
- ▲ Results of previous laboratory tests and examinations related to diabetes (including previous A1C results)
- ▲ Eating patterns, nutritional status, and weight history; physical growth and development (in children and adolescents)
- ▲ Information on current treatment of diabetes; glucose monitoring results; current exercise and medications
- ▲ Modifying factors, including frequency, severity, and cause of acute complications (eg, ketoacidosis and hypoglycemia)

- ▲ Risk factors for atherosclerosis
- ▲ History of prior and current infections of the skin, teeth and gums, feet, and genitourinary system
- ▲ Alcohol, tobacco, and drug use history
- ▲ Sexual, contraceptive use, and reproductive history
- ▲ Social history, including lifestyle, cultural, psychosocial, educational, and economic factors that might affect diabetes management

Comprehensive Physical Examination

A comprehensive physical examination is essential:

- ▲ Constitutional signs, including general appearance
- ▲ Blood pressure, including orthostatic measurements, when indicated
- ▲ Pulse, respirations, temperature, and height and weight (in children and adolescents include comparison with norms)
- ▲ Eye—include fundoscopic examination
- ▲ Ear, nose, and throat—include lips, teeth and gums, and oropharynx
- ▲ Neck—thyroid examination
- ▲ Respiratory—include auscultation of lung fields
- ▲ Cardiovascular—include auscultation of heart, carotid arteries, and pedal pulses
- ▲ Extremities—inspect digits and nails; foot examination for callous formation or breakdown
- ▲ Abdomen—hepatomegaly
- ▲ Skin—inspect for acanthosis nigricans

- ▲ Neuropathic—deep tendon reflexes, foot sensation to light touch and/or vibration
- ▲ Psychiatric—mood and affect, judgment, and insight

Laboratory Evaluation

A laboratory evaluation will identify any values that need correction:

- ▲ A1C
- ▲ Fasting lipid profile, including total cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, and low-density lipoprotein (LDL) cholesterol
- ▲ Test for microalbuminuria (patients with type 2 diabetes)
- ▲ Urinalysis for ketones, protein, sediment
- ▲ Serum creatinine
- ▲ Thyroid-stimulating hormone (TSH) in type 1 diabetes, and when indicated in type 2 diabetes

Evaluation of Patient Self-Management Skills and Support Systems

An essential part of management of the disease is assessing the patient's ability to cope or comply, as well as identifying the support system at the patient's disposal:

- ▲ Patient understanding of the disease
- ▲ Patient willingness to participate actively in the management of his or her disease and to adopt lifestyle changes
- ▲ Symptoms of denial or depression that persist beyond 1 month after diagnosis
- ▲ Patient resources and support systems

Evaluation forms and tests used to measure patient understanding and self-management skills are available and may be useful.¹

Additional Supportive Management

Some patients may require additional referrals or information. A wide range is available, including:

- ▲ Diabetes educator, if not provided by physician or practice staff
- ▲ Medical nutrition therapy (MNT)
- ▲ Dilated retinal examination, to check for retinopathy (patients with type 2 diabetes)
- ▲ Mental health provider experienced in treating patients with diabetes
- ▲ Foot specialist, if indicated by structural abnormalities or need for protective or palliative footwear

Women of reproductive age should also receive counseling on the importance of achieving glycemic control before becoming pregnant. Also, use of concomitant medications such as anti-hypertensives should be reviewed in pregnant women.

MANAGEMENT PLAN

Once an initial evaluation has been completed, the primary health care provider and the patient should construct a management plan in cooperation with the other members of the diabetes treatment team (eg, certified diabetes educator, registered dietitian, and/or endocrinologist). The treatment strategy should be tailored to meet the needs, abilities, and preferences of the individual patient. No single management plan, diet, or exercise regimen will be effective for all, or even most, patients. Elements should include:

- ▲ Identification of the diabetes management team members
- ▲ Treatment goals (including pre- and post-meal blood glucose levels and A1C targets)
- ▲ Self-management education
- ▲ Tailored guidelines for MNT and physical activity

Patient Assessment

When developing a treatment strategy, it is important to use a patient-centered approach and consider the patient's individual characteristics, rather than attempt to assign a standardized regimen. The patient assessment should include:

- ▲ *Metabolic needs:* The intensity and complexity of a therapeutic plan will depend on the specific needs of the patient.
- ▲ *Patient age:* Younger patients will need to manage their disease for a longer span of time than will elderly patients. This should be considered when designing a plan. A 40-year-old or 65-year-old patient and an 85-year-old patient with similar metabolic needs will not necessarily receive similar treatment plans, as the younger patient is apt to have significantly more time to develop complications and may require more intensive therapy.
- ▲ *Comorbid conditions:* Hypertension and dyslipidemia often accompany diabetes. Treatment for these conditions is fundamental to the management plan. Other considerations that may affect treatment options include serious comorbidities, such as cancer, dementia, or liver disease.
- ▲ *Lifestyle:* The patient with a varying daily schedule and erratic eating patterns may benefit from a more flexible management plan, such as multiple daily insulin injections taken before meals or combination oral medications. Another patient's routines may be better suited to a program of regular injections or monotherapy and a regimented diet. Food preferences and ethnic variations in diet must also be taken into consideration.
- ▲ *Skills and education:* Some patients may lack the skills or understanding to be involved in a complex or intensive management program. Health care providers should balance a patient's abilities against metabolic needs.

Creating a Diabetes Team

Diabetes is a complex disease requiring continuous lifetime management. The aim of a team of diabetes specialists is to support the patient and the primary health care provider in long-term efforts to achieve and maintain glycemic control.

Core diabetes team

- ▲ *Patient:* The patient is the most critical diabetes team member. Successful management depends on the patient's level of involvement. In children and adolescents with diabetes, parents or caregivers serve as primary team members.
- ▲ *Primary health care provider:* One member of the management team should act as leader, coordinating all elements of the management plan and communicating with other team members. Often the primary care physician will fulfill this role. In other cases, it will be carried out by an endocrinologist, internist, certified diabetes educator, nurse practitioner, or physician assistant.
- ▲ *Certified diabetes educator:* Diabetes education and support is critical to effective self-management. Diabetes educators teach patients about nutrition, exercise, medication, and glucose and ketone monitoring, as well as how to deal with psychological issues related to diabetes.
- ▲ *Registered dietitian:* The nutritional needs of the patient with diabetes can be complex. Weight reduction is often a significant element of the management plan. A registered dietitian specializing in diabetes is a key member of the management team.
- ▲ *Advanced practice health care provider:* Nurse practitioners and physician assistants with specialized training in diabetes management may serve as valuable members of the diabetes team by providing enhanced medical care and follow-up evaluation to patients.

Additional diabetes team members may include pharmacists, exer-

cise physiologists, mental health professionals, registered nurses (RNs), licensed practical nurses (LPNs), and school nurses.

Diabetes Self-Management Education

Patient education and self-management is the cornerstone of effective diabetes treatment. The effectiveness of diabetes self-management education (DSME) in improving patient outcomes is well documented.^{3,4} A diabetes education program involves the following components:

- ▲ Assessing the patients' knowledge and understanding of diabetes and self-management skills
- ▲ Developing an education plan based on patient assessment and unique needs
- ▲ Implementing the plan and setting specific goals
- ▲ Evaluating the plan by reviewing patient behavior and glycemic levels

The following topics, defined by the National Standards for Diabetes Self-Management Education, are recommended for inclusion in diabetes education programs⁵:

- ▲ Diabetes overview
- ▲ Psychosocial adjustment, including family involvement and social support
- ▲ Nutrition
- ▲ Physical activity
- ▲ Medications
- ▲ Blood glucose and ketone monitoring; appropriate utilization of results
- ▲ Prevention, detection, and treatment of acute complications, such as hypoglycemia and hyperglycemia

- ▲ Prevention, detection, and treatment of chronic complications
- ▲ Goal setting, risk factor reduction, and problem solving
- ▲ Preconception care, pregnancy, and gestational diabetes

Medical Nutrition Therapy

Newly diagnosed patients with diabetes need to understand how food intake and physical activity affect their condition. Careful balance of insulin, food, and physical activity contributes to metabolic stability in patients with type 1 diabetes. Weight loss is important for most patients with type 2 diabetes. Reliance on medications alone to control blood glucose is to be avoided—diet and exercise always remain critical elements of any diabetes management plan. MNT has evolved from somewhat rigid and prescriptive guidelines to much more flexible, patient-centered strategies.

- ▲ Outcome studies have demonstrated that MNT provided by a registered dietitian can achieve a 1-2% decrease in A1C in patients with type 1 and type 2 diabetes.⁶⁻⁸
- ▲ The effectiveness of registered dietitian-delivered MNT in improving dyslipidemia has been demonstrated.⁷
- ▲ The registered dietitian will generally require two to three appointments to design and monitor a personalized MNT regimen. In the long run, this valuable approach will provide the optimum results desired by both the health care provider and the patient.

MNT recommendations should be based on an individualized assessment of the patient's metabolic needs, usual eating style, and readiness to change. All members of the diabetes team should be knowledgeable about MNT and supportive of the patient's need to make lifestyle changes. Medicare reimburses for qualifying registered dietitians to provide MNT according to nationally accepted nutrition protocols.

Implementing MNT

Part of the challenge of implementing MNT is to identify the most important priority based on the patient's metabolic needs, usual behaviors, and readiness to change. Health care providers should listen to patients' description of what, where and how much they eat in a typical day. Should the emphasis be on controlling carbohydrates? Reducing saturated fat? Reducing portion size to control calories? Eating more or less frequently? Increasing high-fiber, high-nutrition foods? The following section highlights evidence-based guidelines to help the clinician develop an MNT intervention that will enhance the likelihood of success.

Controlling glucose, lipids, and weight Attaining control of glucose and lipid levels and achieving a desirable weight are clearly important, but may present too great a combined burden for an initial MNT focus. For most patients with type 2 diabetes, weight and the body mass index (BMI) will be above target. However, standard weight-reduction diets generally fail to produce the desired long-term weight-loss outcomes. The primary reason is that patients tend to return to their former eating patterns.⁷ Therefore, the best initial strategy is generally to encourage long-term lifestyle change by focusing on improving glucose and/or lipid levels.

- ▲ If A1C is above target—and carbohydrate intake appears excessive or erratic, or both—the health care provider should consider a focus on glucose control.
- ▲ If LDL cholesterol is above target—and the patient reports frequent intake of saturated fats and processed foods—this may be the best target.

Medications and meal plans It is difficult to change a person's lifestyle. For the newly diagnosed patient with diabetes, the best results will be achieved by recommending a medication regimen that will match the patient's usual eating and activity patterns. For example, patients using insulin pumps or a basal-bolus insulin reg-

imen have the most flexibility in eating, as they learn to match their bolus insulin to anticipated carbohydrate intake before each meal and snack.

Counting calories or carbohydrates? Traditionally, meal plans for patients with type 2 diabetes focus on caloric restriction for weight control. However, experience has demonstrated that guiding patients to count something more specific, such as carbohydrates or fat, is more easily achieved, and more effective in targeting desired metabolic outcomes. Table 5-1 shows the caloric requirements for achieving and maintaining desired weight. Table 5-2 suggests carbohydrate guidelines as a starting point for meal planning. All patients with diabetes should learn to identify foods that contain carbohydrates (starches, fruit, milk/yogurt, sweets/desserts), as well

Table 5.1 Estimating Caloric Requirements

Maintaining weight

- ▲ Somewhat inactive adult of moderate weight: 11 calories/lb of ideal body weight per day
- ▲ Moderately active adult: add 20% to above total
- ▲ Very active adult: add 40% to above total

Attempting weight loss

- ▲ Reduction of 500 calories from the above formula = an approximate loss of 2–4 lb/mo

Attempting weight gain

- ▲ Add additional calories to above formula as necessary

Meeting energy needs in children

- ▲ Range of 36–45 calories/lb (adolescent boys: 20–36 calories/lb; adolescent girls: 15–20 calories/lb)

During pregnancy/lactation

- ▲ Add 300 calories to above formula for pregnancy, and 500 calories for lactation
-

Table 5-2 Suggested Guidelines for Carbohydrate Intake*

Kcal/Day	No. of Servings/Day Carbohydrate	No. of g/Day Carbohydrate	Sample Distribution of Carbohydrate Servings				Sample Distribution of Carbohydrate Grams			
			B	L	D	Sn	B	L	D	Sn
1,200	10	150	2	3	4	1	30	45	60	15
1,400	12	180	3	3	4	2	45	45	60	30
1,600	13	195	3	4	4	2	45	60	60	30
1,800	15	225	3	4	5	3	45	60	75	45
2,000	17	255	3	5	6	3	45	75	90	45

B, breakfast; L, lunch; D, dinner; Sn, snack. * These are intended as a guideline for carbohydrate distribution. The actual number of servings per day and distribution between meals and snacks will be based on metabolic goals and the patient's eating habits and preferences.

as to recognize food portion sizes containing one carbohydrate serving of 15 grams. Suggested choices are presented in Table 5-3. However, individual dietary recommendations should be tailored after the patient has undergone an in-depth assessment with a registered dietitian.

Diet plans The popular press keeps nutrition in the forefront of everyone's mind. Every day, one can read about new diets, new food classification systems (eg, food pyramids), as well as new ingredients and how they may be beneficial or harmful. The busy practitioner has the challenging task of staying abreast of the latest controversies and providing answers to patients who express concerns. The evidence-based nutrition recommendations published by the American Diabetes Association (ADA) offer a thorough review of available research. Table 5-4 summarizes current evidence-based recommendations.^{1,8} Table 5-5 offers recommendations on some current diet controversies.

Key messages for patients The few minutes that health care providers have with a patient may not provide enough time to develop a meal plan. A few key messages should be emphasized:

- ▲ Meal planning for diabetes is no longer as restrictive as it was in the past. New treatment regimens allow for much greater meal flexibility.
- ▲ If glycemic control does not improve despite serious lifestyle changes, the patient should not feel as if he or she has "failed." Diabetes is progressive.
- ▲ It is important for patients to have several appointments with either a registered dietitian or a diabetes educator to develop an individualized meal plan.

Physical Activity

Physical activity is a key component of any diabetes management strategy. For patients with type 1 diabetes, education will center on how physical activity affects their condition and how to avoid

Table 5-3 Carbohydrate Choices: 15 g per Serving

Starch/Bread	Fruit	Milk	Other
1 slice bread (1 oz)	1 small apple or other small whole fruit	1 cup milk	1/2 cup ice cream
1/3 cup rice or pasta	1/2 cup fruit juice	1/3 cup regular fruited yogurt	1/4 cup sherbet
1/2 cup oatmeal	2 tbsp raisins	1 cup aspartame-sweetened fruit yogurt	2 small cookies
1/2 cup corn, peas or beans	1 1/4 cup strawberries		1 tbsp honey, sugar, or jam
1/2 cup sweetened cereal			
3/4 cup unsweetened cereal			

Table 5-4 Nutrition Recommendations

Calories	<ul style="list-style-type: none">▲ Adults: Attain and/or maintain reasonable body weight▲ Children: Ensure proper growth and development▲ During pregnancy and lactation: Ensure adequate nutrition
Carbohydrates	<ul style="list-style-type: none">▲ Total amount of carbohydrates consumed is more important than source or type▲ Avoiding sucrose and sucrose-containing foods is not necessary. However, they must be substituted for other carbohydrates or compensated for with insulin or medication▲ Non-nutritive sweeteners are safe when consumed within the acceptable daily intake levels established by the FDA▲ Recommendations for fiber intake are same as for the general population. Additional fiber is not necessary
Protein	<ul style="list-style-type: none">▲ 15–20% of total daily caloric intake▲ With evidence of nephropathy: no more than 0.8 g/kg body weight per day (RDA)
Fats	<ul style="list-style-type: none">▲ <10% saturated fat (<7% in those with elevated LDL)▲ Dietary cholesterol <300 mg/day (<200 mg/day in those with elevated LDL)▲ Limit intake of trans fatty acids

(table continues)

Table 5-4 (continued)

Vitamins and minerals	<ul style="list-style-type: none">▲ Adequate diet: no need for vitamin supplements▲ Patients at risk of nutritional deficiency may need vitamin supplements:<ul style="list-style-type: none">• Vegetarians• Elderly• Pregnant and lactating women• Congestive heart failure or previous myocardial infarction• On very low-calorie diets
Alcohol	<ul style="list-style-type: none">▲ Men: ≤ 2 alcoholic beverages per day; Women: ≤ 1 alcoholic beverage per day▲ Alcoholic beverages contribute calories without nutritional benefit. Patients should select drinks and mixers with lower calories and carbohydrate content, such as light beer and dry white wine, using diet sodas, club soda, and seltzer water as mixers▲ Alcohol should not be consumed on an empty stomach or after physical activity, as it may lead to hypoglycemia▲ Symptoms of low blood sugar and intoxication are similar; patients should alert companions to their condition and always carry identification

FDA, Food and Drug Administration; RDA, Recommended Daily Allowance; LDL, low-density lipoprotein.

Sources: AACE Guidelines, 2002¹; ADA, 2004.⁸

Table 5-5 Recommendations on Popular Diets

Question	Evidence	Recommendation
Should I recommend low-carbohydrate, high-protein diets to facilitate weight loss, while controlling blood glucose?	Long-term health effects are unknown. Little research available.	These diets are not recommended. However, if the patient is already following one and reports success, monitor lipid profiles. Encourage patients to add back carbohydrate foods gradually after initial weight loss.
Do my patients need to avoid high glycemic index (GI) foods such as potatoes and pasta?	The ADA indicates that there is insufficient evidence to recommend the use of low GI diets as a primary strategy in food/meal planning.	There is not enough evidence to support or refute the GI principles of meal planning. However, GI awareness is a useful tool that may be used for problem-solving and "fine tuning" blood glucose control. Awareness of carbohydrate foods thought of as "high GI" (eg, potatoes, instant rice, white bread, and low-fiber breakfast cereals) is helpful.
Will adding soy, fish oils, or plant stanols help lower LDL cholesterol?	ATP III guidelines (NCEP) list these as possibly beneficial.	Research indicates that a number of dietary factors, including soluble fiber (in oats, beans), soy, omega-3 fats (fish oils) and plant stanols may improve lipid levels. Support recommendations advocating their adjunctive use to other therapeutic lifestyle changes.

ADA, American Diabetes Association; NCEP, National Cholesterol Education Program; LDL, low-density lipoprotein.

hypoglycemia. Patients with type 2 diabetes need to understand the relationship of physical activity to weight loss, blood glucose control, and reductions in metabolic syndrome risk factors. All patients with diabetes need education on how to exercise safely. See Table 5-6 glucose level–based exercise guidelines.¹⁰

Physical activity for patients with type 1 diabetes

- ▲ When type 1 diabetes is well controlled, patients may be able to handle physical activity as well as those without diabetes.
- ▲ During exercise, the body requires additional fuel in the form of glucose. To address this need, patients will need to adjust food consumption and insulin dosing before engaging in exercise.

Table 5-6 Glucose-Based Guidelines for Physical Activity

Diabetes Type	Blood Glucose Levels	Ketones	Exercise Permitted?
Type 1	≥250 mg/dL	Present	No
	251–300 mg/dL	Absent	Yes
	>300 mg/dL	Absent	Yes, with extreme caution
Children with type 1	Follow guidelines above except that exercise is permitted with blood glucose levels of ≤400 mg/dL		
Type 2	≤400 mg/dL		Yes (whether using insulin or not)

Source: Beaser, 2001.¹⁰

- ▲ In poorly controlled patients, available muscle and blood glucose are used during physical activity, forcing the body to seek alternative energy sources. The liver increases glucose production to meet the demand but, because insulin levels are low, muscle cells cannot use the additional glucose. This causes blood glucose levels to rise.¹⁰
- ▲ Therefore, patients with type 1 diabetes should not undertake exercise programs unless their glucose levels are well regulated.

Physical activity in patients with type 2 diabetes

- ▲ Increased physical activity leads to decreased insulin resistance and lowered blood glucose levels in patients with type 2 diabetes. Weight loss can also contribute to improvements in chronic microvascular and macrovascular complications.
- ▲ Patients with type 2 diabetes on oral medications or insulin therapy should be aware that they are at risk of hypoglycemia during or after physical activity.¹¹
- ▲ Patients with poorly controlled glucose should not start exercise regimens until control has been achieved.

Education goals for physical activity

Newly diagnosed patients with diabetes should have an understanding of the following points¹³:

- ▲ Physical activity is recommended for overall health and for diabetes treatment, as it helps lower blood glucose levels and decrease insulin resistance.
- ▲ As the body requires additional glucose for energy during exercise, there is a higher risk of hypoglycemia during and after exercise. Hypoglycemia may be avoided by adjusting

food or insulin before physical activity and carrying a high-carbohydrate, low-fat snack.

- ▲ Keeping blood glucose records related to exercise (before, during, and after physical activity) is important. This step will avoid hypoglycemia during exercise and will indicate how to make appropriate adjustments in insulin, oral medications, and/or food consumption.
- ▲ Patients should not exercise on sick days or when ketonuric.
- ▲ Patients should understand the need to alert friends and family to the possibility of hypoglycemia during physical activity. They should educate these key people on how to recognize and treat hypoglycemia.
- ▲ Patients should understand the need to consult with health care professionals before starting an exercise program.

Diabetes complications and physical activity

Before a physical activity regimen is undertaken, health care providers should carefully evaluate patients for existing complications that can be adversely affected by the rise in blood pressure that accompanies physical exertion. Before initiating an exercise plan, a stress test may be recommended for:

- ▲ Patients older than 40 years of age
- ▲ Patients who have had type 1 diabetes for more than 15 years
- ▲ Patients who have had type 2 diabetes for more than 10 years
- ▲ Patients with suspected cardiovascular disease

Recommendations on assessing for and addressing existing complications are found in Table 5-7.^{10,13}

Table 5-7 Assessing for Existing Complications Before Prescribing an Exercise Plan

System	Complication	Recommendation
Cardiovascular	<ul style="list-style-type: none"> ▶ Cardiovascular disease ▶ Autonomic neuropathy affecting cardiac function <ul style="list-style-type: none"> • Decreased cardiovascular response to exercise • Decreased maximum aerobic capacity • Impaired response to hydration • Hypotension after exercise 	<ul style="list-style-type: none"> ▶ Perform stress test ▶ Focus on moderate exercise. Avoid any aerobic exercise that promotes heavy perspiration or vasodilation
	<ul style="list-style-type: none"> ▶ Proliferative retinopathy <ul style="list-style-type: none"> • Vitreous hemorrhage • Retinal detachment 	<ul style="list-style-type: none"> ▶ Avoid exercise requiring increased venous pressure (eg, yoga positions such as headstands) and/or exercise requiring bending head-down position (eg, toe touches) ▶ Avoid intensive upper-extremity exercise (ie, weightlifting) and high-impact aerobic activities ▶ Remind patients to breathe deeply and regularly when exercising—never to hold their breath
Eye		

- | | | |
|-------------------|--|---|
| Renal | <ul style="list-style-type: none"> ▶ Nephropathy <ul style="list-style-type: none"> • Increased proteinuria | <ul style="list-style-type: none"> ▶ If neuropathy exists in combination with high blood pressure, control blood pressure before starting exercise regimen ▶ Avoid high-intensity exercise, following the same guidelines for retinopathy, above |
| Lower extremities | <ul style="list-style-type: none"> ▶ Peripheral neuropathies ▶ Peripheral vascular disease ▶ Foot abnormalities | <ul style="list-style-type: none"> ▶ Avoid exercise that can cause further damage to affected extremities (eg, long-distance running, step exercise) ▶ Encourage moderate walking as exercise; however, special footwear and/or intensive regular foot care may be needed |

Sources: Beaser, 2001¹⁰; ADA, 2004.¹³

Exercise guidelines

Other patient-specific factors (eg, age, physical condition, motivation level) will also contribute to the implementation of an effective exercise plan. General recommendations for exercise in patients with type 2 diabetes may be found in Table 5-8.^{10,11}

Sedentary patients should begin slowly. As little as 5 minutes of aerobic activity per day, 3 times a week, can be helpful. The duration of exercise can increase by 1-2 minutes every 1-2 weeks.

Table 5-8 General Recommendations for a Physical Activity Program in Patients With Type 2 Diabetes

Type of activity	<ul style="list-style-type: none"> ▲ Aerobic preferred, personal preferences and abilities should determine
Intensity	<ul style="list-style-type: none"> ▲ Determined by monitoring heart rate and other signs of stress; patients should try to reach 60–80% of maximum heart rate achieved on a graded exercise test ▲ Alternatively, patients should attempt exercise that they perceive as “hard” or “somewhat hard,” without reaching “very hard” ▲ Patients should be able to talk and breathe comfortably during exercise
Duration	<ul style="list-style-type: none"> ▲ For blood glucose control: 20–40 min (including 5–10 min warm-up and cool-down) ▲ For weight loss: 45–60 min (including 5–10 min warm-up and cool-down)
Frequency	<ul style="list-style-type: none"> ▲ Blood glucose control: 3–4 times weekly ▲ Weight loss: 4–5 times weekly

Sources: Beaser, 2001¹⁰; ADA, 1998.¹¹

Note that any activity is preferable over none and that activities as simple as walking, biking, or swimming can be beneficial when performed regularly.

MEASURING BLOOD GLUCOSE

Results from the DCCT demonstrated the importance of frequent self-monitoring of blood glucose (SMBG) in patients with insulin-treated diabetes.¹² When patients check glucose levels several times daily and adjust insulin, food, and physical activity accordingly, the body's metabolic system is replicated more closely. This will lead to lower blood glucose levels over the course of the patient's life and will delay complications. Home glucose monitoring is important for most patients with diabetes, although the frequency and timing of testing will vary based on individual needs and goals.

Education Goals for SMBG

Newly diagnosed patients with diabetes should be educated on the following issues listed by the ADA¹²:

- ▲ How food, insulin, and physical activity affect blood glucose levels
- ▲ How and when to perform SMBG and urine testing for ketones
- ▲ How A1C relates to SMBG glucose levels
- ▲ How to monitor blood glucose, target glucose levels, and dispose of lancets properly
- ▲ When blood glucose and ketone testing results indicate the need to alert health care providers
- ▲ How to keep records of blood glucose and ketone measurements
- ▲ How SMBG testing results are used to modify treatment plans

Patient-Performed SMBG

The ability of patients to monitor their own blood glucose levels is a major development in diabetes management. The equipment used in self-monitoring is as follows:

- ▲ *Lancet finger sticks:* The lancet is held against the fingertip and is activated to puncture the skin for a small droplet of blood. Lancets that use a laser light are now available. Used lancets should be placed in a heavy-duty plastic container with a tight-fitting lid for disposal. Containers made specifically for this purpose are available.
- ▲ *Glucose strips:* A drop of blood is applied to a small strip containing a chemical that reacts to glucose. The strip changes color to indicate the amount of glucose present. Test strips are visually compared with a chart or are inserted into a glucose meter for results.
- ▲ *Glucose meters:* These devices automatically measure blood glucose. Many can be used in alternate sites other than the fingertip, such as the forearm. All contain timers and are able to record results and analyze data.

Frequency and timing

The frequency and timing of SMBG is determined by individual needs and goals. Based on the results of the DCCT, it is generally recommended that patients with type 1 diabetes on insulin therapy test blood glucose levels three to four times a day before meals.¹⁶ Frequency of testing in patients with type 2 diabetes should be sufficient to meet glycemic goals. Table 5-9 outlines recommendations for appropriate SMBG intervals.

Keeping records

Recording blood glucose measurements is particularly important for the newly diagnosed patient in order to establish a management plan. But accurate record keeping is also an important aspect of lifelong diabetes treatment. Although some glucose meters store

Table 5-9 Recommended Timing of Patient SMBG

Patient	Recommendations
Patients with type 1 diabetes	<ul style="list-style-type: none"> ▲ ≥3 times/day ▲ Nocturnal testing when indicated, to control hypoglycemia ▲ Preprandial testing to adjust insulin dose; postprandial to monitor glucose excursions
Pregnant women taking insulin	<ul style="list-style-type: none"> ▲ ≥3 times/day
Patients with type 2 diabetes	<ul style="list-style-type: none"> ▲ As needed to facilitate reaching glycemic goals; 1–2 times per day is usually adequate at first; when goals are reached and stable, 3–4 times a week. Patients with type 2 diabetes in later stages with significant insulin resistance/insulin secretory defect may require multiple daily testing ▲ Particularly important in those taking insulin or sulfonylureas for hypoglycemia prevention ▲ Vary test times to include morning, postprandial, bedtime, and nocturnal levels
Patients modifying existing therapy	<ul style="list-style-type: none"> ▲ Test more often than usual until glycemic control is established

Sources: ADA, 2004.¹⁵

results, patients should still manually record results in order to pick up on any trends, make treatment adjustments, or verify treatment efficacy.

Testing for ketones

Another aspect of patient self-monitoring is testing urine for the presence of ketones. To do this, a urine sample is collected and tested with strips. Testing should be done¹⁵:

- ▲ When blood glucose levels are consistently higher than 300 mg/dL
- ▲ When patients are ill or under stress
- ▲ During pregnancy
- ▲ Whenever symptoms of ketoacidosis (nausea, vomiting, or abdominal pain) are observed

Office-Performed Testing

Glycated hemoglobin testing (HbA1c, A1C)

Glycated hemoglobin testing, commonly referred to as HbA1c or A1C, monitors A1C glycation and is the preferred office-performed glucose testing method. Because the average life span of erythrocytes is approximately 120 days, this test demonstrates how well blood glucose has been controlled over a 2- to 3-month period. This information can be used to evaluate patient management plans or to verify SMBG results. A1C testing should be done every 3 months. In well-managed patients with type 2 diabetes ($A1C \leq 7\%$), A1C testing every 6 months may be sufficient.

Fructosamine

Health care providers may also use the fructosamine assay, which measures the amount of glycated serum proteins. This test measures glycation over a shorter period of time than is required for A1C (approximately 2 weeks). Fructosamine testing may be a useful supplement to A1C or SMBG; however, it is expensive, not standardized, and can be labile.

Continuous glucose monitoring

Continuous monitoring devices are now available that use an inserted catheter (similar to that of an insulin pump) to monitor

blood glucose 3 times per hour for 3 consecutive days. These devices offer a wealth of daily glucose information and may be effective for establishing a management plan.

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