

Expanded ABCs of Diabetes

Samuel L. Abbate, MD, CDE

Each year, the American Diabetes Association (ADA) publishes clinical practice recommendations that include standards of care for patients with diabetes mellitus.¹ A clear, simple message about comprehensive care has been difficult to develop because of the large number of tasks involved in fulfilling these standards of care. Providers and patients have struggled to remember the elements of appropriate care, the frequency at which tests and evaluations should be conducted, and the goals for each of the clinical standards.

The elements of comprehensive care can be remembered using an extended version of the “ABCs of Diabetes” presented below and summarized in Table 1. A summary of the recommendations for adults with diabetes is given in Table 2. Recommendations on achieving the clinical goals are detailed in the standards of care as well as in the various position statements and technical reviews of the ADA.

A: A1C

The letter “A” stands for the hemoglobin A_{1c} (A1C) blood test and reminds patients and providers of the importance of blood glucose control in preventing the complications of diabetes. Each 1% decrease in A1C translates into a 35–40% decrease in the frequency of microvascular complications.

Standard. The A1C blood test provides a measure of a patient’s average glucose control over the preceding 2–3 months and, thus, overall treatment efficacy.² Glycemic control is best judged by the combination of the patient’s self-

monitoring of blood glucose (SMBG) results and current A1C result.

Frequency. Perform the A1C test at least two times a year for patients who are meeting treatment goals and who have stable glycemic control and quarterly for patients whose therapy has changed or who are not meeting glycemic goals. For any individual patient, the frequency of A1C testing should be dependent on the clinical situation, the treatment regimen used, and the judgment of the clinician.

Goal. Blood glucose should be managed to achieve normal or near-normal glucose levels with an A1C goal of <7%. There is no A1C threshold below which further lowering does not reduce the risk of complications. However, the absolute risks and benefits of lower targets are unknown. Less stringent treatment goals may be appropriate for patients with a history of severe hypoglycemia, patients with limited life expectancies, very young children or older adults, and individuals with comorbid conditions. The correlation between the A1C result and

the average plasma glucose level is given in Table 3.

B: Blood Pressure/Microalbumin

The letter “B” reminds patients and providers of the importance of blood pressure control in preventing both microvascular and macrovascular complications. This letter also reminds us of the importance of urine microalbumin as an indicator of diabetic nephropathy and cardiovascular disease (CVD). Diminishing or eliminating microalbuminuria is a goal of antihypertensive therapy.

Blood pressure

Standard. Measuring blood pressure is an essential element of each encounter with a patient with diabetes. Hypertension (blood pressure $\geq 140/90$ mmHg) is a common comorbidity of diabetes, affecting 20–60% of people with diabetes, depending on age, obesity, and ethnicity. Hypertension is also a major risk factor for CVD and microvascular complications such as retinopathy and nephropathy. Randomized clinical trials have demonstrated the incontrovertible benefit of lowering blood pressure to <140 mmHg systolic and <80 mmHg diastolic in people with diabetes.^{3,4} Epidemiological analyses show that blood pressures >120/80 mmHg are associated with increased cardiovascular event rates and mortality in people with diabetes.⁵

Frequency. Blood pressure should be measured at every routine diabetes visit. Patients found to have systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 80 mmHg should have

Table 1. Expanded ABCs of Diabetes

Letter	Standard of Care
A	A1C
B	Blood pressure/microalbumin
C	Cholesterol/aspirin
D	Diabetes education
E	Eye examinations
F	Foot examinations
G	Glucose monitoring
H	Health maintenance
I	Indications for specialty care

Table 2. Summary of Recommendations for Adults With Diabetes

Glycemic control	
• A1C	<7.0%*
• Preprandial plasma glucose	90–130 mg/dl
• Peak postprandial plasma glucose	<180 mg/dl
Blood pressure	
	<130/80 mmHg
Lipids	
• LDL cholesterol	<100 mg/dl
• Triglycerides†	<150 mg/dl
• HDL cholesterol	>40 mg/dl‡

Key concepts in setting glycemic goals:

- Goals should be individualized.
- Certain populations (children, pregnant women, and the elderly) require special considerations.
- Less intensive glycemic goals may be indicated in patients with severe or frequent hypoglycemia.
- More intensive glycemic goals may further reduce microvascular complications at the cost of increasing hypoglycemia.
- Postprandial glucose may be targeted if A1C goals are not met despite reaching preprandial glucose goals.

*Referenced to a nondiabetic range of 4.0–6.0% using a Diabetes Control and Complications Trial-based assay.

†Current National Cholesterol Education Program Adult Treatment Panel III guidelines suggest that in patients with triglycerides ≥200 mg/dl, the “nonHDL cholesterol” (total cholesterol minus HDL) be utilized. The goal is ≤130 mg/dl.

‡For women, it has been suggested that the HDL goal be increased by 10 mg/dl.

blood pressure confirmed on a separate day to establish a diagnosis of hypertension.

Goal. Patients with diabetes should be treated to a systolic blood pressure <130 mmHg and a diastolic blood pressure <80 mmHg if it can be safely achieved. Providers are directed to the ADA’s 2003 standards of care¹ and position statement on the treatment of hypertension⁶ for a complete discussion of the management of hypertension in adults with diabetes.

Urine microalbumin

Standard. Microalbuminuria (persistent albuminuria in the range of 30–299 mg/24 hours) has been shown to be the earliest stage of diabetic nephropathy in type 1 diabetes and a marker for development of nephropathy in type 2 diabetes. Microalbuminuria is also a

well-established marker of increased CVD.⁷

Frequency. Perform an annual test for the presence of microalbumin in type 1 diabetic patients with a diabetes duration of ≥5 years and in all type 2 diabetic patients starting at diagnosis. Although screening for microalbuminuria can be performed by several methods, the analysis of a spot sample for the albumin-to-creatinine ratio is strongly encouraged.⁸ At least two of three tests measured within a 6-month period should show elevated levels before a patient is designated as having microalbuminuria.

The role of annual microalbuminuria assessment is less clear after diagnosis of microalbuminuria and institution of angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blocker (ARB) therapy and blood pressure con-

trol. Many experts, however, recommend continued surveillance to assess both response to therapy and progression of disease.

Goal. Diabetes is managed to prevent the occurrence of microalbuminuria or to minimize or eliminate it once it is found. In patients with type 1 diabetes with or without hypertension, with any degree of albuminuria, ACE inhibitors have been shown to delay the progression of nephropathy. In patients with type 2 diabetes, hypertension, and microalbuminuria, ACE inhibitors and ARBs have been shown to delay the progression to macroalbuminuria. In those with type 2 diabetes, hypertension, macroalbuminuria (>300 mg/day), nephropathy, or renal insufficiency, an ARB should be strongly considered. In patients >55 years of age, with or without hypertension but with another cardiovascular risk factor (history of CVD, dyslipidemia, microalbuminuria, smoking), an ACE inhibitor (if not contraindicated) should be considered to reduce the risk of cardiovascular events.

C: Cholesterol/Aspirin

The letter “C” reminds patients and providers of the important role of lipid management and aspirin prophylaxis in the prevention of CVD and stroke.

Cholesterol (lipid management)

Standard. Patients with diabetes have an increased prevalence of lipid abnormalities that contributes to higher rates of CVD. Lipid management aimed at low-

Table 3. Correlation Between A1C Concentration and Mean Plasma Glucose Levels²⁴

A1C (%)	Mean plasma glucose (mg/dl)
6	135
7	170
8	205
9	240
10	275
11	310
12	345

ering LDL cholesterol, raising HDL cholesterol, and lowering triglycerides has been shown to reduce macrovascular disease and mortality in patients with diabetes, particularly those who have had prior cardiovascular events. Target lipid levels are given in Table 2.

Frequency. In adult patients, test for lipid disorders at least annually and more often if needed to achieve goals. In adults with low-risk lipid values (LDL <100 mg/dl, HDL >50 mg/dl, triglycerides <150 mg/dl), repeat lipid assessments every 2 years. In children >2 years of age, perform a lipid profile after diagnosis of diabetes and when glucose control has been established. If values are considered low risk and there is no family history, assessments should be repeated every 5 years.

Goal. Lower LDL cholesterol to <100 mg/dl as the primary goal of therapy for adults. Treatment also endeavors to lower triglycerides to <150 mg/dl and to raise HDL cholesterol to >40 mg/dl. In women, an HDL goal 10 mg/dl higher may be appropriate. Based on the Friedewald equation,⁹ these values translate into a total cholesterol of ~170 mg/dl for men and 180 mg/dl for women.

Aspirin

Standard. The platelets of patients with diabetes demonstrate increased aggregation that may be related to excess thromboxane release. Aspirin blocks thromboxane synthesis and has been used as a primary and secondary prevention of cardiovascular events in nondiabetic and diabetic individuals. Large-scale collaborative trials in men and women with diabetes support the use of low-dose aspirin as a secondary prevention strategy, if no contraindications exist.¹⁰

The ADA recommends the use of aspirin therapy (75–325 mg/day) in all adult patients with diabetes and macrovascular disease. Providers should also consider beginning aspirin therapy for primary prevention in patients ≥30 years of age with diabetes and one or more other cardiovascular risk factors.

Providers should not use aspirin in patients <21 years of age because of the increased risk of Reye's syndrome.¹¹

Clopidogrel has been demonstrated to reduce CVD rates in diabetic individuals.¹² Clopidogrel may be used as adjunctive therapy in very-high-risk patients or as alternative therapy in aspirin-intolerant patients.

Frequency. Patients with diabetes should be evaluated at each visit to determine the appropriateness of aspirin use. Instructions should be given to take the aspirin on a daily basis.

Goal. Aspirin is recommended as part of the overall approach to decrease CVD and stroke. Many trials have shown an ~30% decrease in myocardial infarction and a 20% decrease in stroke in a wide range of patients, including young and middle-aged patients, patients with and without a history of CVD, males and females, and patients with hypertension. Patients can be reassured that aspirin does not increase the risk of hemorrhage from diabetic retinopathy.

D: Diabetes Education

The letter "D" reminds patients and providers of the need for ongoing medical nutritional therapy (MNT) and diabetes self-management education to aid in achieving their management goals and preventing acute and chronic diabetes-related complications.

Standard. Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and reduce the risk of long-term complications. Diabetes self-management education is the process of providing people with diabetes the knowledge and skills to perform self-care on a day-to-day basis. Self-management education teaches people with diabetes to assess the relationships among MNT, activity level, emotional and physical status, and medications and then respond appropriately and continually to those factors to achieve and maintain optimal glucose control.¹ People with diabetes should receive individualized MNT as needed to

achieve treatment goals, preferably provided by a registered dietitian familiar with the components of diabetes MNT.

Today, self-management education is a critical part of the medical plan for people with diabetes, such that medical treatment of diabetes without systematic self-management education cannot be regarded as acceptable care. Furthermore, numerous studies have demonstrated that self-management education leads to reductions in the costs associated with all types of diabetes.¹³

Frequency. The ADA standards currently do not indicate a minimal frequency for the provision of diabetes education. Instead, they emphasize the necessity of self-management education as a continuous process. Many experts recommend that patients visit with a nurse diabetes educator and a dietitian diabetes educator at least annually.

Goal. The primary goal of self-management education is to equip patients to understand their diabetes and to actively participate in the care process in order to prevent diabetes-related complications. Self-management education also assists patients in adopting healthier lifestyles, including a regular physical activity program that is adapted to the presence of complications and advice to not smoke or counseling for smoking cessation.

E: Eye Examinations

The letter "E" reminds patients and providers of the importance of regular eye examinations in order to prevent blindness from diabetes.

Standard. Diabetic retinopathy is the most frequent cause of new cases of blindness among adults aged 20–74 years. During the first two decades of disease, nearly all patients with type 1 diabetes and >60% of patients with type 2 diabetes will develop retinopathy. Optimal blood pressure and glycemic control can substantially reduce the risk of progression of diabetic retinopathy. Timely laser photocoagulation therapy can also prevent loss of vision in a large

proportion of patients with severe non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR) and/or macular edema. Because a significant number of patients with vision-threatening disease may not have symptoms, ongoing evaluation for retinopathy is a valuable and required strategy.¹⁴

Frequency. Eye examinations should be performed as follows:

- Patients with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 3–5 years after the onset of diabetes.
- Patients with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist shortly after the diagnosis of diabetes.
- Subsequent examinations for type 1 and type 2 diabetic patients should be repeated annually by an ophthalmologist or optometrist who is knowledgeable and experienced in diagnosing the presence of diabetic retinopathy and is aware of its management. Examinations will be required more frequently if retinopathy is progressing.
- When planning pregnancy, women with preexisting diabetes should have a comprehensive eye examination and should be counseled on the risk of development and/or progression of diabetic retinopathy. Women with diabetes who become pregnant should have a comprehensive eye examination in the first trimester and close follow-up throughout pregnancy and for 1 year postpartum. This guideline does not apply to women who develop gestational diabetes, because such individuals are not at increased risk for diabetic retinopathy.

Patients with any level of macular edema, severe NPDR, or any PDR should be promptly referred to an ophthalmologist who is knowledgeable and experienced in the management and treatment of diabetic retinopathy.

Goal. The early detection of diabetic retinopathy and the opportunity to intervene with effective treatments in order to preserve vision are the goals of this standard of care.

F: Foot Examinations

The letter “F” reminds patients and providers of the importance of regular foot examinations and proper foot care to prevent morbidity and disability, including amputations, from foot problems.

Standard. Amputation and foot ulceration are among the most common consequences of diabetic neuropathy and are major causes of morbidity and disability in people with diabetes. Early recognition and management of independent risk factors can prevent or delay adverse outcomes. Foot-related risk conditions that are associated with an increased risk of amputation include:¹⁵

- Peripheral neuropathy with loss of protective sensation
- Altered biomechanics (in the presence of neuropathy)
- Evidence of increased pressure (erythema, hemorrhage under a callus)
- Bony deformity
- Peripheral vascular disease (decreased or absent pedal pulses)
- A history of ulcers or amputation
- Severe nail pathology

Frequency. Perform a comprehensive foot examination annually on patients with diabetes to identify risk factors predictive of ulcers and amputations. The foot examination should include the use of a Semmes-Weinstein monofilament, a tuning fork, palpation, and a visual examination. At least in patients with a history of abnormal foot exams, a visual inspection of the feet should be performed at each routine visit.¹⁵

Goal. Identification of people at increased risk for amputation and education of all patients about the risk and prevention of foot problems is the primary goal of this standard of care. Comprehensive foot care programs can reduce amputation rates by 45–85%.¹⁶

G: Glucose Monitoring

The letter “G” reminds patients and providers of the important role of glucose monitoring in achieving glycemic control and preventing diabetes-related complications.

Standard. Monitoring of glycemic status, as performed by patients and health care providers, is considered a cornerstone of diabetes care. Major clinical trials demonstrate that SMBG is a component of effective therapy.¹⁷

Frequency. The frequency and timing of SMBG should be determined by the particular needs and goals of the patient in question. Daily SMBG is especially important for patients treated with insulin to monitor for and prevent asymptomatic hypoglycemia. For most patients with type 1 diabetes and for pregnant women taking insulin, SMBG is recommended three or more times daily. The optimal frequency and timing of SMBG for patients with type 2 diabetes is not known, but the frequency should be sufficient to facilitate reaching glucose goals. When adding to or modifying therapy, type 1 and type 2 diabetic patients should test more often than usual. The role of SMBG in stable diet-treated patients with type 2 diabetes is not known.

Goal. SMBG allows patients to evaluate their individual responses to therapy and assess whether glycemic targets are being achieved. Patients should be taught how to use SMBG data to adjust food intake, exercise, or pharmacological therapy to achieve specific glycemic goals and prevent hypoglycemia. Health professionals should evaluate at regular intervals patients’ ability to use SMBG data to guide treatment.

H: Health Maintenance

The letter “H” reminds patients and providers of the importance of the health maintenance practice of immunization to prevent infections from influenza and pneumococcal pneumonia.

Standard. Epidemiological studies support the fact that patients with diabetes are at high risk for complications,

hospitalization, and death from influenza and pneumococcal disease. Safe and effective vaccines are available that can greatly reduce the risk of serious complications from these diseases.^{18,19}

Frequency. Immunizations should be performed as follows:

- Influenza vaccine should be provided annually to all patients with diabetes who are 6 months of age or older.¹
- Pneumococcal vaccine should be provided at least once for adults with diabetes. A one-time revaccination is recommended for individuals >64 years of age previously immunized when they were <65 years of age if the vaccine was administered >5 years ago. Other indications for repeat vaccination include nephrotic syndrome, chronic renal disease, and other immunocompromised states, such as post-organ transplantation.¹

Goal. Prevention of morbidity and mortality from influenza and pneumonia are the goals of this standard of care. Influenza vaccine reduces diabetes-related hospital admission by as much as 79% during flu epidemics.²⁰ Many studies have shown that the pneumococcal vaccine is effective in reducing life-threatening bacteremic disease in people with diabetes.²¹ Identification of patients, creation of registries, and effective recall and reminder systems have all proven efficient in improving immunization rates.

I: Indications for Specialty Care

The letter "I" reminds patients and providers that there are circumstances in which additional health care professionals may need to be involved in the diabetes team. The following are indications for involving other providers.¹

Referral for diabetes management

- For a variety of reasons (e.g., intercurrent illness, diabetic ketoacidosis, recurrent hypoglycemia), it may not be possible to provide care that achieves the desired goals of treatment. In such instances, additional

suggested actions might include enhanced diabetes self-management education, comanagement with a diabetes team, or referral to an endocrinologist if a primary care provider is currently following the patient.

- Hospitalized patients should be treated by a physician with expertise in the management of diabetes, and recent studies suggest that achieving very stringent glycemic control may reduce mortality in the immediate post-myocardial infarction period.²² Aggressive glycemic management with insulin may reduce morbidity in patients with severe acute illness.²³

Referral for diabetic eye disease

- Promptly refer patients with any level of macular edema, severe NPDR, or any PDR to an ophthalmologist who is knowledgeable and experienced in the management and treatment of diabetic retinopathy.

Referral for management of hypertension and renal disease

- Patients not achieving target blood pressure on three drugs, including a diuretic, and/or patients with significant renal disease (see below) should be referred to a specialist experienced in the care of patients with hypertension.
- Consider referral to a physician experienced in the care of diabetic renal disease when the estimated glomerular filtration rate has fallen to <60 ml · min⁻¹ · 1.73 m⁻² or if difficulties occur in the management of hypertension or hyperkalemia.

Referral for foot care

- Refer high-risk patients to foot care specialists for ongoing preventive care and lifelong surveillance.
- Refer patients with significant claudication for further vascular assessment and consider exercise and surgical options.

Referral for cardiac evaluation

- Refer patients with signs and symptoms of CVD or with a positive non-

invasive test for coronary artery disease to a cardiologist for further evaluation.

REFERENCES

- ¹American Diabetes Association: Standards of medical care for patients with diabetes mellitus (Position Statement). *Diabetes Care* 26 (Suppl. 1):S33–S50, 2003
- ²Sacks DB, Bruns DE, Goldstein DE, MacLaren NK, McDonald JM, Parrott M: Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. *Diabetes Care* 25:750–786, 2002
- ³Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure: The sixth report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VI). *Arch Intern Med* 157:2413–2446, 1997
- ⁴U.K. Prospective Diabetes Study Group: Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *BMJ* 317:703–713, 1998
- ⁵Hansson L, Zanchetti A, Carruthers SG, Dahlof B, Elmfeldt D, Julius S, Menard J, Rahn KH, Wedel H, Westerling S: Effects of intensive blood-pressure lowering and low-dose aspirin on patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomized trial. *Lancet* 351:1755–1762, 1998
- ⁶American Diabetes Association: Treatment of hypertension in adults with diabetes mellitus (Position Statement). *Diabetes Care* 26 (Suppl. 1):S80–S82, 2003
- ⁷Garg J, Bakris GL: Microalbuminuria: marker of vascular dysfunction, risk factor for cardiovascular disease. *J Vasc Med* 7:35–43, 2002
- ⁸Kidney Disease Outcome Quality Initiative: Clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis* 39 (Suppl. 2):SI–S246, 2002
- ⁹Friedewald WT, Levy RI, Fredrickson DS: Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem* 18:499–502, 1972
- ¹⁰Colwell JA: Aspirin therapy in diabetes (Technical Review). *Diabetes Care* 20:1767–1771, 1997
- ¹¹American Diabetes Association: Aspirin therapy in diabetes (Position Statement). *Diabetes Care* 26 (Suppl. 1):S87–S88, 2003
- ¹²Bhatt DL, Marso SP, Hirsch AT, Ringleb PA, Hacke W, Topol EJ: Amplified benefit of clopidogrel versus aspirin in patients with diabetes mellitus. *Am J Cardiol* 90:625–628, 2002
- ¹³American Diabetes Association: Third-party reimbursement for diabetes care, self-management education, and supplies. *Diabetes Care* 26 (Suppl. 1):S143–S144, 2003
- ¹⁴American Diabetes Association: Diabetic retinopathy (Position Statement). *Diabetes Care* 26 (Suppl. 1):S99–S102, 2003

¹⁵American Diabetes Association: Preventive foot care in people with diabetes (Position Statement). *Diabetes Care* 26 (Suppl. 1):S78–S79, 2003

¹⁶National Institute of Diabetes and Digestive and Kidney Diseases: National diabetes statistics. Available online at www.niddk.nih.gov/health/diabetes/pubs/dmstats/dmstats.htm

¹⁷American Diabetes Association: Tests of glycemia in diabetes (Position Statement). *Diabetes Care* 26 (Suppl. 1):S106–S108, 2003

¹⁸Centers for Disease Control and Prevention: Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morb Mortal Wkly Rep* 51:1–31, 2002

¹⁹Centers for Disease Control and Prevention: Prevention and control of pneumococcal disease:

recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morb Mortal Wkly Rep* 46:1–24, 1997

²⁰Colquhoun AJ, Nicholson KG, Botha NT: Effectiveness of influenza vaccine in reducing hospital admissions in people with diabetes. *Epidemiol Infect* 119:335–341, 1997

²¹American Diabetes Association: Immunization and the prevention of influenza and pneumococcal disease in people with diabetes (Position Statement). *Diabetes Care* 26 (Suppl. 1):S126–S128, 2003

²²Malmberg K, for the DIGAMI Study Group: Prospective randomized study of intensive insulin treatment on long term survival after myocardial infarction in patients with diabetes. *BMJ* 314:512–515, 1997

²³Van den Berghe G, Wouters P, Weekers F, Verwaest C, Bruyninckx F, Schetz M, Vlasselaers

D, Ferdinande P, Lauwers P, Bouillon R: Intensive insulin therapy in critically ill patients. *N Engl J Med* 345:1359–1367, 2001

²⁴Rohlfing CL, Wiedmeyer HM, Little RR, England JD, Tennill A, Goldstein DE: Defining the relationship between plasma glucose and HbA_{1c}: analysis of glucose profiles and HbA_{1c} in the Diabetes Control and Complications Trial. *Diabetes Care* 25:275–278, 2002

Samuel L. Abbate, MD, CDE, is medical director of the North Dakota Health Care Review and an assistant clinical professor of medicine at the University of North Dakota in Bismarck.