
Standards of Medical Care for Patients With Diabetes Mellitus*

Diabetes is a chronic illness that requires continuing medical care and education to prevent acute complications and to reduce the risk of long-term complications. People with diabetes should receive their treatment and care from a physician-coordinated team. Such teams include, but are not limited to, physicians, nurses, dietitians, and mental health professionals with expertise and a special interest in diabetes.

The following standards define basic medical care for people with diabetes. These standards are not intended to preclude more extensive evaluation and management of the patient by other specialists as needed.

These standards of diabetes care seek to provide:

1. Physicians and other health care professionals who treat people with diabetes with a means to

- Set treatment goals
- Assess the quality of diabetes treatment provided
- Identify areas where more attention or self-management training is needed
- Define timely and necessary referral patterns to appropriate specialists

2. People with diabetes with a means to

- Assess the quality of medical care they receive
- Develop expectations for their role in the medical treatment
- Compare their treatment outcomes with standard goals

For more detailed information, refer to Skyler (Ed.): *Medical Management of Type 1 Diabetes* and Zimmerman (Ed.): *Medical Management of Type 2 Diabetes* (see bibliography).

General Principles

Persistent hyperglycemia is the hallmark of all forms of diabetes. Treatment aimed at lowering blood glucose to or near normal levels in all patients is mandated by the following proven benefits:

1. The danger of acute decompensation due to diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemic nonketotic syndrome, with their accompanying morbidity and mortality, is markedly reduced.
2. The symptoms of blurred vision are alleviated, and the risk of polyuria, polydipsia, fatigue, weight loss with polyphagia, vaginitis, or balanitis may be decreased.
3. The risks of development or progression of diabetic retinopathy, nephropathy, and neuropathy are all greatly decreased. It is possible that these complications may even be prevented by early effective management.
4. Near normalization of blood glucose has been demonstrated to be associated with a less atherogenic lipid profile.

Achieving near normal or normal blood glucose levels in patients requires comprehensive education in self-management and, for most individuals, intensive treatment programs. Such programs include the following components according to individual patient need:

- Appropriate frequency of self-monitoring of blood glucose (SMBG)
- Medical nutrition therapy (MNT)
- Regular exercise
- Physiologically based insulin regimens, i.e., multiple daily injections of rapid-acting insulin analogs (e.g., lispro), short-acting (e.g., regular), intermediate-acting (e.g., NPH or lente), or long-acting (e.g., ultralente) insulins or continuous subcutaneous insulin infusion, in type 1 and some type 2 patients
- Less-complex insulin regimens or oral glucose-lowering agents in some type 2 patients
- Instruction in the prevention and treatment of hypoglycemia and other acute and chronic complications
- Continuing education and reinforcement
- Periodic assessment of treatment goals

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To be effective, treatment programs require ongoing support from the clinical care team.

Specific Goals of Treatment

Type 1 diabetes, Setting individual patient glycemic targets should take into account the results of prospective randomized clinical trials, most notably the Diabetes Control and Complications Trial (DCCT). This trial conclusively demonstrated that in patients with type 1 diabetes the risk of development or progression of retinopathy, nephropathy, and neuropathy is reduced 50–75% by intensive treatment regimens when compared with conventional treatment regimens. These benefits were observed with an average HbA_{1c} of 7.2% in intensively treated groups of patients compared with 9.0% in conventionally treated groups of patients. The reduction in risk of these complications correlated continuously with the reduction in HbA_{1c} produced by intensive treatment. This relationship implies that near normalization of glycemic levels may prevent complications. The nondiabetic reference range for the HbA_{1c} in the DCCT was 4.0–6.0. Because different assays can give varying glycosylated hemoglobin (HbA_{1c}) values, it is important that laboratories only use assay methods that are certified as traceable to the DCCT HbA_{1c} reference method.

SMBG targets in the DCCT were 70–120 mg/dl (3.9–6.7 mmol/l) before meals and at bedtime and <180 mg/dl (<10.0 mmol/l) when measured 1.5–2.0 h postprandially. However, these goals were associated with a threefold increased risk of severe hypoglycemia. Therefore, it may be appropriate to increase these targets (e.g., 80–120 mg/dl [4.4–6.7 mmol/l] before meals and 100–140 mg/dl [5.6–7.8 mmol/l] at bedtime) (Table 1, top). These targets should be further adjusted upward in patients with a history of recurrent severe or unrecognized hypoglycemia.

Table 1. Glycemic control for people with diabetes*

	Normal	Goal	Additional action suggested
Whole blood values			
Average preprandial glucose (mg/dl)	<100	80-120	<80/>140
Average bedtime glucose (mg/dl)	<110	100-140	<100/>160
Plasma value			
Average preprandial glucose (mg/dl)	<110	90-130	<90/>150
Average bedtime glucose (mg/dl)	<120	110-150	<110/>180
HbA _{1c} (%)	<6	<7	>8

*The values shown in this table are by necessity generalized to the entire population of individuals with diabetes. Patients with comorbid diseases, the very young and older adults, and others with unusual conditions or circumstances may warrant different treatment goals. These are for nonpregnant adults. "Additional action suggested" depends on individual patient circumstances. Such actions may include enhanced diabetes self management with a diabetes team, referral to an endocrinologist, change in pharmacological therapy, initiation of or increase in SMBG or more frequent contact with the patient. HbA_{1c} is referenced to a nondiabetic range of 4.0-6.0% (mean 5.0%, SD 0.5%)

Whole blood glucose values were provided for the SMBG targets in the DCCT. Because laboratory methods measure plasma glucose, many blood glucose monitors approved for home use and some test strips now calibrate blood glucose readings to plasma values. Plasma glucose values are 10–15% higher than whole blood glucose values, and it is crucial that people with diabetes know whether their monitor and strips provide whole blood or plasma results. The preprandial and bedtime glucose values in the bottom of Table 1 have been modified to show plasma readings.

Individual treatment goals should take into account the patient's capacity to understand and carry out the treatment regimen, the patient's risk for severe hypoglycemia, and other patient factors that may increase risk or decrease benefit (e.g., very young or old age, end-stage renal disease (ESRD), advanced cardiovascular or cerebrovascular disease, or other coexisting diseases that will materially shorten life expectancy).

The desired outcome of glycemic control in type 1 diabetes is to lower HbA_{1c} (or any equivalent measure of chronic glycemia) so as to achieve maximum prevention of complications with due regard for patient safety. To achieve these goals with intensive management, the following may be necessary:

- Frequent SMBG (at least three or four times per day)
- Medical nutrition therapy
- Education in self-management and problem solving
- Possible hospitalization for initiation of therapy

In situations where resources are unavailable or insufficient, referral to a diabetes care team for consultation and/or comanagement is recommended.

Type 2 diabetes, The largest and longest study of patients with type 2 diabetes, the United Kingdom Prospective Diabetes Study (UKPDS), conclusively demonstrated that improved blood glucose control in these patients reduces the risk of developing retinopathy and nephropathy and possibly reduces neuropathy. The overall microvascular complications rate was decreased by 25% in patients receiving intensive therapy versus conventional therapy. Epidemiological analysis of the UKPDS data showed a continuous relationship between the risk of microvascular complications and glycemia, such that for every percentage point decrease in HbA_{1c} (e.g., 9 to 8%) there was a 35% reduction in the risk of microvascular complications. These results confirm in type 2 diabetes that lowering blood glucose is beneficial. The UKPDS also showed that aggressive control of blood pressure, consistent with American Diabetes Association recommendations, significantly reduced strokes, diabetes-

related deaths, heart failure, microvascular complications, and visual loss.

Several observational studies, including the results of the epidemiologic analysis of UKPDS data, have shown strong and statistically significant associations between blood glucose control and the risk of cardiovascular disease morbidity and mortality. The UKPDS showed a 16% reduction (not statistically significant, $P = 0.052$) in the risk of combined fatal or nonfatal myocardial infarction and sudden death in the intensively treated group.

For further discussion, see the American Diabetes Association's position statement "Implications of the United Kingdom Prospective Diabetes Study."

When setting treatment goals for type 2 diabetes (Table 1), the same individual patient characteristics should be considered as for type 1 diabetes: the patient's capacity to understand and carry out the treatment regimen, the patient's risk for severe hypoglycemia, and other patient factors that may increase risk or decrease benefit (e.g., advanced age, ESRD, advanced cardiovascular or cerebrovascular disease, or other coexisting diseases that will materially shorten life expectancy).

Daily SMBG is especially important for patients treated with insulin or sulfonylureas to monitor for and prevent asymptomatic hypoglycemia. The optimal frequency of SMBG for patients with type 2 diabetes is not known, but it should be sufficient to facilitate reaching glucose goals. The role of SMBG in stable diet-treated patients with type 2 diabetes is not known.

Type 2 diabetes treatment methods should emphasize diabetes management as a multiple risk factor approach including MNT, exercise, weight reduction when indicated, and use of oral glucose-lowering agents and/or insulin, with careful attention given to cardiovascular risk factors, including hypertension, smoking, dyslipidemia, and family history. Whether treated with insulin or oral glucose-lowering agents, or a combination, goals remain those outlined in Table 1.

Initial Visit

Medical history. The comprehensive medical history can uncover symptoms that will help establish the diagnosis in the patient with previously unrecognized diabetes. If the diagnosis of diabetes has already been made, the history should confirm the diagnosis, review the previous treatment, allow evaluation of the past and present degrees of glycemic control, determine the presence or absence of the chronic complications of diabetes, assist in formulating a management plan, and provide a basis for continuing care. Elements of the medical history of particular concern in patients with diabetes

include the following:

- Symptoms, results of laboratory tests, and special examination results related to the diagnosis of diabetes
- Prior HbA_{1c} records
- Eating patterns, nutritional status, and weight history; growth and development in children and adolescents
- Details of previous treatment programs, including nutrition and diabetes self-management education
- Current treatment of diabetes, including medications, meal plan, and results of glucose monitoring and patients' use of the data
- Exercise history
- Frequency, severity, and cause of acute complications such as ketoacidosis and hypoglycemia
- Prior or current infections, particularly skin, foot, dental, and genitourinary infections
- Symptoms and treatment of chronic eye; kidney; nerve; genitourinary (including sexual), bladder, and gastrointestinal function; heart; peripheral vascular; foot; and cerebrovascular complications associated with diabetes
- Other medications that may affect blood glucose levels
- Risk factors for atherosclerosis: smoking, hypertension, obesity, dyslipidemia, and family history
- History and treatment of other conditions, including endocrine and eating disorders
- Family history of diabetes and other endocrine disorders
- Gestational history: hyperglycemia, delivery of an infant weighing >9 lb, toxemia, stillbirth, polyhydramnios, or other complications of pregnancy
- Lifestyle, cultural, psychosocial, educational, and economic factors that might influence the management of diabetes
- Tobacco and alcohol use

Physical examination. A physical examination should be performed during the initial evaluation. People with diabetes have a high risk of developing eye, kidney, foot, nerve, cardiac, and vascular complications. Patients with type 1 diabetes have an increased frequency of autoimmune disorders, especially thyroid disease. All individuals with poorly controlled diabetes are at increased risk for infections. Children with poorly controlled diabetes

may have delayed growth and maturation. Therefore, certain aspects of the detailed physical examination require particular attention. These include the following:

- Height and weight measurement (and comparison to norms in children and adolescents)
- Sexual maturation staging (during peripubertal period)
- Blood pressure determination (with orthostatic measurements when indicated) and comparison to age-related norms
- Ophthalmoscopic examination (preferably with dilation)
- Oral examination
- Thyroid palpation
- Cardiac examination
- Abdominal examination (e.g., for hepatomegaly)
- Evaluation of pulses (by palpation and auscultation)
- Hand/finger examination
- Foot examination
- Skin examination (including insulin-injection sites)
- Neurological examination

The clinician should also be alert for signs of diseases that can cause secondary diabetes, e.g., hemochromatosis, pancreatic disease, and endocrine disorders such as acromegaly, pheochromocytoma, and Cushing's syndrome.

Laboratory evaluation. Blood glucose testing and urine ketone testing should be available in the office for immediate use as needed. In addition, each patient should undergo laboratory tests that are appropriate to the evaluation of the individual's general medical condition. Certain tests should be performed to establish the diagnosis of diabetes (see the American Diabetes Association's "Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus" for a complete discussion on this subject), determine the degree of glycemic control, and define associated complications and risk factors. These include the following:

- Fasting plasma glucose (a random plasma glucose test may be performed in an undiagnosed symptomatic patient for diagnostic purposes)
- HbA_{1c}
- Fasting lipid profile: total cholesterol, HDL cholesterol, triglycerides, and LDL cholesterol
- Serum creatinine in adults; in children if proteinuria is present
- Urinalysis: glucose, ketones, protein, sediment

- Test for microalbuminuria (e.g., timed specimen or the albumin-to-creatinine ratio) in pubertal and postpubertal type 1 patients who have had diabetes for at least 5 years and in all patients with type 2 diabetes. However, some evidence suggests that the prepubertal duration of diabetes may be important in the development of microvascular complications; therefore, clinical judgment should be used when applying these recommendations to individual patients.
- Urine culture if sediment is abnormal or symptoms are present
- Thyroid-stimulating hormone (TSH) in all type 1 patients
- Electrocardiogram in adults

Management plan. A complete, organized medical record system is essential to providing ongoing care of people with diabetes. The records must always be accessible to the diabetes treatment team and organized so that they not only document what has occurred but also serve as a reminder of what should be done at appropriate intervals.

The management plan should be formulated as an individualized therapeutic alliance among the patient and family, the physician, and other members of the health care team skilled in the management of diabetes to achieve the desired level of diabetes control. Patient self-management should be emphasized. To this end, the management plan should be formulated in collaboration with the patient, and the plan should emphasize the involvement of the patient in problem solving as much as possible. A variety of strategies and techniques should be employed to provide adequate education and development of problem-solving skills in the various aspects of diabetes management.

In formulating this management plan, consideration should be given to the patient's age, school or work schedule and conditions, physical activity, eating patterns, social situation and personality, cultural factors, and presence of complications of diabetes or other medical conditions. Implementation of the management plan requires that each aspect be understood and agreed on by the patient and the care providers and that the goals and treatment plan are reasonable. The management plan should include the following:

- Statement of short- and long-term goals
- Medications (insulin, oral glucose-lowering agents, glucagon, antihypertensive and lipid-lowering agents, aspirin therapy, other endocrine drugs, and other medications)
- Individualized nutrition recommendations and

instructions, preferably by a registered dietitian familiar with the components of diabetes MNT

- Recommendations for appropriate lifestyle changes (e.g., exercise, smoking cessation)
 - Patient and family education for self-management that is consistent with the National Standards for Diabetes Self-Management Education Programs
 - Monitoring instructions: SMBG, urine ketones, and use of a record system. Frequency of SMBG should be individualized according to clinical circumstances, the form of treatment employed, and the response to treatment. Urine glucose may be considered as an alternative only if the patient is unable or unwilling to perform blood glucose testing or if the only goal is avoidance of symptomatic hyperglycemia.
 - Annual comprehensive dilated eye and visual examinations by an ophthalmologist or optometrist for all patients of age 10 years and older who have had diabetes for 3–5 years, all patients diagnosed after age 30 years, and any patient with visual symptoms and/or abnormalities. However, some evidence suggests that the prepubertal duration of diabetes may be important in the development of microvascular complications; therefore, clinical judgment should be used when applying these recommendations to individual patients.
 - Consultation for podiatry services as indicated
 - Consultation for specialized services as indicated
 - Agreement on continuing support, follow-up, and return appointments
 - Instructions on when and how to contact the physician or other members of the health care team when the patient has not been able to solve problems and when management of acute problems is required
 - For women of childbearing age, discussion of contraception and emphasis on the necessity of optimal blood glucose control before conception and during pregnancy
 - Dental hygiene
 - Pneumococcal vaccine; influenza vaccine annually
- See Table 2 for a summary of the initial visit.

Continuing Care

Continuing care is essential in the management of every patient with diabetes. At each visit, the patient's progress in achieving treatment goals should be evaluated by the

Table 2. Components of the initial visit

I. Medical history	
A.	Symptoms, laboratory results related to diagnosis
B.	Nutritional assessment, weight history
C.	Previous and present treatment plans
	1. Medications
	2. MNT
	3. Self-management training
	4. SMBG and use of results
D.	Current treatment program
E.	Exercise history
F.	Acute complications
G.	History of infections
H.	Chronic diabetic complications
I.	Medication history
J.	Family history
K.	CHD risk factors
L.	Psychosocial/economic factors
M.	Tobacco and alcohol use
II. Physical examination	
A.	Height and weight
B.	Blood pressure
C.	Ophthalmoscopic examination
D.	Thyroid palpation
E.	Cardiac examination
F.	Evaluation of pulses
G.	Foot examination
H.	Skin examination
I.	Neurological examination
J.	Oral examination
K.	Sexual maturation (if peripubertal)
III. Laboratory evaluation	
A.	Fasting plasma glucose (optional)
B.	HbA
C.	Fasting lipid profile
D.	Serum creatinine
E.	Urinalysis
F.	Urine culture (if indicated)
G.	TSH (type 1 patients)
H.	Electrocardiogram (adults)

Continue next page

Table 2. Components of the initial visit

IV. Management plan
A. Short-and long-term goals
B. Medications
C. Medical nutrition therapy
D. Lifestyle changes
E. Self-management education
F. Monitoring instructions
G. Annual referral to eye specialist
H. Specialty consultation (as indicated)
I. Agreement on continuing support/follow-up
J. Pneumococcal and influenza vaccines

health care team, and problems that have occurred should be reviewed. If goals are not being met, the management plan needs to be revised and/or the goals need to be reassessed.

Visit frequency. The frequency of patient visits depends on the following:

- Type of diabetes
- Blood glucose goals and the degree to which they are achieved
- Changes in the treatment regimen
- Presence of complications of diabetes or other medical conditions

Patients initiating insulin therapy or having a major change in their insulin program may need to be in contact with their health care providers as often as daily until glucose control is achieved, the risk of hypoglycemia is low, and they are competent and comfortable implementing the treatment plan. Some patients may require hospitalization for initiation or change of therapy.

Patients beginning treatment with MNT or oral glucose-lowering agents may need to be contacted as often as weekly until reasonable glucose control is achieved and they are competent to conduct the treatment program. Regular visits should be scheduled for all patients with diabetes. Patients should generally be seen at least quarterly until achievement of treatment goals. Thereafter, the frequency of visits may be decreased as long as patients continue to achieve all treatment goals. More frequent contact also may be required if patients are undergoing intensive insulin therapy, not meeting glycemic or blood pressure goals, or have evidence of progression in microvascular or macrovascular complications. Patients must be taught to recognize problems with their glucose control as indicated by their SMBG records and to promptly report concerns to the health care team to clarify and strengthen their self-management skills. They also

should be taught to recognize early signs and symptoms of acute and chronic complications and to report these immediately. Severe hypoglycemic reactions requiring the assistance of another person must be reported as soon as possible.

Medical history. An interim history should be obtained at each visit and should include the following:

- Frequency, causes, and severity of hypoglycemia or hyperglycemia
- Results of SMBG
- Adjustments by the patient of the therapeutic regimen
- Problems with adherence
- Symptoms suggesting development of the complications of diabetes
- Other medical illnesses
- Current medications
- Psychosocial issues
- Lifestyle changes
- Tobacco and alcohol use

Physical examination. The routine follow-up examination should include the following:

- Height (until maturity)
- Weight
- Blood pressure
- Sexual maturation (in peripubertal patients)
- Funduscopy in patients at risk (referral if retinopathy detected)
- Foot examination in patients at risk

If abnormalities are identified, more frequent follow-up may be required.

Comprehensive dilated eye and visual examinations should be performed annually by an ophthalmologist or optometrist who is knowledgeable and experienced in the management of diabetic retinopathy for all patients age 10 years and older who have had diabetes for 3–5 years, all patients diagnosed after age 30, and any patient with visual symptoms and/or abnormalities. For further discussion, see the American Diabetes Association's position statement "Diabetic Retinopathy."

All individuals with diabetes should receive a thorough foot examination at least once a year to identify high-risk foot conditions. This examination should include an assessment of protective sensation, foot structure and biomechanics, vascular status, and skin integrity. People with one or more high-risk foot conditions should be evaluated more frequently for the development of additional risk factors. People with neuropathy should have a visual inspection of their feet at every contact with

a health care professional. For further discussion, see the American Diabetes Association's position statement, "Preventive Foot Care in People With Diabetes."

Laboratory evaluation. An HbA_{1c} determination should be performed routinely in all patients with diabetes, first to document the degree of glycemic control at initial assessment, then as part of continuing care. Since HbA_{1c} reflects mean glycemia over the preceding 2–3 months, measurement approximately every 3 months is required to determine whether a patient's metabolic control has remained continuously within the target range. Thus, regular measurements of HbA_{1c} permit detection of departures from the target range in a timely fashion. For any individual patient, the frequency of HbA_{1c} testing should depend on the treatment regimen employed and the judgment of the clinician. In the absence of well-controlled studies that suggest a definite testing protocol, expert opinion recommends HbA_{1c} testing at least twice a year in patients who are meeting treatment goals and who have stable glycemic control and more frequently (quarterly assessment) in patients whose therapy has changed or who are not meeting glycemic goals.

Low-risk, borderline, and high-risk lipid levels for adults are shown in Table 3. Adult patients with diabetes should be tested annually for lipid disorders with fasting serum cholesterol, triglyceride, HDL cholesterol, and calculated LDL cholesterol measurements. If values fall in lower-risk levels, assessment may be repeated every 2 years. Tests resulting in borderline or abnormal values should be repeated for confirmation. Tests resulting in abnormal values requiring institution of therapy should be repeated, following the National Cholesterol Education Program recommendations. Lipid values should be reevaluated following a macrovascular event.

Table 3. Category of risk based on lipoprotein levels in adults with diabetes

Risk	LDL cholesterol	HDL cholesterol	Triglyceride
High	≥130	<35	≥400
Borderline	100-129	35-45	200-399
Low	<100	<45	<200

Data are given in milligrams per deciliter. *For women, HDL cholesterol values should be increased by 10mg/dl.

A lipid profile should be performed on children older than 2 years after diagnosis of diabetes and when glucose control has been established. Tests resulting in borderline or abnormal values should be repeated for confirmation. If values fall within accepted risk levels, assessment should be repeated every 5 years. Tests resulting in abnormal values requiring institution of therapy should be repeated,

following the National Cholesterol Education Program recommendations for children and adolescents.

In the absence of previously demonstrated microalbuminuria, an annual test for the presence of microalbumin is necessary. Screening for microalbuminuria in individuals with type 1 diabetes should begin with puberty and after 5 years' duration of the disease. Because of the difficulty in precise dating of the onset of type 2 diabetes, such screening should begin at the time of diagnosis. Screening for microalbuminuria can be performed by three methods:

1. Measurement of the albumin-to-creatinine ratio in a random, spot collection
2. 24-h collection with creatinine, allowing the simultaneous measurement of creatinine clearance
3. Timed (e.g., 4-h or overnight) collection

The first method is often found to be the easiest in an office setting and generally provides accurate information. First-void or other morning collections are preferred because of the known diurnal variation in albumin excretion, but if this timing cannot be used, uniformity of timing for different collections in the same individual should be employed.

The role of annual urine protein dipstick testing and microalbuminuria assessment is less clear after diagnosis of microalbuminuria and institution of ACE inhibitor therapy and blood pressure control. Many experts recommend continued surveillance both to assess response to therapy and progression of disease. In addition to assessment of urinary albumin excretion, assessment of renal function is important in patients with diabetic kidney disease.

Management plan. The management plan should be reviewed at each regular visit to determine progress in meeting goals and to identify problems. This review should include the control of blood glucose levels, assessment of complications, control of blood pressure, control of dyslipidemia, nutrition assessment, frequency of hypoglycemia, adherence to all aspects of self-care, evaluation of the exercise regimen, follow-up of referrals, and psychosocial adjustment. In addition, knowledge of diabetes and self-management skills should be reassessed at least annually. Continuing education should be provided or encouraged.

Special Considerations

Children and adolescents. Approximately three-quarters of all newly diagnosed cases of type 1 diabetes occur in individuals younger than 18 years. Care of this group requires integration of diabetes management with the See

Table 4 for a summary of continuing care

Table 4. Potential components of continuing care visits

I. Contact frequency
A. Daily for initiation of insulin or change in regimen
B. Weekly for initiation of oral glucose-lowering agent(s) or change in regimen
C. Routine diabetes visits
1. Quarterly for patients who are not meeting goals
2. Semiannually for other patients
II. Medical history
A. Assess treatment regimen
1. Frequency/severity of hypo-/hyperglycemia
2. SMBG results
3. Patient regimen adjustments
4. Adherence problems
5. Lifestyle changes
6. Symptoms of complications
7. Other medical illnesses
8. Medications
9. Psychosocial issues
10. Tobacco and alcohol use
III. Physical examination
A. Physical examination annually
B. Dilated eye examination annually
C. Every regular diabetes visit
1. Weight
2. Blood pressure
3. Previous abnormalities on the physical exam
D. Foot examination annually; more often in patients with high-risk foot conditions
IV. Laboratory evaluation
A. HbA _{1c}
1. Quarterly if treatment changes or patient is not meeting goals
2. Twice per year if stable
B. Fasting plasma glucose (optional)
C. Fasting lipid profile annually, unless low risk
D. Microalbumin measurement annually (if indicated)
V. Evaluation of management plan
A. Short/and long/term goals
B. Medications
C. Glycemia
D. Frequency/severity of hypoglycemia
E. SMBG results
F. Complications
G. control of dyslipidemia
H. Blood pressure

Table 4. Potential components of continuing care visits

I. Weight
J. MNT
K. Exercise regimen
L. Adherence to self-management training
M. Follow up of referrals
N. Psychosocial adjustment
O. Knowledge of diabetes
P. Self-management skills
Q. Smoking cessation, if indicated
R. Annual influenza vaccine

complicated physical and emotional growth needs of children, adolescents, and their families. Diabetes care for children of this age-group should be provided by a team that can deal with these special medical, educational, nutritional, and behavioral issues.

At the time of initial diagnosis, it is extremely important to establish the goals of care and to begin diabetes self-management education. A firm educational base should be provided so that the individual and family can become increasingly independent in the self-management of diabetes. Glycemic goals may need to be modified to take into account the fact that most children younger than 6 or 7 years have a form of "hypoglycemic unawareness," in that they lack the cognitive capacity to recognize and respond to hypoglycemic symptoms. Intercurrent illnesses are more frequent in young children. Sick-day management rules must be established and taught to prevent severe hyperglycemia and diabetic ketoacidosis (DKA) that require hospitalization. A nutritional assessment should be performed at diagnosis, and at least annually thereafter, by an individual experienced with the nutritional needs of the growing child and the behavioral issues that have an impact on adolescent diets. Caution must be exercised to avoid overaggressive dietary manipulation in the very young. Assessment of lifestyle needs should be accompanied by possible modifications of the diabetic regimen. For example, an adolescent who requires more flexibility might be switched to a three- or four-insulin-injection program when needed.

A major issue deserving emphasis in this age-group is that of "adherence." No matter how sound the medical regimen, it can only be as good as the ability of the family and/or individual to implement it. Health care providers who care for children and adolescents, therefore, must be capable of evaluating the behavioral, emotional, and psychosocial factors that interfere with implementation and then must work with the individual and family to resolve problems that occur and/or to modify goals as appropriate.

Continue

Information should be supplied to the school or day care setting so that school personnel are aware of the diagnosis of diabetes in the student and of the signs, symptoms, and treatment of hypoglycemia. It is desirable that blood glucose testing be performed at the school or day care setting before lunch and when signs or symptoms of abnormal blood glucose levels are present.

For further discussion, see the American Diabetes Association's position statement, "The Care of Children With Diabetes in the School and Day Care Setting."

The incidence of type 2 diabetes in children and adolescents has been shown to be increasing. Although there are insufficient data to make definite recommendations, a recent American Diabetes Association consensus statement provides guidance on the prevention, screening and treatment of type 2 diabetes in young people. The ideal goal of treatment is normalization of blood glucose values and HbA_{1c}. Accurate diagnosis and classification of diabetes is crucial in determining appropriate treatment for these patients. Many patients can be managed initially with MNT and exercise, but most will eventually require drug therapy. Successful control of comorbidities, such as hypertension and hyperlipidemia, is also important. For further discussion, see the American Diabetes Association consensus statement, "Type 2 Diabetes in Children and Adolescents."

Referral for diabetes management. For a variety of reasons (e.g., intercurrent illness, DKA, recurrent hypoglycemia), it may not be possible to provide care that meets these standards or achieves the desired goals of treatment (Table 1). In such instances, additional actions suggested may include enhanced education of diabetes self-management, comanagement with a diabetes team, or referral to an endocrinologist.

Intercurrent illness. The stress of illness frequently aggravates glycemic control and necessitates more frequent monitoring of blood glucose and urine ketones. Marked hyperglycemia requires temporary adjustment of the treatment program, and, if accompanied by ketosis, frequent interaction with the diabetes care team. The patient treated with oral glucose-lowering agents or MNT alone may temporarily require insulin. Adequate fluid and caloric intake must be assured. Infection or dehydration is more likely to necessitate hospitalization of the person with diabetes than the person without diabetes. The hospitalized patient should be treated by a physician with expertise in the management of diabetes.

Diabetic ketoacidosis and hyperosmolar hyperglycemic nonketotic syndrome. These conditions represent decompensation in diabetic control and require immediate treatment. Careful evaluation of the patient for associated or precipitating events must be undertaken (e.g., infection,

medications, vascular events), and associated problems must be treated appropriately. Depending on the severity of the illness and available resources, treatment can be initiated in the physician's office, but it is best carried out in the emergency room, hospital room, or intensive care unit. Because of the potential morbidity and mortality of DKA and the hyperosmolar hyperglycemic nonketotic syndrome, prompt consultation with a diabetologist/endocrinologist is recommended when the initial clinical and/or biochemical state is markedly abnormal, when the initial response to standard therapy is unsatisfactory, or when metabolic complications or cerebral edema occur. Recurrence of DKA demands a detailed psychosocial and educational evaluation by a diabetes specialist.

For further discussion, see the American Diabetes Association position statement "The Management of Hyperglycemic Crises."

Severe or frequent hypoglycemia. The occurrence of severe, frequent, or unexplained episodes of hypoglycemia may be due to a number of factors such as defective counterregulation, hypoglycemic unawareness, insulin dose errors, and excessive alcohol intake. Hypoglycemia may also be a consequence of the therapeutic regimen and always requires evaluation of both the management plan and its execution by the patient. Family members and close associates of the patient who uses insulin should be taught to use glucagon.

The successful accomplishment of these goals requires more frequent patient contacts during readjustment of the treatment program and patient/family reeducation.

Pregnancy. To reduce the risk of fetal malformations and maternal and fetal complications, pregnant women and women planning to become pregnant require excellent blood glucose control. These women need to be seen frequently by a multidisciplinary team, including a diabetologist, internist or family practice physician, obstetrician, diabetes educators, including a nurse, registered dietitian, and social worker, and other specialists as necessary. In addition, these women must be trained in SMBG and may require specialized laboratory and diagnostic tests. For further discussion, see the American Diabetes Association's position statement "Preconception Care of Women with Diabetes."

Because of the need for prepregnancy planning and excellent glucose control, every pregnancy in a woman with diabetes should be planned in advance. Therefore, any diabetic woman who is not currently attempting to conceive should be informed of and offered acceptable and effective methods of contraception.

For information on gestational diabetes mellitus, see the American Diabetes Association's position statement on this topic.

Retinopathy

In addition to undergoing the annual retinal examination by an ophthalmologist or optometrist who is knowledgeable and experienced in the management of diabetic retinopathy, patients with any level of macular edema, severe nonproliferative retinopathy, or any proliferative retinopathy require the prompt care of an ophthalmologist who is knowledgeable and experienced in the management of diabetic retinopathy. (For further discussion, see the American Diabetes Association's position statement "Diabetic Retinopathy.")

Hypertension

Hypertension contributes to the development and progression of chronic complications of diabetes. In patients with type 1 diabetes, persistent hypertension is often a manifestation of diabetic nephropathy, as indicated by concomitant elevated levels of urinary albumin and, in later stages, by a decrease in the glomerular filtration rate (GFR). In patients with type 2 diabetes, hypertension often is part of a syndrome that includes glucose intolerance, insulin resistance, obesity, dyslipidemia, and coronary artery disease. Isolated systolic hypertension may occur with long duration of either type of diabetes and is in part due to inelasticity of atherosclerotic large vessels. Control of hypertension has been demonstrated conclusively to reduce the rate of progression of diabetic nephropathy and to reduce the complications of hypertensive nephropathy, cerebrovascular disease, and cardiovascular disease.

General principles. Lifestyle modifications should initially be employed to reduce blood pressure unless hypertension is at an urgent level. Such modifications include weight loss, exercise, reduction of dietary sodium, and limits on alcohol consumption. If lifestyle modifications do not achieve specified goals, medications should be added in a stepwise fashion until blood pressure goals are reached. Several medications in patients with albuminuria (e.g., ACE inhibitors) appear to have selective benefit in patients with diabetes. Other cardiovascular risk factors, such as smoking, inactivity, and elevated LDL cholesterol levels, should also be managed concomitantly.

Specific goals of treatment. The primary goal of therapy for adults should be to decrease blood pressure to <130/80 mmHg. In children, blood pressure should be decreased to the corresponding age-adjusted 90th percentile values.

Hypertension in adults has traditionally been defined as a systolic blood pressure ≥ 140 mmHg and/or a diastolic blood pressure ≥ 90 mmHg. Most epidemiological studies have suggested that risk due to elevated blood pressure

is a continuous function, so these cutoff levels are arbitrary. In the general population, the risks for end-organ damage appear to be lowest when the systolic blood pressure is <120 mmHg and the diastolic blood pressure is <80 mmHg.

For patients with an isolated systolic hypertension of ≥ 180 mmHg, the goal is a blood pressure <160 mmHg. For those with systolic blood pressure of 160–179, the goal is a reduction of 20 mmHg. If these goals are achieved and well tolerated, further lowering to 140 mmHg may be appropriate. (For more detailed information, see the consensus statement "Treatment of Hypertension in Diabetes.")

Nephropathy

General principles. Persistent albuminuria in the range of 30–299 mg/24 h (microalbuminuria) has been shown to be the earliest stage of diabetic nephropathy and is a significant risk marker for cardiovascular disease. Patients with microalbuminuria will likely progress to clinical albuminuria (>300 mg/24 h) and decreasing GFR over a period of years. Once clinical albuminuria occurs, the risk for ESRD is high in type 1 diabetes and significant in type 2 diabetes. If untreated, hypertension can hasten the progression of renal disease. Over the past several years, a number of interventions have been demonstrated to retard the initial development or rate of progression of renal disease.

Specific goals of treatment. Intensive diabetes management with the goal of achieving near normoglycemia has been proved to delay the onset of microalbuminuria, and the progression of microalbuminuria to clinical albuminuria, in patients with type 1 diabetes.

Lowering blood pressure to <130/80, by any effective means, should be the goal in hypertensive individuals. A reduction in blood pressure will also decrease the rate of progression of diabetic nephropathy.

In hypertensive patients with either type 1 or type 2 diabetes who have microalbuminuria or clinical albuminuria, treatment with ACE inhibitors has been shown to delay progression from microalbuminuria to clinical albuminuria and to slow the decline in GFR in clinical albuminuria. Because of the high proportion of patients who progress from microalbuminuria to overt nephropathy and subsequently to ESRD, the use of ACE inhibitors is recommended for all type 1 patients with microalbuminuria, even if they are normotensive. However, because of the more variable rate of progression from microalbuminuria to overt nephropathy and ESRD in patients with type 2 diabetes, the use of ACE inhibitors in normotensive type 2 diabetic patients is not as well substantiated as in normotensive type 1 diabetic patients. Therefore, treatment

with ACE inhibitors in normotensive type 2 patients should be based on physician assessment. Should such a patient show progression of albuminuria or develop hypertension, then ACE inhibitors would clearly be indicated.

The albumin-to-creatinine ratio can be measured in a random urine specimen. Alternatively, measurement of urine albumin may be done on a 24-h or other timed urine collection. There is marked day-to-day variability in albumin excretion, so that at least two of three collections measured in a 3- to 6-month period should show elevated levels before a patient is designated as having microalbuminuria.

Table 5. Definitions of abnormalities in albumin excretion

Category	24-h collection (mg/24h)	Timed collection (µg/min)	Spot collection (µg/mg creatinine)
Normal	30	20	30
Microalbuminuria	30-299	20-199	30-299
Clinical albuminuria	300	200	300

Because of variability in urinary albumin excretion, two of three specimens collected within a 3- to 6- month period should be abnormal before considering a patient to have crossed one of these diagnostic thresholds. Exercise with 24 h, infection, fever, congestive heart failure, marked hyperglycemia, and marked hypertension may elevate urinary albumin excretion over baseline values.

Abnormalities of albumin excretion are defined in Table 5.

Assessment of the creatinine clearance should be performed by using the serum creatinine and formulas that take into account the patient's age, sex, and body size or by measuring creatinine in serum and in a timed urine specimen.

Repeat timed or overnight urine collections or measurements of albumin-to-creatinine ratios should be obtained periodically to document the effect of treatment on albumin excretion and to detect the rare case of a deleterious effect of drug therapy. If ACE inhibitors are used, serum potassium levels should also be monitored for the development of hyperkalemia, with an increased frequency of monitoring when there is a progressive decrease in GFR or in patients with hyporeninemic hypoaldosteronism.

Protein restriction to $0.8 \text{ g} \cdot \text{kg}^{-1} \text{ body wt} \cdot \text{day}^{-1}$ (~10% of daily calories), the current adult recommended daily allowance for protein, should be instituted with the onset of overt nephropathy. However, it has been suggested that once the GFR begins to fall, further restriction to $0.6 \text{ g} \cdot \text{kg}^{-1} \text{ body wt} \cdot \text{day}^{-1}$ may prove useful in slowing the decline of GFR in selected patients. On the other hand, nutritional deficiency may occur in some individuals and

may be associated with muscle weakness. Protein-restricted meal plans should be designed by a registered dietitian familiar with all components of the dietary management of diabetes.

Referral to a physician experienced in the care of diabetic renal disease should be considered when the GFR has fallen to either $<70 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{ m}^2$, when serum creatinine has increased to $>2.0 \text{ mg/dl}$ ($>180 \text{ µmol/l}$), or when difficulties occur in management of hypertension or hyperkalemia. (For a complete discussion on the treatment of nephropathy, see the American Diabetes Association's position statement "Diabetic Nephropathy.")

Cardiovascular Disease

Evidence of cardiovascular disease, such as angina, claudication, decreased pulses, vascular bruits, and electrocardiogram abnormalities, requires efforts to correct contributing risk factors (e.g., obesity, smoking, hypertension, sedentary lifestyle, dyslipidemia, poorly regulated diabetes) in addition to specific treatment of the cardiovascular problem. Daily intake of aspirin has been shown to reduce cardiovascular events in patients with diabetes. (For specific recommendations and further discussion, see the American Diabetes Association's position statement "Aspirin Therapy in Diabetes.")

Although evidence from randomized controlled studies is lacking, the American Diabetes Association Consensus Development Conference on the Diagnosis of Coronary Heart Disease in People With Diabetes has recommended that patients with an established coronary heart disease (CHD) history or who have had a prior cardiac event warrant cardiac testing for risk stratification. Further, in patients without a prior history of an event or symptoms strongly suggesting CHD, testing for CHD is warranted in patients with the following: 1) typical or atypical cardiac symptoms; 2) resting electrocardiogram suggestive of ischemia or infarction; 3) peripheral or carotid occlusive arterial disease; 4) sedentary lifestyle, age ≥ 35 years, and plans to begin a vigorous exercise program; and 5) in addition to diabetes, two or more cardiac risk factors (total cholesterol $\geq 240 \text{ mg/dl}$, LDL cholesterol $\geq 160 \text{ mg/dl}$, or HDL cholesterol $<35 \text{ mg/dl}$; blood pressure $>140/90 \text{ mmHg}$; smoking; family history of premature CHD; positive micro-/macroalbuminuria test). Cardiac testing might consist of exercise stress testing, stress perfusion imaging, stress echocardiography, or catheterization. The type of testing and need for referral to a cardiologist depend on the severity of underlying or suspected coronary artery disease. (For further discussion, see the American Diabetes Association's Consensus Statement "Diagnosis of Coronary Heart Disease in People With Diabetes.")

Dyslipidemia

General principles. Diabetes increases the risk for atherosclerotic vascular disease. This risk is greatest in people who have other known risk factors, such as dyslipidemia, hypertension, smoking, and obesity. Furthermore, in type 2 diabetes there is an additional increased risk for obesity and lipid abnormalities independent of the level of glycemic control. A common abnormal lipid pattern in such patients is an elevation of VLDL, a reduction in HDL, and an LDL fraction that contains a greater proportion of small, dense LDL particles.

Data about treatment of dyslipidemia in people with diabetes, especially in children, are limited. However, current recommendations from the National Cholesterol Education Program Adult Treatment Panel II Report and the Expert Panel on Blood Cholesterol Levels in Children and Adolescents Report on the general management of elevated cholesterol and triglycerides have set increasingly stringent treatment targets based on the number of cardiovascular risk factors and the presence of CHD. Risk factors include age (men ≥ 45 years or women ≥ 55 years, or premature menopause without estrogen replacement therapy), diabetes mellitus, hypertension, HDL cholesterol < 35 mg/dl (< 0.90 mmol/l) in men and < 45 mg/dl (< 1.15 mmol/l) in women, smoking, microalbuminuria, and a family history of premature CHD. Because diabetes appears to eliminate the protective effect of female sex against CHD, all adults with diabetes are candidates for progressively aggressive therapy.

The following recommendations are designed to achieve two major goals as a result of treatment of dyslipidemia: 1) to reduce the risk for development of CHD in people without documented CHD and 2) to reduce the risk for progression of CHD or to cause regression in people with known CHD.

A meal plan designed both to lower glucose levels and to alter lipid patterns and regular physical activity are the cornerstones in the management of lipid disorders. The goal of MNT should focus on three major strategies: weight loss if indicated, increased physical activity, and MNT individualized for the patient.

Weight loss is achieved by reducing total caloric and fat intake and by increasing physical activity. Recommendations for increased physical activity, however, need to be made in the context of the patient's history and medical status. The recommendations should detail a frequency, duration, and intensity of exercise. Lipid-lowering pharmacological agents are indicated if there is an inadequate response to a trial of MNT, exercise, and improved glucose control. (For a complete discussion of the treatment of lipid disorders, see the American Diabetes

Association's position statement "Management of Dyslipidemia in Adults with Diabetes.")

The primary emphasis in children and adolescents with serum lipid abnormalities should be on glucose control, MNT, and exercise. Because there are important considerations regarding the efficacy and safety of drug therapy for dyslipidemia in children and adolescents, drug therapy in these individuals should be undertaken only in consultation with a physician experienced in the area of lipid disorders in children.

Specific goals of treatment. The primary goal of therapy for adult patients with diabetes is to lower LDL cholesterol to < 100 mg/dl (< 2.60 mmol/l).

People with diabetes who have triglyceride levels $\geq 1,000$ mg/dl (≥ 11.3 mmol/l) are at risk of pancreatitis and other manifestations of the hyperchylomicronemic syndrome. These individuals need special, immediate attention to lower triglyceride levels to < 400 mg/dl (< 4.50 mmol/l). Further reduction to Adult Treatment Panel II goals of < 200 mg/dl (< 2.30 mmol/l) may be beneficial.

A secondary goal of therapy is to raise HDL cholesterol to > 45 mg/dl (> 1.15 mmol/l) in men and > 55 mg/dl (> 1.40 mmol/l) in women.

The primary goal of therapy for children with risk factors in addition to diabetes is to lower LDL cholesterol to < 110 mg (< 2.80 mmol/l), following the recommendations of the National Cholesterol Education Program's Report of the Expert Panel on Blood Cholesterol Levels in Children and Adolescents.

Neuropathy

Peripheral diabetic neuropathy may result in pain, loss of sensation, and muscle weakness. Autonomic involvement can affect gastrointestinal, cardiovascular, and genitourinary function. Each condition may require special diagnostic testing and consultation with an appropriate medical specialist. Improvement in neuropathy should be sought by increased attention to blood glucose control. Relief can be provided by various medications, alterations in MNT, or specialized procedures.

Foot Care

Problems involving the feet may require care by a podiatrist, orthopedic surgeon, vascular surgeon, or rehabilitation specialist experienced in the management of people with diabetes. All patients, especially those with evidence of sensory neuropathy, peripheral vascular disease, and/or altered biomechanics must be educated about the risk and prevention of foot problems, and this education must be regularly reinforced.

Patients with a history of previous foot lesions, especially those with prior amputations, require preventive foot care and lifelong surveillance, preferably by a foot care specialist. (For a complete discussion on foot care, see the American Diabetes Association's position statement "Preventive Foot Care in People With Diabetes.")

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