Medical Education Systems, Inc.

Course 711

Diabetes

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Caring for Diabetic Patients

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Learning Objectives

Upon successful completion of this course, you will be able to:

- List and discuss the current Standards of Medical Care in Diabetes
- Explain the existing systems for the Classification and Diagnosis of diabetes
- Discuss the processes of DETECTION AND DIAGNOSIS OF GDM
- Explain the differences of DIABETES CARE IN SPECIFIC POPULATIONS
- Identify and discuss the systems for Diagnosis and Classification of Diabetes Mellitus
- Explain the Diabetes Care in the School and Day Care Setting

Introduction

The American Diabetes Association (ADA) has been actively involved in the development and dissemination of diabetes care standards, guidelines, and related documents for many years. These statements are published in one or more of the Association's professional journals. This supplement contains ADA's "Standards of Medical Care in Diabetes," our major position statement, which contains all or key recommendations. In addition, contained herein are selected position statements on certain topics not adequately covered in the "Standards." We hope that this is a convenient and important resource for all health care professionals who care for people with diabetes.

ADA Clinical Practice Recommendations consist of position statements that represent official ADA opinion as denoted by formal review and approval by the Professional Practice Committee and the Executive Committee of the Board of Directors. ADA Statements, consensus statements, and technical reviews are not official ADA recommendations; however, they are produced under the auspices of the Association by invited experts. These publications are reviewed by the Professional Practice Committee for general content and used as source documents for the updating of the "Standards."

ADA has adopted the following definitions for its clinically related reports.

Position Statement

An official point of view or belief of the ADA: Position statements are issued on scientific or medical issues related to diabetes. They are published in ADA journals and other scientific/medical publications as appropriate. Position statements must be reviewed and approved by the Professional Practice Committee and, subsequently, by the Executive Committee of the Board of Directors. ADA position statements are typically based on a technical review or other published review and are peer reviewed on an annual basis.

ADA Statement

A focused review on a clinical topic with recommendations. It is authored, and the recommendations are those of the authors based on the evidence presented. ADA Statements are reviewed externally and also by the Professional Practice Committee for overall content. As noted above, the recommendations made are considered by the Professional Practice Committee as part of the review and updating of the "Standards of Medical Care in Diabetes."

Technical Review

A balanced review and analysis of the literature on a scientific or medical topic related to diabetes. The technical review provides a scientific rationale for a position statement and undergoes peer review before submission to the Professional Practice Committee for approval.

In some cases, in place of a technical review, original research publications, conference proceedings, or other comprehensive review articles are used as a basis for a position statement.

Consensus Statement

A comprehensive examination by a panel of experts (i.e., consensus panel) of a scientific or medical issue related to diabetes. A consensus statement is developed immediately following a consensus conference at which presentations are made on the issue under review. The statement represents the panel's collective analysis, evaluation, and opinion based in part on the conference proceedings. The need for a consensus conference arises when clinicians or scientists desire guidance on a subject for which there is a relative deficiency of "evidence" that might otherwise allow a more definite statement to be made. Once written by the panel, a consensus statement is not subject to subsequent review or approval and does not represent official Association opinion

The Association's Professional Practice Committee is responsible for reviewing official position statements. Appointment to the Professional Practice Committee is based on excellence in clinical practice and research. The committee comprises physicians, diabetes educators, and registered dietitians who have expertise in a range of areas, including adult and pediatric endocrinology, epidemiology and public health, lipid research, hypertension, and preconception and pregnancy care. The committee regularly reviews each previously approved statement and makes necessary revisions. Both new and revised position statements are also reviewed by outside experts, after which they are approved by the Executive Committee.

Grading of Scientific Evidence

Since the ADA first began publishing practice guidelines, considerable evolution has occurred in the evaluation of scientific evidence and in the development of evidence-based guidelines. Accordingly, we have developed a classification system to grade the quality of scientific evidence supporting ADA recommendations. The system outlined in Table 1 will be used for all new and revised ADA position statements.

Recommendations have been assigned ratings of A, B, or C, depending on the quality of evidence (Table 1). Expert opinion (E) is a separate category for recommendations in which there is as yet no evidence from clinical trials, in which clinical trials may be impractical, or in which there is conflicting evidence. Recommendations with an "A" rating are based on large well-designed clinical trials or well-done meta-analyses. Generally, these recommendations have the best chance of improving outcomes when applied to the population to which they are appropriate. Recommendations with lower levels of evidence may be equally important but are not as well supported. This supplement contains seven statements that have used this system. The level of evidence supporting a given recommendation is noted either as a heading for a group of recommendations or after a given recommendation in parentheses.

Table 1— ADA evidence grading system for clinical practice recommendations

Level of evidence	Description
A	Clear evidence from well-conducted, generalizable, randomized controlled trials that are adequately powered, including: • Evidence from a well-conducted multicenter trial • Evidence from a meta-analysis that incorporated quality ratings in the analysis • Compelling nonexperimental evidence, i.e., "all or none" rule developed by the Center for Evidence Based Medicine at Oxford*
	Supportive evidence from well-conducted randomized controlled trials that are adequately powered, including: • Evidence from a well-conducted trial at one or more institutions • Evidence from a meta-analysis that incorporated quality ratings in the analysis
B	Supportive evidence from well-conducted cohort studies, including: • Evidence from a well-conducted prospective cohort study or registry • Evidence from a well-conducted meta-analysis of cohort studies
	Supportive evidence from a well-conducted case-control study
C	Supportive evidence from poorly controlled or uncontrolled studies, including: • Evidence from randomized clinical trials with one or more major or three or more minor methodological flaws that could invalidate the results • Evidence from observational studies with high potential for bias (such as case series with comparison with historical controls) •Evidence from case series or case reports
	Conflicting evidence with the weight of evidence supporting the recommendation
E	Expert consensus or clinical experience

* Either all patients died before therapy and at least some survived with therapy or some patients died without therapy and none died with therapy. Example: use of insulin in the treatment of diabetic ketoacidosis.

Of course, evidence is only one component of clinical decision-making. Clinicians care for patients, not populations; guidelines must always be interpreted with the needs of the individual patient in mind.

Individual circumstances, such as comorbid and coexisting diseases, age, education, disability, and, above all, patients' values and preferences, must also be considered and may lead to different treatment targets and strategies. Also, conventional evidence hierarchies, such as the one adapted by the ADA, may miss some nuances that are important in diabetes care. For example, while there is excellent

evidence from clinical trials supporting the importance of achieving glycemic control, the optimal way to achieve this result is less clear. It is difficult to assess each component of such a complex intervention.

The ADA will continue to improve and update the Clinical Practice Recommendations to ensure that clinicians, health plans, and policy makers can continue to rely on them as the most authoritative and current guidelines for diabetes care.

Standards of Medical Care in Diabetes–2006

American Diabetes Association

Abbreviations: ABI, ankle-brachial index • AMI, acute myocatdial infarction • ARB, angiotensin receptor blocker • CAD, coronary artery disease • CBG, capillary blood glucose • CHD, coronary heart disease • CHF, congestive heart failure • CKD, chronic kidney disease • CVD, cardiovascular disease • DCCB, dihydropyridine calcium channel blocker • DCCT, Diabetes Control and Complications Trial • DKA, diabetic ketoacidosis • DMMP, diabetes medical management plan • DPN, distal symmetric polyneuropathy • DPP, Diabetes Prevention Program • DRI, dietary reference intake • DRS, Diabetic Retinopathy Study • DSME, diabetes self-management education • DSMT, diabetes self-management training • ECG, electrocardiogram • ESRD, end-stage renal disease • ETDRS, Early Treatment Diabetic Retinopathy Study • FDA, Food and Drug Administration • FPG, fasting plasma glucose • GDM, gestational diabetes mellitus • GFR, glomerular filtration rate • HRC, high-risk characteristic • ICU, intensive care unit • IFG, impaired fasting glucose • IGT, impaired glucose tolerance • MNT, medical nutrition therapy • NPDR, nonproliferative diabetic retinopathy • OGTT, oral glucose tolerance test • PAD, peripheral arterial disease • PDR, proliferative diabetic retinopathy • PPG, postprandial plasma glucose • RDA, recommended dietary allowance • SMBG, self-monitoring of blood glucose • TZD, thiazolidinedione

Diabetes is a chronic illness that requires continuing medical care and patient self-management education to prevent acute complications and to reduce the risk of long-term complications. Diabetes care is complex and requires that many issues, beyond glycemic control, be addressed. A large body of evidence exists that supports a range of interventions to improve diabetes outcomes.

These standards of care are intended to provide clinicians, patients, researchers, payors, and other interested individuals with the components of diabetes care, treatment goals, and tools to evaluate the quality of care. While individual preferences, comorbidities, and other patient factors may require modification of goals, targets that are desirable for most patients with diabetes are provided. These standards are not intended to preclude more extensive evaluation and management of the patient by other specialists as needed.

The recommendations included are diagnostic and therapeutic actions that are known or believed to favorably affect health outcomes of patients with diabetes. A grading system (Table 1), developed by the American Diabetes Association (ADA) and modeled after existing methods, was utilized to clarify and codify the evidence that forms the basis for the recommendations.

The level of evidence that supports each recommendation is listed after each recommendation using the letters A, B, C, or E.

I. Classification and Diagnosis

A. Classification
In 1997, the ADA issued new diagnostic and classification criteria; in 2003, modifications were made regarding the diagnosis of impaired fasting glucose (IFG). The classification of diabetes includes four clinical classes:

- Type 1 diabetes (results from ß-cell destruction, usually leading to absolute insulin deficiency).
- Type 2 diabetes (results from a progressive insulin secretory defect on the background of insulin resistance).
- Other specific types of diabetes due to other causes, e.g., genetic defects in ß-cell function, genetic defects in insulin action, diseases of the exocrine pancreas (such as cystic fibrosis), and drug or chemical induced (such as in the treatment of AIDS or after organ transplantation).
- Gestational diabetes mellitus (GDM) (diagnosed during pregnancy).

B. Diagnosis
Recommendations

- The FPG is the preferred test to diagnose diabetes in children and nonpregnant adults. (E)
- The use of the A1C for the diagnosis of diabetes is not recommended at this time. (E)

Criteria for the diagnosis of diabetes in nonpregnant adults are shown in Table 2. Three ways to diagnose diabetes are available, and each must be confirmed on a subsequent day unless unequivocal symptoms of hyperglycemia are present. Although the 75-g oral glucose tolerance test (OGTT) is more sensitive and modestly more specific than fasting plasma glucose (FPG) to diagnose diabetes, it is poorly reproducible and rarely performed in practice. Because of ease of use, acceptability to patients, and lower cost, the FPG is the preferred diagnostic test. It should be noted that the vast majority of people who meet diagnostic criteria for diabetes by OGTT, but not by FPG, will have an A1C value <7.0%. The use of the A1C for the diagnosis of diabetes is not recommended at this time.

Table 2— Criteria for the diagnosis of diabetes

1. Symptoms of diabetes and a casual plasma glucose 200 mg/dl (11.1 mmol/l). Casual is defined

as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.

OR

2. FPG 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h.

OR

3. 2-h plasma glucose 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.

Hyperglycemia not sufficient to meet the diagnostic criteria for diabetes is categorized as either IFG or impaired glucose tolerance (IGT), depending on whether it is identified through a FPG or an OGTT:

- IFG = FPG 100 mg/dl (5.6 mmol/l) to 125 mg/dl (6.9 mmol/l)
- IGT = 2-h plasma glucose 140 mg/dl (7.8 mmol/l) to 199 mg/dl (11.0 mmol/l)

Recently, IFG and IGT have been officially termed "pre-diabetes." Both categories, IFG and IGT, are risk factors for future diabetes and cardiovascular disease (CVD).

In the absence of unequivocal hyperglycemia, these criteria should be confirmed by repeat testing on a different day. The OGTT is not recommended for routine clinical use but may be required in the evaluation of patients with IFG (see text) or when diabetes is still suspected despite a normal FPG, as with the postpartum evaluation of women with GDM.

II. Screening for Diabetes

Recommendations

- Screening to detect pre-diabetes (IFG or IGT) and diabetes should be considered in individuals ≥45 years of age, particularly in those with a BMI ≥25 kg/m^2. Screening should also be considered for people who are <45 years of age and are overweight if they have another risk factor for diabetes (Table 3). Repeat testing should be carried out at 3-year intervals. (E)
- Screen for pre-diabetes and diabetes in high-risk, asymptomatic, undiagnosed adults and children within the health care setting. (E)
- To screen for diabetes/pre-diabetes, either an FPG test or 2-h OGTT (75-g glucose load) or both are appropriate. (B)
- An OGTT may be considered in patients with IFG to better define the risk of diabetes. (E)

Table 3— Criteria for testing for diabetes in asymptomatic adult individuals

1. Testing for diabetes should be considered in all individuals at age 45 years and above,

particularly in those with a BMI 25 kg/m^{2*}, and, if normal, should be repeated at 3-year intervals.

2. Testing should be considered at a younger age or be carried out more frequently in individuals who are overweight (BMI 25 kg/m^{2*}) and have additional risk factors:

• are habitually physically inactive

• have a first-degree relative with diabetes

• are members of a high-risk ethnic population (e.g., African American, Latino, Native American, Asian American, Pacific Islander)

• have delivered a baby weighing >9 lb or have been diagnosed with GDM

• are hypertensive (≥140/90 mmHg)

• have an HDL cholesterol level <35 mg/dl (0.90 mmol/l) and/or a triglyceride level >250 mg/dl (2.82 mmol/l)

• have PCOS

• on previous testing, had IGT or IFG

• have other clinical conditions associated with insulin resistance (e.g. PCOS or acanthosis nigricans)

• have a history of vascular disease

* May not be correct for all ethnic groups. PCOS, polycystic ovary syndrome.

There is a major distinction between diagnostic testing and screening. Both utilize the same clinical tests, which should be done within the context of the health care setting. When an individual exhibits symptoms or signs of the disease, diagnostic tests are performed, and such tests do not represent screening. The purpose of screening is to identify asymptomatic individuals who are likely to have diabetes or pre-diabetes. Separate diagnostic tests using standard criteria are required after positive screening tests to establish a definitive diagnosis as described above.

Type 1 diabetes

Generally, people with type 1 diabetes present with acute symptoms of diabetes and markedly elevated blood glucose levels. Because of the acute onset of symptoms, most cases of type 1 diabetes are detected soon after symptoms develop. Widespread clinical testing of asymptomatic individuals for the presence of autoantibodies related to type 1 diabetes cannot be recommended at this time as a means to identify individuals at risk. Reasons for this include the following: *1*) cutoff values for some of the immune marker assays have not been completely established in clinical settings; *2*) there is no consensus as to what action should be taken when a positive autoantibody test result is obtained; and *3*) because the incidence of type 1 diabetes is low, testing of healthy children will identify only a very small number (<0.5%) who at that moment may be "pre-diabetic."

Clinical studies are being conducted to test various methods of preventing type 1 diabetes in high-risk individuals (e.g., siblings of type 1 diabetic patients). These studies may uncover an effective means of preventing type 1 diabetes, in which case targeted screening may be appropriate in the future.

Type 2 diabetes

Type 2 diabetes is frequently not diagnosed until complications appear, and approximately one-third of all people with diabetes may be undiagnosed. Individuals at high risk should be screened for diabetes and pre-diabetes. Criteria for testing for diabetes in asymptomatic, undiagnosed adults are listed in Table 3. The effectiveness of early diagnosis through screening of asymptomatic individuals has not been determined.

Screening should be carried out within the health care setting. Either an FPG test or 2-h OGTT (75-g glucose load) is appropriate. The 2-h OGTT identifies people with IGT, and thus, more people who are at increased risk for the development of diabetes and CVD. It should be noted that the two tests do not necessarily detect the same individuals. It is important to recognize that although the efficacy of interventions for primary prevention of type 2 diabetes have been demonstrated among individuals with IGT, such data among individuals with IFG (who do not also have IGT) are not available. The FPG test is more convenient to patients, more reproducible, less costly, and easier to administer than the 2-h OGTT. Therefore, the recommended initial screening test for nonpregnant adults is the FPG. An OGTT may be considered in patients with IFG to better define the risk of diabetes. The incidence of type 2 diabetes in children and adolescents has increased dramatically in the last decade. Consistent with screening recommendations for adults, only children and youth at increased risk for the presence or the development of type 2 diabetes should be tested (Table 4).

Table 4— Testing for type 2 diabetes in children

Criteria:
• Overweight (BMI >85th percentile for age and sex, weight for height >85th percentile, or weight >120% of ideal for height)
Plus any two of the following risk factors:
• Family history of type 2 diabetes in first- or second-degree relative
• Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander)
• Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, or PCOS)
• Maternal history of diabetes or GDM
Age of initiation: age 10 years or at onset of puberty, if puberty occurs at a younger age
Frequency: every 2 years
Test: FPG preferred

Clinical judgment should be used to test for diabetes in high-risk patients who do not meet these criteria. PCOS, polycystic ovary syndrome.

The effectiveness of screening may also depend on the setting in which it is performed. In general, community screening outside a health care setting may be less effective because of the failure of people with a positive screening test to seek and obtain appropriate follow-up testing and care or, conversely, to ensure appropriate repeat testing for individuals who screen negative. That is, screening outside of clinical settings may yield abnormal tests that are never discussed with a primary care provider, low

compliance with treatment recommendations, and a very uncertain impact on long-term health. Community screening may also be poorly targeted, i.e., it may fail to reach the groups most at risk and inappropriately test those at low risk (the worried well) or even those already diagnosed.

On the basis of expert opinion, screening should be considered by health care providers at 3-year intervals beginning at age 45, particularly in those with BMI ≥25 kg/m^2. The rationale for this interval is that false negatives will be repeated before substantial time elapses, and there is little likelihood of an individual developing any of the complications of diabetes to a significant degree within 3 years of a negative screening test result. Testing should be considered at a younger age or be carried out more frequently in individuals who are overweight and have one or more of the other risk factors for type 2 diabetes.

III. DETECTION AND DIAGNOSIS OF GDM

Recommendations

- Screen for diabetes in pregnancy using risk factor analysis and, if appropriate, use of an OGTT. (C)
- Women with GDM should be screened for diabetes 6–12 weeks postpartum and should be followed up with subsequent screening for the development of diabetes or pre-diabetes. (E)

Risk assessment for GDM should be undertaken at the first prenatal visit. Women with clinical characteristics consistent with a high risk for GDM (those with marked obesity, personal history of GDM, glycosuria, or a strong family history of diabetes) should undergo glucose testing as soon as possible. An FPG ≥126 mg/dl or a casual plasma glucose ≥200 mg/dl meets the threshold for the diagnosis of diabetes and needs to be confirmed on a subsequent day unless unequivocal symptoms of hyperglycemia are present. High-risk women not found to have GDM at the initial screening and average-risk women should be tested between 24 and 28 weeks of gestation. Testing should follow one of two approaches:

- One-step approach: perform a diagnostic 100-g OGTT
- Two-step approach: perform an initial screening by measuring the plasma or serum glucose concentration 1 h after a 50-g oral glucose load (glucose challenge test) and perform a diagnostic 100-g OGTT on that subset of women exceeding the glucose threshold value on the glucose challenge test. When the two-step approach is used, a glucose threshold value ≥140 mg/dl identifies ~80% of women with GDM, and the yield is further increased to 90% by using a cutoff of ≥130 mg/dl.

Diagnostic criteria for the 100-g OGTT are as follows: ≥95 mg/dl fasting, ≥180 mg/dl at 1 h, ≥155 mg/dl at 2 h, and ≥140 mg/dl at 3 h. Two or more of the plasma glucose values must be met or exceeded for a positive diagnosis. The test should be done in the morning after an overnight fast of 8–14 h. The diagnosis can be made using a 75-g glucose load, but that test is not as well validated for detection of at-risk infants or mothers as the 100-g OGTT.

Low-risk status requires no glucose testing, but this category is limited to those women meeting all of the following characteristics:

- Age <25 years.
- Weight normal before pregnancy.
- Member of an ethnic group with a low prevalence of GDM.
- No known diabetes in first-degree relatives.
- No history of abnormal glucose tolerance.
- No history of poor obstetric outcome.

IV. PREVENTION/DELAY OF TYPE 2 DIABETES

Recommendations

- Individuals at high risk for developing diabetes need to become aware of the benefits of modest weight loss and participating in regular physical activity. (A)
- Patients with IGT should be given counseling on weight loss as well as instruction for increasing physical activity. (A)
- Patients with IFG should be given counseling on weight loss as well as instruction for increasing physical activity. (E)
- Follow-up counseling appears important for success. (B)
- Monitoring for the development of diabetes in those with pre-diabetes should be performed every 1–2 years. (E)
- Close attention should be given to, and appropriate treatment given for, other CVD risk factors (e.g., tobacco use, hypertension, dyslipidemia). (A)
- Drug therapy should not be routinely used to prevent diabetes until more information is known about its cost-effectiveness. (E)

Studies have been initiated in the last decade to determine the feasibility and benefit of various strategies to prevent or delay the onset of type 2 diabetes. Five well-designed randomized controlled trials have been reported. The strategies shown to be effective in preventing diabetes relied on lifestyle modification or glucose-lowering drugs that have been approved for treating diabetes.

In the Finnish study, middle-aged obese subjects with IGT were randomized to receive either brief diet and exercise counseling (control group) or intensive individualized instruction on weight reduction, food intake, and guidance on increasing physical activity (intervention group). After an average follow-up of 3.2 years, there was a 58% relative reduction in the incidence of diabetes in the intervention group compared with the control subjects.

In the Diabetes Prevention Program (DPP), enrolled subjects were slightly younger and more obese but had nearly identical glucose intolerance compared with subjects in the Finnish study. About 45% of the participants were from minority groups (e.g., African American, Hispanic), and 20% were ≥60 years of

age. Subjects were randomized to one of three intervention groups, which included the intensive nutrition and exercise counseling ("lifestyle") group or either of two masked medication treatment groups: the biguanide metformin group or the placebo group. The latter interventions were combined with standard diet and exercise recommendations. After an average follow-up of 2.8 years, a 58% relative reduction in the progression to diabetes was observed in the lifestyle group and a 31% relative reduction in the progression of diabetes was observed in the metformin group compared with control subjects. On average, 50% of the lifestyle group achieved the goal of ≥7% weight reduction and 74% maintained at least 150 min/week of moderately intense activity. In the troglitazone arm of the DPP (discontinued after a mean of 0.9 years when the drug was withdrawn from the market), troglitazone markedly reduced the incidence of diabetes during the period the drug was given.

In the Da Qing Study, men and women from health care clinics in the city of Da Qing, China, were screened with OGTT, and those with IGT were randomized by clinic to a control group or to one of three active treatment groups: diet only, exercise only, or diet plus exercise. Subjects were reexamined biannually, and after an average of 6 years' follow-up, the diet, exercise, and diet plus exercise interventions were associated with 31, 46, and 42% reductions in risk of developing type 2 diabetes, respectively.

Three other studies, each using a different class of glucose-lowering agent, have shown a reduction in progression to diabetes with pharmacological intervention. In the Troglitazone in Prevention of Diabetes (TRIPOD) study, Hispanic women with previous GDM were randomized to receive either placebo or troglitazone (a drug now withdrawn from commercial sale in the U.S. but belonging to the thiazolidinedione [TZD] class). After a median follow-up of 30 months, troglitazone treatment was associated with a 56% relative reduction in progression to diabetes. In the STOP-IDDM trial, participants with IGT were randomized in a double-blind fashion to receive either the α-glucosidase inhibitor acarbose or a placebo. After a mean follow-up of 3.3 years, a 25% relative risk reduction in progression to diabetes, based on one OGTT, was observed in the acarbose-treated group compared with the placebo group. If this diagnosis was confirmed by a second OGTT, a 36% relative risk reduction was observed in the acarbose group compared with the placebo group.

Finally, in the XENical in the prevention of Diabetes in Obese Subjects (XENDOS) study, orlistat was examined for its ability to delay type 2 diabetes when added to lifestyle change in a group with BMI ≥ 30 kg/m^2 with or without IGT. After 4 years of treatment, the effect of orlistat addition corresponded to a 45% risk reduction in the IGT group, with no effect observed in those without IGT.

Our knowledge of the early stages of hyperglycemia that portend the diagnosis of diabetes, and the recent success of major intervention trials, clearly show that individuals at high risk can be identified and diabetes delayed, if not prevented. The cost-effectiveness of intervention strategies is unclear, but the huge burden resulting from the complications of diabetes and the potential ancillary benefits of some of the interventions suggest that an effort to prevent diabetes is worthwhile.

Lifestyle modification

In well-controlled studies that included a lifestyle intervention arm, substantial efforts were necessary to achieve only modest changes in weight and exercise, but those changes were sufficient to achieve an important reduction in the incidence of diabetes. In the Finnish Diabetes Prevention Study, weight loss averaged 9.2 lb at 1 year, 7.7 lb after 2 years, and 4.6 lb after 5 years; "moderate exercise," such as brisk walking, for 30 min/day was suggested. In the Finnish study, there was a direct relationship between adherence with the lifestyle intervention and the reduced incidence of diabetes.

In the DPP, the lifestyle group lost ~12 lb at 2 years and 9 lb at 3 years (mean weight loss for the study duration was ~12 lb or 6% of initial body weight). In both of these studies, most of the participants were obese (BMI >30 kg/m^2).

A low-fat (<25% fat) intake was recommended; if reducing fat did not produce weight loss to goal, calorie restriction was also recommended. Participants weighing 120–174 lb (54–78 kg) at baseline were instructed to follow a 1,200-kcal/day diet (33 g fat), those 175–219 lb (79–99 kg) were instructed to follow a 1,500-kcal/day diet (42 g fat), those 220–249 lb (100–113 kg) were instructed to follow an 1,800-kcal/day diet (50 g fat), and those >250 lb (114 kg) were instructed to follow a 2,000-kcal/day diet (55 g fat).

Pharmacological interventions
Three diabetes prevention trials used pharmacological therapy, and all have reported a significant lowering of the incidence of diabetes. The biguanide metformin reduced the risk of diabetes by 31% in the DPP, the α-glucosidase inhibitor acarbose reduced the risk by 32% in the STOP-IDDM trial, and the TZD troglitazone reduced the risk by 56% in the TRIPOD study.

In the DPP, metformin was about half as effective as diet and exercise in delaying the onset of diabetes overall, but it was nearly ineffective in older individuals (≥60 years of age) or in those who were less overweight (BMI <30 kg/m^2). Conversely, metformin was as effective as lifestyle modification in individuals aged 24–44 years or in those with a BMI ≥35 kg/m^2. Thus, the population of people in whom treatment with metformin has equal benefit to that of a lifestyle intervention is only a small subset of those who are likely to have pre-diabetes (IFG or IGT).

There are also data to suggest that blockade of the renin-angiotensin system may lower the risk of developing diabetes, but more studies are necessary before these drugs can be recommended for preventing diabetes.

Lifestyle or medication?
The DPP is the only study in which a comparison of the two was made, and lifestyle modification was nearly twice as effective in preventing diabetes (58 vs. 31% relative reductions, respectively). The greater benefit of weight loss and physical activity strongly suggests that lifestyle modification should be the first choice to prevent or delay diabetes. Modest weight loss (5–10% of body weight) and modest physical activity (30 min daily) are the recommended goals. Because this intervention not only has been shown to prevent or delay diabetes, but also has a variety of other benefits, health care providers should urge all overweight or sedentary individuals to adopt these changes, and such recommendations should be made at every opportunity.

When all factors are considered, there is insufficient evidence to support the use of drug therapy as a substitute for, or routinely used in addition to, lifestyle modification to prevent diabetes. Public health messages, health care professionals, and health care systems should all encourage behavior changes to achieve a healthy lifestyle. Further research is necessary to understand better how to facilitate effective and efficient programs for the primary prevention of type 2 diabetes.

V. DIABETES CARE

A. Initial evaluation

A complete medical evaluation should be performed to classify the patient, detect the presence or absence of diabetes complications, assist in formulating a management plan, and provide a basis for continuing care. If the diagnosis of diabetes has already been made, the evaluation should review the

previous treatment and the past and present degrees of glycemic control. Laboratory tests appropriate to the evaluation of each patient's general medical condition should be performed. A focus on the components of comprehensive care (Table 5) will assist the health care team to ensure optimal management of the patient with diabetes.

Table 5— Components of the comprehensive diabetes evaluation

Medical history

- Symptoms, results of laboratory tests, and special examination results related to the diagnosis of diabetes
- Prior A1C 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, attitudes, and health beliefs
- Current treatment of diabetes, including medications, meal plan, and results of glucose monitoring and patients' use of 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 (including symptoms of celiac disease in type 1 diabetic patients); 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
- Assessment for mood disorder
- Family history of diabetes and other endocrine disorders
- Lifestyle, cultural, psychosocial, educational, and economic factors that might influence the management of diabetes
- Tobacco, alcohol, and/or controlled substance use
- Contraception and reproductive and sexual history

Physical examination

- Height and weight measurement (and comparison to norms in children and adolescents)
- Sexual maturation staging (during pubertal period)

• Blood pressure determination, including orthostatic measurements when indicated, and comparison to age-related norms

• Fundoscopic examination

• Oral examination

• Thyroid palpation

• Cardiac examination

• Abdominal examination (e.g., for hepatomegaly)

• Evaluation of pulses by palpation and with auscultation

• Hand/finger examination

• Foot examination

• Skin examination (for acanthosis nigricans and insulin-injection sites)

• Neurological examination

• Signs of diseases that can cause secondary diabetes (e.g., hemochromatosis, pancreatic disease)

Laboratory evaluation

• A1C

• Fasting lipid profile, including total cholesterol, HDL cholesterol, triglycerides, and LDL cholesterol, liver function tests with further evaluation for fatty liver or hepatitis if abnormal

• Test for microalbuminuria in type 1 diabetic patients who have had diabetes for at least 5 years and in all patients with type 2 diabetes; some advocate beginning screening of pubertal children before 5 years of diabetes

• Serum creatinine and calculated GFR in adults (check creatinine in children if proteinuria is present)

• Thyroid-stimulating hormone (TSH) in all type 1 diabetic patients; in type 2 if clinically indicated

• Electrocardiogram in adults, if clinically indicated

• Urinalysis for ketones, protein, sediment

Referrals

• Eye exam, if indicated

• Family planning for women of reproductive age

• MNT, as indicated

• Diabetes educator, if not provided by physician or practice staff

• Behavioral specialist, as indicated

• Foot specialist, as indicated

- Other specialties and services as appropriate

B. Management

People with diabetes should receive medical care from a physician-coordinated team. Such teams may include, but are not limited to, physicians, nurse practitioners, physician's assistants, nurses, dietitians, pharmacists, and mental health professionals with expertise and a special interest in diabetes. It is essential in this collaborative and integrated team approach that individuals with diabetes assume an active role in their care.

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. Any plan should recognize diabetes self-management education (DSME) as an integral component of care. In developing the 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. A variety of strategies and techniques should be used to provide adequate education and development of problem-solving skills in the various aspects of diabetes management. Implementation of the management plan requires that each aspect is understood and agreed on by the patient and the care providers and that the goals and treatment plan are reasonable.

C. Glycemic control

1. Assessment of glycemic control

Techniques are available for health providers and patients to assess the effectiveness of the management plan on glycemic control.

a. Self-monitoring of blood glucose

Recommendations

- Clinical trials using insulin that have demonstrated the value of tight glycemic control have used self-monitoring of blood glucose (SMBG) as an integral part of the management strategy. (A)
- SMBG should be carried out three or more times daily for patients using multiple insulin injections. (A)
- For patients using less frequent insulin injections or oral agents or medical nutrition therapy (MNT) alone, SMBG is useful in achieving glycemic goals. (E)
- To achieve postprandial glucose targets, postprandial SMBG may be appropriate. (E)
- Instruct the patient in SMBG and routinely evaluate the patient's technique and ability to use data to adjust therapy. (E)

The ADA's consensus statements on SMBG provide a comprehensive review of the subject. Major clinical trials assessing the impact of glycemic control on diabetes complications have included SMBG as part of multifactorial interventions, suggesting that SMBG is a component of effective therapy.

SMBG allows patients to evaluate their individual response to therapy and assess whether glycemic targets are being achieved. Results of SMBG can be useful in preventing hypoglycemia and adjusting medications, MNT, and physical activity.

The frequency and timing of SMBG should be dictated by the particular needs and goals of the patients. Daily SMBG is especially important for patients treated with insulin to monitor for and prevent asymptomatic hypoglycemia and hyperglycemia. For most patients with type 1 diabetes and 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 on oral agent therapy is not known but should be sufficient to facilitate reaching glucose goals. Patients with type 2 diabetes on insulin typically need to perform SMBG more frequently than those not using insulin. 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.

Because the accuracy of SMBG is instrument and user dependent, it is important for health care providers to evaluate each patient's monitoring technique, both initially and at regular intervals thereafter. In addition, optimal use of SMBG requires proper interpretation of the data. Patients should be taught how to use the data to adjust food intake, exercise, or pharmacological therapy to achieve specific glycemic goals. Health professionals should evaluate at regular intervals the patient's ability to use SMBG data to guide treatment.

b. A1C

Recommendations

- Perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control). (E)
- Perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals. (E)
- Use of point-of-care testing for A1C allows for timely decisions on therapy changes, when needed. (E)

By performing an A1C test, health providers can measure a patient's average glycemia over the preceding 2–3 months and, thus, assess treatment efficacy. A1C testing should be performed routinely in all patients with diabetes, first to document the degree of glycemic control at initial assessment and then as part of continuing care. Since the A1C test 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 been reached and maintained within the target range. Thus, regular performance of the A1C test permits detection of departures from the target (Table 6) in a timely fashion. 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.

Table 6— Summary of recommendations for adults with diabetes

Glycemic control	
A1C	<7.0%*
Preprandial capillary plasma glucose	90–130 mg/dl (5.0–7.2 mmol/l)
Peak postprandial capillary plasma glucose†	<180 mg/dl (<10.0 mmol/l)
Blood pressure	<130/80 mmHg
Lipids‡	
LDL	<100 mg/dl (<2.6 mmol/l)
Triglycerides	<150 mg/dl (<1.7 mmol/l)
HDL	>40 mg/dl (>1.1 mmol/l)§
Key concepts in setting glycemic goals:	
• A1C is the primary target for glycemic control	
• Goals should be individualized	
• Certain populations (children, pregnant women, and elderly) require special considerations	
• More stringent glycemic goals (i.e., a normal A1C, <6%) may further reduce complications at the cost of increased risk of hypoglycemia	
• Less intensive glycemic goals may be indicated in patients with severe or frequent 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 DCCT-based assay.

†Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes.

‡Current NCEP/ATP III guidelines suggest that in patients with triglycerides ≥200 mg/dl, the "non-HDL cholesterol" (total cholesterol minus HDL) be utilized. The goal is ≤130 mg/dl (34).

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

The A1C test is subject to certain limitations. Conditions that affect erythrocyte turnover (hemolysis, blood loss) and hemoglobin variants must be considered, particularly when the A1C result does not correlate with the patient's clinical situation. The availability of the A1C result at the time that the patient is seen (point of care testing) has been reported to result in the frequency of intensification of therapy and improvement in glycemic control.

Glycemic control is best judged by the combination of the results of the patient's SMBG testing (as performed) and the current A1C result. The A1C should be used not only to assess the patient's control over the preceding 2–3 months but also as a check on the accuracy of the meter (or the patient's self-reported results) and the adequacy of the SMBG testing schedule. Table 7 contains the correlation between A1C levels and mean plasma glucose levels based on data from the Diabetes Control and Complications Trial (DCCT).

Table 7**— Correlation between A1C level and mean plasma glucose levels on multiple testing over 2–3 months (23)**

A1C (%)	Mean plasma glucose	
	mg/dl	mmol/l
6	135	7.5
7	170	9.5
8	205	11.5
9	240	13.5
10	275	15.5
11	310	17.5
12	345	19.5

2. Glycemic goals

Recommendations

- Lowering A1C has been associated with a reduction of microvascular and neuropathic complications of diabetes. (A)
- The A1C goal *for patients in general* is an A1C goal of <7%. (B)
- The A1C goal *for the individual patient* is an A1C as close to normal (<6%) as possible without significant hypoglycemia. (E)

- 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. (E)

- Aggressive glycemic management with insulin may reduce morbidity in patients with severe acute illness, perioperatively, following myocardial infarction, and in pregnancy. (B)

Glycemic control is fundamental to the management of diabetes. The goal of therapy is to acheive an A1C as close to normal as possible (representing normal fasting and postprandial glucose concentrations) in the absence of hypoglycemia. However, this goal is difficult to achieve with present therapies. Prospective randomized clinical trials such as the DCCT and the U.K. Prospective Diabetes Study (UKPDS) have shown that improved glycemic control is associated with sustained decreased rates of retinopathy, nephropathy, and neuropathy. In these trials, treatment regimens that reduced average A1C to ~7% (~1% above the upper limits of normal) were associated with fewer long-term microvascular complications; however, intensive control was found to increase the risk of severe hypoglycemia and weight gain. The potential of intensive glycemic control to reduce CVD is supported by epidemiological studies and a recent meta-analysis, but this potential benefit on CVD events has not yet been demonstrated in a randomized clinical trial.

Recommended glycemic goals for nonpregnant individuals are shown in Table 6. A major limitation to the available data is that they do not identify the optimum level of control for particular patients, as there are individual differences in the risks of hypoglycemia, weight gain, and other adverse effects. Furthermore, with multifactorial interventions, it is unclear how different components (e.g., educational interventions, glycemic targets, lifestyle changes, pharmacological agents) contribute to the reduction of complications. There are no clinical trial data available for the effects of glycemic control in patients with advanced complications, the elderly (≥65 years of age), or young children (<13 years of age). Less stringent treatment goals may be appropriate for patients with limited life expectancies, in the very young or older adults, and in individuals with comorbid conditions. Severe or frequent hypoglycemia is an indication for the modification of treatment regimens, including setting higher glycemic goals.

More stringent goals (i.e., a normal A1C, <6%) should be considered in individual patients based on epidemiological analyses suggesting that there is no lower limit of A1C at which further lowering does not reduce the risk of complications, at the risk of increased hypoglycemia (particularly in those with type 1 diabetes). However, the absolute risks and benefits of lower targets are unknown. The risks and benefits of an A1C goal of <6% are currently being tested in an ongoing study (ACCORD [Action to Control Cardiovascular Risk in Diabetes]) in type 2 diabetes.

Elevated postchallenge (2-h OGTT) glucose values have been associated with increased cardiovascular risk independent of FPG in some epidemiological studies. Postprandial plasma glucose (PPG) levels >140 mg/dl are unusual in nondiabetic individuals, although large evening meals can be followed by plasma glucose values up to 180 mg/dl. There are now pharmacological agents that primarily modify PPG and thereby reduce A1C in parallel. Thus, in individuals who have premeal glucose values within target but who are not meeting A1C targets, consideration of monitoring PPG 1–2 h after the start of the meal and treatment aimed at reducing PPG values <180 mg/dl may lower A1C. However, it should be noted that the effect of these approaches on micro- or macrovascular complications has not been studied.

As regards goals for glycemic control for women with GDM, recommendations from the Fourth International Workshop-Conference on Gestational Diabetes suggest lowering maternal capillary blood glucose concentrations to ≤95 mg/dl (5.3 mmol/l) fasting, ≤140 mg/dl (7.8 mmol/l) at 1 h, and/or ≤120 mg/dl (6.7 mmol/l) at 2 h after the meal. For further information on GDM, refer to the ADA position statement.

D. MNT

Recommendations

- 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. (B)
- Both the amount (grams) of carbohydrate as well as the type of carbohydrate in a food influence blood glucose level. Monitoring total grams of carbohydrate, whether by use of exchanges or carbohydrate counting, remains a key strategy in achieving glycemic control. (A)
- The use of the glycemic index/glycemic load may provide an additional benefit over that observed when total carbohydrate is considered alone. (B)
- Low-carbohydrate diets (restricting total carbohydrate to <130 g/day) are not recommended in the management of diabetes. (E)
- To reduce the risk of nephropathy, protein intake should be limited to the recommended dietary allowance (RDA) (0.8 g/kg) in those with any degree of CKD. (B)
- Saturated fat intake should be <7% of total calories. (A)
- Intake of *trans* fat should be minimized. (E)
- Weight loss is recommended for all overweight (BMI 25.0–29.9 kg/m^2) or obese (BMI ≥30.0 kg/m^2) adults who have, or are at risk for developing, type 2 diabetes. (E)
- The primary approach for achieving weight loss is therapeutic lifestyle change, which includes a reduction in energy intake and an increase in physical activity. A moderate decrease in caloric balance (500–1,000 kcal/day) will result in a slow but progressive weight loss (1–2 lb/week). For most patients, weight loss diets should supply at least 1,000–1,200 kcal/day for women and 1,200–1,600 kcal/day for men. (E)
- Initial physical activity recommendations should be modest and based on the patient's willingness and ability, gradually increasing the duration and frequency to 30–45 min of moderate aerobic activity, 3–5 days/week (goal at least 150 min/week). Greater activity levels of at least 1 h/day of moderate (walking) or 30 min/day of vigorous (jogging) activity may be needed to achieve successful long-term weight loss. (E)
- Drug therapy for obesity and surgery to induce weight loss may be appropriate in selected patients. (E)
- Nonnutritive sweeteners are safe when consumed within the acceptable daily intake levels established by the Food and Drug Administration (FDA). (A)

- If adults with diabetes choose to use alcohol, daily intake should be limited to a moderate amount (one drink per day or less for adult women and two drinks per day or less for adult men); one drink is defined as 12 oz beer, 5 oz wine, or 1.5 oz distilled spirits. (A)

- Routine supplementation with antioxidants, such as vitamins E and C and ß-carotene, is not advised because of lack of evidence of efficacy and concern related to long-term safety. (A)

- Benefit from chromium supplementation in people with diabetes or obesity has not been conclusively demonstrated and, therefore, cannot be recommended. (E)

MNT is an integral component of diabetes prevention, management, and self-management education. In addition to its role in preventing and controlling diabetes, the ADA recognizes the importance of nutrition as an essential component of an overall healthy lifestyle. These guidelines are based on principles of good nutrition for the overall population from the 2005 Dietary Guidelines and the RDAs from the Institute of Medicine of the National Academies of Sciences. A review of the evidence and detailed information can be found in the 2002 ADA technical review on this topic and the 2004 ADA Statements regarding dietary carbohydrate and weight management..

Goal of MNT that applies to individuals with pre-diabetes:

- Decrease the risk of diabetes and CVD by promoting physical activity and healthy food choices that result in moderate weight loss that is maintained or, at a minimum, prevents weight gain.

Goal of MNT that applies to all individuals with diabetes:

- Prevent and treat the chronic complications of diabetes by attaining and maintaining optimal metabolic outcomes, including blood glucose and A1C level, LDL and HDL cholesterol and triglyceride levels, blood pressure, and body weight (Table 6).

Achieving nutrition-related goals requires a coordinated team effort that includes the active involvement of the person with pre-diabetes or diabetes. Because of the complexity of nutrition issues, it is recommended that a registered dietitian who is knowledgeable and skilled in implementing nutrition therapy into diabetes management and education be the team member who provides MNT. However, it is essential that all team members are knowledgeable about nutrition therapy and are supportive of the person with diabetes who needs to make lifestyle changes.

MNT involves a nutrition assessment to evaluate the patient's food intake, metabolic status, lifestyle, readiness to make changes, goal setting, dietary instruction, and evaluation. To facilitate adherence, the plan should be individualized and take into account individual cultural, lifestyle, and financial considerations. Monitoring of glucose and A1C, lipids, blood pressure, and renal status is essential to evaluate nutrition-related outcomes. If goals are not met (Table 6), changes must be made in the overall diabetes care and management plan.

Weight management

Overweight and obesity are strongly linked to the development of type 2 diabetes and can complicate its management. Obesity is also an independent risk factor for hypertension and dyslipidemia as well as CVD, which is the major cause of death in those with diabetes. Moderate weight loss improves glycemic control, reduces CVD risk, and can prevent the development of type 2 diabetes in those with pre-diabetes. Therefore, weight loss is an important therapeutic strategy in all overweight or obese individuals who have type 2 diabetes or are at risk for developing diabetes.

The primary approach for achieving weight loss, in the vast majority of cases, is therapeutic lifestyle change, which includes a reduction in energy intake and an increase in physical activity. A moderate decrease in caloric balance (500–1,000 kcal/day) will result in a slow but progressive weight loss (1–2 lb/week). For most patients, weight loss diets should supply at least 1,000–1,200 kcal/day for women and 1,200–1,600 kcal/day for men.

In selected patients, drug therapy to achieve weight loss as an adjunct to lifestyle change may be appropriate. However, it is important to note that regain of weight commonly occurs on discontinuation of medication. In patients with severe/morbid obesity, surgical options, such as gastric bypass and gastroplasty, may be appropriate and allow significant improvement in glycemic control with reduction or discontinuation of medications. It is important to fully evaluate the patient for existing or risk for CVD and improve glycemic control preoperatively in order to decrease the risk of complications. It is important to counsel patients on the risks of surgery, including mortality, depression, hypoglycemia, nutritional deficiencies, osteoporosis, and weight regain over the long term. Very little data are currently available on the long-term consequences of surgery for weight loss in people with diabetes. The potential benefits should be weighed against short- and long-term risks.

Physical activity is an important component of a comprehensive weight-management program. Regular moderate-intensity physical activity enhances long-term weight maintenance. Regular activity also improves insulin sensitivity, glycemic control, and selected risk factors for CVD (i.e., hypertension and dyslipidemia), and increased aerobic fitness decreases the risk of coronary heart disease (CHD). Initial physical activity recommendations should be modest, based on the patient's willingness and ability, gradually increasing the duration and frequency to 30–45 min of moderate aerobic activity, 3–5 days/week, when possible. Greater activity levels of at least 1 h/day of moderate (walking) or 30 min/day of vigorous (jogging) activity may be needed to achieve successful long-term weight loss.

Dietary carbohydrate

Regulation of blood glucose to achieve near-normal levels is a primary goal in the management of diabetes, and thus, dietary techniques that limit hyperglycemia following a meal are important in limiting the complications of diabetes. Both the amount (grams) and type of carbohydrate in a food influence blood glucose level. The total amount of carbohydrate consumed is a strong predictor of glycemic response, and thus, monitoring total grams of carbohydrate, whether by use of exchanges or carbohydrate counting, remains a key strategy in achieving glycemic control. A recent analysis of the randomized controlled trials that have examined the efficacy of the glycemic index (a measure of the effect of type of carbohydrate) on overall blood glucose control indicates that the use of this technique may provide an additional benefit over that observed when total carbohydrate is considered alone.

Low-carbohydrate diets are not recommended in the management of diabetes. Although dietary carbohydrate is the major contributor to postprandial glucose concentration, it is an important source of energy, water-soluble vitamins and minerals, and fiber. Thus, in agreement with the National Academy of Sciences–Food and Nutrition Board, a recommended range of carbohydrate intake is 45–65% of total calories. In addition, because the brain and central nervous system have an absolute requirement for glucose as an energy source, restricting total carbohydrate to <130 g/day is not recommended.

Dietary protein

In the U.S., mean protein intake from foods (not including supplements) accounts for 15–20% of average energy intake, is fairly consistent across all ages from childhood to old age, and appears to be similar in individuals with diabetes. The dietary reference intake (DRI)-acceptable macronutrient distribution range for protein is 10–35% of energy intake and the RDA is 0.8 g high-quality protein · kg body $wt^{-1} \cdot day^{-1}$.

Dietary intake of protein is similar to that of the general public in individuals with diabetes and usually does not exceed 20% of energy intake. Intake of protein in this range may be a risk factor for the development of diabetic nephropathy. Based on studies in patients with varying stages of nephropathy, it seems prudent to limit protein intake in those with diabetes to the RDA (0.8 g/kg), which would be ~ 10% of total calories.

Dietary fat

Saturated and *trans* fatty acids are the principal dietary determinant of plasma LDL cholesterol, the major risk factor for CVD. In nondiabetic individuals, reducing saturated and *trans* fatty acids and cholesterol intake decreases plasma total and LDL cholesterol but may also reduce HDL cholesterol. Importantly, the ratio of LDL to HDL cholesterol is not adversely affected. Studies in individuals with diabetes demonstrating the effects of specific percentages of dietary saturated and *trans* fatty acids and specific amounts of dietary cholesterol on CVD risk are not available. However, those with diabetes are considered to be at similar risk to those with a past history of CVD. Therefore, because of a lack of specific information, the goal for dietary fat intake (amount and type) for individuals with diabetes is the same as for those without diabetes with a history of CVD. The most recent guidelines from the National Cholesterol Education Program recommend that total fat be 25–35% of total calories and saturated fat <7%. Guidelines from the American Heart Association also recommend that saturated fat be <7% in those with diabetes, given their increased risk of CVD. Intake of *trans* fat should be minimized.

Optimal macronutrient mix

For those individuals seeking guidance regarding macronutrient distribution, the DRIs may be helpful The DRI report recommends that to meet the body's daily nutritional needs while minimizing risk for chronic diseases, adults (in general, not specifically those with diabetes) should consume 45–65% of total energy from carbohydrate, 20–35% from fat, and 10–35% from protein. Although numerous studies have attempted to identify the optimal combination of macronutrients for those with diabetes, it is unlikely that any one such combination of macronutrients exists. The best mix of carbohydrate, protein, and fat appears to vary depending on individual circumstances.

Fiber

Similar to the general population, people with diabetes are encouraged to choose a variety of fiber-containing foods, such as legumes, fiber-rich cereals (≥5 g fiber/serving), as well as fruits, vegetables, and whole-grain products because they provide vitamins, minerals, fiber, and other substances important for good health.

Reduced calorie sweeteners

Reduced calorie sweeteners approved by the FDA include sugar alcohols (erythritol, hydrogenated starch hydrolysates, isomalt, lactitol, maltitol, mannitol, sorbitol, and xylitol) and tagatose. Studies using subjects with and without diabetes have shown that sugar alcohols produce a lower postprandial glucose response than sucrose or glucose and have lower available energy. Sugar alcohols contain, on average, ~2 calories/gram (one-half the calories of other sweeteners such as sucrose). With foods containing sugar alcohols, subtraction of one-half of sugar alcohol grams from total carbohydrate grams is appropriate, particularly when using the carbohydrate counting method for meal planning.

There is no evidence that the amounts of sugar alcohol likely to be consumed will result in significant reduction in energy intake or long-term improvement in glycemia. The use of sugar alcohols appears to be safe.

The FDA has approved five nonnutritive sweeteners for use in the U.S.: acesulfame potassium, aspartame, neotame, saccharin, and sucralose. All have undergone rigorous scrutiny and have been shown to be safe when consumed by the public, including people with diabetes and women who are pregnant.

Antioxidants
Since diabetes may be a state of increased oxidative stress, there has been interest in prescribing antioxidant vitamins to individuals with diabetes. While observational studies have shown a correlation between dietary or supplemental consumption of antioxidants and a variety of clinical outcomes such as prevention of disease states, large placebo-controlled clinical trials have failed to show a benefit and, in some instances, have suggested adverse effects.

Chromium
Several small studies have suggested a role for chromium supplementation in the management of glucose intolerance, body weight, GDM, and corticosteroid-induced diabetes. Also, placebo-controlled studies conducted in China found that chromium supplementation had beneficial effects on glycemia, although it is important to note that the study population in China may have had marginal baseline chromium status. A recent FDA statement indicated that there is insufficient evidence to support any of the proposed health claims for chromium supplementation. The FDA concluded that although a small study suggested that chromium picolinate may reduce the risk of insulin resistance, the existence of a relationship between chromium picolinate and either insulin resistance or type 2 diabetes was highly uncertain (see "chromium picolinate and insulin resistance" at www.cfsan.fda.gov/~dms/qhccr.html). In addition, a meta-analysis of randomized controlled trials suggested no benefit of chromium picolinate supplementation in reducing body weight.

Alcohol
For individuals with diabetes, the same precautions apply regarding the use of alcohol that apply to the general population. If individuals choose to use alcohol, alcohol-containing beverages should be limited to a moderate amount (less than one drink per day for adult women and less than two drinks per day for adult men). One alcohol containing beverage is defined as 12 oz beer, 5 oz wine, or 1.5 oz distilled spirits. Each contains ~15 g alcohol.

E. DSME

Recommendations

- People with diabetes should receive DSME according to national standards when their diabetes is diagnosed and as needed thereafter. (B)
- DSME should be provided by health care providers who are qualified to provide that DSME based on their professional training and continuing education. (E)
- DSME should address psychosocial issues, since emotional well-being is strongly associated with positive diabetes outcomes. (C)
- DSME should be reimbursed by third-party payors. (E)

DSME is an essential element of diabetes care, and National Standards for DSME are based on evidence for its benefits. Education helps people with diabetes initiate effective self-care when they are first diagnosed. Ongoing DSME also helps people with diabetes maintain effective self-management as their diabetes presents new challenges and treatment advances become available. DSME helps patients

optimize metabolic control, prevent and manage complications, and maximize quality of life, in a cost-effective manner.

Evidence for the benefits of DSME
Since the 1990s, there has been a shift from a didactic approach with DSME focusing on providing information to a skill-based approach that focuses on helping those with diabetes make informed self-management choices. Several studies have found that DSME is associated with improved diabetes knowledge, improved self-care behavior, improved clinical outcomes such as lower A1C, lower self-reported weight, and improved quality of life. Better outcomes were reported for DSME that were longer and included follow-up support, were tailored to individual needs and preferences , and addressed psychosocial issues.

The national standards for DSME
ADA-recognized DSME programs have staff that includes at least a registered nurse and a registered dietitian; these staff must be certified diabetes educators or have recent experience in diabetes education and management. The curriculum of ADA-recognized DSME programs must cover all areas of diabetes management, with the assessed needs of the individual determining which areas are addressed. All ADA-recognized DSME programs utilize a process of continuous quality improvement to evaluate the effectiveness of the DSME provided and to identify opportunities for improvement.

Reimbursement for DSME
DSME is reimbursed as part of the Medicare program as overseen by the Center for Medicare and Medicaid Services (CMS) (http://www.hcfa.gov/coverage).

F. Physical activity

Recommendations

- To improve glycemic control, assist with weight maintenance, and reduce risk of CVD, at least 150 min/week of moderate-intensity aerobic physical activity (50–70% of maximum heart rate) is recommended and/or at least 90 min/week of vigorous aerobic exercise (>70% of maximum heart rate). The physical activity should be distributed over at least 3 days/week and with no more than 2 consecutive days without physical activity. (A)

- In the absence of contraindications, people with type 2 diabetes should be encouraged to perform resistance exercise three times a week, targeting all major muscle groups, progressing to three sets of 8–10 repetitions at a weight that cannot be lifted more than 8–10 times. (A)

Indications for graded exercise test with electrocardiogram monitoring

- A graded exercise test with electrocardiogram (ECG) monitoring should be seriously considered before undertaking aerobic physical activity with intensity exceeding the demands of everyday living (more intense than brisk walking) in previously sedentary diabetic individuals whose 10-year risk of a coronary event is likely to be ≥10%.

ADA technical reviews on exercise in patients with diabetes have summarized the value of exercise in the diabetes management plan. Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being. Furthermore, regular exercise may prevent type 2 diabetes in high-risk individuals.

Definitions
The following definitions are based on those outlined in "Physical Activity and Health," the 1996

report of the Surgeon General. Physical activity is defined as bodily movement produced by the contraction of skeletal muscle that requires energy expenditure in excess of resting energy expenditure. Exercise is a subset of physical activity: planned, structured, and repetitive bodily movement performed to improve or maintain one or more components of physical fitness. Aerobic exercise consists of rhythmic, repeated, and continuous movements of the same large muscle groups for at least 10 min at a time. Examples include walking, bicycling, jogging, swimming, water aerobics, and many sports. Resistance exercise consists of activities that use muscular strength to move a weight or work against a resistive load. Examples include weight lifting and exercises using weight machines.

Effects of structured exercise interventions on glycemic control and body weight in type 2 diabetes

Boulé et al. undertook a systematic review and meta-analysis on the effects of structured exercise interventions in clinical trials of duration ≥8 weeks on HbA_{1c} and body mass in people with type 2 diabetes. Twelve aerobic training studies and two resistance training studies were included (totaling 504 subjects), and the results were pooled using standard meta-analytic statistical methods. Postintervention HbA_{1c} was significantly lower in exercise than control groups. Metaregression confirmed that the beneficial effect of exercise on HbA_{1c} was independent of any effect on body weight. Therefore, structured exercise programs had a statistically and clinically significant beneficial effect on glycemic control, and this effect was not mediated primarily by weight loss.

Boulé et al. later undertook a meta-analysis of the interrelationships among exercise intensity, exercise volume, change in cardiorespiratory fitness, and change in HbA_{1c}. This meta-analysis provides support for higher-intensity aerobic exercise in people with type 2 diabetes as a means of improving HbA_{1c}. These results would provide support for encouraging type 2 diabetic individuals who are already exercising at moderate intensity to consider increasing the intensity of their exercise in order to obtain additional benefits in both aerobic fitness and glycemic control.

Frequency of exercise

The U.S. Surgeon General's report recommended that most people accumulate ≥30 min of moderate intensity activity on most, ideally all, days of the week. The American College of Sports Medicine now recommends resistance training be included in fitness programs for adults with type 2 diabetes. Resistance exercise improves insulin sensitivity to about the same extent as aerobic exercise. Two clinical trials published in 2002 provided strong evidence for the value of resistance training in type 2 diabetes.

Evaluation of the diabetic patient before recommending an exercise program

Before beginning a program of physical activity more vigorous than brisk walking, people with diabetes should be assessed for conditions that might be associated with increased likelihood of CVD or that might contraindicate certain types of exercise or predispose to injury, such as uncontrolled hypertension, severe autonomic neuropathy, severe peripheral neuropathy, and preproliferative or proliferative retinopathy or macular edema.

The patient's age and previous physical activity level should be considered.

A recent systematic review for the U.S. Preventive Services Task Force came to the conclusion that stress tests should usually not be recommended to detect ischemia in asymptomatic individuals at low CAD risk (<10% risk of a cardiac event over 10 years) because the risks of subsequent invasive testing triggered by false-positive tests outweighed the expected benefits from detection of previously unsuspected ischemia.

Exercise in the presence of nonoptimal glycemic control
Hyperglycemia.
When people with type 1 diabetes are deprived of insulin for 12–48 h and ketotic, exercise can worsen hyperglycemia and ketosis. Vigorous activity should probably be avoided in the presence of ketosis. Therefore, provided the patient feels well and urine and/or blood ketones are negative, it is not necessary to postpone exercise based simply on hyperglycemia.

Hypoglycemia
In individuals taking insulin and/or insulin secretagogues, physical activity can cause hypoglycemia if medication dose or carbohydrate consumption is not altered. Hypoglycemia would be rare in diabetic individuals who are not treated with insulin or insulin secretagogues. Added carbohydrate should be ingested if pre-exercise glucose levels are <100 mg/dl (5.6 mmol/l). We agree with this recommendation for individuals on insulin and/or an insulin secretagogue. However, the revised guidelines clarify that supplementary carbohydrate is generally not necessary for individuals treated only with diet, metformin, α-glucosidase inhibitors and/or TZDs without insulin or a secretagogue.

Exercise in the presence of specific long-term complications of diabetes
Retinopathy
In the presence of proliferative diabetic retinopathy (PDR) or severe nonproliferative diabetic retinopathy (NPDR), vigorous aerobic or resistance exercise may be contraindicated because of the risk of triggering vitreous hemorrhage or retinal detachment.

Peripheral neuropathy
Decreased pain sensation in the extremities would result in increased risk of skin breakdown and infection and of Charcot joint destruction. Therefore, in the presence of severe peripheral neuropathy, it may be best to encourage non–weight-bearing activities such as swimming, bicycling, or arm exercises.

Autonomic neuropathy
Autonomic neuropathy can increase the risk of exercise-induced injury by decreasing cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation due to impaired skin blood flow and sweating, impaired night vision due to impaired papillary reaction, impaired thirst increasing risk of dehydration, and gastroparesis with unpredictable food delivery. Autonomic neuropathy is also strongly associated with CVD in people with diabetes. People with diabetic autonomic neuropathy should definitely undergo cardiac investigation before beginning physical activity more intense than they are accustomed to.

Microalbuminuria and nephropathy
Physical activity can acutely increase urinary protein excretion. There is no evidence from clinical trials or cohort studies demonstrating that vigorous exercise increases the rate of progression of diabetic kidney disease. There may be no need for any specific exercise restrictions for people with diabetic kidney disease.

G. Psychosocial assessment and care

Recommendations

- Preliminary assessment of psychological and social status should be included as part of the medical management of diabetes. (E)

- Psychosocial screening should include but is not limited to attitudes about the illness, expectations for medical management and outcomes, affect/mood, general and diabetes-related quality of life, resources (financial, social, and emotional), and psychiatric history. (E)
- Screening for psychosocial problems such as depression, eating disorders, and cognitive impairment is needed when adherence to the medical regimen is poor. (E)
- It is preferable to incorporate psychological treatment into routine care rather than wait for identification of a specific problem or deterioration in psychological status. (E)

Psychological and social state can impact the patient's ability to carry out diabetes care tasks. As a result, health status may be compromised. Family conflict around diabetes care tasks is also common and may interfere with treatment outcomes. There are opportunities for the clinician to assess psychosocial status in a timely and efficient manner so that referral for appropriate services can be accomplished.

Key opportunities for screening of psychosocial status occur at diagnosis, during regularly scheduled management visits, during hospitalizations, at discovery of complications, or at the discretion of the clinician when problems in glucose control, quality of life, or adherence are identified. Patients are likely to exhibit psychological vulnerability at diagnosis and when their medical status changes: the end of the honeymoon period, when the need for intensified treatment is evident and when complications are discovered.

Psychosocial screening should include but is not limited to attitudes about the illness, expectations for medical management and outcomes, affect/mood, general and diabetes-related quality of life, resources (financial, social, and emotional), and psychiatric history. Particular attention needs to be paid to gross noncompliance with medical regimen (due to self or others), depression with the possibility of self-harm, indications of an eating disorder or a problem that appears to be organic in origin, and cognitive functioning that significantly impairs judgment. In these cases, immediate referral for further evaluation by a mental health specialist familiar with diabetes management should occur. Behavioral assessment of management skills is also recommended.

It is preferable to incorporate psychological treatment into routine care rather than waiting for identification of a specific problem or deterioration in psychological status. Screening tools can facilitate this goal, and although the clinician may not feel qualified to treat psychological problems, utilizing the patient-provider relationship as a foundation for further treatment can increase the likelihood that the patient will accept referral for other services. It is important to establish that emotional well-being is part of diabetes management.

H. Referral for diabetes management

For a variety of reasons, some people with diabetes and their health care providers do not achieve the desired goals of treatment (Table 6).

Intensification of the treatment regimenis suggested and includes identification (or assessment) of barriers to adherence, culturally appropriate and enhanced DSME, comanagement with a diabetes team, change in pharmacological therapy, initiation of or increase in SMBG, more frequent contact with the patient, and referral to an endocrinologist.

I. Intercurrent illness

The stress of illness, trauma, and/or surgery frequently aggravates glycemic control and may precipitate diabetic ketoacidosis (DKA) or nonketotic hyperosmolar state. Any condition leading to deterioration in glycemic control necessitates more frequent monitoring of blood glucose and urine or blood ketones. A vomiting illness accompanied by ketosis may indicate DKA, a life-threatening condition that requires immediate medical care to prevent complications and death; the possibility of DKA should always be considered. 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, and recent studies suggest that achieving very stringent glycemic control may reduce mortality in the immediate postmyocardial infarction period. Aggressive glycemic management with insulin may reduce morbidity in patients with severe acute illness.

For further information on management of patients in the hospital with DKA or nonketotic hyperosmolar state, refer to the ADA position statement.

J. Hypoglycemia

Recommendations

- Glucose (15–20 g) is the preferred treatment for hypoglycemia, although any form of carbohydrate that contains glucose may be used, and treatment effects should be apparent in 15 min. (E)
- Treatment effects on hypoglycemia may only be temporarily corrected. Therefore, plasma glucose should be tested again in ~15 min as additional treatment may be necessary. (B)
- Glucagon should be prescribed for all patients at significant risk of severe hypoglycemia and does not require a health care professional for its administration. (E)

Hypoglycemia, especially in insulin-treated patients, is the leading limiting factor in the glycemic management of type 1 and type 2 diabetes. Treatment of hypoglycemia (plasma glucose <70 mg/dl) requires ingestion of glucose- or carbohydrate-containing foods. The acute glycemic response correlates better with the glucose content than with the carbohydrate content of the food. Although pure glucose may be the preferred treatment, any form of carbohydrate that contains glucose will raise blood glucose. Adding protein to carbohydrate does not affect the glycemic response and does not prevent subsequent hypoglycemia. Adding fat, however, may retard and then prolong the acute glycemic response.

Rare situations of severe hypoglycemia (where the individual requires the assistance of another person and cannot be treated with oral carbohydrate) should be treated using emergency glucagon kits, which require a prescription. Those in close contact with, or having custodial care of, people with diabetes, such as family members, roommates, school personnel, child care providers, correctional institution staff, and coworkers, should be instructed in use of such kits. An individual does not need to be a health care professional to safely administer glucagon. Care should be taken to ensure that unexpired glucagon kits are available.

K. Immunization

Recommendations

- Annually provide an influenza vaccine to all diabetic patients ≥6 months of age. (C)
- Provide at least one lifetime pneumococcal vaccine 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 after transplantation. (C)

Influenza and pneumonia are common, preventable infectious diseases associated with high mortality and morbidity in the elderly and in people with chronic diseases. There are limited studies reporting the morbidity and mortality of influenza and pneumococcal pneumonia specifically in people with diabetes. Observational studies of patients with a variety of chronic illnesses, including diabetes, show that these conditions are associated with an increase in hospitalizations for influenza and its complications. Based on a case-control series, influenza vaccine has been shown to reduce diabetes-related hospital admission by as much as 79% during flu epidemics. People with diabetes may be at increased risk of the bacteremic form of pneumococcal infection and have been reported to have a high risk of nosocomial bacteremia, which has a mortality rate as high as 50%.

Safe and effective vaccines are available that can greatly reduce the risk of serious complications from these diseases. There is sufficient evidence to support that people with diabetes have appropriate serologic and clinical responses to these vaccinations. The Centers for Disease Control's Advisory Committee on Immunization Practices recommends influenza and pneumococcal vaccines for all individuals >65 years of age, as well as for all individuals of any age with diabetes.

For a complete discussion on the prevention of influenza and pneumococcal disease in people with diabetes, consult the technical review and position statement on this subject.

VI. PREVENTION AND MANAGEMENT OF DIABETES COMPLICATIONS

A. CVD

CVD is the major cause of mortality for individuals with diabetes. It is also a major contributor to morbidity and direct and indirect costs of diabetes. Type 2 diabetes is an independent risk factor for macrovascular disease, and its common coexisting conditions (e.g., hypertension and dyslipidemia) are also risk factors.

Studies have shown the efficacy of reducing cardiovascular risk factors in preventing or slowing CVD. Evidence is summarized in the following sections and reviewed in detail in the ADA technical reviews on hypertension, dyslipidemia , aspirin therapy , and smoking cessation and the consensus statement on CHD in people with diabetes. Emphasis should be placed on reducing cardiovascular risk factors, when possible, and clinicians should be alert for signs and symptoms of atherosclerosis.

1. Hypertension/blood pressure control

Recommendations

Screening and diagnosis

- 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 blood pressure confirmed on a separate day. (C)

Goals

- Patients with diabetes should be treated to a systolic blood pressure <130 mmHg. (C)
- Patients with diabetes should be treated to a diastolic blood pressure <80 mmHg. (B)

Treatment

- Patients with hypertension (systolic blood pressure ≥140 or diastolic blood pressure ≥90 mmHg) should receive drug therapy in addition to lifestyle and behavioral therapy. (A)
- Multiple drug therapy (two or more agents at proper doses) is generally required to achieve blood pressure targets. (B)
- Patients with a systolic blood pressure of 130–139 mmHg or a diastolic blood pressure of 80–89 mmHg should be given lifestyle and behavioral therapy alone for a maximum of 3 months and then, if targets are not achieved, in addition, be treated with pharmacological agents that block the renin-angiotensin system. (E)
- Initial drug therapy for those with a blood pressure >140/90 mmHg should be with a drug class demonstrated to reduce CVD events in patients with diabetes (ACE inhibitors, ARBs, ß-blockers, diuretics, and calcium channel blockers). (A)
- All patients with diabetes and hypertension should be treated with a regimen that includes either an ACE inhibitor or an ARB. If one class is not tolerated, the other should be substituted. If needed to achieve blood pressure targets, a thiazide diuretic should be added. (E)
- If ACE inhibitors, ARBs, or diuretics are used, monitor renal function and serum potassium levels. (E)
    - In patients with type 1 diabetes, with hypertension and any degree of albuminuria, ACE inhibitors have been shown to delay the progression of nephropathy. (A)
    - In patients with type 2 diabetes, hypertension, and microalbuminuria, ACE inhibitors and ARBs have been shown to delay the progression to macroalbuminuria. (A)
    - In those with type 2 diabetes, hypertension, macroalbuminuria, and renal insufficiency, ARBs have been shown to delay the progression of nephropathy. (A)

- In pregnant patients with diabetes and chronic hypertension, blood pressure target goals of 110–129/65–79 mmHg are suggested in the interest of long-term maternal health and minimizing impaired fetal growth. ACE inhibitors and ARBs are contraindicated during pregnancy. (E)
- In elderly hypertensive patients, blood pressure should be lowered gradually to avoid complications. (E)
- Patients not achieving target blood pressure despite multiple drug therapy should be referred to a physician experienced in the care of patients with hypertension. (E)
- Orthostatic measurement of blood pressure should be performed in people with diabetes and hypertension when clinically indicated. (E)

Hypertension (blood pressure ≥140/90 mmHg) is a common comorbidity of diabetes, affecting the majority of people with diabetes, depending on type of diabetes, age, obesity, and ethnicity. Hypertension is also a major risk factor for CVD and microvascular complications such as retinopathy and nephropathy. In type 1 diabetes, hypertension is often the result of underlying nephropathy. In type 2 diabetes, hypertension may be present as part of the metabolic syndrome (i.e., obesity, hyperglycemia and dyslipidemia) that is accompanied by high rates of CVD.

Randomized clinical trials have demonstrated the benefit (reduction of CHD events, stroke, and nephropathy) of lowering blood pressure to <140 mmHg systolic and <80 mmHg diastolic in individuals with diabetes. Epidemiologic analyses show that blood pressures >115/75 mmHg are associated with increased cardiovascular event rates and mortality in individuals with diabetes. Therefore, a target blood pressure goal of <130/80 mmHg is reasonable if it can be safely achieved.

Although there are no well-controlled studies of diet and exercise in the treatment of hypertension in individuals with diabetes, reducing sodium intake and body weight (when indicated), increasing consumption of fruits, vegetables, and low-fat dairy products, avoiding excessive alcohol consumption, and increasing activity levels have been shown to be effective in reducing blood pressure in nondiabetic individuals. These nonpharmacological strategies may also positively affect glycemia and lipid control. Their effects on cardiovascular events have not been well measured.

Lowering of blood pressure with regimens based on antihypertensive drugs, including ACE inhibitors, angiotensin receptor blockers (ARBs), ß-blockers, diuretics, and calcium channel blockers, has been shown to be effective in lowering cardiovascular events.

Several studies suggest that ACE inhibitors may be superior to dihydropyridine calcium channel blockers (DCCBs) in reducing cardiovascular events. Additionally, in people with diabetic nephropathy indicate that ARBs may be superior to DCCBs for reducing heart failure but not overall cardiovascular events. Conversely, in the recently completed International Verapamil Study (INVEST) of >22,000 people with CAD and hypertension, the non-DCCB verapamil demonstrated a similar reduction in cardiovascular mortality to a ß-blocker. Moreover, this relationship held true in the diabetic subgroup.

ACE inhibitors have been shown to improve cardiovascular outcomes in high–cardiovascular risk patients with or without hypertension. In patients with congestive heart failure (CHF), the addition of ARBs to either ACE inhibitors or other therapies reduces the risk of cardiovascular death or hospitalization for heart failure. In one study, an ARB was superior to a ß-blocker as a therapy to improve cardiovascular outcomes in a subset of diabetic patients with hypertension and left ventricular

hypertrophy. The compelling effect of ACE inhibitors or ARBs in patients with albuminuria or renal insufficiency provide additional rationale for use of these agents (see section VI, B below).

The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT), a large randomized trial of different initial blood pressure pharmacological therapies, found no large differences between initial therapy with a chlorthalidone, amlodipine and lisinopril. Diuretics appeared slightly more effective than other agents, particularly for reducing heart failure. The α-blocker arm of the ALLHAT was terminated after interim analysis showed that doxazosin was substantially less effective in reducing CHF than diuretic therapy .

Before beginning treatment, patients with elevated blood pressure should have their blood pressure reexamined within 1 month to confirm the presence of hypertension. Systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥100 mmHg, however, mandates that immediate pharmacological therapy be initiated. Patients with hypertension should be seen as often as needed until the recommended blood pressure goal is obtained and then seen as necessary. In these patients, other cardiovascular risk factors, including obesity, hyperlipidemia, smoking, presence of microalbuminuria (assessed before initiation of treatment), and glycemic control, should be carefully assessed and treated. Many patients will require three or more drugs to reach target goals.

During pregnancy in diabetic women with chronic hypertension, target blood pressure goals of systolic blood pressure 110–129 mmHg and diastolic blood pressure 65–79 mmHg are reasonable, as they may contribute to long-term maternal health. Lower blood pressure levels may be associated with impaired fetal growth. During pregnancy treatment with ACE inhibitors and ARBs is contraindicated, since they are likely to cause fetal damage. Antihypertensive drugs known to be effective and safe in pregnancy include methyldopa, labetalol, diltiazem, clonidine, and prazosin. Chronic diuretic use during pregnancy has been associated with restricted maternal plasma volume, which might reduce uteroplacental perfusion.

2. Dyslipidemia/lipid management

Recommendations

Screening

- 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, and triglycerides <150 mg/dl), lipid assessments may be repeated every 2 years. (E)

Treatment recommendations and goals

- Lifestyle modification focusing on the reduction of saturated fat and cholesterol intake, weight loss (if indicated), and increased physical activity has been shown to improve the lipid profile in patients with diabetes. (A)
- In individuals without overt CVD
    - The primary goal is an LDL <100 mg/dl (2.6 mmol/l). (A)
    - For those over the age of 40 years, statin therapy to achieve an LDL reduction of 30–40% regardless of baseline LDL levels is recommended. (A)

- For those under the age of 40 years but at increased risk due to other cardiovascular risk factors who do not achieve lipid goals with lifestyle modifications alone, the addition of pharmacological therapy is appropriate. (C)

- In individuals with overt CVD
  - All patients should be treated with a statin to achieve an LDL reduction of 30–40%. (A)
  - A lower LDL cholesterol goal of <70 mg/dl (1.8 mmol/l), using a high dose of a statin, is an option. (B)

- Lower triglycerides to <150 mg/dl (1.7 mmol/l) and raise HDL cholesterol to >40 mg/dl (1.15 mmol/l). In women, an HDL goal 10 mg/dl higher (>50 mg/dl) should be considered. (C)
- Lowering triglycerides and increasing HDL cholesterol with a fibrate is associated with a reduction in cardiovascular events in patients with clinical CVD, low HDL, and near-normal levels of LDL. (A)
- Combination therapy using statins and other lipid-lowering agents may be necessary to achieve lipid targets but has not been evaluated in outcomes studies for either CVD event reduction or safety. (E)
- Statin therapy is contraindicated in pregnancy. (E)

Patients with type 2 diabetes have an increased prevalence of lipid abnormalities that contributes to higher rates of CVD. Lipid management aimed at lowering LDL cholesterol, raising HDL cholesterol, and lowering triglycerides has been shown to reduce macrovascular disease and mortality in patients with type 2 diabetes, particularly in those who have had prior cardiovascular events. In studies using HMG (hydroxymethylglutaryl)-CoA reductase inhibitors (statins), patients with diabetes achieved significant reductions in coronary and cerebrovascular events. In two studies using the fibric acid derivative gemfibrozil, reductions in cardiovascular end points were also achieved.

Target lipid levels are shown in Table 6.

Lifestyle intervention, including MNT, increased physical activity, weight loss, and smoking cessation, should allow some patients to reach these lipid levels.

Nutrition intervention should be tailored according to each patient's age, type of diabetes, pharmacological treatment, lipid levels, and other medical conditions and should focus on the reduction of saturated fat, cholesterol, and transunsaturated fat intake. Glycemic control can also beneficially modify plasma lipid levels. Particularly in patients with very high triglycerides and poor glycemic control, glucose lowering may be necessary to control hypertriglyceridemia. Pharmacological treatment is indicated if there is an inadequate response to lifestyle modifications and improved glucose control. However, in patients with clinical CVD and LDL >100 mg/dl, pharmacological therapy should be initiated at the same time that lifestyle intervention is started. In patients with diabetes aged <40 years, similar consideration for LDL-lowering therapy should be given if they have increased cardiovascular risk (e.g., additional cardiovascular risk factors or long duration of diabetes). Very little clinical trial data exist in patients in this age-group.

The first priority of pharmacological therapy is to lower LDL cholesterol to a target goal of <100 mg/dl (2.60 mmol/l) or therapy to achieve a reduction in LDL of 30–40%. For LDL lowering, statins are the drugs of choice. Other drugs that lower LDL include nicotinic acid, ezetimbe, bile acid sequestrants, and fenofibrate.

The Heart Protection Study demonstrated that in individuals with diabetes over the age of 40 years with a total cholesterol >135 mg/dl, LDL reduction of ~30% from baseline with the statin simvastatin was associated with an ~25% reduction in the first event rate for major coronary artery events independent of baseline LDL, preexisting vascular disease, type or duration of diabetes, or adequacy of glycemic control. Similarly, in the Coronary Artery Diabetes Study (CARDS), patients with type 2 diabetes randomized to 10 mg atorvastatin daily had a significant reduction in cardiovascular events including stroke.

Recent clinical trials in high-risk patients, such as those with acute coronary syndromes or previous cardiovascular events, have demonstrated that more aggressive therapy with high doses of statins to achieve an LDL of <70 mg/dl led to a significant reduction in further events. The risk of side effects with high doses of statins is significantly outweighed by the benefits of such therapy in these high-risk patients. Therefore, a reduction in LDL to a goal of <70 mg/dl is an option in very-high-risk patients with overt CVD. The combination of statins with other lipid-lowering drugs such as ezetimibe may allow achievement of the LDL goal with a lower dose of a statin in such patients, but no data are available as to whether such combination therapy is more effective than a statin alone in preventing cardiovascular events.

Relatively little data are available on lipid-lowering therapy in subjects with type 1 diabetes. In the Heart Protection Study, ~600 patients with type 1 diabetes had a proportionately similar, but not statistically significant, reduction in risk compared with patients with type 2 diabetes. Although the data are not definitive, consideration should be given for similar lipid-lowering therapy in type 1 diabetic patients as in type 2 diabetic patients, particularly if they have other cardiovascular risk factors or features of the metabolic syndrome.

If the HDL is <40 mg/dl and the LDL is between 100 and 129 mg/dl, a fibric acid derivative or niacin might be used. Niacin is the most effective drug for raising HDL but can significantly increase blood glucose at high doses. More recent studies demonstrate that at modest doses (750–2,000 mg/day), significant benefit with regards to LDL, HDL, and triglyceride levels are accompanied by only modest changes in glucose that are generally amenable to adjustment of diabetes therapy.

Combination therapy, with a statin and a fibrate or statin and niacin, may be efficacious for patients needing treatment for all three lipid fractions, but this combination is associated with an increased risk for abnormal transaminase levels, myositis, or rhabdomyolysis. The risk of rhabdomyolysis seems to be lower when statins are combined with fenofibrate than gemfibrozil. There is also a risk of a rise in plasma creatinine, particularly with fenofibrate. It is important to note that clinical trials with fibrates and niacin have demonstrated benefits in patients who were not on treatment with statins and that there are no data available on reduction of events with such combinations. The risks may be greater in patients who are treated with combinations of these drugs with high doses of statins.

3. Antiplatelet agents

Recommendations

- Use aspirin therapy (75–162 mg/day) as a secondary prevention strategy in those with diabetes with a history of CVD. (A)
- Use aspirin therapy (75–162 mg/day) as a primary prevention strategy in those with:
    - Type 2 diabetes at increased cardiovascular risk, including those who are >40 years of age or who have additional risk factors (family history of CVD, hypertension, smoking, dyslipidemia, or albuminuria). (A)
    - Type 1 diabetes at increased cardiovascular risk, including those who are >40 years of age or who have additional risk factors (family history of CVD, hypertension, smoking, dyslipidemia, or albuminuria). (C)
- Consider aspirin therapy in people between the age of 30 and 40 years, particularly in the presence of other cardiovascular risk factors. (E)
- Aspirin therapy should not be recommended for patients under the age of 21 years because of the increased risk of Reye's syndrome associated with aspirin use in this population. People <30 years have not been studied. (E)
- Combination therapy using other antiplatelet agents such as clopidrogel in addition to aspirin should be used in patients with severe and progressive CVD. (C)
- Other antiplatelet agents may be a reasonable alternative for high-risk patients with aspirin allergy, bleeding tendency, receiving anticoagulant therapy, recent gastrointestinal bleeding, and clinically active hepatic disease who are not candidates for aspirin therapy. (E)

The use of aspirin in diabetes is reviewed in detail in the ADA technical review and position statement on aspirin therapy. Aspirin has been recommended as a primary and secondary therapy to prevent cardiovascular events in diabetic and nondiabetic individuals. One large meta-analysis and several clinical trials demonstrate the efficacy of using aspirin as a preventive measure for cardiovascular events, including stroke and myocardial infarction.

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.

Dosages used in most clinical trials ranged from 75 to 325 mg/day. There is no evidence to support any specific dose, but using the lowest possible dosage may help reduce side effects. There is no evidence for a specific age at which to start aspirin, but at ages <30 years, aspirin has not been studied.

Clopidogrel has been demonstrated to reduce CVD rates in diabetic individuals. Adjunctive therapy in very-high-risk patients or as alternative therapy in aspirin-intolerant patients should be considered.

4. Smoking cessation

Recommendations

- Advise all patients not to smoke. (A)
- Include smoking cessation counseling and other forms of treatment as a routine component of diabetes care. (B)

Issues of smoking in diabetes are reviewed in detail in the ADA technical review and position statement on smoking cessation. A large body of evidence from epidemiological, case-control, and cohort studies provides convincing documentation of the causal link between cigarette smoking and health risks. Cigarette smoking contributes to one of every five deaths in the U.S. and is the most important modifiable cause of premature death. Much of the prior work documenting the impact of smoking on health did not separately discuss results on subsets of individuals with diabetes, suggesting that the identified risks are at least equivalent to those found in the general population. Other studies of individuals with diabetes consistently found a heightened risk of morbidity and premature death associated with the development of macrovascular complications among smokers. Smoking is also related to the premature development of microvascular complications of diabetes and may have a role in the development of type 2 diabetes.

A number of large randomized clinical trials have demonstrated the efficacy and cost-effectiveness of counseling in changing smoking behavior. Such studies, combined with others specific to individuals with diabetes, suggest that smoking cessation counseling is effective in reducing tobacco use.

The routine and thorough assessment of tobacco use is important as a means of preventing smoking or encouraging cessation. Special considerations should include assessment of level of nicotine dependence, which is associated with difficulty in quitting and relapse.

5. CHD screening and treatment

Recommendations

- In patients >55 years of age, with or without hypertension but with another cardiovascular risk factor (history of CVD, dyslipidemia, microalbuminuria, or smoking), an ACE inhibitor (if not contraindicated) should be considered to reduce the risk of cardiovascular events. (A)
- In patients with a prior myocardial infarction or in patients undergoing major surgery, ß-blockers, in addition, should be considered to reduce mortality. (A)
- In asymptomatic patients, consider a risk factor evaluation to stratify patients by 10-year risk and treat risk factors accordingly. (B)
- In patients with treated CHF, metformin use is contraindicated. The TZDs are associated with fluid retention, and their use can be complicated by the development of CHF. Caution in prescribing TZDs in the setting of known CHF or other heart diseases, as well as in patients with preexisting edema or concurrent insulin therapy, is required. (C)

CHD screening and treatment are reviewed in detail in the ADA consensus statement on CHD in people with diabetes. To identify the presence of CHD in diabetic patients without clear or suggestive symptoms of CAD, a risk factor–based approach to the initial diagnostic evaluation and subsequent follow-up is recommended. However, a recent study concluded that using current guidelines fails to detect a significant percentage of patients with silent ischemia.

At least annually, cardiovascular risk factors should be assessed. These risk factors include dyslipidemia, hypertension, smoking, a positive family history of premature coronary disease, and the presence of micro- or macroalbuminuria. Abnormal risk factors should be treated as described elsewhere in these guidelines. Patients at increased CHD risk should receive aspirin and may warrant an ACE inhibitor.

Candidates for a diagnostic cardiac stress test include those with *1*) typical or atypical cardiac symptoms and *2*) an abnormal resting ECG. The screening of asymptomatic patients remains controversial.

Studies have demonstrated that a significant percentage of patients with diabetes who have no symptoms of CAD have abnormal stress tests, either by ECG or echo and nuclear perfusion imaging. Some of these patients, though clearly not all, have significant coronary stenoses if they proceed to angiography. It has also been demonstrated that patients with silent myocardial ischemia have a poorer prognosis than those with normal stress tests. Their risk is further accentuated if cardiac autonomic neuropathy coexists. Candidates for a screening cardiac stress test include those with *1*) a history of peripheral or carotid occlusive disease and *2*) sedentary lifestyle, age >35 years, and plans to begin a vigorous exercise program. There are no data to suggest that patients who start to increase their physical activity by walking or similar exercise increase their risk of a CVD event and therefore are unlikely to need a stress test.

It has previously been proposed to screen those with two or more additional cardiac risk factors. However, this likely includes the vast majority of patients with type 2 diabetes (given that the risk factors frequently cluster). The Detection of Silent Myocardial Ischemia in Asymptomatic Diabetic Subjects (DIAD) study suggested that conventional cardiac risk factors did not help to identify those patients with abnormal perfusion imaging.

Current evidence suggests that noninvasive tests can improve assessment of future CHD risk. There is, however, no current evidence that such testing in asymptomatic patients with risk factors improves outcomes or leads to better utilization of treatments.

Approximately 1 in 5 will have an abnormal test, and ≈1 in 15 will have a major abnormality. More information is needed concerning prognosis, and the value of early intervention (invasive or noninvasive) before widespread screening is recommended.

All patients irrespective of their CAD status should have aggressive risk factor modification, including control of glucose, lipids, and blood pressure and prophylactic aspirin therapy.

Patients with abnormal exercise ECG and patients unable to perform an exercise ECG require additional or alternative testing. Currently, stress nuclear perfusion and stress echocardiography are valuable next-level diagnostic procedures. A consultation with a cardiologist is recommended regarding further work-up.

When identified, the optimal therapeutic approach to the diabetic patient with silent myocardial ischemia is unknown. Certainly if major CAD is identified, aggressive intervention appears warranted. If minor stenoses are detected, however, whether there is any benefit to further invasive evaluation and/or therapy is unknown. There are no well-conducted prospective trials with adequate control groups to shed light on this question. Accordingly, there are no evidence-based guidelines for screening the asymptomatic diabetic patient for CAD.

B. Nephropathy screening and treatment
Recommendations
General recommendations

- To reduce the risk and/or slow the progression of nephropathy, optimize glucose control. (A)

- To reduce the risk and/or slow the progression of nephropathy, optimize blood pressure control. (A)
- To reduce the risk of nephropathy, protein intake should be limited to the RDA (0.8 g/kg) in those with any degree of CKD. (B)

Screening

- Perform an annual test for the presence of microalbuminuria in type 1 diabetic patients with diabetes duration of ≥5 years and in all type 2 diabetic patients, starting at diagnosis and during pregnancy. (E)
- Serum creatinine should be measured at least annually for the estimation of glomerular filtration rate (GFR) in all adults with diabetes regardless of the degree of urine albumin excretion. The serum creatinine alone should not be used as a measure of kidney function but instead used to estimate GFR and stage the level of chronic kidney disease (CKD). (E)

Treatment

- In the treatment of both micro- and macroalbuminuria, either ACE inhibitors or ARBs should be used except during pregnancy. (A)
- While there are no adequate head-to-head comparisons of ACE inhibitos and ARBs, there is clinical trial support for each of the following statements:
    - In patients with type 1 diabetes, with hypertension and any degree of albuminuria, ACE inhibitors have been shown to delay the progression of nephropathy. (A)
    - In patients with type 2 diabetes, hypertension, and microalbuminuria, ACE inhibitors and ARBs have been shown to delay the progression to macroalbuminuria. (A)
    - In patients with type 2 diabetes, hypertension, macroalbuminuria, and renal insufficiency (serum creatinine >1.5 mg/dl), ARBs have been shown to delay the progression of nephropathy. (A)
    - If one class is not tolerated, the other should be substituted. (E)

- With presence of nephropathy, initiate protein restriction to ≤0.8 g · kg body wt^{-1} · day^{-1} (≈10% of daily calories), the current adult RDA for protein. Further restriction may be useful in slowing the decline of GFR in patients whose nephropathy is progressing despite maximized glycemic and blood pressure control and use of ACE inhibitors and/or ARBs. (B)
- With regards to slowing the progression of nephropathy, the use of DCCBs as initial therapy is not more effective than placebo. Their use in nephropathy should be restricted to additional therapy to further lower blood pressure in patients already treated with ACE inhibitors or ARBs. (B)
- In the setting of albuminuria or nephropathy, in patients unable to tolerate ACE inhibitors and/or ARBs, consider the use of non-DCCBs, ß-blockers, or diuretics for the management of blood pressure. Use of non-DCCBs may reduce albuminuria in diabetic patients, including during pregnancy. (E)

- If ACE inhibitors, ARBs, or diuretics are used, monitor serum potassium levels for the development of hyperkalemia. (B)
- Continued surveillance of microalbuminuria/proteinuria to assess both response to therapy and progression of disease is recommended. (E)
- Consider referral to a physician experienced in the care of diabetic renal disease when the estimated (GFR) has fallen to <60 ml/min per 1.73 m^2 or if difficulties occur in the management of hypertension or hyperkalemia. (B)

Diabetic nephropathy occurs in 20–40% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD). Persistent albuminuria in the range of 30–299 mg/24 h (microalbuminuria) 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 risk.

Patients with microalbuminuria who progress to macroalbuminuria (≥300 mg/24 h) are likely to progress to ESRD over a period of years. Over the past several years, a number of interventions have been demonstrated to reduce the risk and slow the progression of renal disease.

Intensive diabetes management with the goal of achieving near normoglycemia has been shown in large prospective randomized studies to delay the onset of microalbuminuria and the progression of micro- to macroalbuminuria in patients with type 1 and type 2 diabetes. The UKPDS provided strong evidence that control of blood pressure can reduce the development of nephropathy. In addition, large prospective randomized studies in patients with type 1 diabetes have demonstrated that achievement of lower levels of systolic blood pressure (<140 mmHg) achieved with treatment using ACE inhibitors provides a selective benefit over other antihypertensive drug classes in delaying the progression from micro- to macroalbuminuria and can slow the decline in GFR in patients with macroalbuminuria.

In addition, ACE inhibitors have been shown to reduce severe CVD (i.e., myocardial infarction, stroke, death), thus further supporting the use of these agents in patients with microalbuminuria. ARBs have also been shown to reduce the rate of progression from micro- to macroalbuminuria as well as ESRD in patients with type 2 diabetes. Some evidence suggests that ARBs have a smaller magnitude of rise in potassium compared with ACE inhibitors in people with nephropathy. With regards to slowing the progression of nephropathy, the use of DCCBs as initial therapy is not more effective than placebo. Their use in nephropathy should be restricted to additional therapy to further lower blood pressure in patients already treated with ACE inhibitors or ARBs. In the setting of albuminuria or nephropathy, in patients unable to tolerate ACE inhibitors and/or ARBs, consider the use of non-DCCBs, ß-blockers, or diuretics for the management of blood pressure.

Studies in patients with varying stages of nephropathy have shown that protein restriction is of benefit in slowing the progression of albuminuria, GFR decline, and occurrence of ESRD. Protein restriction should be considered particularly in patients whose nephropathy seems to be progressing despite optimal glucose and blood pressure control and use of ACE inhibitor and/or ARBs.

Screening for microalbuminuria can be performed by three methods: *1*) measurement of the albumin-to-creatinine ratio in a random spot collection (preferred method); *2*) 24-h collection with creatinine, allowing the simultaneous measurement of creatinine clearance; and *3*) timed (e.g., 4-h or overnight) collection.

The analysis of a spot sample for the albumin-to-creatinine ratio is strongly recommended by most authorities. The other two alternatives (24-h collection and a timed specimen) are rarely necessary. Measurement of a spot urine for albumin only, whether by immunoassay or by using a dipstick test specific for microalbumin, without simultaneously measuring urine creatinine, is less expensive than the recommended methods but is susceptible to false-negative and -positive determinations as a result of variation in urine concentration due to hydration and other factors.

At least two of three tests measured within a 6-month period should show elevated levels before a patient is designated as having microalbuminuria. Abnormalities of albumin excretion are defined in Table 8.

Table 8— Definitions of abnormalities in albumin excretion

Category	Spot collection (µg/mg creatinine)
Normal	<30
Microalbuminuria	30–299
Macro (clinical)-albuminuria	≥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 within 24 h, infection, fever, CHF, marked hyperglycemia, and marked hypertension may elevate urinary albumin excretion over baseline values.

Screening for microalbuminuria is indicated in pregnancies complicated by diabetes, since microalbuminuria in the absence of urinary tract infection is a strong predictor of superimposed preeclampsia. In the presence of macroalbuminuria or urine dipstick proteinuria, estimation of GFR by serum creatinine (see below) or 24-h urine creatinine clearance is indicated to stage the patient's renal disease, and other tests may be necessary to diagnose preeclampsia.

Information on presence of urine albumin excretion in addition to level of GFR may be used to stage CKD according to the National Kidney Foundation. The current National Kidney Foundation classification (Table 9) is primarily based on GFR levels and therefore differs from some earlier staging systems used by others, in which staging is based primarily on urinary albumin excretion. Studies have found decreased GFR in the absence of increase urine albumin excretion in a substantial percentage of adults with diabetes. Thus, these studies demonstrate that significant decline in GFR may be noted in adults with type 1 and type 2 diabetes in the absence of increased urine albumin excretion. It is now clear that stage 3 or high CKD (GFR <60 ml/min per 1.73 m^2) occurs in the absence of urine albumin excretion in a substantial proportion of adults with diabetes. Screening this population for increased urine albumin excretion alone, therefore, will miss a considerable number of CKD cases.

Table 9— Stages of CKD

Stage	Description	GFR (ml/min per 1.73 m^2body surface area)
1	Kidney damage* with normal or increased GFR	≥90
2	Kidney damage* with mildly decreased GFR	60–89
3	Moderately decreased GFR	30–59
4	Severely decreased GFR	15–29
5	Kidney failure	<15 or dialysis

* Kidney damage defined as abnormalities on pathologic, urine, blood, or imaging tests. Adapted from ref. 167.

Serum creatinine should be measured at least annually for the estimation of GFR in all adults with diabetes regardless of the degree of urine albumin excretion. Serum creatinine alone should not be used as a measure of kidney function, but used to estimate GFR and stage the level of CKD. The GFR can be easily estimated using formulae like the Cockroft-Gault formula or a newer prediction formula developed by researchers using data collected from the Modification of Diet and Renal Disease (MDRD) study. The estimated GFR can easily be calculated by going to http://www.kidney.org/professionals/kdoqi/gfr_calculator.cfm.

The role of annual microalbumuria assessment is less clear after diagnosis of microalbuminuria and institution of ACE inhibitor or ARB therapy and blood pressure control. Most experts, however, recommend continued surveillance to assess both response to therapy and progression of disease. Some experts suggest that reducing urine microalbuminuria to the normal or near-normal range, if possible, may improve renal and cardiovascular prognosis. This approach has not been formally evaluated in prospective trials.

Consider referral to a physician experienced in the care of diabetic renal disease either when the GFR has fallen to <60 ml/min per 1.73 m^2 or if difficulties occur in the management of hypertension or hyperkalemia. It is suggested that consultation with a nephrologist be obtained when the GFR is <30 ml/min per 1.73 m^2. Early referral of such patients has been found to reduce cost and improve quality of care and keep people off dialysis longer.

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 within 24 h, infection, fever, CHF, marked hyperglycemia, and marked hypertension may elevate urinary albumin excretion over baseline values.

C. Retinopathy screening and treatment
Recommendations
General recommendations

- Optimal glycemic control can substantially reduce the risk and progression of diabetic retinopathy. (A)
- Optimal blood pressure control can reduce the risk and progression of diabetic retinopathy. (A)
- Aspirin therapy does not prevent retinopathy or increase the risks of hemorrhage. (A)

Screening

- Adults and adolescents 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. (B)
- 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. (B)
- Subsequent examinations for type 1 and type 2 diabetic patients should be repeated annually by an ophthalmologist or optometrist. Less frequent exams (every 2–3 years) may be considered in the setting of a normal eye exam. Examinations will be required more frequently if retinopathy is progressing. (B)
- Women who are planning pregnancy or who have become pregnant should have a comprehensive eye examination and should be counseled on the risk of development and/or progression of diabetic retinopathy. Eye examination should occur in the first trimester with close follow-up throughout pregnancy and for 1 year postpartum. This guideline does not apply to women who develop GDM because such individuals are not at increased risk for diabetic retinopathy. (B)

Treatment

- Laser therapy can reduce the risk of vision loss in patients with high-risk characteristics (HRCs). (A)
- 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. (A)

Diabetic retinopathy is a highly specific vascular complication of both type 1 and type 2 diabetes. The prevalence of retinopathy is strongly related to the duration of diabetes. Diabetic retinopathy is estimated to be the most frequent cause of new cases of blindness among adults aged 20–74 years. Glaucoma, cataracts, and other disorders of the eye may occur earlier in people with diabetes and should also be evaluated.

Intensive diabetes management with the goal of achieving near normoglycemia has been shown in large prospective randomized studies to prevent and/or delay the onset of diabetic retinopathy. In addition to glycemic control, several other factors seem to increase the risk of retinopathy. The presence of nephropathy is associated with retinopathy. High blood pressure is an established risk factor for the development of macular edema and is associated with the presence of PDR. Lowering blood pressure, as demonstrated by the UKPDS, has been shown to decrease the progression of retinopathy. Several case series and a controlled prospective study suggest that pregnancy in type 1 diabetic patients may aggravate retinopathy. During pregnancy and 1 year postpartum, retinopathy may be transiently aggravated; laser photocoagulation surgery can minimize this risk.

Patients with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 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. Less frequent exams (every 2–3 years) may be considered with the advice of an eye care professional in the setting of a normal eye exam. Examinations will be required more frequently if retinopathy is progressing.

Examinations can also be done by the taking of retinal photographs (with or without dilation of the pupil) and having these read by experienced experts in this field. In-person exams are still necessary when the photos are unacceptable and for follow up of abnormalities detected. This technology has it greatest potential in areas where qualified eye care professionals are not available. Results of eye examinations should be documented and transmitted to the referring health care professional.

One of the main motivations for screening for diabetic retinopathy is the established efficacy of laser photocoagulation surgery in preventing visual loss. Two large National Institutes of Health–sponsored trials, the Diabetic Retinopathy Study (DRS) and the Early Treatment Diabetic Retinopathy Study (ETDRS), provide the strongest support for the therapeutic benefit of photocoagulation surgery.

The DRS tested whether scatter (panretinal) photocoagulation surgery could reduce the risk of vision loss from PDR. Severe visual loss (i.e., best acuity of 5/200 or worse) was seen in 15.9% of untreated vs. 6.4% of treated eyes. The benefit was greatest among patients whose baseline evaluation revealed HRCs (chiefly disc neovascularization or vitreous hemorrhage with any retinal neovascularization). Of control eyes with HRCs, 26% progressed to severe visual loss vs. 11% of treated eyes. Given the risk of a modest loss of visual acuity and of contraction of visual field from panretinal laser surgery, such therapy has been primarily recommended for eyes approaching or reaching HRCs.

The ETDRS established the benefit of focal laser photocoagulation surgery in eyes with macular edema, particularly those with clinically significant macular edema. In patients with clinically significant macular edema after 2 years, 20% of untreated eyes had a doubling of the visual angle (e.g., 20/50 to 20/100) compared with 8% of treated eyes. Other results from the ETDRS indicate that, provided careful follow-up can be maintained, scatter photocoagulation surgery is not recommended for eyes with mild or moderate NPDR. When retinopathy is more severe, scatter photocoagulation surgery should be considered, and usually should not be delayed, if the eye has reached the high-risk proliferative stage. In older-onset patients with severe NPDR or less-than-high-risk PDR, the risk of severe visual loss and vitrectomy is reduced ~50% by laser photocoagulation surgery at these earlier stages.

Laser photocoagulation surgery in both the DRS and the ETDRS was beneficial in reducing the risk of further visual loss, but generally not beneficial in reversing already diminished acuity. This preventive effect and the fact that patients with PDR or macular edema may be asymptomatic provide strong support for a screening program to detect diabetic retinopathy.

For a detailed review of the evidence and further discussion, see the ADA's technical review and position statement on this subject.

D. Neuropathy screening and treatment
Recommendations

- All patients should be screened for distal symmetric polyneuropathy (DPN) at diagnosis and at least annually thereafter, using simple clinical tests. (A)
- Electrophysiological testing is rarely ever needed, except in situations where the clinical features are atypical. (E)
- Once the diagnosis of DPN is established, special foot care is appropriate for insensate feet to decrease the risk of amputation. (B)
- Simple inspection of insensate feet should be performed at 3- to 6-month intervals. An abnormality should trigger referral for special footwear, preventive specialist, or podiatric care. (B)
- Screening for autonomic neuropathy should be instituted at diagnosis of type 2 diabetes and 5 years after the diagnosis of type 1 diabetes. Special electrophysiological testing for autonomic neuropathy is rarely needed and may not affect management and outcomes. (E)
- Education of patients about self-care of the feet and referral for special shoes/inserts are vital components of patient management. (B)
- A wide variety of medications is recommended for the relief of specific symptoms related to autonomic neuropathy and are recommended, as they improve the quality of life of the patient. (E)

The diabetic neuropathies are heterogeneous with diverse clinical manifestations. They may be focal or diffuse. Most common among the neuropathies are chronic sensorimotor DPN and autonomic neuropathy. Although DPN is a diagnosis of exclusion, complex investigations to exclude other conditions are rarely needed.

The early recognition and appropriate management of neuropathy in the patient with diabetes is important for a number of reasons: *1*) nondiabetic neuropathies may be present in patients with diabetes and may be treatable; *2*) a number of treatment options exist for symptomatic diabetic neuropathy; *3*) up to 50% of DPN may be asymptomatic and patients are at risk of insensate injury to their feet; *4*) autonomic neuropathy may involve every system in the body; and *5*) cardiovascular autonomic neuropathy causes substantial morbidity and mortality. Specific treatment for the underlying nerve damage is currently not available, other than improved glycemic control, which may slow progression but rarely reverses neuronal loss. Effective symptomatic treatments are available for the manifestations of DPN and autonomic neuropathy.

Diagnosis of neuropathy
Patients with diabetes should be screened annually for DPN using tests such as pinprick sensation, temperature and vibration perception (using a 128-Hz tuning fork), 10-g monofilament pressure sensation at the dorsal surface of both great toes, just proximal to the nail bed, and ankle reflexes. Combinations of more than one test have >87% sensitivity in detecting DPN. Loss of 10-g monofilament perception and reduced vibration perception predict foot ulcers. A minimum of one clinical test should be carried out annually, and the use of two tests will increase diagnostic ability.

Focal and multifocal neuropathy assessment requires clinical examination in the area related to the neurological symptoms.

Diabetic autonomic neuropathy
The symptoms of autonomic dysfunction should be elicited carefully during the history and review of systems, particularly since many of these symptoms are potentially treatable. Major clinical manifestations of diabetic autonomic neuropathy include resting tachycardia, exercise intolerance, orthostatic hypotension, constipation, gastroparesis, erectile dysfunction, sudomotor dysfunction, impaired neurovascular function, "brittle diabetes," and hypoglycemic autonomic failure.

Cardiovascular autonomic neuropathy is the most studied and clinically important form of diabetic autonomic neuropathy. Cardiac autonomic neuropathy may be indicated by resting tachycardia (>100 bpm), orthostasis (a fall in systolic blood pressure >20 mmHg upon standing), or other disturbances in autonomic nervous system function involving the skin, pupils, or gastrointestinal and genitourinary systems.

Gastrointestinal disturbances (e.g., esophageal enteropathy, gastroparesis, constipation, diarrhea, fecal incontinence) are common, and any section of the gastrointestinal tract may be affected. Gastroparesis should be suspected in individuals with erratic glucose control. Upper gastrointestinal symptoms should lead to consideration of all possible causes, including autonomic dysfunction. Evaluation of solid-phase gastric emptying using double-isotope scintigraphy may be done if symptoms are suggestive, but test results often correlate poorly with symptoms.
Barium studies or referral for endoscopy may be required to rule out structural abnormalities. Constipation is the most common lower gastrointestinal symptom but can alternate with episodes of diarrhea. Endoscopy may be required to rule out other causes.

Diabetic autonomic neuropathy is also associated with genitourinary tract disturbances, including bladder and/or sexual dysfunction. Evaluation of bladder dysfunction should be performed for individuals with diabetes who have recurrent urinary tract infections, pyelonephritis, incontinence, or a palpable bladder. In men, diabetic autonomic neuropathy may cause loss of penile erection and/or retrograde ejaculation.

Symptomatic treatments
DPN.
The first step in management of patients with DPN should be to aim for stable and optimal glycemic control. Although controlled trial evidence is lacking, several observational studies suggest that neuropathic symptoms improve not only with optimization of control but also with the avoidance of extreme blood glucose fluctuations. Most patients will require pharmacological treatment for painful symptoms: many agents have efficacy confirmed in published randomized controlled trials, though none are specifically licensed for the management of painful DPN.

Tricyclic drugs.
The usefulness of the tricyclic drugs such as amitriptyline and imipramine has been confirmed in several randomized controlled trials, although they do not have formal FDA approval for this condition. Although cheap and generally efficacious in the management of neuropathic pain, side effects limit their use in many patients. Tricylcic drugs may also exacerbate some autonomic symptoms such as gastroparesis.

Anticonvulsants.
Gabapentin is a commonly prescribed anticonvulsant that has been shown to be efficacious in the treatment of neuropathic pain, although not approved for this condition. It is advisable to start at a small dose and then increase over days to weeks to the dosage that is well tolerated and produces symptomatic relief. The structurally related compound pregabalin is longer acting, has recently been

confirmed to be useful in painful diabetic neuropathy in a randomized controlled trial, and is approved for use in this condition. Other anticonvulsant drugs may also be efficacious in the management of neuropathic pain.

Other agents.
The 5-hydroxytryptamine and norepinephrine reuptake inhibitor duloxetine has been approved by the FDA for the treatment of neuropathic pain.

Treatment of autonomic neuropathy
A wide variety of agents are used to treat the symptoms of autonomic neuropathy including metoclopramide for gastroparesis and several medications for bladder and erectile dysfunction. These treatments are frequently used to provide symptomatic relief to patients. Although they do not change the underlying pathology and natural history of the disease process, their use is recommended due to the impact they may have on the quality of life of the patient.

E. Foot care

Recommendations

- Perform a comprehensive foot examination and provide foot self care education annually on patients with diabetes to identify risk factors predictive of ulcers and amputations. (B)
- The foot examination can be accomplished in a primary care setting and should include the use of a monofilament, tuning fork, palpation, and a visual examination. (B)
- A multidisciplinary approach is recommended for individuals with foot ulcers and high-risk feet, especially those with a history of prior ulcer or amputation. (B)
- Refer patients who smoke or with prior lower-extremity complications to foot care specialists for ongoing preventive care and life-long surveillance. (C)
- Initial screening for peripheral arterial disease (PAD) should include a history for claudication and an assessment of the pedal pulses. Consider obtaining an ankle-brachial index (ABI), as many patients with PAD are asymptomatic. (C)
- Refer patients with significant claudication or a positive ABI for further vascular assessment and consider exercise, medications, and surgical options. (C)

Amputation and foot ulceration are the most common consequences of diabetic neuropathy and major causes of morbidity and disability in people with diabetes. Early recognition and management of independent risk factors can prevent or delay adverse outcomes.

The risk of ulcers or amputations is increased in people who have had diabetes >10 years, are male, have poor glucose control, or have cardiovascular, retinal, or renal complications. The following foot-related risk conditions are associated with an increased risk of amputation:

- 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.

All individuals with diabetes should receive an annual foot examination to identify high-risk foot conditions. This examination should include assessment of protective sensation, foot structure and biomechanics, vascular status, and skin integrity. People with one or more high-risk foot condition 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 visit with a health care professional. Evaluation of neurological status in the low-risk foot should include a quantitative somatosensory threshold test, using the Semmes-Weinstein 5.07 (10-g) monofilament.

The skin should be assessed for integrity, especially between the toes and under the metatarsal heads. The presence of erythema, warmth, or callus formation may indicate areas of tissue damage with impending breakdown. Bony deformities, limitation in joint mobility, and problems with gait and balance should be assessed.

People with neuropathy or evidence of increased plantar pressure may be adequately managed with well-fitted walking shoes or athletic shoes. Patients should be educated on the implications of sensory loss and the ways to substitute other sensory modalities (hand palpation, visual inspection) for surveillance of early problems. People with evidence of increased plantar pressure (e.g., erythema, warmth, callus, or measured pressure) should use footwear that cushions and redistributes the pressure. Callus can be debrided with a scalpel by a foot care specialist or other health professional with experience and training in foot care. People with bony deformities (e.g., hammertoes, prominent metatarsal heads, or bunions) may need extra-wide shoes or depth shoes. People with extreme bony deformities (e.g., Charcot foot) that cannot be accommodated with commercial therapeutic footwear may need custom-molded shoes.

Initial screening for PAD should include a history for claudication and an assessment of the pedal pulses. Consider obtaining an ABI, as many patients with PAD are asymptomatic. Refer patients with significant or a positive ABI for further vascular assessment and consider exercise, medications, and surgical options.

Patients with diabetes and high-risk foot conditions should be educated regarding their risk factors and appropriate management. Patients at risk should understand the implications of the loss of protective sensation, the importance of foot monitoring on a daily basis, the proper care of the foot, including nail and skin care, and the selection of appropriate footwear. The patient's understanding of these issues and their physical ability to conduct proper foot surveillance and care should be assessed. Patients with visual difficulties, physical constraints preventing movement, or cognitive problems that impair their ability to assess the condition of the foot and to institute appropriate responses will need other people, such as family members, to assist in their care. Patients at low risk may benefit from education on foot care and footwear.

For a detailed review of the evidence and further discussion, see the ADA's technical review and position statement in this subject.

Problems involving the feet, especially ulcers and wound care, may require care by a podiatrist, orthopedic surgeon, or rehabilitation specialist experienced in the management of individuals with diabetes. For a complete discussion on wound care, see the ADA's consensus statement on diabetic foot wound care.

VII. DIABETES CARE IN SPECIFIC POPULATIONS

A. Children and adolescents

1. Type 1 diabetes

Although approximately three-quarters of all cases of type 1 diabetes are diagnosed in individuals <18 years of age, historically, ADA recommendations for management of type 1 diabetes have pertained most directly to adults with type 1 diabetes. Because children are not simply "small adults," it is appropriate to consider the unique aspects of care and management of children and adolescents with type 1 diabetes. Children with diabetes differ from adults in many respects, including insulin sensitivity related to sexual maturity, physical growth, ability to provide self-care, and unique neurologic vulnerability to hypoglycemia. Attention to such issues as family dynamics, developmental stages, and physiologic differences related to sexual maturity all are essential in developing and implementing an optimal diabetes regimen. Although current recommendations for children and adolescents are less likely to be based on evidence derived from rigorous research because of current and historical restraints placed on conducting research in children, expert opinion and a review of available and relevant experimental data are summarized in a recent ADA Statement. The following represents a summary of recommendations and guidelines pertaining specifically to the care and management of children and adolescents that are included in that document.

Ideally, the care of a child or adolescent with type 1 diabetes should be provided by a multidisciplinary team of specialists trained in the care of children with pediatric diabetes, although this may not always be possible. At the very least, education of the child and family should be provided by health care providers trained and experienced in childhood diabetes and sensitive to the challenges posed by diabetes in this age-group. At the time of initial diagnosis, it is essential that diabetes education be provided in a timely fashion, with the expectation that the balance between adult supervision and self-care should be defined by, and will evolve according to, physical, psychologic, and emotional maturity. MNT should be provided 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.

a. Glycemic control.

While current standards for diabetes management reflect the need to maintain glucose control as near to normal as safely possible, special consideration must be given to the unique risks of hypoglycemia in

young children. Glycemic goals need to be modified to take into account the fact that most children <6 or 7 years of age have a form of "hypoglycemic unawareness," in that counterregulatory mechanisms are immature, and young children lack the cognitive capacity to recognize and respond to hypoglycemic symptoms, placing them at greater risk for hypoglycemia and its sequelae. In addition, extensive evidence indicates that near normalization of blood glucose levels is seldom attainable in children and adolescents after the honeymoon (remission) period. The A1C level achieved in the "intensive" adolescent cohort of the DCCT group was >1% higher than that achieved for older patients and current ADA recommendations for patients in general.

In selecting glycemic goals, the benefits of achieving a lower A1C must be weighed against the unique risks of hypoglycemia and the disadvantages of targeting a higher, although more achievable, goal that may not promote optimal long-term health outcomes. Age-specific glycemic and A1C goals are presented in Table 10.

Table 10— Plasma blood glucose and A1C goals for type 1 diabetes by age group

	Plasma blood glucose goal range (mg/dl)			
Values by age (years)	Before meals	Bedtime/overnight	A1C	Rationale
Toddlers and preschoolers (0–6)	100–180	110–200	<8.5% (but >7.5%)	High risk and vulnerability to hypoglycemia
School age (6–12)	90–180	100–180	<8%	Risks of hypoglycemia and relatively low risk of complications prior to puberty
Adolescents and young adults (13–19)	90–130	90–150	<8%	• Risk of severe hypoglycemia • Developmental and psychological issues • A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment.
- Blood glucose goals should be higher than those listed above in children with frequent hypoglycemia or hypoglycemia unawareness.

• Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1C levels.

b. Screening and management of chronic complications in children and adolescents with type 1 diabetes.

i. Nephropathy

Recommendations

- Annual screening for microalbuminuria should be initiated once the child is 10 years of age and has had diabetes for 5 years. Screening may be done with a random spot urine sample analyzed for microalbumin-to-creatinine ratio. (E)
- Confirmed, persistently elevated microalbumin levels should be treated with an ACE inhibitor, titrated to normalization of microalbumin excretion (if possible). (E)

ii. Hypertension

Recommendations

- Treatment of high-normal blood pressure (systolic or diastolic blood pressure consistently above the 90th percentile for age, sex, and height) should include dietary intervention and exercise, aimed at weight control and increased physical activity, if appropriate. If target blood pressure is not reached within 3–6 months of lifestyle intervention, pharmacologic treatment should be initiated. (E)
- Pharmacologic treatment of hypertension (systolic or diastolic blood pressure consistently above the 95th percentile for age, sex, and height or consistently greater than 130/80 mmHg, if 95% exceeds that value) should be initiated as soon as the diagnosis is confirmed. (E)
- ACE inhibitors should be considered for the initial treatment of hypertension. (E)
- Hypertension in childhood is defined as an average systolic or diastolic blood pressure ≥95th percentile for age, sex, and height percentile measured on at least three separate days. "High-normal" blood pressure is defined as an average systolic or diastolic blood pressure ≥90th but <95th percentile for age, sex, and height percentile measured on at least 3 separate days. Normal blood pressure levels for age, sex, and height and appropriate methods for determinations are available online at www.nhlbi.nih.gov/health/prof/heart/hbp/hbp_ped.pdf.

iii. Dyslipidemia

Recommendations

Screening

- Prepubertal children: a fasting lipid profile should be performed on all children >2 years of age at the time of diagnosis (after glucose control has been established) if there is a family history of hypercholesterolemia (total cholesterol >240 mg/dl), if there is a history of a cardiovascular event before age 55 years, or if family history is unknown. If family history is not of concern, then the first lipid screening should be performed at puberty (>12 years). If values are within the accepted risk levels (LDL <100 mg/dl [2.6 mmol/l]), a lipid profile should be repeated every 5 years. (E)
- Pubertal children (>12 years of age): a fasting lipid profile should be performed at the time of diagnosis (after glucose control has been established). If values fall within the accepted risk levels (LDL <100 mg/dl [2.6 mmol/l]), the measurement should be repeated every 5 years. (E)
- If lipids are abnormal, annual monitoring is recommended in both age-groups. (E)

Treatment

- Treatment should be based on fasting lipid levels (mainly LDL) obtained after glucose control is established. (E)
- Initial therapy should consist of optimization of glucose control and MNT aimed at a decrease in the amount of saturated fat in the diet. (E)
- The addition of a pharmacologic lipid-lowering agents is recommended for LDL >160 mg/dl (4.1 mmol/l), and is also recommended in patients who have LDL cholesterol values of 130–159 mg/dl (3.4–4.1 mmol/l) based on the patient's CVD risk profile, after failure of MNT and lifestyle changes. (E)
- The goal of therapy is an LDL value <100 mg/dl (2.6 mmol/l). (E)

iv. Retinopathy

Recommendations

- The first ophthalmologic examination should be obtained once the child is ≥10 years of age and has had diabetes for 3–5 years. (E)
- After the initial examination, annual routine follow-up is generally recommended. Less frequent examinations may be acceptable on the advice of an eye care professional. (E)

Although retinopathy most commonly occurs after the onset of puberty and after 5–10 years of diabetes duration, it has been reported in prepubertal children and with diabetes duration of only 1–2 years. Referrals should be made to eye care professionals with expertise in diabetic retinopathy, an understanding of the risk for retinopathy in the pediatric population, and experience in counseling the pediatric patient and family on the importance of early prevention/intervention.

c. Other issues.

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. Family involvement in diabetes remains an important component of optimal diabetes management

throughout childhood and into adolescence. 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.

Since a sizable portion of a child's day is spent in school, close communication with school or day care personnel is essential for optimal diabetes management. Information should be supplied to school personnel, so that they may be made aware of the diagnosis of diabetes in the student and of the signs, symptoms, and treatment of hypoglycemia. In most cases it is imperative 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.
Many children may require support for insulin administration by either injection or continuous subcutaneous insulin infusion before lunch (and often also before breakfast) at school or in day care. For further discussion, see the ADA position statement and the report from the National Diabetes Education Program.

2. Type 2 diabetes
Finally, the incidence of type 2 diabetes in children and adolescents has been shown to be increasing, especially in ethnic minority populations. Distinction between type 1 and type 2 diabetes in children can be difficult, since autoantigens and ketosis may be present in a substantial number of patients with otherwise straightforward type 2 diabetes (including obesity and acanthosis nigricans). Such a distinction at the time of diagnosis is critical since treatment regimens, educational approaches, and dietary counsel will differ markedly between the two diagnoses. The ADA consensus statement provides guidance to the prevention, screening, and treatment of type 2 diabetes, as well as its comorbidities in young people.

B. Preconception care
Recommendations

- A1C levels should be normal or as close to normal as possible (<1% above the upper limits of normal) in an individual patient before conception is attempted. (B)
- All women with diabetes and child-bearing potential should be educated about the need for good glucose control before pregnancy. They should participate in family planning. (E)
- Women with diabetes who are contemplating pregnancy should be evaluated and, if indicated, treated for diabetic retinopathy, nephropathy, neuropathy, and CVD. (E)
- Among the drugs commonly used in the treatment of patients with diabetes, statins are pregnancy category X and should be discontinued before conception if possible. ACE inhibitors and ARBs are category C in the first trimester (maternal benefit may outweigh fetal risk in certain situations), but category D in later pregnancy, and should generally be discontinued before pregnancy. Among the oral antidiabetic agents, metformin and acarbose are classified as category B and all others as category C; potential risks and benefits of oral antidiabetic agents in the preconception period must be carefully weighed, recognizing that sufficient data are not available to establish the safety of these agents in pregnancy. They should generally be discontinued in pregnancy. (E)

Major congenital malformations remain the leading cause of mortality and serious morbidity in infants of mothers with type 1 and type 2 diabetes. Observational studies indicate that the risk of malformations increases continuously with increasing maternal glycemia during the first 6–8 weeks of

gestation, as defined by first-trimester A1C concentrations. There is no threshold for A1C values above which the risk begins or below which it disappears. However, malformation rates above the 1–2% background rate seen in nondiabetic pregnancies appear to be limited to pregnancies in which first-trimester A1C concentrations are >1% above the normal range.

Preconception care of diabetes appears to reduce the risk of congenital malformations. Five nonrandomized studies have compared rates of major malformations in infants between women who participated in preconception diabetes care programs and women who initiated intensive diabetes management after they were already pregnant.

The preconception care programs were multidisciplinary and designed to train patients in diabetes self-management with diet, intensified insulin therapy, and SMBG. Goals were set to achieve normal blood glucose concentrations, and >80% of subjects achieved normal A1C concentrations before they became pregnant. In all five studies, the incidence of major congenital malformations in women who participated in preconception care (range 1.0–1.7% of infants) was much lower than the incidence in women who did not participate (range 1.4–10.9% of infants). One limitation of these studies is that participation in preconception care was self-selected by patients rather than randomized. Thus, it is impossible to be certain that the lower malformation rates resulted fully from improved diabetes care. Nonetheless, the overwhelming evidence supports the concept that malformations can be reduced or prevented by careful management of diabetes before pregnancy.

Planned pregnancies greatly facilitate preconception diabetes care. Unfortunately, nearly two-thirds of pregnancies in women with diabetes are unplanned, leading to a persistent excess of malformations in infants of diabetic mothers. To minimize the occurrence of these devastating malformations, standard care for all women with diabetes who have child-bearing potential should include *1*) education about the risk of malformations associated with unplanned pregnancies and poor metabolic control and *2*) use of effective contraception at all times, unless the patient is in good metabolic control and actively trying to conceive.

Women contemplating pregnancy need to be seen frequently by a multidisciplinary team experienced in the management of diabetes before and during pregnancy. Teams may vary but should include a diabetologist, an internist or a family physician, an obstetrician, a diabetes educator, a dietitian, a social worker, and other specialists as necessary. The goals of preconception care are to *1*) integrate the patient into the management of her diabetes, *2*) achieve the lowest A1C test results possible without excessive hypoglycemia, *3*) assure effective contraception until stable and acceptable glycemia is achieved, and *4*) identify, evaluate, and treat long-term diabetic complications such as retinopathy, nephropathy, neuropathy, hypertension, and CAD.

For further discussion, see the ADA's technical review and position statement on this subject.

C. Older individuals

Diabetes is an important health condition for the aging population; at least 20% of patients over the age of 65 years have diabetes. The number of older individuals with diabetes can be expected to grow rapidly in the coming decades. A recent publication contains evidence-based guidelines produced in conjunction with the American Geriatric Society. This document contains an excellent discussion of this area, and specific guidelines and language from it have been incorporated below. Unfortunately, there are no long-term studies in individuals >65 years of age demonstrating the benefits of tight glycemic control, blood pressure, and lipid control. Older individuals with diabetes have higher rates of premature death, functional disability, and coexisting illnesses such as hypertension, CHD, and stroke than those without diabetes. Older adults with diabetes are also at greater risk than other older adults

for several common geriatric syndromes, such as polypharmacy, depression, cognitive impairment, urinary incontinence, injurious falls, and persistent pain.

The care of older adults with diabetes is complicated by their clinical and functional heterogeneity. Some older individuals developed diabetes in middle age and face years of comorbidity; others who are newly diagnosed may have had years of undiagnosed comorbidity or few complications from the disease. Some older adults with diabetes are frail and have other underlying chronic conditions, substantial diabetes-related comorbidity, or limited physical or cognitive functioning, but other older individuals with diabetes have little comorbidity and are active.
Life expectancies are also highly variable for this population. Clinicians caring for older adults with diabetes must take this heterogeneity into consideration when setting and prioritizing treatment goals.

All this having been said, patients who can be expected to live long enough to reap the benefits of long-term intensive diabetes management (~10 years) and who are active, cognitively intact, and willing to undertake the responsibility of self-management should be encouraged to do so and be treated using the stated goals for younger adults with diabetes.

There is good evidence from middle-aged and older adults suggesting that multidisciplinary interventions that provide education on medication use, monitoring, and recognizing hypo- and hyperglycemia can significantly improve glycemic control. Although control of hyperglycemia is important, in older individuals with diabetes, greater reductions in morbidity and mortality may result from control of all cardiovascular risk factors rather than from tight glycemic control alone. There is strong evidence from clinical trials of the value of treating hypertension in the elderly. There is less evidence for lipid-lowering and aspirin therapy, although as diabetic patients have such an elevated risk for CVD, aggressive management of lipids and aspirin use when not contraindicated are reasonable interventions.

As noted above, for patients with advanced diabetes complications, life-limiting comorbid illness, or cognitive or functional impairment, it is reasonable to set less intensive glycemic target goals. These patients are less likely to benefit from reducing the risk of microvascular complications and more likely to suffer serious adverse effects from hypoglycemia. Patients with poorly controlled diabetes may be subject to acute complications of diabetes, including hyperglycemic hyperosmolar coma. Older patients can be treated with the same drug regimens as younger patients, but special care is required in prescribing and monitoring drug therapy. Metformin is often contraindicated because of renal insufficiency or heart failure. Sulfonylureas and other insulin secretagogues can cause hypoglycemia. Insulin can also cause hypoglycemia as well as require good visual and motor skills and cognitive ability of the patient or a caregiver. TZDs should not be used in patients with CHF (New York Heart Association class III and IV). Drugs should be started at the lowest dose and titrated up gradually until targets are reached or side effects develop. As well as regards blood pressure and lipid management, the potential benefits must always be weighed against potential risks.

VIII. DIABETES CARE IN SPECIFIC SETTINGS

A. Diabetes care in the hospital

Recommendations

- All patients with diabetes admitted to the hospital should be identified in the medical record as having diabetes. (E)

- All patients with diabetes should have an order for blood glucose monitoring, with results available to all members of the health care team. (E)
- Goals for blood glucose levels:
    - Critically ill patients: blood glucose levels should be kept as close to 110 mg/dl (6.1 mmol/l) as possible and generally <180 mg/dl (10 mmol/l). These patients will usually require intravenous insulin. (B)
    - Non–critically ill patients: premeal blood glucose levels should be kept as close to 90–130 mg/dl (5.0–7.2 mmol/l; midpoint of range 110 mg/dl) as possible given the clinical situation and postprandial blood glucose levels <180 mg/dl. Insulin should be used as necessary. (E)
    - Due to concerns regarding the risk of hypoglycemia, some institutions may consider these blood glucose levels to be overly aggressive for initial targets. Through quality improvement, glycemic goals should systematically be reduced to the recommended levels. (E)
- Scheduled prandial insulin doses should be given in relation to meals and should be adjusted according to point of care glucose levels. The traditional sliding-scale insulin regimens are ineffective and are not recommended. (C)
- A plan for treating hypoglycemia should be established for each patient. Episodes of hypoglycemia in the hospital should be tracked. (E)
- All patients with diabetes admitted to the hospital should have an A1C obtained for discharge planning if the result of testing in the previous 2–3 months is not available. (E)
- A diabetes education plan including "survival skills education" and follow-up should be developed for each patient. (E)
- Patients with hyperglycemia in the hospital who do not have a diagnosis of diabetes should have appropriate plans for follow-up testing and care documented at discharge. (E)

The management of diabetes in the hospital is extensively reviewed in an ADA technical review by Clement et al.. This review forms the basis for these guidelines. In addition, the American Association of Clinical Endocrinologists held a conference on this topic, and the recommendations from this meeting were also carefully reviewed and discussed in the formulation of the guidelines that follow. The management of diabetes in the hospital is generally considered secondary in importance compared with the condition that prompted admission.

Patients with hyperglycemia fall into three categories:

- Medical history of diabetes: diabetes has been previously diagnosed and acknowledged by the patient’s treating physician.
- Unrecognized diabetes: hyperglycemia (fasting blood glucose 126 mg/dl or random blood glucose 200 mg/dl) occurring during hospitalization and confirmed as diabetes after hospitalization by standard diagnostic criteria but unrecognized as diabetes by the treating physician during hospitalization.

- Hospital-related hyperglycemia: hyperglycemia (fasting blood glucose 126 mg/dl or random blood glucose ≥200 mg/dl) occurring during the hospitalization that reverts to normal after hospital discharge.

The prevalence of diabetes in hospitalized adult patients is not precisely known. In the year 2000, 12.4% of hospital discharges in the U.S. listed diabetes as a diagnosis.

The prevalence of diabetes in hospitalized adults is conservatively estimated at 12–25%, depending on the thoroughness used in identifying patients. Patients presenting to hospitals may have diabetes, unrecognized diabetes, or hospital-related hyperglycemia. Using the A1C test may be a valuable case-finding tool for identifying diabetes in hospitalized patients.

A rapidly growing body of literature supports targeted glucose control in the hospital setting with potential for improved mortality, morbidity, and health care economic outcomes. Hyperglycemia in the hospital may result from stress, decompensation of type 1 diabetes, type 2 diabetes, or other forms of diabetes and/or may be iatrogenic due to administration or withholding of pharmacologic agents, including glucocorticoids, vasopressors, etc. Distinction between decompensated diabetes and stress hyperglycemia is often not made.

1. Blood glucose targets

a. General medicine and surgery.

Observational studies suggest an association between hyperglycemia and increased mortality. General medical and surgical patients with a blood glucose value(s) >220 mg/dl (12.2 mmol/l) have higher infection rates.

When admissions on general medicine and surgery units were studied, patients with new hyperglycemia had significantly increased inhospital mortality, as did patients with known diabetes. In addition, length of stay was higher for the new hyperglycemic group, and both the patients with new hyperglycemia and those with known diabetes were more likely to require intensive care unit (ICU) care and transitional or nursing home care. Better outcomes were demonstrated in patients with fasting and admission blood glucose <126 mg/dl (7 mmol/l) and all random blood glucose levels <200 mg/dl (11.1 mmol/l).

b. CVD and critical care.

The relationship of blood glucose levels and mortality in the setting of acute myocatdial infarction (AMI) has been reported. A meta-analysis of 15 previously published studies compared in-hospital mortality and CHF in both hyper- and normoglycemic patients with and without diabetes. In subjects without known diabetes whose admission blood glucose was 109.8 mg/dl (6.1 mmol/l), the relative risk for in-hospital mortality was increased significantly. When diabetes was present and admission glucose 180 mg/dl (10 mmol/l), risk of death was moderately increased compared with patients who had diabetes but no hyperglycemia on admission. In another study, admission blood glucose values were analyzed in consecutive patients with AMI. Analysis revealed an independent association of admission blood glucose and mortality. The 1-year mortality rate was significantly lower in subjects with admission plasma glucose <100.8 mg/dl (5.6 mmol/l) than in those with plasma glucose 199.8 mg/dl (11 mmol/l).

Finally, in the first Diabetes and Insulin-Glucose Infusion in Acute Myocardial Infarction (DIGAMI) study, insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with AMI was examined. Intensive subcutaneous insulin therapy for ≥3 months improved long-term survival. Mean blood glucose in the intensive insulin intervention arm was 172.8 mg/dl (9.6 mmol/l)

(compared with 210.6 mg/dl [11.7 mmol/l] in the "conventional" group). The broad range of blood glucose levels within each arm limits the ability to define specific blood glucose target thresholds.

c. Cardiac surgery.
Attainment of targeted glucose control in the setting of cardiac surgery is associated with reduced mortality and risk of deep sternal wound infections in cardiac surgery patients with diabetes and supports the concept that perioperative hyperglycemia is an independent predictor of infection in patients with diabetes , with the lowest mortality in patients with blood glucose <150 mg/dl (8.3 mmol/l).

d. Critical care.
A mixed group of patients with and without diabetes admitted to a surgical ICU were randomized to receive intensive insulin therapy (target blood glucose 80–110 mg/dl [4.4–6.1 mmol/l]). The mean blood glucose of 103 mg/dl (5.7 mmol/l) had reduced mortality during the ICU stay and decreased overall in-hospital mortality. Subsequent analysis demonstrated that for each 20 mg/dl (1.1 mmol/l) glucose was elevated above 100 mg/dl (5.5 mmol/l), the risk of ICU death increased. Hospital and ICU survival were linearly associated with ICU glucose levels, with the highest survival rates occurring in patients achieving an average blood glucose <110 mg/dl (6.1 mmol/l).

e. Acute neurological disorders.
Hyperglycemia is associated with worsened outcomes in patients with acute stroke and head injury, as evidenced by the large number of observational studies in the literature. A meta-analysis identified an admission blood glucose >110 mg/dl (6.1 mmol/l) for increased mortality for acute stroke.

2. Treatment options
a. Oral diabetes agents.
No large studies have investigated the potential roles of various oral agents on outcomes in hospitalized patients with diabetes. While the various classes of oral agents are commonly used in the outpatient setting with good response, their use in the inpatient setting presents some specific issues.

i. *Sulfonylureas and meglitinides*. The long action and predisposition to hypoglycemia in patients not consuming their normal nutrition serve as relative contraindications to routine use of sulfonylureas in the hospital for many patients. Sulfonylureas do not generally allow rapid dose adjustment to meet the changing inpatient needs. Sulfonylureas also vary in duration of action between individuals and likely vary in the frequency with which they induce hypoglycemia. While the two available meglitinides, repaglinide and neteglinide, theoretically would produce less hypoglycemia than sulfonylureas, lack of clinical trial data for these agents would preclude their use.

ii. *Metformin*. The major limitation to metformin use in the hospital is a number of specific contraindications to its use, many of which occur in the hospital. All of these contraindications relate to lactic acidosis, a potentially fatal complication of metformin therapy. The most common risk factors for lactic acidosis in metformin-treated patients are cardiac disease, including CHF, hypoperfusion, renal insufficiency, old age, and chronic pulmonary disease. Recent evidence continues to indicate lactic acidosis is a rare complication, despite the relative frequency of risk factors. However, in the hospital, where the risk for hypoxia, hypoperfusion, and renal insufficiency is much higher, it still seems prudent to avoid the use of metformin in most patients.

iii. *TZDs*. TZDs are not suitable for initiation in the hospital because of their delayed onset of effect. In addition, they do increase intravascular volume, a particular problem in those predisposed to CHF and

potentially a problem for patients with hemodynamic changes related to admission diagnoses (e.g., acute coronary ischemia) or interventions common in hospitalized patients.

In summary, each of the major classes of oral agents has significant limitations for inpatient use. Additionally, they provide little flexibility or opportunity for titration in a setting where acute changes demand these characteristics. Therefore, insulin, when used properly, may have many advantages in the hospital setting.

b. Insulin.
The inpatient insulin regimen must be matched or tailored to the specific clinical circumstance of the individual patient. A recent meta-analysis concluded that insulin therapy in critically ill patients had a beneficial effect on short-term mortality in different clinical settings.

i. *Subcutaneous insulin therapy*. Subcutaneous insulin therapy may be used to attain glucose control in most hospitalized patients with diabetes. The components of the daily insulin dose requirement can be met by a variety of insulins, depending on the particular hospital situation. Subcutaneous insulin therapy is subdivided into programmed or scheduled insulin and supplemental or correction-dose insulin. Correction-dose insulin therapy is an important adjunct to scheduled insulin, both as a dose-finding strategy and as a supplement when rapid changes in insulin requirements lead to hyperglycemia. If correction doses are frequently required, it is recommended that the appropriate scheduled insulin doses be increased the following day to accommodate the increased insulin needs. There are no studies comparing human regular insulin with rapid-acting analogs for use as correction-dose insulin. However, due to the longer duration with human regular insulin, there is a greater risk of "insulin stacking" when the usual next blood glucose measurement is performed 4–6 h later.

The traditional sliding-scale insulin regimens, usually consisting of regular insulin without any intermediate or long-acting insulins, have been shown to be ineffective. Problems cited with sliding-scale insulin regimens are that the sliding-scale regimen prescribed on admission is likely to be used throughout the hospital stay without modification. Second, sliding-scale insulin therapy treats hyperglycemia after it has already occurred, instead of preventing the occurrence of hyperglycemia. This "reactive" approach can lead to rapid changes in blood glucose levels, exacerbating both hyper- and hypoglycemia.

ii. *Intravenous insulin infusion*. The only method of insulin delivery specifically developed for use in the hospital is continuous intravenous infusion, using regular crystalline insulin. There is no advantage to using insulin lispro or aspart in an intravenous insulin infusion. The medical literature supports the use of intravenous insulin infusion in preference to the subcutaneous route of insulin administration for several clinical indications among nonpregnant adults. These include DKA and nonketotic hyperosmolar state; general preoperative, intraoperative, and postoperative care; the postoperative period following heart surgery; following organ transplantation; with cardiogenic shock; exacerbated hyperglycemia during high-dose glucocorticoid therapy; patients who are not eating (NPO) or in critical care illness in general; and as a dose-finding strategy in anticipation of initiation or reinitiation of subcutaneous insulin therapy in type 1 or type 2 diabetes.

Many institutions use insulin infusion algorithms that can be implemented by nursing staff. Algorithms should incorporate the concept that maintenance requirements differ between patients and change over the course of treatment. Although numerous algorithms have been published, there have been no head-to-head comparisons, and thus no single algorithm can be recommended for an individual hospital. Ideally, intravenous insulin algorithms should consider both the glucose level and its rate of change. For all algorithms, frequent bedside glucose testing is required but the ideal frequency is not known.

iii. *Transition from intravenous to subcutaneous insulin therapy*. There are no specific clinical trials examining how to best transition from intravenous to subcutaneous insulin or which patients with type 2 diabetes may be transitioned to oral agents. For those who will require subcutaneous insulin, it is necessary to administer short- or rapid-acting insulin subcutaneously 1–2 h before discontinuation of the intravenous insulin infusion. An intermediate- or long-acting insulin must be injected 2–3 h before discontinuing the insulin infusion. In transitioning from intravenous insulin infusion to subcutaneous therapy, the caregiver may order subcutaneous insulin with appropriate duration of action to be administered as a single dose or repeatedly to maintain basal effect until the time of day when the choice of insulin or analog preferred for basal effect normally would be provided.

3. Self-management in the hospital

Self-management in the hospital may be appropriate for competent adult patients who have a stable level of consciousness and reasonably stable known daily insulin requirements and successfully conduct self-management of diabetes at home, have physical skills appropriate to successfully self-administer insulin, perform SMBG, and have adequate oral intake. Appropriate patients are those already proficient in carbohydrate counting, use of multiple daily injections of insulin or insulin pump therapy, and sick-day management. The patient and physician in consultation with nursing staff must agree that patient self-management is appropriate under the conditions of hospitalization.

4. Preventing hypoglycemia

Hypoglycemia, especially in insulin-treated patients, is the leading limiting factor in the glycemic management of type 1 and type 2 diabetes. In the hospital, multiple additional risk factors for hypoglycemia are present, even among patients who are neither "brittle" nor tightly controlled. Patients who do not have diabetes may experience hypoglycemia in the hospital, in association with factors such as altered nutritional state, heart failure, renal or liver disease, malignancy, infection, or sepsis. Patients having diabetes may develop hypoglycemia in association with the same conditions. Additional triggering events leading to iatrogenic hypoglycemia include sudden reduction of corticosteroid dose, altered ability of the patient to self-report symptoms, reduction of oral intake, emesis, new NPO status, reduction of rate of administration of intravenous dextrose, and unexpected interruption of enteral feedings or parenteral nutrition. Altered consciousness from anesthesia may also alter typical hypoglycemic symptoms.

Despite the preventable nature of many inpatient episodes of hypoglycemia, institutions are more likely to have nursing protocols for the treatment of hypoglycemia than for its prevention.

5. Diabetes care providers

Diabetes management may be effectively offered by primary care physicians or hospitalists, but involvement of appropriately trained specialists or specialty teams may reduce length of stay, improve glycemic control, and improve outcomes. In the care of diabetes, implementation of standardized order sets for scheduled and correction-dose insulin may reduce reliance on sliding-scale management. A team approach is needed to establish hospital pathways. To implement intravenous infusion of insulin for the majority of patients having prolonged NPO status, hospitals will need multidisciplinary support for using insulin infusion therapy outside of critical care units.

6. DSME

Teaching diabetes self-management to patients in hospitals is a difficult and challenging task. Patients are hospitalized because they are ill, are under increased stress related to their hospitalization and diagnosis, and are in an environment that is not conducive to learning Ideally, people with diabetes should be taught at a time and place conducive to learning: as an outpatient in a nationally recognized program of diabetes education classes.

For the hospitalized patient, diabetes "survival skills" education is generally considered a feasible approach. Patients are taught sufficient information to enable them to go home safely. Those newly diagnosed with diabetes or who are new to insulin and or blood glucose monitoring need to be instructed before discharge to help ensure safe care upon returning home. Those patients hospitalized because of a crisis related to diabetes management or poor care at home need education to hopefully prevent subsequent episodes of hospitalization.

7. MNT

Even though hospital diets continue to be ordered by calorie levels based on the "ADA diet," it has been recommended that the term "ADA diet" no longer be used. Since 1994, the ADA has not endorsed any single meal plan or specified percentages of macronutrients. Current nutrition recommendations advise individualization based on treatment goals, physiologic parameters, and medication usage.

Because of the complexity of nutrition issues, it is recommended that a registered dietitian, knowledgeable and skilled in MNT, serve as the team member who provides MNT. The dietitian is responsible for integrating information about the patient's clinical condition, eating, and lifestyle habits and for establishing treatment goals in order to determine a realistic plan for nutrition therapy.

8. Bedside blood glucose monitoring

Implementing intensive diabetes therapy in the hospital setting requires frequent and accurate blood glucose data. This measure is analogous to an additional "vital sign" for hospitalized patients with diabetes. Bedside glucose monitoring using capillary blood has advantages over laboratory venous glucose testing because the results can be obtained rapidly at the "point of care," where therapeutic decisions are made. For this reason, the terms bedside and point-of-care glucose monitoring are used interchangeably.

For patients who are eating, commonly recommended testing frequencies are premeal and at bedtime. For patients not eating, testing every 4–6 h is usually sufficient for determining correction insulin doses. Patients controlled with continuous intravenous insulin typically require hourly blood glucose testing until the blood glucose levels are stable, then every 2 h.

Bedside blood glucose testing is usually performed with portable glucose devices that are identical or similar to devices for home SMBG.

B. Diabetes care in the school and day care setting

Recommendations

- An individualized diabetes medical management plan (DMMP) should be developed by the parent/guardian and the student's diabetes health care team. (E)
- An adequate number of school personnel should be trained in the necessary diabetes procedures (including monitoring of blood glucose levels and administration of insulin and glucagon) and in the appropriate response to high and low blood glucose levels. These school personnel need not be health care professionals. (E)
- The student with diabetes should have immediate access to diabetes supplies at all times, with supervision as needed. (E)

- The student should be permitted to monitor his or her blood glucose level and take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity if indicated in the student's DMMP. (E)

There are ≈206,000 individuals <20 years of age with diabetes in the U.S., most of whom attend school and/or some type of day care and need knowledgeable staff to provide a safe environment. Despite legal protections, children in the school and day care setting still face discrimination. Parents and the health care team should provide school systems and day care providers with the information necessary by developing an individualized DMMP, including information necessary for children with diabetes to participate fully and safely in the school/day care experience. Appropriate diabetes care in the school and day care setting is necessary for the child's immediate safety, long-term well-being, and optimal academic performance.

An adequate number of school personnel should be trained in the necessary diabetes procedures (e.g., blood glucose monitoring and insulin and glucagon administration) and in the appropriate response to high and low blood glucose levels. This will ensure that at least one adult is present to perform these procedures in a timely manner while the student is at school, on field trips, and during extracurricular activities or other school-sponsored events. These school personnel need not be health care professionals.

The student with diabetes should have immediate access to diabetes supplies at all times, with supervision as needed. A student with diabetes should be able to obtain a blood glucose level and respond to the results as quickly and conveniently as possible, minimizing the need for missing instruction in the classroom. Accordingly, a student who is capable of doing so should be permitted to monitor his or her blood glucose level and take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity. The student's desire for privacy during testing and should also be accommodated.

C. Diabetes care at diabetes camps

Recommendations

- Each camper should have a standardized medical form completed by his/her family and the physician managing the diabetes. (E)
- It is imperative that the medical staff is led by someone with expertise in managing type 1 and type 2 diabetes and includes a nursing staff (including diabetes educators and diabetes clinical nurse specialists) and registered dietitians with expertise in diabetes. (E)
- All camp staff, including medical, nursing, nutrition, and volunteer, should undergo background testing to ensure appropriateness in working with children. (E)

The concept of specialized residential and day camps for children with diabetes has become widespread throughout the U.S. and many other parts of the world. The mission of camps specialized for children and youth with diabetes is to allow for a camping experience in a safe environment.

An equally important goal is to enable children with diabetes to meet and share their experiences with one another while they learn to be more personally responsible for their disease. For this to occur, a

skilled medical and camping staff must be available to ensure optimal safety and an integrated camping/educational experience.

The diabetes camping experience is short term and is most often associated with increased physical activity relative to that experienced while at home. Thus, goals of glycemic control are more related to the avoidance of extremes in blood glucose levels than to the optimization of intensive glycemic control while away at camp.

Each camper should have a standardized medical form completed by his/her family and the physician managing the diabetes that details the camper's past medical history, immunization record, and diabetes regimen. The home insulin dosage should be recorded for each camper, including number and timing of injections or basal and bolus dosages given by continuous subcutaneous insulin infusion and type(s) of insulin used.

During camp, a daily record of the camper's progress should be made. All blood glucose levels and insulin dosages should be recorded. To ensure safety and optimal diabetes management, multiple blood glucose determinations should be made throughout each 24-h period: before meals, at bedtime, after or during prolonged and strenuous activity, and in the middle of the night when indicated for prior hypoglycemia. If major alterations of a camper's regimen appear to be indicated, it is important to discuss this with the camper and the family in addition to the child's local physician. The record of what transpired during camp should be discussed with the family when the camper is picked up.

A formal relationship with a nearby medical facility should be secured for each camp so that camp medical staff have the ability to refer to this facility for prompt treatment of medical emergencies. It is imperative that the medical staff is led by someone with expertise in managing type 1 and type 2 diabetes. Nursing staff should include diabetes educators and diabetes clinical nurse specialists. Registered dietitians with expertise in diabetes should also have input into the design of the menu and the education program. All camp staff, including medical, nursing, nutrition, and volunteer, should undergo background testing to ensure appropriateness in working with children.

D. Diabetes management in correctional institutions

Recommendations

- Patients with a diagnosis of diabetes should have a complete medical history and undergo an intake physical examination by a licensed health professional in a timely manner. (E)
- Insulin-treated patients should have a capillary blood glucose (CBG) determination within 1–2 h of arrival. (E)
- Medications and MNT should be continued without interruption upon entry into the correctional environment. (E)
- Correctional staff should be trained in the recognition, treatment, and appropriate referral for hypo- and hyperglycemia. (E)
- Train staff to recognize symptoms and signs of serious metabolic decompensation and to immediately refer the patient for appropriate medical care. (E)

- Institutions should implement a policy requiring staff to notify a physician of all CBG results outside of a specified range, as determined by the treating physician. (E)
- Identify patients with type 1 diabetes who are at high risk for DKA. (E)
- In the correctional setting, policies and procedures need to be developed and implemented to enable CBG monitoring to occur at the frequency necessitated by the individual patient's glycemic control and diabetes regimen. (E)
- Include diabetes in correctional staff education programs. (E)
- For all interinstitutional transfers, complete a medical transfer summary to be transferred with the patient. (E)
- Diabetes supplies and medication should accompany the patient during transfer. (E)
- Begin discharge planning with adequate lead time to insure continuity of care and facilitate entry into community diabetes care. (E)

At any given time, >2 million people are incarcerated in prisons and jails in the U.S. It is estimated that nearly 80,000 of these inmates have diabetes. In addition, many more people with diabetes pass through the corrections system in a given year.

People with diabetes in correctional facilities should receive care that meets national standards. Correctional institutions have unique circumstances that need to be considered so that all standards of care may be achieved. Correctional institutions should have written policies and procedures for the management of diabetes and for training of medical and correctional staff in diabetes care practices.

Reception screening should emphasize patient safety. In particular, rapid identification of all insulin-treated individuals with diabetes is essential in order to identify those at highest risk for hypo- and hyperglycemia and DKA. All insulin-treated patients should have a CBG determination within 1–2 h of arrival. Patients with a diagnosis of diabetes should have a complete medical history and physical examination by a licensed health care provider with prescriptive authority in a timely manner. It is essential that medication and MNT be continued without interruption upon entry into the correctional system, as a hiatus in either medication or appropriate nutrition may lead to either severe hypo- or hyperglycemia.

All patients must have access to prompt treatment of hypo- and hyperglycemia. Correctional staff should be trained in the recognition and treatment of hypo- and hyperglycemia, and appropriate staff should be trained to administer glucagon. Institutions should implement a policy requiring staff to notify a physician of all CBG results outside of a specified range, as determined by the treating physician.

Correctional institutions should have systems in place to ensure that insulin administration and meals are coordinated to prevent hypo- and hyperglycemia, taking into consideration the transport of residents off site and the possibility of emergency schedule changes.

Monitoring of CBG is a strategy that allows caregivers and people with diabetes to evaluate diabetes management regimens. The frequency of monitoring will vary by patients' glycemic control and diabetes regimens. Policies and procedures should be implemented to ensure that the health care staff has adequate knowledge and skills to direct the management and education of individuals with diabetes.

Patients in jails may be housed for a short period of time before being transferred or released, and it is not unusual for patients in prison to be transferred within the system several times during their incarceration. Transferring a patient with diabetes from one correctional facility to another requires a coordinated effort as does planning for discharge.

IX. HYPOGLYCEMIA AND EMPLOYMENT/LICENSURE

Recommendations

- People with diabetes should be individually considered for employment based on the requirements of the specific job and the individual's medical condition, treatment regimen, and medical history. (E)

Any person with diabetes, whether insulin treated or non–insulin treated, should be eligible for any employment for which he/she is otherwise qualified. Despite the significant medical and technological advances made in managing diabetes, discrimination in employment and licensure against people with diabetes still occurs. This discrimination is often based on apprehension that the person with diabetes may present a safety risk to the employer or the public, a fear sometimes based on misinformation or lack of up-to-date knowledge about diabetes. Perhaps the greatest concern is that hypoglycemia will cause sudden unexpected incapacitation. However, most people with diabetes can manage their condition in such a manner that there is minimal risk of incapacitation from hypoglycemia.

Because the effects of diabetes are unique to each individual, it is inappropriate to consider all people with diabetes the same. People with diabetes should be individually considered for employment based on the requirements of the specific job. Factors to be weighed in this decision include the individual's medical condition, treatment regimen (MNT, oral glucose-lowering agent, and/or insulin), and medical history, particularly in regard to the occurrence of incapacitating hypoglycemic episodes.

X. THIRD-PARTY REIMBURSEMENT FOR DIABETES CARE, SELF-MANAGEMENT EDUCATION, AND SUPPLIES

Recommendations

- Patients and practitioners should have access to all classes of antidiabetic medications, equipment, and supplies without undue controls. (E)
- MNT and DSME should be covered by insurance and other payors. (E)

To achieve optimal glucose control, the person with diabetes must be able to access health care providers who have expertise in the field of diabetes. Treatments and therapies that improve glycemic control and reduce the complications of diabetes will also significantly reduce health care costs. Access to the integral components of diabetes care, such as health care visits, diabetes supplies and medications, and self-management education, is essential. All medications and supplies, such as syringes, strips, and meters, related to the daily care of diabetes must also be reimbursed by third-party payors.

It is recognized that the use of formularies, prior authorization, and related provisions, such as competitive bidding, can manage provider practices as well as costs to the potential benefit of payors and patients. However, any controls should ensure that all classes of antidiabetic agents with unique mechanisms of action and all classes of equipment and supplies designed for use with such equipment are available to facilitate achieving glycemic goals and to reduce the risk of complications. To reach diabetes treatment goals, practitioners should have access to all classes of antidiabetic medications, equipment, and supplies without undue controls. Without appropriate safeguards, these controls could constitute an obstruction of effective care.

Medicare and many other third-party payors cover DSME (diabetes self-management training [DSMT]) and MNT. The qualified beneficiary, who meets the diagnostic criteria and medical necessity, can receive an initial benefit of 10 h of DSMT and 3 h of MNT with a potential total of 13 h of initial education as long as the services are not provided on the same date. However, not all Medicare beneficiaries with a diagnosis of diabetes will qualify for both MNT and DSMT benefits. More information on Medicare policy, including follow-up benefits, is available at http://www.diabetes.org/for-health-professionals-and-scientists/recognition/dsmt-mntfaqs.jsp.

XI. STRATEGIES FOR IMPROVING DIABETES CARE

The implementation of the standards of care for diabetes has been suboptimal in most clinical settings. A recent report (24) indicated that only 37% of adults with diagnosed diabetes achieved an A1C of <7%, only 36% had a blood pressure <130/80 mmHg, and just 48% had a cholesterol <200 mg/dl. Most distressing was that only 7.3% of diabetes subjects achieved all three treatment goals.

While numerous interventions to improve adherence to the recommended standards have been implemented, the challenge of providing uniformly effective diabetes care has thus far defied a simple solution. A major contributor to suboptimal care is a delivery system that too often is fragmented, lacks clinical information capabilities, often duplicates services, and is poorly designed for the delivery of chronic care. The Institute of Medicine has called for changes so that delivery systems provide care that is evidence based, patient centered, and systems oriented and takes advantage of information technologies that foster continuous quality improvement. Collaborative, multidisciplinary teams should be best suited to provide such care for people with chronic conditions like diabetes and to empower patients' performance of appropriate self-management. Alterations in reimbursement that reward the provision of quality care, as defined by the attainment of quality measures developed by such activities as the ADA/National Committee for Quality Assurance Diabetes Provider Recognition Program will also be required to achieve desired outcome goals.

The National Diabetes Education Program recently launched a new online resource to help health care professionals better organize their diabetes care. The www.betterdiabetescare.nih.gov website should help users design and implement more effective health care delivery systems for those with diabetes.

In recent years, numerous health care organizations, ranging from large health care systems such as the U.S. Veteran's Administration to small private practices, have implemented strategies to improve diabetes care. Successful programs have published results showing improvement in important outcomes such as A1C measurements and blood pressure and lipid determinations as well as process measures such as provision of eye exams. Successful interventions have been focused at the level of health care professionals, delivery systems, and patients. Features of successful programs reported in the literature include:

- Improving health care professional education regarding the standards of care through formal and informal education programs.
- Delivery of DSME, which has been shown to increase adherence to standard of care.
- Adoption of practice guidelines, with participation of health care professionals in the process. Guidelines should be readily accessible at the point of service, such as on patient charts, in examining rooms, in "wallet or pocket cards," on PDAs, or on office computer systems. Guidelines should begin with a summary of their major recommendations instructing health care professionals what to do and how to do it.
- Use of checklists that mirror guidelines have been successful at improving adherence to standards of care.
- Systems changes, such as provision of automated reminders to health care professionals and patients, reporting of process and outcome data to providers, and especially identification of patients at risk because of failure to achieve target values or a lack of reported values.
- Quality improvement programs combining continuous quality improvement or other cycles of analysis and intervention with provider performance data.
- Practice changes, such as clustering of dedicated diabetes visits into specific times within a primary care practice schedule and/or visits with multiple health care professionals on a single day and group visits.

- Tracking systems with either an electronic medical record or patient registry have been helpful at increasing adherence to standards of care by prospectively identifying those requiring assessments and/or treatment modifications. They likely could have greater efficacy if they suggested specific therapeutic interventions to be considered for a particular patient at a particular point in time (225).
- A variety of nonautomated systems, such as mailing reminders to patients, chart stickers, and flow sheets, have been useful to prompt both providers and patients.
- Availability of case or (preferably) care management services, usually by a nurse. Nurses, pharmacists, and other nonphysician health care professionals using detailed algorithms working under the supervision of physicians and/or nurse education calls have also been helpful. Similarly dietitians using MNT guidelines have been demonstrated to improve glycemic control.
- Availability and involvement of expert consultants, such as endocrinologists and diabetes educators.

Evidence suggests that these individual initiatives work best when provided as components of a multifactorial intervention. Therefore, it is difficult to assess the contribution of each component; however, it is clear that optimal diabetes management requires an organized, systematic approach and involvement of a coordinated team of health care professionals.

Diagnosis and Classification of Diabetes Mellitus

American Diabetes Association

Abbreviations: FPG, fasting plasma glucose • GAD, glutamic acid decarboxylase • GCT, glucose challenge test • GDM, gestational diabetes mellitus • HNF, hepatocyte nuclear factor • IFG, impaired fasting glucose • IGT, impaired glucose tolerance • MODY, maturity-onset diabetes of the young • WHO, World Health Organization

DEFINITION AND DESCRIPTION OF DIABETES MELLITUS

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.

Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the ß-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in diabetes is deficient action of insulin on target tissues. Deficient insulin action results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in the complex pathways of hormone action. Impairment of insulin secretion and defects in insulin action frequently coexist in the same patient, and it is often unclear which abnormality, if either alone, is the primary cause of the hyperglycemia.

Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. Impairment of growth and susceptibility to certain infections may also accompany chronic hyperglycemia. Acute, life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome.

Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes.

The vast majority of cases of diabetes fall into two broad etiopathogenetic categories (discussed in greater detail below). In one category, type 1 diabetes, the cause is an absolute deficiency of insulin secretion. Individuals at increased risk of developing this type of diabetes can often be identified by serological evidence of an autoimmune pathologic process occurring in the pancreatic islets and by genetic markers. In the other, much more prevalent category, type 2 diabetes, the cause is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response. In the latter category, a degree of hyperglycemia sufficient to cause pathologic and functional changes in various target tissues, but without clinical symptoms, may be present for a long period of time before diabetes is detected. During this asymptomatic period, it is possible to demonstrate an abnormality in carbohydrate metabolism by measurement of plasma glucose in the fasting state or after a challenge with an oral glucose load.

The degree of hyperglycemia (if any) may change over time, depending on the extent of the underlying disease process (Fig. 1). A disease process may be present but may not have progressed far enough to cause hyperglycemia. The same disease process can cause impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT) without fulfilling the criteria for the diagnosis of diabetes. In some individuals with diabetes, adequate glycemic control can be achieved with weight reduction, exercise, and/or oral glucose-lowering agents. These individuals therefore do not require insulin. Other individuals who have some residual insulin secretion but require exogenous insulin for adequate glycemic control can survive without it. Individuals with extensive ß-cell destruction and therefore no residual insulin secretion require insulin for survival. The severity of the metabolic abnormality can progress, regress, or stay the same. Thus, the degree of hyperglycemia reflects the severity of the underlying metabolic process and its treatment more than the nature of the process itself.

Figure 1— Disorders of glycemia: etiologic types and stages. ∗Even after presenting in ketoacidosis, these patients can briefly return to normoglycemia without requiring continuous therapy (i.e., "honeymoon" remission); ∗∗in rare instances, patients in these categories (e.g., Vacor toxicity, type 1 diabetes presenting in pregnancy) may require insulin for survival.

CLASSIFICATION OF DIABETES MELLITUS AND OTHER CATEGORIES OF GLUCOSE REGULATION

Assigning a type of diabetes to an individual often depends on the circumstances present at the time of diagnosis, and many diabetic individuals do not easily fit into a single class. For example, a person with gestational diabetes mellitus (GDM) may continue to be hyperglycemic after delivery and may be determined to have, in fact, type 2 diabetes. Alternatively, a person who acquires diabetes because of large doses of exogenous steroids may become normoglycemic once the glucocorticoids are discontinued, but then may develop diabetes many years later after recurrent episodes of pancreatitis. Another example would be a person treated with thiazides who develops diabetes years later. Because thiazides in themselves seldom cause severe hyperglycemia, such individuals probably have type 2 diabetes that is exacerbated by the drug. Thus, for the clinician and patient, it is less important to label the particular type of diabetes than it is to understand the pathogenesis of the hyperglycemia and to treat it effectively.

Type 1 diabetes (ß-cell destruction, usually leading to absolute insulin deficiency)

Immune-mediated diabetes.

This form of diabetes, which accounts for only 5–10% of those with diabetes, previously encompassed by the terms insulin-dependent diabetes, type I diabetes, or juvenile-onset diabetes, results from a cellular-mediated autoimmune destruction of the ß-cells of the pancreas. Markers of the immune destruction of the ß-cell include islet cell autoantibodies, autoantibodies to insulin, autoantibodies to glutamic acid decarboxylase (GAD_{65}), and autoantibodies to the tyrosine phosphatases IA-2 and IA-2ß. One and usually more of these autoantibodies are present in 85–90% of individuals when fasting

hyperglycemia is initially detected. Also, the disease has strong HLA associations, with linkage to the DQA and DQB genes, and it is influenced by the DRB genes. These *HLA-DR/DQ* alleles can be either predisposing or protective.

In this form of diabetes, the rate of ß-cell destruction is quite variable, being rapid in some individuals (mainly infants and children) and slow in others (mainly adults). Some patients, particularly children and adolescents, may present with ketoacidosis as the first manifestation of the disease. Others have modest fasting hyperglycemia that can rapidly change to severe hyperglycemia and/or ketoacidosis in the presence of infection or other stress. Still others, particularly adults, may retain residual ß-cell function sufficient to prevent ketoacidosis for many years; such individuals eventually become dependent on insulin for survival and are at risk for ketoacidosis. At this latter stage of the disease, there is little or no insulin secretion, as manifested by low or undetectable levels of plasma C-peptide. Immune-mediated diabetes commonly occurs in childhood and adolescence, but it can occur at any age, even in the 8th and 9th decades of life.

Autoimmune destruction of ß-cells has multiple genetic predispositions and is also related to environmental factors that are still poorly defined. Although patients are rarely obese when they present with this type of diabetes, the presence of obesity is not incompatible with the diagnosis. These patients are also prone to other autoimmune disorders such as Graves' disease, Hashimoto's thyroiditis, Addison's disease, vitiligo, celiac sprue, autoimmune hepatitis, myasthenia gravis, and pernicious anemia.

Idiopathic diabetes.
Some forms of type 1 diabetes have no known etiologies. Some of these patients have permanent insulinopenia and are prone to ketoacidosis, but have no evidence of autoimmunity. Although only a minority of patients with type 1 diabetes fall into this category, of those who do, most are of African or Asian ancestry. Individuals with this form of diabetes suffer from episodic ketoacidosis and exhibit varying degrees of insulin deficiency between episodes. This form of diabetes is strongly inherited, lacks immunological evidence for ß-cell autoimmunity, and is not HLA associated. An absolute requirement for insulin replacement therapy in affected patients may come and go.

Type 2 diabetes (ranging from predominantly insulin resistance with relative insulin deficiency to predominantly an insulin secretory defect with insulin resistance)
This form of diabetes, which accounts for ~90–95% of those with diabetes, previously referred to as non-insulin-dependent diabetes, type II diabetes, or adult-onset diabetes, encompasses individuals who have insulin resistance and usually have relative (rather than absolute) insulin deficiency At least initially, and often throughout their lifetime, these individuals do not need insulin treatment to survive. There are probably many different causes of this form of diabetes. Although the specific etiologies are not known, autoimmune destruction of ß-cells does not occur, and patients do not have any of the other causes of diabetes listed above or below.

Most patients with this form of diabetes are obese, and obesity itself causes some degree of insulin resistance. Patients who are not obese by traditional weight criteria may have an increased percentage of body fat distributed predominantly in the abdominal region. Ketoacidosis seldom occurs spontaneously in this type of diabetes; when seen, it usually arises in association with the stress of another illness such as infection. This form of diabetes frequently goes undiagnosed for many years because the hyperglycemia develops gradually and at earlier stages is often not severe enough for the patient to notice any of the classic symptoms of diabetes.
Nevertheless, such patients are at increased risk of developing macrovascular and microvascular complications. Whereas patients with this form of diabetes may have insulin levels that appear normal

or elevated, the higher blood glucose levels in these diabetic patients would be expected to result in even higher insulin values had their ß-cell function been normal. Thus, insulin secretion is defective in these patients and insufficient to compensate for insulin resistance. Insulin resistance may improve with weight reduction and/or pharmacological treatment of hyperglycemia but is seldom restored to normal The risk of developing this form of diabetes increases with age, obesity, and lack of physical activity. It occurs more frequently in women with prior GDM and in individuals with hypertension or dyslipidemia, and its frequency varies in different racial/ethnic subgroups. It is often associated with a strong genetic predisposition, more so than is the autoimmune form of type 1 diabetes. However, the genetics of this form of diabetes are complex and not clearly defined.

Other specific types of diabetes
Genetic defects of the ß-cell.
Several forms of diabetes are associated with monogenetic defects in ß-cell function. These forms of diabetes are frequently characterized by onset of hyperglycemia at an early age (generally before age 25 years). They are referred to as maturity-onset diabetes of the young (MODY) and are characterized by impaired insulin secretion with minimal or no defects in insulin action. They are inherited in an autosomal dominant pattern. Abnormalities at six genetic loci on different chromosomes have been identified to date. The most common form is associated with mutations on chromosome 12 in a hepatic transcription factor referred to as hepatocyte nuclear factor (HNF)-1α. A second form is associated with mutations in the glucokinase gene on chromosome 7p and results in a defective glucokinase molecule. Glucokinase converts glucose to glucose-6-phosphate, the metabolism of which, in turn, stimulates insulin secretion by the ß-cell. Thus, glucokinase serves as the "glucose sensor" for the ß-cell. Because of defects in the glucokinase gene, increased plasma levels of glucose are necessary to elicit normal levels of insulin secretion. The less common forms result from mutations in other transcription factors, including HNF-4α, HNF-1ß, insulin promoter factor (IPF)-1, and NeuroD1.

Point mutations in mitochondrial DNA have been found to be associated with diabetes mellitus and deafness The most common mutation occurs at position 3243 in the tRNA leucine gene, leading to an A-to-G transition. An identical lesion occurs in the MELAS syndrome (mitochondrial myopathy, encephalopathy, lactic acidosis, and stroke-like syndrome); however, diabetes is not part of this syndrome, suggesting different phenotypic expressions of this genetic lesion.

Genetic abnormalities that result in the inability to convert proinsulin to insulin have been identified in a few families, and such traits are inherited in an autosomal dominant pattern. The resultant glucose intolerance is mild. Similarly, the production of mutant insulin molecules with resultant impaired receptor binding has also been identified in a few families and is associated with an autosomal inheritance and only mildly impaired or even normal glucose metabolism.

Genetic defects in insulin action.
There are unusual causes of diabetes that result from genetically determined abnormalities of insulin action. The metabolic abnormalities associated with mutations of the insulin receptor may range from hyperinsulinemia and modest hyperglycemia to severe diabetes. Some individuals with these mutations may have acanthosis nigricans. Women may be virilized and have enlarged, cystic ovaries. In the past, this syndrome was termed type A insulin resistance. Leprechaunism and the Rabson-Mendenhall syndrome are two pediatric syndromes that have mutations in the insulin receptor gene with subsequent alterations in insulin receptor function and extreme insulin resistance.
The former has characteristic facial features and is usually fatal in infancy, while the latter is associated with abnormalities of teeth and nails and pineal gland hyperplasia.

Alterations in the structure and function of the insulin receptor cannot be demonstrated in patients with insulin-resistant lipoatrophic diabetes. Therefore, it is assumed that the lesion(s) must reside in the postreceptor signal transduction pathways.

Diseases of the exocrine pancreas
Any process that diffusely injures the pancreas can cause diabetes. Acquired processes include pancreatitis, trauma, infection, pancreatectomy, and pancreatic carcinoma. With the exception of that caused by cancer, damage to the pancreas must be extensive for diabetes to occur; adrenocarcinomas that involve only a small portion of the pancreas have been associated with diabetes. This implies a mechanism other than simple reduction in ß-cell mass. If extensive enough, cystic fibrosis and hemochromatosis will also damage ß-cells and impair insulin secretion. Fibrocalculous pancreatopathy may be accompanied by abdominal pain radiating to the back and pancreatic calcifications identified on X-ray examination. Pancreatic fibrosis and calcium stones in the exocrine ducts have been found at autopsy.

Endocrinopathies
Several hormones (e.g., growth hormone, cortisol, glucagon, epinephrine) antagonize insulin action. Excess amounts of these hormones (e.g., acromegaly, Cushing's syndrome, glucagonoma, pheochromocytoma, respectively) can cause diabetes. This generally occurs in individuals with preexisting defects in insulin secretion, and hyperglycemia typically resolves when the hormone excess is resolved.

Somatostatinoma- and aldosteronoma-induced hypokalemia can cause diabetes, at least in part, by inhibiting insulin secretion. Hyperglycemia generally resolves after successful removal of the tumor.

Drug- or chemical-induced diabetes
Many drugs can impair insulin secretion. These drugs may not cause diabetes by themselves, but they may precipitate diabetes in individuals with insulin resistance. In such cases, the classification is unclear because the sequence or relative importance of ß-cell dysfunction and insulin resistance is unknown. Certain toxins such as Vacor (a rat poison) and intravenous pentamidine can permanently destroy pancreatic ß-cells. Such drug reactions fortunately are rare. There are also many drugs and hormones that can impair insulin action. Examples include nicotinic acid and glucocorticoids. Patients receiving α-interferon have been reported to develop diabetes associated with islet cell antibodies and, in certain instances, severe insulin deficiency. The list shown in Table 1 is not all-inclusive, but reflects the more commonly recognized drug-, hormone-, or toxin-induced forms of diabetes.

Table 1— Etiologic classification of diabetes mellitus

I. Type 1 diabetes (ß-cell destruction, usually leading to absolute insulin deficiency)
A. Immune mediated
B. Idiopathic
II. Type 2 diabetes (may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance)
III. Other specific types
A. Genetic defects of ß-cell function

1. Chromosome 12, HNF-1α (MODY3)
2. Chromosome 7, glucokinase (MODY2)
3. Chromosome 20, HNF-4α (MODY1)
4. Chromosome 13, insulin promoter factor-1 (IPF-1; MODY4)
5. Chromosome 17, HNF-1ß (MODY5)
6. Chromosome 2, *NeuroD1* (MODY6)
7. Mitochondrial DNA
8. Others

B. Genetic defects in insulin action

1. Type A insulin resistance
2. Leprechaunism
3. Rabson-Mendenhall syndrome
4. Lipoatrophic diabetes
5. Others

C. Diseases of the exocrine pancreas

1. Pancreatitis
2. Trauma/pancreatectomy
3. Neoplasia
4. Cystic fibrosis
5. Hemochromatosis
6. Fibrocalculous pancreatopathy
7. Others

D. Endocrinopathies

1. Acromegaly
2. Cushing's syndrome
3. Glucagonoma
4. Pheochromocytoma
5. Hyperthyroidism
6. Somatostatinoma
7. Aldosteronoma
8. Others

E. Drug- or chemical-induced

1. Vacor
2. Pentamidine
3. Nicotinic acid
4. Glucocorticoids
5. Thyroid hormone
6. Diazoxide
7. ß-adrenergic agonists
8. Thiazides
9. Dilantin
10. α-Interferon
11. Others

F. Infections

1. Congenital rubella
2. Cytomegalovirus
3. Others

G. Uncommon forms of immune-mediated diabetes

1. "Stiff-man" syndrome
2. Anti–insulin receptor antibodies
3. Others

H. Other genetic syndromes sometimes associated with diabetes

1. Down's syndrome
2. Klinefelter's syndrome
3. Turner's syndrome
4. Wolfram's syndrome
5. Friedreich's ataxia
6. Huntington's chorea
7. Laurence-Moon-Biedl syndrome
8. Myotonic dystrophy
9. Porphyria
10. Prader-Willi syndrome

11. Others

IV. Gestational diabetes mellitus (GDM)

Patients with any form of diabetes may require insulin treatment at some stage of their disease. Such use of insulin does not, of itself, classify the patient.

Infections
Certain viruses have been associated with ß-cell destruction. Diabetes occurs in patients with congenital rubella, although most of these patients have HLA and immune markers characteristic of type 1 diabetes. In addition, coxsackievirus B, cytomegalovirus, adenovirus, and mumps have been implicated in inducing certain cases of the disease.

Uncommon forms of immune-mediated diabetes
In this category, there are two known conditions, and others are likely to occur. The stiff-man syndrome is an autoimmune disorder of the central nervous system characterized by stiffness of the axial muscles with painful spasms. Patients usually have high titers of the GAD autoantibodies, and approximately one-third will develop diabetes.

Anti–insulin receptor antibodies can cause diabetes by binding to the insulin receptor, thereby blocking the binding of insulin to its receptor in target tissues. However, in some cases, these antibodies can act as an insulin agonist after binding to the receptor and can thereby cause hypoglycemia. Anti–insulin receptor antibodies are occasionally found in patients with systemic lupus erythematosus and other autoimmune diseases. As in other states of extreme insulin resistance, patients with anti–insulin receptor antibodies often have acanthosis nigricans. In the past, this syndrome was termed type B insulin resistance.

Other genetic syndromes sometimes associated with diabetes
Many genetic syndromes are accompanied by an increased incidence of diabetes mellitus. These include the chromosomal abnormalities of Down's syndrome, Klinefelter's syndrome, and Turner's syndrome. Wolfram's syndrome is an autosomal recessive disorder characterized by insulin-deficient diabetes and the absence of ß-cells at autopsy. Additional manifestations include diabetes insipidus, hypogonadism, optic atrophy, and neural deafness. Other syndromes are listed in Table 1.

Gestational diabetes mellitus (GDM)
GDM is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The definition applies regardless of whether insulin or only diet modification is used for treatment or whether the condition persists after pregnancy. It does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy. GDM complicates ~4% of all pregnancies in the U.S., resulting in ~135,000 cases annually. The prevalence may range from 1 to 14% of pregnancies, depending on the population studied. GDM represents nearly 90% of all pregnancies complicated by diabetes.

Deterioration of glucose tolerance occurs normally during pregnancy, particularly in the 3rd trimester.

Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG)
The Expert Committee recognized an intermediate group of subjects whose glucose levels, although not meeting criteria for diabetes, are nevertheless too high to be considered normal. This group is defined as having fasting plasma glucose (FPG) levels ≥100 mg/dl (5.6 mmol/l) but <126 mg/dl (7.0

mmol/l) *or* 2-h values in the oral glucose tolerance test (OGTT) of ≥140 mg/dl (7.8 mmol/l) but <200 mg/dl (11.1 mmol/l). Thus, the categories of FPG values are as follows:

- FPG <100 mg/dl (5.6 mmol/l) = normal fasting glucose;
- FPG 100–125 mg/dl (5.6–6.9 mmol/l) = IFG (impaired fasting glucose);
- FPG ≥126 mg/dl (7.0 mmol/l) = provisional diagnosis of diabetes (the diagnosis must be confirmed, as described below).

The corresponding categories when the OGTT is used are the following:

- 2-h postload glucose <140 mg/dl (7.8 mmol/l) = normal glucose tolerance;
- 2-h postload glucose 140–199 mg/dl (7.8–11.1 mmol/l) = IGT (impaired glucose tolerance);
- 2-h postload glucose ≥200 mg/dl (11.1 mmol/l) = provisional diagnosis of diabetes (the diagnosis must be confirmed, as described below).

Patients with IFG and/or IGT are now referred to as having "pre-diabetes" indicating the relatively high risk for development of diabetes in these patients. In the absence of pregnancy, IFG and IGT are not clinical entities in their own right but rather risk factors for future diabetes as well as cardiovascular disease. They can be observed as intermediate stages in any of the disease processes listed in Table 1. IFG and IGT are associated with the metabolic syndrome, which includes obesity (especially abdominal or visceral obesity), dyslipidemia of the high-triglyceride and/or low-HDL type, and hypertension. It is worth mentioning that medical nutrition therapy aimed at producing 5–10% loss of body weight, exercise, and certain pharmacological agents have been variably demonstrated to prevent or delay the development of diabetes in people with IGT; the potential impact of such interventions to reduce cardiovascular risk has not been examined to date.

Note that many individuals with IGT are euglycemic in their daily lives. Individuals with IFG or IGT may have normal or near normal glycated hemoglobin levels. Individuals with IGT often manifest hyperglycemia only when challenged with the oral glucose load used in the standardized OGTT.

DIAGNOSTIC CRITERIA FOR DIABETES MELLITUS

The criteria for the diagnosis of diabetes are shown in Table 2. Three ways to diagnose diabetes are possible, and each, in the absence of unequivocal hyperglycemia, must be confirmed, on a subsequent day, by any one of the three methods given in Table 2. The use of the hemoglobin A1c (A1C) for the diagnosis of diabetes is not recommended at this time.

Table 2— Criteria for the diagnosis of diabetes mellitus

1. Symptoms of diabetes plus casual plasma glucose concentration ≥200 mg/dl (11.1 mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss. OR 2. FPG ≥126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h. OR 3. 2-h postload glucose ≥200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.

In the absence of unequivocal hyperglycemia, these criteria should be confirmed by repeat testing on a different day. The third measure (OGTT) is not recommended for routine clinical use.

Diagnosis of GDM

The criteria for abnormal glucose tolerance in pregnancy are those of Carpenter and Coustan. Recommendations from the American Diabetes Association's Fourth International Workshop-Conference on Gestational Diabetes Mellitus held in March 1997 support the use of the Carpenter/Coustan diagnostic criteria as well as the alternative use of a diagnostic 75-g 2-h OGTT. These criteria are summarized below.

Testing for gestational diabetes

Previous recommendations included screening for GDM performed in all pregnancies. However, there are certain factors that place women at lower risk for the development of glucose intolerance during pregnancy, and it is likely not cost-effective to screen such patients. Pregnant women who fulfill *all* of these criteria need not be screened for GDM.

This low-risk group comprises women who

- are <25 years of age
- are a normal body weight
- have no family history (i.e., first-degree relative) of diabetes
- have no history of abnormal glucose metabolism
- have no history of poor obstetric outcome
- are not members of an ethnic/racial group with a high prevalence of diabetes (e.g., Hispanic American, Native American, Asian American, African American, Pacific Islander)

Risk assessment for GDM should be undertaken at the first prenatal visit. Women with clinical characteristics consistent with a high risk of GDM (marked obesity, personal history of GDM, glycosuria, or a strong family history of diabetes) should undergo glucose testing (see below) as soon as feasible.

If they are found not to have GDM at that initial screening, they should be retested between 24 and 28 weeks of gestation. Women of average risk should have testing undertaken at 24–28 weeks of gestation.

A fasting plasma glucose level >126 mg/dl (7.0 mmol/l) or a casual plasma glucose >200 mg/dl (11.1 mmol/l) meets the threshold for the diagnosis of diabetes. In the absence of unequivocal hyperglycemia, the diagnosis must be confirmed on a subsequent day. Confirmation of the diagnosis precludes the need for any glucose challenge. In the absence of this degree of hyperglycemia, evaluation for GDM in women with average or high-risk characteristics should follow one of two approaches.

One-step approach
Perform a diagnostic OGTT without prior plasma or serum glucose screening. The one-step approach may be cost-effective in high-risk patients or populations (e.g., some Native-American groups).

Two-step approach
Perform an initial screening by measuring the plasma or serum glucose concentration 1 h after a 50-g oral glucose load (glucose challenge test [GCT]) and perform a diagnostic OGTT on that subset of women exceeding the glucose threshold value on the GCT. When the two-step approach is used, a glucose threshold value >140 mg/dl (7.8 mmol/l) identifies ~80% of women with GDM, and the yield is further increased to 90% by using a cutoff of >130 mg/dl (7.2 mmol/l).

With either approach, the diagnosis of GDM is based on an OGTT. Diagnostic criteria for the 100-g OGTT are derived from the original work of O'Sullivan and Mahan (4) modified by Carpenter and Coustan (3) and are shown in the top of Table 3. Alternatively, the diagnosis can be made using a 75-g glucose load and the glucose threshold values listed for fasting, 1 h, and 2 h (Table 2, bottom); however, this test is not as well validated as the 100-g OGTT.

Table 3— Diagnosis of GDM with a 100-g or 75-g glucose load

	mg/dl	mmol/l
100-g glucose load		
Fasting	95	5.3
1-h	180	10.0
2-h	155	8.6
3-h	140	7.8
75-g glucose load		
Fasting	95	5.3
1-h	180	10.0
2-h	155	8.6

Two or more of the venous plasma concentrations must be met or exceeded for a positive diagnosis. The test should be done in the morning after an overnight fast of between 8 and 14 h and after at least 3

days of unrestricted diet (≥150 g carbohydrate per day) and unlimited physical activity. The subject should remain seated and should not smoke throughout the test.

Diabetes Care in the School and Day Care Setting

INTRODUCTION

Diabetes is one of the most common chronic diseases of childhood. There are about 176,000 individuals <20 years of age with diabetes in the U.S. The majority of these young people attend school and/or some type of day care and need knowledgeable staff to provide a safe school environment. Both parents and the health care team should work together to provide school systems and day care providers with the information necessary to allow children with diabetes to participate fully and safely in the school experience.

DIABETES AND THE LAW

Federal laws that protect children with diabetes include Section 504 of the Rehabilitation Act of 1973, the Individuals with Disabilities Education Act of 1991 (originally the Education for All Handicapped Children Act of 1975), and the Americans with Disabilities Act. Under these laws, diabetes has been considered to be a disability, and it is illegal for schools and/or day care centers to discriminate against children with disabilities. In addition, any school that receives federal funding or any facility considered open to the public must reasonably accommodate the special needs of children with diabetes. Indeed, federal law requires an individualized assessment of any child with diabetes. The required accommodations should be provided within the child's usual school setting with as little disruption to the school's and the child's routine as possible and allowing the child full participation in all school activities.

Despite these protections, children in the school and day care setting still face discrimination. For example, some day care centers may refuse admission to children with diabetes, and children in the classroom may not be provided the assistance necessary to monitor blood glucose and may be prohibited from eating needed snacks. The American Diabetes Association works to ensure the safe and fair treatment of children with diabetes in the school and day care setting (www.diabetes.org/schooldiscrimination).

Diabetes care in schools

Appropriate diabetes care in the school and day care setting is necessary for the child's immediate safety, long-term well being, and optimal academic performance. The Diabetes Control and Complications Trial showed a significant link between blood glucose control and the later development of diabetes complications, with improved glycemic control decreasing the risk of these complications. To achieve glycemic control, a child must monitor blood glucose frequently, follow a meal plan, and take medications. Insulin is usually taken in multiple daily injections or through an infusion pump. Crucial to achieving glycemic control is an understanding of the effects of physical activity, nutrition therapy, and insulin on blood glucose levels.

To facilitate the appropriate care of the student with diabetes, school and day care personnel must have an understanding of diabetes and must be trained in its management and in the treatment of diabetes emergencies. Knowledgeable trained personnel are essential if the student is to avoid the immediate health risks of low blood glucose and to achieve the metabolic control required to decrease risks for later development of diabetes complications. Studies have shown that the majority of school personnel have an inadequate understanding of diabetes and that parents of children with diabetes lack confidence in their teachers' ability to manage diabetes effectively. Consequently, diabetes education must be targeted toward day care providers, teachers, and other school personnel who interact with the child, including school administrators, school coaches, school nurses, health aides, bus drivers, secretaries, etc. Current recommendations and up-to-date resources regarding appropriate care for children with diabetes in the school are universally available to all school personnel.

The purpose of this position statement is to provide recommendations for the management of children with diabetes in the school and day care setting.

GENERAL GUIDELINES FOR THE CARE OF THE CHILD IN THE SCHOOL AND DAY CARE SETTING

I. Diabetes Medical Management Plan

An individualized Diabetes Medical Management Plan should be developed by the parent/ guardian and the student's diabetes health care team. Inherent in this process are delineated responsibilities assumed by all parties, including the parent/guardian, the school personnel, and the student. These responsibilities are outlined in this position statement. The Diabetes Medical Management Plan should address the specific needs of the child and provide specific instructions for each of the following:

1. Blood glucose monitoring, including the frequency and circumstances requiring blood glucose checks.
2. Insulin administration (if necessary), including doses/injection times prescribed for specific blood glucose values and the storage of insulin.
3. Meals and snacks, including food content, amounts, and timing.
4. Symptoms and treatment of hypoglycemia (low blood glucose), including the administration of glucagon if recommended by the student's treating physician.
5. Symptoms and treatment of hyperglycemia (high blood glucose).
6. Checking for ketones and appropriate actions to take for abnormal ketone levels, if requested by the student's health care provider.

II. Responsibilities of the various care providers

A. The parent/guardian should provide the school or day care provider with the following:

   1. All materials and equipment necessary for diabetes care tasks, including blood glucose monitoring, insulin administration (if needed), and urine or blood ketone monitoring. The parent/guardian is responsible for the maintenance of the blood glucose monitoring

equipment (i.e., cleaning and performing controlled testing per the manufacturer's instructions) and must provide materials necessary to ensure proper disposal of materials. A separate logbook should be kept at school with the diabetes supplies for the staff or student to record blood glucose and ketone results; blood glucose values should be transmitted to the parent/guardian for review as often as requested.

2. Supplies to treat hypoglycemia, including a source of glucose and a glucagon emergency kit, if indicated in the Diabetes Medical Management Plan.

3. Information about diabetes and the performance of diabetes-related tasks.

4. Emergency phone numbers for the parent/guardian and the diabetes health care team so that the school can contact these individuals with diabetes-related questions and/or during emergencies.

5. Information about the student's meal/snack schedule. The parent should work with the school to coordinate this schedule with that of the other students as closely as possible. For young children, instructions should be given for when food is provided during school parties and other activities.

6. In most locations and increasingly, a signed release of confidentiality from the legal guardian will be required so that the health care team can communicate with the school. Copies should be retained both at school and in the health care professionals' offices.

B. The school or day care provider should provide the following:

1. Training to all adults who provide education/care for the student on the symptoms and treatment of hypoglycemia and hyperglycemia and other emergency procedures. An adult and back-up adult(s) trained to *1*) perform fingerstick blood glucose monitoring and record the results; *2*) take appropriate actions for blood glucose levels outside of the target ranges as indicated in the student's Diabetes Medical Management Plan; and *3*) test the urine or blood for ketones, when necessary, and respond to the results.

2. Immediate accessibility to the treatment of hypoglycemia by a knowledgeable adult. The student should remain supervised until appropriate treatment has been administered, and the treatment should be available as close to where the student is as possible.

3. If indicated by the child's developmental capabilities and the Diabetes Medical Management Plan, an adult and back-up adult(s) trained in insulin administration.

4. An adult and back-up adult(s) trained to administer glucagon, in accordance with the student's Diabetes Medical Management Plan.

5. A location in the school to provide privacy during blood glucose monitoring and insulin administration, if desired by the student and family, or permission for the student to check his or her blood glucose level and to take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity, if indicated in the student's Diabetes Medical Management Plan.

6. An adult and back-up adult(s) responsible for the student who will know the schedule of the student's meals and snacks and work with the parent/guardian to coordinate this

schedule with that of the other students as closely as possible. This individual also will notify the parent/guardian in advance of any expected changes in the school schedule that affect the student's meal times or exercise routine. Young children should be reminded of snack times.

7. Permission for the student to see the school nurse and other trained school personnel upon request.
8. Permission for the student to eat a snack anywhere, including the classroom or the school bus, if necessary to prevent or treat hypoglycemia.
9. Permission to miss school without consequences for required medical appointments to monitor the student's diabetes management. This should be an excused absence with a doctor's note, if required by usual school policy.
10. Permission for the student to use the restroom and have access to fluids (i.e., water) as necessary.
11. An appropriate location for insulin and/or glucagon storage, if necessary.

An adequate number of school personnel should be trained in the necessary diabetes procedures (e.g., blood glucose monitoring, insulin and glucagon administration) and in the appropriate response to high and low blood glucose levels to ensure that at least one adult is present to perform these procedures in a timely manner while the student is at school, on field trips, and during extracurricular activities or other school-sponsored events. These school personnel need not be health care professionals.

The student with diabetes should have immediate access to diabetes supplies at all times, with supervision as needed. Provisions similar to those described above must be available for field trips, extracurricular activities, other school-sponsored events, and on transportation provided by the school or day care facility to enable full participation in school activities.

It is the school's legal responsibility to provide appropriate training to school staff on diabetes-related tasks and in the treatment of diabetes emergencies. This training should be provided by health care professionals with expertise in diabetes unless the student's health care provider determines that the parent/guardian is able to provide the school personnel with sufficient oral and written information to allow the school to have a safe and appropriate environment for the child. If appropriate, members of the health care team should provide instruction and materials to the parent/guardian to facilitate the education of school staff. Educational materials from the American Diabetes Association and other sources targeted to school personnel and/or parents are avail-able. Table 1 includes a listing of appropriate resources.

Table 1— Resources for teachers, child care providers, parents, and health professionals

Helping the Student with Diabetes Succeed: A Guide for School Personnel, National Diabetes Education Program, 2003; available online at www.ndep.nih.gov.

Diabetes Care Tasks at School: What Key Personnel Need to Know, Alexandria, VA, American Diabetes Association; available online at www.diabetes.org/schooltraining.

Health in Action: Diabetes and the School Community, American School Health Association, American Diabetes Association, Aug/Sept. 2002, Vol. 1, No. 1, 330-678-1601.

Your School & Your Rights: Protecting Children with Diabetes Against Discrimination in Schools and Day Care Centers, Alexandria, VA, American Diabetes Association, 2001 (brochure); available online at http://www.diabetes.orgype1/parents_kids/away/scrights.jsp.*

Your Child Has Type 1 Diabetes: What You Should Know, Alexandria, VA, American Diabetes Association, 2001 (brochure); available online at http://www.diabetes.org/main/community/advocacyype1.jsp.*

Treating Diabetes Emergencies: What You Need to Know, Alexandria, VA, American Diabetes Association, 1995 (video); 1-800-232-6733.

American Diabetes Association: *Complete Guide to Diabetes*, Alexandria, VA, American Diabetes Association, 2005; 1-800-232-6733.

Raising a Child with Diabetes: A Guide for Parents, Alexandria, VA, American Diabetes Association, 2000; 1-800-232-6733.

Clarke W: Advocating for the child with diabetes. *Diabetes Spectrum* 12:230–236, 1999.

Education Discrimination Resources List, Alexandria VA, American Diabetes Association, 2000.*

Wizdom: A Kit of Wit and Wisdom for Kids with Diabetes (and their parents), Alexandria, VA, American Diabetes Association, 2000. Order information and select resources available at www.diabetes.org/wizdom.

The Care of Children with Diabetes in Child Care and School Setting (video); available from, Managed Design, Inc., P.O. Box 3067, Lawrence, KS 66046, (785) 842-9088.

Fredrickson L, Griff M: *Pumper in the School, Insulin Pump Guide for School Nurses, School Personnel and Parents. MiniMed Professional Education, Your Clinical Coach. First Edition, May 2000*. MiniMed, Inc., 1-800-440-7867.

Tappon D. Parker M, Bailey W: *Easy As ABC, What You Need to Know About Children Using Insulin Pumps in School*. Disetronic Medical Systems, Inc., 1-800-280-7801.

* These documents are available in the American Diabetes Association's Education Discrimination Packet by calling 1-800-DIABETES.

III. Expectations of the student in diabetes care

Children and youths should be able to implement their diabetes care at school with parental consent to

the extent that is appropriate for the student's development and his or her experience with diabetes. The extent of the student's ability to participate in diabetes care should be agreed upon by the school personnel, the parent/guardian, and the health care team, as necessary. The ages at which children are able to perform self-care tasks are very individual and variable, and a child's capabilities and willingness to provide self-care should be respected.

1. *Preschool and day care*. The preschool child is usually unable to perform diabetes tasks independently. By 4 years of age, children may be expected to generally cooperate in diabetes tasks.

2. *Elementary school*. The child should be expected to cooperate in all diabetes tasks at school. By age 8 years, most children are able to perform their own fingerstick blood glucose tests with supervision. By age 10, some children can administer insulin with supervision.

3. *Middle school or junior high school*. The student should be able to administer insulin with supervision and perform self-monitoring of blood glucose under usual circumstances when not experiencing a low blood glucose level.

4. *High school*. The student should be able to perform self-monitoring of blood glucose under usual circumstances when not experiencing low blood glucose levels. In high school, adolescents should be able to administer insulin without supervision.

At all ages, individuals with diabetes may require help to perform a blood glucose check when the blood glucose is low. In addition, many individuals require a reminder to eat or drink during hypoglycemia and should not be left unsupervised until such treatment has taken place and the blood glucose value has returned to the normal range.

MONITORING BLOOD GLUCOSE IN THE CLASSROOM

It is best for a student with diabetes to monitor a blood glucose level and to respond to the results as quickly and conveniently as possible. This is important to avoid medical problems being worsened by a delay in monitoring reatment and to minimize educational problems caused by missing instruction in the classroom. Accordingly, as stated earlier, a student should be permitted to monitor his or her blood glucose level and take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity, if preferred by the student and indicated in the student's Diabetes Medical Management Plan. However, some students desire privacy for blood glucose monitoring and other diabetes care tasks and this preference should also be accommodated.

In summary, with proper planning and the education and training of school personnel, children and youth with diabetes can fully participate in the school experience. To this end, the family, the health care team, and the school should work together to ensure a safe learning environment.

APPENDIX: BACKGROUND INFORMATION ON DIABETES FOR SCHOOL PERSONNEL

Diabetes is a serious, chronic disease that impairs the body's ability to use food. Insulin, a hormone produced by the pancreas, helps the body convert food into energy. In people with diabetes, either the pancreas does not make insulin or the body cannot use insulin properly. Without insulin, the body's

main energy source—glucose—cannot be used as fuel. Rather, glucose builds up in the blood. Over many years, high blood glucose levels can cause damage to the eyes, kidneys, nerves, heart, and blood vessels.

The majority of school-aged youth with diabetes have type 1 diabetes. People with type 1 diabetes do not produce insulin and must receive insulin through either injections or an insulin pump. Insulin taken in this manner does not cure diabetes and may cause the student's blood glucose level to become dangerously low. Type 2 diabetes, the most common form of the disease typically afflicting obese adults, has been shown to be increasing in youth. This may be due to the increase in obesity and decrease in physical activity in young people. Students with type 2 diabetes may be able to control their disease through diet and exercise alone or may require oral medications and/or insulin injections. All people with type 1 and type 2 diabetes must carefully balance food, medications, and activity level to keep blood glucose levels as close to normal as possible.

Low blood glucose (hypoglycemia) is the most common immediate health problem for students with diabetes. It occurs when the body gets too much insulin, too little food, a delayed meal, or more than the usual amount of exercise. Symptoms of mild to moderate hypoglycemia include tremors, sweating, light-headedness, irritability, confusion, and drowsiness. A student with this degree of hypoglycemia will need to ingest carbohydrates promptly and may require assistance. Severe hypoglycemia, which is rare, may lead to unconsciousness and convulsions and can be life-threatening if not treated promptly.

High blood glucose (hyperglycemia) occurs when the body gets too little insulin, too much food, or too little exercise; it may also be caused by stress or an illness such as a cold. The most common symptoms of hyperglycemia are thirst, frequent urination, and blurry vision. If untreated over a period of days, hyperglycemia can cause a serious condition called diabetic ketoacidosis (DKA), which is characterized by nausea, vomiting, and a high level of ketones in the blood and urine. For students using insulin infusion pumps, lack of insulin supply may lead to DKA more rapidly. DKA can be life-threatening and thus requires immediate medical attention.

Diabetes Care at Diabetes Camps

INTRODUCTION

Since Leonard F.C. Wendt, MD, opened the doors of the first diabetes camp in Michigan in 1925, the concept of specialized residential and day camps for children with diabetes has become widespread throughout the U.S. and many other parts of the world. It is estimated that worldwide camps serve 15,000–20,000 campers with diabetes each summer.

The mission of camps specialized for children and youth with diabetes is to facilitate a traditional camping experience in a medically safe environment. An equally important goal is to enable children with diabetes to meet and share their experiences with one another while they learn to be more responsible for their condition. For this to occur, a skilled medical and camping staff must be available to ensure optimal safety and an integrated camping/educational experience.

DIABETES MANAGEMENT AT CAMP

The recommendations for diabetes management of children at a diabetes camp are not significantly

different from what has been outlined by the American Diabetes Association (ADA) as the standards of care for people with type 1 diabetes or for children with diabetes in the school or day care setting. In general, the diabetes camping experience is short term and is most often associated with increased physical activity relative to that experienced at home. Thus, goals of glycemic control are more related to the avoidance of extremes of blood glucose than to the optimization of overall glycemic control while away at camp. The management protocol aims to balance insulin dosage with activity level and food intake so that blood glucose levels stay within a safe target range, especially with respect to the prevention and management of hypoglycemia. Each camper should have a standardized comprehensive health history form completed by his/her family and a health evaluation form completed by the physician managing the diabetes that details the camper's past medical history, immunization record, and diabetes regimen. The home insulin dosage should be recorded for each camper, including number and timing of injections or basal and bolus dosages given by continuous subcutaneous insulin infusion (CSII) and type(s) of insulin used. Records for insulin dosages and blood glucose values for the week immediately before camp should be provided. Additional medical information, such as prior diabetes-related illnesses and hospitalizations, history of severe hypoglycemia, previous A1C levels, other medications, significant medical conditions, and psychological issues should also be available to camp personnel and reviewed with diligence by those responsible for the health and well-being of the individual camper.

During camp, a record of the camper's diabetes care progress should be documented daily. All blood glucose levels and insulin dosages should be recorded in a format that allows for review and analysis to determine whether alterations in the diabetes regimen are required. A record of the degree of activity and food intake may also be helpful in determining subsequent alterations in the diabetes regimen. It is imperative that the medical staff have knowledge about the exercise schedule and the meal plan at camp so that they can make appropriate insulin dosage adjustments.

To ensure safety and optimal diabetes management, multiple blood glucose determinations should be made and recorded throughout each 24-h period: before meals, at bedtime, after or during prolonged and strenuous activity, in the middle of the night when indicated for prior hypoglycemia, and after extra doses of insulin. Consideration may also be given to parental or camper requests. Because exercise may still impact blood glucose 12–18 h after completion, campers who have repeated lows during exercise may also need nocturnal testing. Any camper with a bedtime blood glucose level <100 mg/dl and campers on an insulin pump with a blood glucose >240 mg/dl should have their blood glucose rechecked overnight. The intervention for campers with an overnight blood glucose level <100 mg/dl should be determined based on their insulin regimen and risk for nocturnal hypoglycemia. Campers on insulin pumps with a bedtime or overnight blood glucose >240 mg/dl should follow an established pump protocol for ketone testing and change of catheter site. Children should be encouraged to check blood glucose levels at times other than the routine times if they have symptoms of hypo-/hyperglycemia or if they have other physical complaints.

These recommendations imply that there is adequate staffing and that they have received training in blood glucose monitoring procedures as well as the indications and treatment excursions of blood glucose.

Every attempt should be made to follow the home insulin regimen of each camper as closely as possible. If a child's blood glucose record prior to camp indicates tight glucose control and a low activity level, it may be advisable to decrease the insulin dosage in anticipation of the increased activity. Hypoglycemia may occur at the beginning of camp because of increased physical activity and failure to have free access to food. Other alterations in insulin dosage may need to be made for extreme physical activity, such as prolonged hikes or active water sports.

Increasingly, children manage their diabetes with an insulin infusion pump. The camp medical director and other appropriate medical staff should be familiar with the programming of insulin pumps, replacement of insulin infusion catheters, and insulin adjustments using continuous insulin infusion therapy. The medical staff should ensure that adequate backup pump supplies, including extra batteries, are available for the duration of camp.

If major alterations of a camper's regimen appear to be indicated, such as adding an additional insulin injection(s) or changing an insulin type, it is important to discuss this with the camper and the family in addition to the child's local diabetes physician before the change is made. The record of what transpired during camp should be discussed with the family when the camper is picked up. However, this may not be possible for campers who go home by bus or car pool; in these instances, the record should be sent with the camper or by mail to his/her family. A record of the blood glucose values, insulin doses, and other medical care provided at camp, with an additional copy for the family to share with their primary diabetes team (if they choose), should be available to the family at the end of camp. Campers should be advised to return to their precamp regimen once they are home, unless the alterations appear to significantly improve glycemic control. In this circumstance, the family should seek the guidance of their primary diabetes team

Three meals and two to three snacks should be given at set times each day accommodating special dietary needs when needed. These meals and snacks should be balanced, and their composition should be made known to campers and staff. The carbohydrate component of food, exchange value, and/or calorie count should be taught to campers, according to their developmental level, to enable them to learn how to balance food and activity. Supervision of the food intake of children by counselors ensures that the campers are consuming adequate nutrition. Signs of eating disorders should be reported to medical staff for assessment and intervention if necessary. In addition to the need for nutrition support for optimal diabetes management at camp, there is likely to be a need for special nutrition expertise in the area of food allergies, in general, and celiac disease, in particular, with increasing numbers of youth being diagnosed with both diabetes and celiac disease.

A formal relationship with a nearby medical facility should be secured for each camp so that camp medical staff has the ability to refer to this facility for prompt treatment of medical emergencies. (The American Camping Association requires the notification of all emergency medical support systems local to the camp.) If the camp is located in a remote area, an arrangement should be made with a medical helicopter or fixed-wing aircraft to provide rapid transport if necessary.

Universal precautions including Occupational Safety & Health Association (OSHA), Clinical Laboratory Improvement Amendments (CLIA), and state regulations must be followed by all, with gloves worn for all procedures that involve blood draws and appropriate containers placed throughout the camp to dispose of sharps without hazard. Retractable single-use lancets and glucose meters in which blood does not touch the machine itself are preferable for group testing. Retractable needles may be considered to further reduce the risk of untoward blood contamination among campers and staff.

MEDICAL STAFF COMPOSITION AND STAFF TRAINING

It is imperative that each camp have a medical director who is a physician with expertise in managing type 1 and type 2 diabetes. The medical director or their on-site licensed designee is ultimately

responsible for the daily reviewing of blood glucose results, insulin logs, and other prescribed medications of all campers and staff with diabetes to make appropriate adjustments. The medical director or the on-site licensed designee is also responsible for providing guidance in all medical emergencies and should ensure that the medical program is integrated into the overall camping experience. One licensed physician must be on-site at all times for resident camp programs and available on call at all times for a day camp program.

Nursing staff should include diabetes educators and advanced practice diabetes nurses. Licensed physicians and medical residents should also be encouraged to participate in the medical staff. Registered dietitians with expertise in diabetes should also have input into the design of the menu and the education program. It is beneficial to include some medical, nursing, pharmacy, physician assistant, and dietetic students as volunteer counselors or junior medical staff to learn not only about diabetes but also the needs of children with a chronic disease.

All camp staff, including medical, nursing, nutrition, and other volunteer or paid staff, should undergo background testing to ensure the appropriateness of their working with children. Medical staff should receive training concerning routine diabetes management, issues related to lifestyle modification for type 2 diabetes, and the treatment of diabetes-related emergencies (hypoglycemia or ketosis) before camp begins. Camp policies and job descriptions for the medical staff should be understood and available in print before the start of camp. All camp staff should be familiar with the signs and symptoms of hypo-/hyperglycemia, indications for blood glucose testing, and treatment of hypoglycemia, including the administration of glucagon to treat severe hypoglycemia. Diabetes supplies should be monitored and given out by responsible medical staff.

Supplies for routine first aid and for the treatment of intercurrent illnesses, such as allergies, asthma, sore throats, diarrhea/vomiting, and minor trauma, should be available. All medical treatment should be recorded in both the camper's file and in the yearly camp medical log.

TREATMENT OF DIABETES-RELATED EMERGENCIES

Hypoglycemia

Glucagon or intravenous glucose solutions must be available for administration by trained camp personnel for treatment of severe hypoglycemia. All possible measures should be taken to avert severe hypoglycemia.
These may include nighttime blood glucose testing, decreasing insulin dosages for extreme activity, and altering insulin regimens for campers with prior severe hypoglycemia. Extra snacks should be provided to children not on basal-bolus therapy with blood glucose levels <100 mg/dl at bedtime. Additional snacks or modifications of insulin for those on Lantus or pump therapy with blood glucose levels <80 mg/dl should also be considered.

A set protocol for the treatment of mild-to-moderate hypoglycemia with oral glucose at other times should be followed so that hypoglycemia is consistently managed. Repeat blood glucose testing should be performed within 15–20 min to ensure resolution of hypoglycemia.

Ketosis

It may be possible to treat mild-to-moderate diabetic ketosis at camp. Urine or blood should be measured for the presence of ketones if a camper has persistent hyperglycemia (blood glucose level >240 mg/dl [13.3 mmol/l]) or if a camper has an intercurrent illness, regardless of blood glucose level.

Oral or intravenous hydration (if vomiting) should be administered, and adequate insulin should be given to reverse ketosis, with a flow sheet produced to document the progress of the treatment regimen. Referral to an appropriate medical facility is required if vomiting and ketosis do not resolve promptly.

WRITTEN CAMP MANAGEMENT PLAN

A written plan that includes camp policies and medical management procedures must be available at camp. It should be written or reviewed by the camp medical director in collaboration with others, such as the camp program director, members of the camp oversight and/or policy committees, local pediatric endocrinologists and diabetes educators, etc. It must adhere to the ADA's standards of medical care and the American Camping Association's accreditation standards. All medical staff should review this management plan before camp.

The written medical management plan should include information about:

- General diabetes management
- Insulin injections/pump therapy
- Blood glucose monitoring and ketone testing
- Nutrition, timing, and content of meals and snacks
- Routine and special activities
- Hypoglycemia and treatment
- Hyperglycemia/ketosis and treatment
- Medical forms
- Assessment and treatment of intercurrent illness
- Pharmacy compendium
- Universal precautions and policies for needle sticks and handling of infectious wastes
- Psychological issues at camp
- Quality control of medical equipment according to OSHA and CLIA standards
- Incident/accident reporting
- When to notify parents/guardians, primary care physician, and diabetes care provider
- Policies for camp closure and returning home

In addition, camp policies should cover emergency procedures (e.g., medical and natural disasters), out-of-camp excursions, and the prevention of physical, sexual, and psychological abuse. A risk management plan should also be developed and understood by all camp staff. The ADA's *Camp Implementation Guide Modules* includes a variety of resources including sample policies, job descriptions, and medical forms.

DIABETES EDUCATION AND PSYCHOLOGICAL ISSUES AT CAMP

The camp setting is an ideal place for teaching diabetes self-management skills. Education programs should be developmentally appropriate. Examples of educational topics suitable for the camp setting include:

- Blood glucose monitoring
- Recognition and management of hypo-/hyperglycemia and ketosis
- Insulin injection techniques
- Carbohydrate counting
- Insulin dosage adjustment based on nutrition and activity schedules
- Pump issues
- The importance of diabetes control
- Healthy lifestyles issues, including integration of healthy eating, physical activity, and relaxation
- Problem-solving skills for caring for diabetes at home versus camp
- Life skills for independent living
- Stress management and coping skills
- Sexual health and preconception issues
- Diabetes complications
- New therapies including technologies

Medical personnel with the aid of on-site psychologists/social workers, if available, should aim at improving the psychological well-being of campers.
These staff members should be willing to address specific and general psychosocial issues and be able to offer suggestions for subsequent follow-up if indicated. Individualized attention may be needed for campers with type 2 versus type 1 diabetes.

RESEARCH AT CAMP

Clinical research is often performed and encouraged at diabetes camps. However, if such projects are to be done, they must not interfere with the integrity of the camping program. All research conducted in the camp setting should be minimally invasive to the camping experience. All studies should be approved by an institutional review board in good standing and by the camp medical and program director before the camping session. Parents and campers must have the consent form, a summary/synopsis of the research protocol, and the ability to contact the principal investigator before

consenting to enter the research study. Informed consent from parents or guardians and assent from the camper must be obtained, preferably before arrival at camp.

OTHER

At times, industries related to diabetes may wish to have a presence at camp. Camp medical staff and administrative personnel should develop policies for visits from industries while camp is in session. Industries seeking to have a presence at camp should be subject to the same background checks and standards outlined by the ADA. Employees of industries serving in the role of volunteer or paid medical staff at camp are prohibited from soliciting or endorsing their company's products.

CONCLUSION

Camps for children and youth focused on diabetes are invaluable. Most camps have a high return rate for campers, many of whom have gone on to become counselors, staff, and role models for younger campers. Thus, it is reasonable to assume that they have benefited not only from the camp experience but also from the friendships that have developed from being in an environment where the norm is to have diabetes. Providing high-standard diabetes care is imperative to maximize the experience offered by camps specialized for children with diabetes. Using the active camping environment as a teaching opportunity is an invaluable way for children with diabetes to gain skills in managing their disease within the supportive camp community.

Diabetes Management in Correctional Institutions

Abbreviations: CBG, capillary blood glucose • DKA, diabetic ketoacidosis • GDM, gestational diabetes mellitus • MNT, medical nutrition therapy

INTRODUCTION

At any given time, over 2 million people are incarcerated in prisons and jails in the U.S. It is estimated that nearly 80,000 of these inmates have diabetes, a prevalence of 4.8%.
In addition, many more people pass through the corrections system in a given year. In 1998 alone, over 11 million people were released from prison to the community . The current estimated prevalence of diabetes in correctional institutions is somewhat lower than the overall U.S. prevalence of diabetes, perhaps because the incarcerated population is younger than the general population. The prevalence of diabetes and its related comorbidities and complications, however, will continue to increase in the

prison population as current sentencing guidelines continue to increase the number of aging prisoners and the incidence of diabetes in young people continues to increase.

People with diabetes in correctional facilities should receive care that meets national standards. Correctional institutions have unique circumstances that need to be considered so that all standards of care may be achieved. Correctional institutions should have written policies and procedures for the management of diabetes and for training of medical and correctional staff in diabetes care practices. These policies must take into consideration issues such as security needs, transfer from one facility to another, and access to medical personnel and equipment, so that all appropriate levels of care are provided. Ideally, these policies should encourage or at least allow patients to self-manage their diabetes. Ultimately, diabetes management is dependent upon having access to needed medical personnel and equipment. Ongoing diabetes therapy is important in order to reduce the risk of later complications, including cardiovascular events, visual loss, renal failure, and amputation. Early identification and intervention for people with diabetes is also likely to reduce short-term risks for acute complications requiring transfer out of the facility, thus improving security.

This document provides a general set of guidelines for diabetes care in correctional institutions. It is not designed to be a diabetes management manual. More detailed information on the management of diabetes and related disorders can be found in the American Diabetes Association (ADA) Clinical Practice Recommendations, published each year in January as the first supplement to *Diabetes Care*, as well as the "Standards of Medical Care in Diabetes" contained therein. This discussion will focus on those areas where the care of people with diabetes in correctional facilities may differ, and specific recommendations are made at the end of each section.

INTAKE MEDICAL ASSESSMENT

Reception screening

Reception screening should emphasize patient safety. In particular, rapid identification of all insulin-treated persons with diabetes is essential in order to identify those at highest risk for hypo- and hyperglycemia and diabetic ketoacidosis (DKA). All insulin-treated patients should have a capillary blood glucose (CBG) determination within 1–2 h of arrival.

Signs and symptoms of hypo- or hyperglycemia can often be confused with intoxication or withdrawal from drugs or alcohol. Individuals with diabetes exhibiting signs and symptoms consistent with hypoglycemia, particularly altered mental status, agitation, combativeness, and diaphoresis, should have finger-stick blood glucose levels measured immediately.

Intake screening

Patients with a diagnosis of diabetes should have a complete medical history and physical examination by a licensed health care provider with prescriptive authority in a timely manner. If one is not available on site, one should be consulted by those performing reception screening. The purposes of this history and physical examination are to determine the type of diabetes, current therapy, alcohol use, and behavioral health issues, as well as to screen for the presence of diabetes-related complications.

The evaluation should review the previous treatment and the past history of both glycemic control and diabetes complications. It is essential that medication and medical nutrition therapy (MNT) be continued without interruption upon entry into the correctional system, as a hiatus in either medication

or appropriate nutrition may lead to either severe hypo- or hyperglycemia that can rapidly progress to irreversible complications, even death.

Intake physical examination and laboratory

All potential elements of the initial medical evaluation are included in Table 5 of the ADA's "Standards of Medical Care in Diabetes," referred to hereafter as the "Standards of Care". The essential components of the initial history and physical examination are detailed in Fig. 1. Referrals should be made immediately if the patient with diabetes is pregnant.

RECEPTION SCREENING

- **Identify all inmates with diabetes currently using insulin therapy or at high risk for hypoglycemia**
  - **ALL insulin treated patients: screening CBG and urine ketone test (as clinically indicated)**
  - **Any patient exhibiting signs/symptoms consistent with hypoglycemia: immediate CBG**
- **Continue usual meal schedule and medication administration**

INTAKE SCREENING

- **Type and duration of diabetes**
- **Confirm current therapy**
- **Presence of complications**
- **Family history**
- **Pregnancy screen in all female patients of childbearing age with diabetes**
- **Assess alcohol use**
- **Identify behavioral health issues such as depression, distress, suicidal ideation**
- **Assess prior diabetes educa**

ll subjects with diabetes should have physician evaluation. If no physician available, physician should be consulted.

weeks

INTAKE PHYSICAL EXAM
LABORATORY - COMPLICATIONS SCREENING

Complete exam including:

- **Height, weight**
- **Blood pressure**
- **Eye (retinal) exam**
- **Cardiac**
- **Peripheral pulses**
- **Foot and neurologic exam**

Laboratory studies:

- **A1C and glucose**
- **Lipid Profile**
- **Microalbumin screen (Alb/Cr ratio)**
- **Urine ketones (as clinically indicated)**
- **AST/ALT (as clinically indicated)**
- **Creatinine (as clinically indicated)**

Figure 1— Essential components of the initial history and physical examination. Alb/Cr ratio, albumin-to-creatinine ratio; ALT, alanine aminotransferase; AST, aspartate aminotransferase.

Recommendations

- Patients with a diagnosis of diabetes should have a complete medical history and undergo an intake physical examination by a licensed health professional in a timely manner. (E)
- Insulin-treated patients should have a CBG determination within 1–2 h of arrival. (E)
- Medications and MNT should be continued without interruption upon entry into the correctional environment. (E)

SCREENING FOR DIABETES

Consistent with the ADA Standards of Care, patients should be evaluated for diabetes risk factors at the intake physical and at appropriate times thereafter. Those who are at high risk should be considered for blood glucose screening. If pregnant, a risk assessment for gestational diabetes mellitus (GDM) should be undertaken at the first prenatal visit. Patients with clinical characteristics consistent with a high risk for GDM should undergo glucose testing as soon as possible. High-risk women not found to have GDM at the initial screening and average-risk women should be tested between 24 and 28 weeks of gestation. For more detailed information on screening for both type 2 and gestational diabetes, see the ADA Position Statement "Screening for Type 2 Diabetes" and the Standards of Care.

MANAGEMENT PLAN

Glycemic control is fundamental to the management of diabetes. A management plan to achieve normal or near-normal glycemia with an A1C goal of <7% should be developed for diabetes management at the time of initial medical evaluation. Goals should be individualized, and less stringent treatment goals may be appropriate for patients with a history of severe hypoglycemia, patients with limited life expectancies, elderly adults, and individuals with comorbid conditions. This plan should be documented in the patient's record and communicated to all persons involved in his/her care, including security staff. Table 1, taken from the ADA Standards of Care, provides a summary of recommendations for setting glycemic control goals for adults with diabetes.

Table 1— Summary of recommendations for adults with diabetes mellitus

Glycemic control	
A1C	<7.0%*
Preprandial plasma glucose	90–130 mg/dl (5.0–7.2 mmol/l)
Postprandial plasma glucose	<180 mg/dl (<10.0 mmol/l)
Blood pressure	<130/80 mmHg
Lipids	
LDL	<100 mg/dl (<2.6 mmol/l)
Triglycerides†	<150 mg/dl (<1.7 mmol/l)
HDL	>40 mg/dl (>1.1 mmol/l)‡
Key concepts in setting glycemic goals:	
• Goals should be individualized	
• Certain populations (children, pregnant women, and elderly) require special considerations	
• Less intensive glycemic goals may be indicated in patients with severe or frequent hypoglycemia	
• More stringent glycemic goals (i.e., a normal A1C, <6%) may further reduce complications at the cost of increased hypoglycemia (particularly in those with type 1 diabetes)	
• 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 DCCT-based assay.

†Current NCEP/ATP III guidelines suggest that in patients with triglycerides ≥200 mg/dl, the "non-HDL cholesterol" (total cholesterol minus HDL) should be managed to achieve a level ≤130 mg/dl.

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

People with diabetes should ideally receive medical 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. It is essential in this collaborative and integrated team approach that individuals with diabetes assume as active a role in their care as possible. Diabetes self-management education is an integral component of care. Patient self-management should be emphasized, and the plan should encourage the involvement of the patient in problem solving as much as possible.

It is helpful to house insulin-treated patients in a common unit, if this is possible, safe, and consistent with providing access to other programs at the correctional institution. Common housing not only can facilitate mealtimes and medication administration, but also potentially provides an opportunity for diabetes self-management education to be reinforced by fellow patients.

NUTRITION AND FOOD SERVICES

Nutrition counseling and menu planning are an integral part of the multidisciplinary approach to diabetes management in correctional facilities. A combination of education, interdisciplinary communication, and monitoring food intake aids patients in understanding their medical nutritional needs and can facilitate diabetes control during and after incarceration.

Nutrition counseling for patients with diabetes is considered an essential component of diabetes self-management. People with diabetes should receive individualized MNT as needed to achieve treatment goals, preferably provided by a registered dietitian familiar with the components of MNT for persons with diabetes.

Educating the patient, individually or in a group setting, about how carbohydrates and food choices directly affect diabetes control is the first step in facilitating self-management. This education enables the patient to identify better food selections from those available in the dining hall and commissary. Such an approach is more realistic in a facility where the patient has the opportunity to make food choices.

The easiest and most cost-effective means to facilitate good outcomes in patients with diabetes is instituting a heart-healthy diet as the master menu. There should be consistent carbohydrate content at each meal, as well as a means to identify the carbohydrate content of each food selection. Providing carbohydrate content of food selections and/or providing education in assessing carbohydrate content enables patients to meet the requirements of their individual MNT goals. Commissaries should also help in dietary management by offering healthy choices and listing the carbohydrate content of foods.

The use of insulin or oral medications may necessitate snacks in order to avoid hypoglycemia. These snacks are a part of such patients' medical treatment plans and should be prescribed by medical staff.

Timing of meals and snacks must be coordinated with medication administration as needed to minimize the risk of hypoglycemia, as discussed more fully in the MEDICATION section of this document. For further information, see the ADA Position Statement "Nutrition Principles and Recommendations in Diabetes".

URGENT AND EMERGENCY ISSUES

All patients must have access to prompt treatment of hypo- and hyperglycemia. Correctional staff should be trained in the recognition and treatment of hypo- and hyperglycemia, and appropriate staff should be trained to administer glucagon. After such emergency care, patients should be referred for appropriate medical care to minimize risk of future decompensation.

Institutions should implement a policy requiring staff to notify a physician of all CBG results outside of a specified range, as determined by the treating physician (e.g., <50 or >350 mg/dl).

Hyperglycemia
Severe hyperglycemia in a person with diabetes may be the result of intercurrent illness, missed or inadequate medication, or corticosteroid therapy. Correctional institutions should have systems in place to identify and refer to medical staff all patients with consistently elevated blood glucose as well as intercurrent illness.

The stress of illness in those with type 1 diabetes frequently aggravates glycemic control and necessitates more frequent monitoring of blood glucose (e.g., every 4–6 h). Marked hyperglycemia requires temporary adjustment of the treatment program and, if accompanied by ketosis, interaction with the diabetes care team. Adequate fluid and caloric intake must be ensured. Nausea or vomiting accompanied with hyperglycemia may indicate DKA, a life-threatening condition that requires immediate medical care to prevent complications and death. Correctional institutions should identify patients with type 1 diabetes who are at risk for DKA, particularly those with a prior history of frequent episodes of DKA. For further information see "Hyperglycemic Crisis in Diabetes".

Hypoglycemia
Hypoglycemia is defined as a blood glucose level <60 mg/dl. Severe hypoglycemia is a medical emergency defined as hypoglycemia requiring assistance of a third party and is often associated with mental status changes that may include confusion, incoherence, combativeness, somnolence, lethargy, seizures, or coma. Signs and symptoms of severe hypoglycemia can be confused with intoxication or withdrawal. Individuals with diabetes exhibiting signs and symptoms consistent with hypoglycemia, particularly altered mental status, agitation, and diaphoresis, should have their CBG levels checked immediately.

Security staff who supervise patients at risk for hypoglycemia (i.e., those on insulin or oral hypoglycemic agents) should be educated in the emergency response protocol for recognition and treatment of hypoglycemia. Every attempt should be made to document CBG before treatment. Patients must have immediate access to glucose tablets or other glucose-containing foods. Hypoglycemia can generally be treated by the patient with oral carbohydrates. If the patient cannot be relied on to keep hypoglycemia treatment on his/her person, staff members should have ready access to glucose tablets or equivalent. In general, 15–20 g oral glucose will be adequate to treat hypoglycemic events. CBG and treatment should be repeated at 15-min intervals until blood glucose levels return to normal (>70 mg/dl).

Staff should have glucagon for intramuscular injection or glucose for intravenous infusion available to treat severe hypoglycemia without requiring transport of the hypoglycemic patient to an outside facility. Any episode of severe hypoglycemia or recurrent episodes of mild to moderate hypoglycemia require reevaluation of the diabetes management plan by the medical staff.

In certain cases of unexplained or recurrent severe hypoglycemia, it may be appropriate to admit the patient to the medical unit for observation and stabilization of diabetes management.

Correctional institutions should have systems in place to identify the patients at greater risk for hypoglycemia (i.e., those on insulin or sulfonylurea therapy) and to ensure the early detection and treatment of hypoglycemia. If possible, patients at greater risk of severe hypoglycemia (e.g., those with a prior episode of severe hypoglycemia) may be housed in units closer to the medical unit in order to minimize delay in treatment.

Recommendations

- Train correctional staff in the recognition, treatment, and appropriate referral for hypo- and hyperglycemia. (E)
- Train appropriate staff to administer glucagon. (E)
- Train staff to recognize symptoms and signs of serious metabolic decompensation, and immediately refer the patient for appropriate medical care. (E)
- Institutions should implement a policy requiring staff to notify a physician of all CBG results outside of a specified range, as determined by the treating physician (e.g., <50 or >350 mg/dl). (E)
- Identify patients with type 1 diabetes who are at high risk for DKA. (E)

MEDICATION

Formularies should provide access to usual and customary oral medications and insulins necessary to treat diabetes and related conditions. While not every brand name of insulin and oral medication needs to be available, individual patient care requires access to short-, medium-, and long-acting insulins and the various classes of oral medications (e.g., insulin secretagogues, biguanides, α-glucosidase inhibitors, and thiazolidinediones) necessary for current diabetes management.

Patients at all levels of custody should have access to medication at dosing frequencies that are consistent with their treatment plan and medical direction. If feasible and consistent with security concerns, patients on multiple doses of short-acting oral medications should be placed in a "keep on person" program. In other situations, patients should be permitted to self-inject insulin when consistent with security needs. Medical department nurses should determine whether patients have the necessary skill and responsible behavior to be allowed self-administration and the degree of supervision necessary. When needed, this skill should be a part of patient education. Reasonable syringe control systems should be established.

In the past, the recommendation that regular insulin be injected 30–45 min before meals presented a significant problem when "lock downs" or other disruptions to the normal schedule of meals and medications occurred. The use of multiple-dose insulin regimens using rapid-acting analogs can decrease the disruption caused by such changes in schedule.

Correctional institutions should have systems in place to ensure that rapid-acting insulin analogs and oral agents are given immediately before meals if this is part of the patient's medical plan. It should be noted however that even modest delays in meal consumption with these agents can be associated with hypoglycemia. If consistent access to food within 10 min cannot be ensured, rapid-acting insulin

analogs and oral agents are approved for administration during or immediately after meals. Should circumstances arise that delay patient access to regular meals following medication administration, policies and procedures must be implemented to ensure the patient receives appropriate nutrition to prevent hypoglycemia.

Both continuous subcutaneous insulin infusion and multiple daily insulin injection therapy (consisting of three or more injections a day**)** can be effective means of implementing intensive diabetes management with the goal of achieving near-normal levels of blood glucose. While the use of these modalities may be difficult in correctional institutions, every effort should be made to continue multiple daily insulin injection or continuous subcutaneous insulin infusion in people who were using this therapy before incarceration or to institute these therapies as indicated in order to achieve blood glucose targets.

It is essential that transport of patients from jails or prisons to off-site appointments, such as medical visits or court appearances, does not cause significant disruption in medication or meal timing. Correctional institutions and police lock-ups should implement policies and procedures to diminish the risk of hypo- and hyperglycemia by, for example, providing carry-along meals and medication for patients traveling to off-site appointments or changing the insulin regimen for that day. The availability of prefilled insulin "pens" provides an alternative for off-site insulin delivery.

Recommendations

- Formularies should provide access to usual and customary oral medications and insulins to treat diabetes and related conditions. (E)
- Patients should have access to medication at dosing frequencies that are consistent with their treatment plan and medical direction. (E)
- Correctional institutions and police lock-ups should implement policies and procedures to diminish the risk of hypo- and hyperglycemia during off-site travel (e.g., court appearances). (E)

ROUTINE SCREENING FOR AND MANAGEMENT OF DIABETES COMPLICATIONS

All patients with a diagnosis of diabetes should receive routine screening for diabetes-related complications, as detailed in the ADA Standards of Care. Interval chronic disease clinics for persons with diabetes provide an efficient mechanism to monitor patients for complications of diabetes. In this way, appropriate referrals to consultant specialists, such as optometrists/ophthalmologists, nephrologists, and cardiologists, can be made on an as-needed basis and interval laboratory testing can be done.

The following complications should be considered.

- Foot care: Recommendations for foot care for patients with diabetes and no history of an open foot lesion are described in the ADA Standards of Care.
  A comprehensive foot examination is recommended annually for all patients with diabetes to identify risk factors predictive of ulcers and amputations. Persons with an insensate foot, an open foot lesion, or a history of such a lesion should be referred for evaluation by an appropriate licensed health professional (e.g., podiatrist or vascular surgeon). Special shoes

should be provided as recommended by licensed health professionals to aid healing of foot lesions and to prevent development of new lesions.

- Retinopathy: Annual retinal examinations by a licensed eye care professional should be performed for all patients with diabetes, as recommended in the ADA Standards of Care. Visual changes that cannot be accounted for by acute changes in glycemic control require prompt evaluation by an eye care professional.

- Nephropathy: An annual spot urine test for determination of microalbumin-to-creatinine ratio should be performed. The use of ACE inhibitors or angiotensin receptor blockers is recommended for all patients with albuminuria. Blood pressure should be controlled to <130/80 mmHg.

- Cardiac: People with type 2 diabetes are at a particularly high risk of coronary artery disease. Cardiovascular disease risk factor management is of demonstrated benefit in reducing this complication in patients with diabetes. Blood pressure should be measured at every routine diabetes visit. In adult patients, test for lipid disorders at least annually and as needed to achieve goals with treatment. Use aspirin therapy (75–162 mg/day) in all adult patients with diabetes and cardiovascular risk factors or known macrovascular disease. Current national standards for adults with diabetes call for treatment of lipids to goals of LDL ≤100, HDL >40, triglycerides <150 mg/dl and blood pressure to a level of <130/80 mmHg.

MONITORING/TESTS OF GLYCEMIA

Monitoring of CBG is a strategy that allows caregivers and people with diabetes to evaluate diabetes management regimens. The frequency of monitoring will vary by patients' glycemic control and diabetes regimens. Patients with type 1 diabetes are at risk for hypoglycemia and should have their CBG monitored three or more times daily. Patients with type 2 diabetes on insulin need to monitor at least once daily and more frequently based on their medical plan. Patients treated with oral agents should have CBG monitored with sufficient frequency to facilitate the goals of glycemic control, assuming that there is a program for medical review of these data on an ongoing basis to drive changes in medications. Patients whose diabetes is poorly controlled or whose therapy is changing should have more frequent monitoring. Unexplained hyperglycemia in a patient with type 1 diabetes may suggest impending DKA, and monitoring of ketones should therefore be performed.

Glycated hemoglobin (A1C) is a measure of long-term (2- to 3-month) glycemic control. Perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control) and quarterly in patients whose therapy has changed or who are not meeting glycemic goals.

Discrepancies between CBG monitoring results and A1C may indicate a hemoglobinopathy, hemolysis, or need for evaluation of CBG monitoring technique and equipment or initiation of more frequent CBG monitoring to identify when glycemic excursions are occurring and which facet of the diabetes regimen is changing.

In the correctional setting, policies and procedures need to be developed and implemented regarding CBG monitoring that address the following.

- Infection control

- Education of staff and patients

- Proper choice of meter
- Disposal of testing lancets
- Quality control programs
- Access to health services
- Size of the blood sample
- Patient performance skills
- Documentation and interpretation of test results
- Availability of test results for the health care provider

Recommendations

- In the correctional setting, policies and procedures need to be developed and implemented to enable CBG monitoring to occur at the frequency necessitated by the individual patient's glycemic control and diabetes regimen. (E)
- A1C should be checked every 3–6 months. (E)

SELF-MANAGEMENT EDUCATION

Self-management education is the cornerstone of treatment for all people with diabetes. The health staff must advocate for patients to participate in self-management as much as possible. Individuals with diabetes who learn self-management skills and make lifestyle changes can more effectively manage their diabetes and avoid or delay complications associated with diabetes. In the development of a diabetes self-management education program in the correctional environment, the unique circumstances of the patient should be considered while still providing, to the greatest extent possible, the elements of the "National Standards for Diabetes Self-Management Education". A staged approach may be used depending on the needs assessment and the length of incarceration. Table 2 sets out the major components of diabetes self-management education. Survival skills should be addressed as soon as possible; other aspects of education may be provided as part of an ongoing education program.

Table 2— Major components of diabetes self-management education

Survival skills	Daily management issues
•Hypo-/hyperglycemia	•Disease process
•Sick day management	•Nutritional management

•Medication	•Physical activity
•Monitoring	•Medications
•Foot care	•Monitoring
	•Acute complications
	•Risk reduction
	•Goal setting/problem solving
	•Psychosocial adjustment
	•Preconception care/pregnancy/gestational diabetes management

Ideally, self-management education is coordinated by a certified diabetes educator who works with the facility to develop polices, procedures, and protocols to ensure that nationally recognized education guidelines are implemented. The educator is also able to identify patients who need diabetes self-management education, including an assessment of the patients' medical, social, and diabetes histories; diabetes knowledge, skills, and behaviors; and readiness to change.

STAFF EDUCATION

Policies and procedures should be implemented to ensure that the health care staff has adequate knowledge and skills to direct the management and education of persons with diabetes. The health care staff needs to be involved in the development of the correctional officers' training program. The staff education program should be at a lay level. Training should be offered at least biannually, and the curriculum should cover the following**:**

- What is diabetes
- Signs and symptoms of diabetes
- Risk factors
- Signs and symptoms of, and emergency response to, hypo- and hyperglycemia
- Glucose monitoring
- Medications
- Exercise
- Nutrition issues including timing of meals and access to snacks

Recommendations

Include diabetes in correctional staff education programs. (E)

ALCOHOL AND DRUGS

Patients with diabetes who are withdrawing from drugs and alcohol need special consideration. This issue particularly affects initial police custody and jails. At an intake facility, proper initial identification and assessment of these patients are critical. The presence of diabetes may complicate detoxification. Patients in need of complicated detoxification should be referred to a facility equipped to deal with high-risk detoxification. Patients with diabetes should be educated in the risks involved with smoking. All inmates should be advised not to smoke. Assistance in smoking cessation should be provided as practical.

TRANSFER AND DISCHARGE

Patients in jails may be housed for a short period of time before being transferred or released, and it is not unusual for patients in prison to be transferred within the system several times during their incarceration. One of the many challenges that health care providers face working in the correctional system is how to best collect and communicate important health care information in a timely manner when a patient is in initial police custody, is jailed short term, or is transferred from facility to facility. The importance of this communication becomes critical when the patient has a chronic illness such as diabetes.

Transferring a patient with diabetes from one correctional facility to another requires a coordinated effort. To facilitate a thorough review of medical information and completion of a transfer summary, it is critical for custody personnel to provide medical staff with sufficient notice before movement of the patient.

Before the transfer, the health care staff should review the patient's medical record and complete a medical transfer summary that includes the patient's current health care issues. At a minimum, the summary should include the following.

- The patient's current medication schedule and dosages
- The date and time of the last medication administration
- Any recent monitoring results (e.g., CBG and A1C)
- Other factors that indicate a need for immediate treatment or management at the receiving facility (e.g., recent episodes of hypoglycemia, history of severe hypoglycemia or frequent DKA, concurrent illnesses, presence of diabetes complications)
- Information on scheduled treatment/appointments if the receiving facility is responsible for transporting the patient to that appointment
- Name and telephone/fax number of a contact person at the transferring facility who can provide additional information, if needed

The medical transfer summary, which acts as a quick medical reference for the receiving facility, should be transferred along with the patient. To supplement the flow of information and to increase the probability that medications are correctly identified at the receiving institution, sending institutions are encouraged to provide each patient with a medication card to be carried by the patient that contains information concerning diagnoses, medication names, dosages, and frequency. Diabetes supplies, including diabetes medication, should accompany the patient.

The sending facility must be mindful of the transfer time in order to provide the patient with medication and food if needed. The transfer summary or medical record should be reviewed by a health care provider upon arrival at the receiving institution.

Planning for patients' discharge from prisons should include instruction in the long-term complications of diabetes, the necessary lifestyle changes and examinations required to prevent these complications, and, if possible, where patients may obtain regular follow-up medical care. A quarterly meeting to educate patients with upcoming discharges about community resources can be valuable. Inviting community agencies to speak at these meetings and/or provide written materials can help strengthen the community link for patients discharging from correctional facilities.

Discharge planning for the patients with diabetes should begin 1 month before discharge. During this time, application for appropriate entitlements should be initiated. Any gaps in the patient's knowledge of diabetes care need to be identified and addressed. It is helpful if the patient is given a directory or list of community resources and if an appointment for follow-up care with a community provider is made. A supply of medication adequate to last until the first postrelease medical appointment should be provided to the patient upon release. The patient should be provided with a written summary of his/her current heath care issues, including medications and doses, recent A1C values, etc.

Recommendations

- For all interinstitutional transfers, complete a medical transfer summary to be transferred with the patient. (E)
- Diabetes supplies and medication should accompany the patient during transfer. (E)
- Begin discharge planning with adequate lead time to insure continuity of care and facilitate entry into community diabetes care. (E)

SHARING OF MEDICAL INFORMATION AND RECORDS

Practical considerations may prohibit obtaining medical records from providers who treated the patient before arrest. Intake facilities should implement policies that *1*) define the circumstances under which prior medical records are obtained (e.g., for patients who have an extensive history of treatment for complications); *2*) identify person(s) responsible for contacting the prior provider; and *3*) establish procedures for tracking requests.

Facilities that use outside medical providers should implement policies and procedures for ensuring that key information (e.g., test results, diagnoses, physicians' orders, appointment dates) is received from the provider and incorporated into the patient's medical chart after each outside appointment. The procedure should include, at a minimum, a means to highlight when key information has not been received and designation of a person responsible for contacting the outside provider for this information.

All medical charts should contain CBG test results in a specified, readily accessible section and should be reviewed on a regular basis.

CHILDREN AND ADOLESCENTS WITH DIABETES

Children and adolescents with diabetes present special problems in disease management, even outside

the setting of a correctional institution. Children and adolescents with diabetes should have initial and follow-up care with physicians who are experienced in their care. Confinement increases the difficulty in managing diabetes in children and adolescents, as it does in adults with diabetes. Correctional authorities also have different legal obligations for children and adolescents.

Nutrition and activity

Growing children and adolescents have greater caloric/nutritional needs than adults. The provision of an adequate amount of calories and nutrients for adolescents is critical to maintaining good nutritional status. Physical activity should be provided at the same time each day. If increased physical activity occurs, additional CBG monitoring is necessary and additional carbohydrate snacks may be required.

Medical management and follow-up

Children and adolescents who are incarcerated for extended periods should have follow-up visits at least every 3 months with individuals who are experienced in the care of children and adolescents with diabetes. Thyroid function tests and fasting lipid and microalbumin measurements should be performed according to recognized standards for children and adolescents in order to monitor for autoimmune thyroid disease and complications and comorbidities of diabetes.

Children and adolescents with diabetes exhibiting unusual behavior should have their CBG checked at that time. Because children and adolescents are reported to have higher rates of nocturnal hypoglycemia, consideration should be given regarding the use of episodic overnight blood glucose monitoring in these patients. In particular, this should be considered in children and adolescents who have recently had their overnight insulin dose changed.

PREGNANCY

Pregnancy in a woman with diabetes is by definition a high-risk pregnancy. Every effort should be made to ensure that treatment of the pregnant woman with diabetes meets accepted standards (14,15). It should be noted that glycemic standards are more stringent, the details of dietary management are more complex and exacting, insulin is the only antidiabetic agent approved for use in pregnancy, and a number of medications used in the management of diabetic comorbidities are known to be teratogenic and must be discontinued in the setting of pregnancy.

SUMMARY AND KEY POINTS

People with diabetes should receive care that meets national standards. Being incarcerated does not change these standards. Patients must have access to medication and nutrition needed to manage their disease. In patients who do not meet treatment targets, medical and behavioral plans should be adjusted by health care professionals in collaboration with the prison staff. It is critical for correctional institutions to identify particularly high-risk patients in need of more intensive evaluation and therapy, including pregnant women, patients with advanced complications, a history of repeated severe hypoglycemia, or recurrent DKA.

A comprehensive, multidisciplinary approach to the care of people with diabetes can be an effective mechanism to improve overall health and delay or prevent the acute and chronic complications of this disease.

Recent Developments

October 17, 2006

When Advice on Diabetes Is Sound, but Ignored

By GINA KOLATA

Ask any diabetes specialist whether people can protect themselves from Type 2 diabetes through diet and exercise and the answer will be a resounding yes. It has been shown three times, in studies in three countries, one of them the United States.

Weight loss and exercise can do more than just stave off diabetes, diabetes specialists will tell you. They can result in lower blood pressure, lower levels of cholesterol, less sleep apnea, more vigor and, in general, a better life.

But if you ask how likely it is that people at high risk of diabetes will follow the advice to diet and exercise, or about using a drug instead, you will get a different sort of answer.

It is a classic conundrum in medicine: if doctors know that patients can help themselves without taking drugs, but they also know that patients are not likely to follow this advice, what should they do?

Should diabetes specialists even bother to advise patients to try helping themselves through diet and exercise first, before prescribing drugs?

A large federal study, completed several years ago, seemed to make a compelling case that they should. A third of its 3,234 participants were assigned to a low-fat, low-calorie diet and told to exercise for 150 minutes a week. The others were given a placebo or were given metformin, a diabetes drug available as an inexpensive generic.

After an average of three years, just 14.1 percent of those in the diet and exercise group had developed diabetes. In contrast, 28.9 percent of participants taking the placebo had diabetes, and 21.7 percent of those taking metformin.

But the diet and exercise program was nothing like what an ordinary person might expect. The participants got extensive individual counseling and group support, at a cost of $1,356 a person the first year and $672 in each subsequent year. Even so, they shed only about 12 pounds after four years, or 4 percent of their initial weight. Most were continuing with their exercise program, though. If a large health plan decided to offer the same program for its members at risk for diabetes, the plan's price for every member would rise by 1 percent, said Dr. David Eddy, the medical director of Archimedes Inc., a health care consulting company. Over 30 years, 61 percent of the people at risk would develop diabetes, as compared with 72 percent if no such program were instituted.

Last month, another study showed that a newer diabetes drug, rosiglitazone, might be more effective than either metformin or diet and exercise. Over three years, it reduced the risk of developing diabetes by 60 percent in people with elevated blood sugar levels.

Both drugs are relatively safe. Patients may lose about five pounds if they take metformin; other than that its major side effect is gastrointestinal disturbances, like a sense of fullness or soft bowel movements. Patients may gain about five pounds with rosiglitazone, about half of which is from fluid retention. That increases the risk of heart failure in people with heart disease.

But with the drugs' effectiveness in preventing diabetes, maybe, some specialists say, doctors will soon view blood sugar as they do blood pressure or cholesterol. As soon as they spot an abnormally high level, they will whip out their prescription pads.

Already, health authorities have ventured along that path. International treatment guidelines once said that the first step for patients with full spectrum Type 2 diabetes was to exercise and lose weight. Only after patients had tried that and utterly failed were doctors to prescribe drugs.

As of August, however, the guidelines have changed.

"We recommend starting patients on metformin immediately," said Dr. David M. Nathan, who directs the diabetes center at Massachusetts General Hospital and is a member of the group that formulated the new guidelines. "Don't start with lifestyle alone, even for newly diagnosed people. Most end up failing the lifestyle recommendations."

He added: "What classically happened was that the patients would take three months and try to diet. It wouldn't work. Then they joined a health club. It didn't work. Then they take another three months and try some more. By the time they were on effective therapy, they had had diabetes for years and years."

In developing the new guidelines, the group reasoned that the consequences of untreated diabetes — which can include heart attacks, strokes, kidney failure, blindness and amputations — are too dire to allow high blood sugar levels to persist.

But that does not necessarily mean that drugs should be the first choice for people with so-called prediabetes, who have elevated blood sugar levels but have not yet developed the disease.

Or so says Rena Wing, a professor of psychiatry and human behavior at Brown University Medical School. Dr. Wing helped develop the diet and exercise program for the federal study of prediabetes.

Drugs, she said, should be a last resort for people with prediabetes. The answer to the problem of poor compliance with diet and exercise programs is to develop better ways of encouraging people to follow them, she said.

"If you have a problem that can be solved with a lifestyle change, you have to work on how to do that, how to bring it to people," Dr. Wing said. "We have to change the system."

For example, she said, there could be lists of effective programs for weight loss and exercise so doctors would stop telling patients to simply "lose weight" and say instead, "Join this program."

Yet, if people know that a drug can solve their problem, how much incentive is there to change their diet and exercise patterns?

"The behaviorists say that if you have a medication available, you can hang up the idea that the patients will try lifestyle," Dr. Nathan said.

Still, he said, “as a realist, it seems to me that the truth is that whatever your thoughts are on the importance of self-control and willpower and profligacy, and that we shouldn’t be such pigs, that we should exercise more, the truth is that we are what we are.”

Dr. Nathan added, “We have recognized that although lifestyle can be miraculously effective, it often isn’t, because people won’t change.”

FDA Approves New Diabetes Drug

WASHINGTON (Reuters) - A new diabetes drug that helps the body control blood sugar won U.S. approval on Tuesday, making it the first in a new class of pills that treat the disease without the weight gain seen with some other drugs.

The Food and Drug Administration approved Merck & Co. Inc's oral diabetes drug Januvia treat adults with type 2 diabetes, which affects the majority of the nearly 21 million Americans with the disease.

It occurs when the body builds resistance to insulin needed to break down food and causes blood sugar levels to be too high. Obesity is a major risk factor for the disease, which if not controlled can lead to heart problems, blindness and other complications.

Januvia, known generically as sitagliptin, can be used alone or along with other oral diabetes drugs such as metformin and PPAR agonists, the FDA said, adding that diet and exercise should also be part of the treatment.

"We now have another option that treats the disease in an entirely new way that can be added to existing treatment regimens to help patients gain more control over their blood sugar levels," said Dr. Steven Galson, director of the FDA's Center for Drug Evaluation and Research.

Some type 2 diabetes sufferers require insulin shots as part of their treatment but others rely on oral medicines.

Once-a-day Januvia is expected to face competition from Novartis AG's rival medicine Galvus, which is awaiting FDA approval, possibly next month.

Both drugs are part of a new class of medicines called dipeptidyl peptidase IV, or DPP-4, inhibitors that work to enhance the body's own ability to lower blood sugar. In clinical trials of the new drugs, patients did not gain weight.

The drugs will also compete with older diabetes medications known as thiazolidinediones, or TZDs, which make patients less resistant to insulin. Those drugs are used as add-on treatments and have been linked to water retention and weight gain.

"Despite the drugs that are out there, the vast majority of patients out there are not at (their) treatment goal," Jay Galeota, head of Merck's global diabetes franchise, told Reuters last week.

Analysts expect Januvia and Galvus could each generate more than $1 billion a year in sales, but it was not immediately clear how soon Merck would make its drug available for the growing number of patients with diabetes.

Whitehouse Station, New Jersey-based Merck said Januvia would be in pharmacies "in the near future" and would cost $4.86 per tablet. Januvia is already cleared in Mexico and is awaiting approval in other countries, Merck has said.

"If (Merck) can ship fairly quickly here, that month may be important, just to get their samples out first and get it into doctors' hands first," said Natexis Bleichroeder analyst Jon LeCroy, who projects $1.6 billion in Januvia sales in 2010.

A survey of about 60 physicians, conducted by Reuters Primary Research, shows the vast majority of doctors intend to start prescribing Januvia and Galvus right way.

Dr. Stuart Weiss, an New York University Medical Center endocrinologist, said the drug's ability to control blood sugar spikes without added weight gain was a big draw.

"In the face of a diabetes epidemic, this drug ... is particularly an inviting choice," said Weiss, who has consulted for several Merck competitors, including Novartis.

Common side effects in patients studied were diarrhea, sore throat and upper respiratory tract infection, the FDA said.

October 18, 2006

Merck Wins U.S. Approval for a New Diabetes Drug

By ALEX BERENSON

Federal drug regulators yesterday approved a new diabetes medicine from Merck that is expected to become a blockbuster treatment used by millions of people worldwide.

Januvia, the new medicine, is a once-daily pill that has fewer severe side effects than existing diabetes medications and does not cause weight gain, according to clinical trials. The Food and Drug Administration said Januvia could be prescribed either on its own or in addition to other medicines.

It is aimed at Type 2 diabetes, the most common form, which affects nearly 21 million Americans — 7 percent of the population — and more than 200 million people globally.

Merck said Januvia would cost just under $5 a day, or about $145 a month, comparable to existing treatments. Merck shares rose slightly after the approval was announced yesterday morning, which had been expected.

Many doctors say they believe Januvia — and Galvus, a similar drug from Novartis that is expected to be approved later this year — will be valuable for many patients with diabetes, most of whom have dangerously high levels of blood sugar despite existing treatments.

“I can’t wait to put people on the drug,” Dr. James Underberg, a clinical assistant professor at New York University medical school who participated in a clinical trial of Januvia. Januvia is the third major new diabetes drug approved since the summer of 2005, and potentially the most important, analysts and doctors say. The drug works in a different way than existing treatments, and its pill form makes it more convenient than Byetta, a treatment approved last year that has some of the same benefits as Januvia but must be taken by injection.

Analysts predict that Januvia, either as a stand-alone treatment or in combination with an existing diabetes drug called metformin, will have worldwide sales of nearly $2 billion by 2010. Merck hopes to win approval for that combined drug early next year.

Optimism about Januvia has helped push Merck shares up 38 percent this year, compared with an 11 percent gain for the average large drug stock. Merck shares closed yesterday at $43.96, up 20 cents — at their highest level since the company withdrew its arthritis drug Vioxx in September 2004 after a study linked Vioxx to heart attacks and strokes.

Executives at Merck declined to comment on their plans for advertising Januvia to consumers. Unlike several other major drug makers, Merck has not committed to waiting at least six months before advertising new drugs so that doctors have a chance to learn about new therapies before patients begin asking for them.

But physicians like Dr. Underberg are already enthusiastic. “It doesn’t cause weight gain, it doesn’t cause episodes of hypoglycemia, and the side effects otherwise are pretty moderate,” he said.

Hypoglycemia is a potentially dangerous condition in which blood sugar levels drop too fast. In severe instances, it can cause fainting or even coma. Several older diabetes drugs can cause hypoglycemia by pushing the pancreas to produce large amounts insulin quickly.

In contrast, Januvia and Galvus are the first in a newer class of drugs called DPP-IV inhibitors, which work by enhancing levels of a natural protein called GLP-1. The protein stimulates the pancreas to produce insulin and discourages the liver from making glucose. But the DPP-IV inhibitors work only when blood sugar levels are already elevated, such as after a meal, sharply lowering the risk for hypoglycemia.

“The approval of Januvia marks an important advance in the fight against diabetes,” Dr. Steven Galson, director of the F.D.A.’s center for drug evaluation and research, said in a statement. “We now have another new option that treats the disease in an entirely new way.”

Diabetes is a disease in which blood sugar rises uncontrollably from a lack of, or resistance to, insulin, a hormone normally produced in the pancreas. In Type 1 diabetes, the pancreas is unable to produce insulin.

Type 2 diabetes is linked to obesity and inactivity. Typically, the disease progresses over several years as the pancreas gradually loses the ability to produce insulin, and drug treatments lose their effectiveness.

Eventually, many patients wind up injecting themselves with insulin to control their blood sugar. Severe, late-stage diabetes sharply raises the risks of many medical problems, including heart attacks, strokes, kidney disease and blindness.

Jay Galeota, general manager of Merck’s global diabetes division, said Merck planned to ship Januvia to pharmacies and offer samples to doctors’ offices quickly. The company expects to market Januvia to both doctors and patients almost immediately, he said.

“We’re confident that we’re going to communicate the science of Januvia in a very wide way,” he said. “We’re expecting very rapid uptake right away.”

While there are several major classes of diabetes medicines already on the market, many have side effects that discourage patients from taking them, including weight gain and nausea. As a result, the market is ripe for new treatments, doctors and analysts say.

In clinical trials that examined Januvia in 2,719 patients, the most common side effects were sore throat, diarrhea and colds, the F.D.A. said.

Richard Evans, an analyst at Sanford C. Bernstein & Company, said he expected Januvia and Galvus to rapidly replace an older class of drugs called sulfonylureas. The newer drugs are similarly effective but much less likely to cause weight gain and hypoglycemia, he said.

"Everybody knows that sulfonylureas are kind of a losing game," he said. While Galvus and Januvia are very similar, Januvia may have an edge because it clearly works as a once-a-day pill, while Galvus was initially formulated to be taken twice daily, Mr. Evans said. Novartis, the manufacturer of Galvus, now claims that its drug is effective when taken once daily, but doctors may be skeptical of that claim, he said.

Tony Butler, an industry analyst at Lehman Brothers, said he expected that Januvia would have sales of $271 million next year, rising to $1.1 billion by 2010. Mr. Butler said sales of the Januvia-metformin combination pill would be $500 million more in 2010.

Post-Test

Select the best answer to each of the following items. Mark your responses on the Answer Form.

1. The classification of diabetes includes _____ clinical classes.

a. three
b. four
c. six
d. eight

2. Diabetes care is complex and requires that many issues, beyond glycemic control, be addressed.

a. True
b. False

3. The FPG is the preferred test to diagnose diabetes in children and nonpregnant adults.

a. True
b. False

4. Three ways to diagnose diabetes are available, and each must be confirmed _____ unless unequivocal symptoms of hyperglycemia are present.

a. within hours
b. on a subsequent day
c. within three days
d. None of the above

5. Type 1 diabetes (results from ß-cell destruction, usually leading to absolute insulin deficiency).

a. True
b. False

6. The classic symptoms of diabetes include _____.

a. polyuria
b. polydipsia
c. unexplained weight loss
d. All of the above

7. Type 2 diabetes (results from a progressive insulin secretory defect on the background of insulin resistance).

a. True
b. False

8. Screening to detect pre-diabetes (IFG or IGT) and diabetes should be considered in individuals ≥ _____ years of age, particularly in those with a BMI ≥25 kg/m^2.

a. 15
b. 25
c. 45
d. 65

9. To screen for diabetes/pre-diabetes, either an FPG test or 2-h OGTT (75-g glucose load) or both are appropriate.

a. True
b. False

10. There is a major distinction between diagnostic testing and screening. Both utilize the same clinical tests, which should be done within the context of the health care setting.

a. True
b. False

11. Screening should also be considered for people who are <45 years of age and are overweight if they have another risk factor for diabetes. Repeat testing should be carried out at _____ intervals.

a. yearly
b. bi-annual
c. 3-year
d. 5-year

12. The purpose of screening is to identify asymptomatic individuals who are likely to have diabetes or pre-diabetes.

a. True
b. False

13. Generally, people with type 1 diabetes present with acute symptoms of diabetes and markedly elevated blood glucose levels.

a. True
b. False

14. Widespread clinical testing of asymptomatic individuals for the presence of autoantibodies related to type 1 diabetes cannot be recommended at this time as a means to identify individuals at risk.

a. True
b. False

15. Type 2 diabetes is frequently not diagnosed until complications appear, and approximately _____ of all people with diabetes may be undiagnosed. Individuals at high risk should be screened for diabetes and pre-diabetes.

a. 10%
b. 20%
c. 33%
d. 50%

16. Screening should be carried out within the health care setting. Either an FPG test or 2-h OGTT (75-g glucose load) is appropriate. The 2-h OGTT identifies people with IGT, and thus, more people who are at increased risk for the development of diabetes and CVD.

a. True
b. False

17. The incidence of type 2 diabetes in children and adolescents has increased dramatically in the _____.

a. last year
b. last five years
c. last decade
d. last 30 years

18. Screening outside of clinical settings may yield abnormal tests that are never discussed with a primary care provider, low compliance with treatment recommendations, and a very uncertain impact on long-term health.

a. True
b. False

19.On the basis of expert opinion, screening should be considered by health care providers at 3-year intervals beginning at age 45, particularly in those with BMI ≥25 kg/m^2.

a. True
b. False

20. Risk assessment for GDM should be undertaken at the first prenatal visit.

a. True
b. False

21. Which of the following is(are) recommendations for the Prevention/Delay of Type 2 diabetes: _____.

a. Individuals at high risk for developing diabetes need to become aware of the benefits of modest weight loss and participating in regular physical activity.
b. Patients with IGT should be given counseling on weight loss as well as instruction for increasing physical activity. c. Monitoring for the development of diabetes in those with pre-diabetes should be performed every 1–2 years.
d. All of the above

22. Studies have been initiated in the last decade to determine the feasibility and benefit of various strategies to prevent or delay the onset of type 2 diabetes. The strategies shown to be effective in preventing diabetes relied on lifestyle modification or glucose-lowering drugs that have been approved for treating diabetes.

a. True
b. False

23. In well-controlled studies that included a lifestyle intervention arm, substantial efforts were necessary to achieve only modest changes in weight and exercise, but those changes were sufficient to achieve an important reduction in the incidence of diabetes.

a. True
b. False

24. Three diabetes prevention trials used pharmacological therapy, and all have reported a significant lowering of the incidence of diabetes.

a. True
b. False

25. The primary approach for achieving weight loss, in the vast majority of cases, is _____.

a. therapeutic lifestyle
b. a reduction in energy intake
c. an increase in physical activity
d. All of the above

26. In selected patients, drug therapy to achieve weight loss as an adjunct to lifestyle change may be appropriate. However, it is important to note that regain of weight commonly occurs on discontinuation of medication.

a. True
b. False

27. Regulation of blood glucose to achieve near-normal levels is a primary goal in the management of diabetes, and thus, dietary techniques that limit hyperglycemia following a meal are important in limiting the complications of diabetes.

a. True
b. False

28. Guidelines from the American Heart Association also recommend that saturated fat be <_____% in those with diabetes, given their increased risk of CVD. Intake of trans fat should be minimized.

a. 3
b. 7
c. 10
d. 16

29. Similar to the general population, people with diabetes are encouraged to choose a variety of fiber-containing foods, such as legumes, fiber-rich cereals (≥5 g fiber/serving), as well as fruits, vegetables, and whole-grain products because they provide vitamins, minerals, fiber, and other substances important for good health.

a. True
b. False

30. Since diabetes may be a state of increased oxidative stress, there has been interest in prescribing antioxidant vitamins to individuals with diabetes.

a. True
b. False

31. The FDA concluded that although a small study suggested that chromium picolinate may reduce the risk of insulin resistance, the existence of a relationship between chromium picolinate and either insulin resistance or type 2 diabetes was highly uncertain.

a. True
b. False

32. Since the _____, there has been a shift from a didactic approach with DSME focusing on providing information to a skill-based approach that focuses on helping those with diabetes make informed self-management choices.

a. 1960s
b. 1970s
c. 1980s
d. 1990s

33. The curriculum of ADA-recognized DSME programs must cover all areas of diabetes management, with the assessed needs of the individual determining which areas are addressed. All ADA-recognized DSME programs utilize a process of continuous quality improvement to evaluate the effectiveness of the DSME provided and to identify opportunities for improvement.

a. True
b. False

34. _____ at least 150 min/week of moderate-intensity aerobic physical activity (50–70% of maximum heart rate) is recommended and/or at least 90 min/week of vigorous aerobic exercise (>70% of maximum heart rate). The physical activity should be distributed over at least 3 days/week and with no more than 2 consecutive days without physical activity.

a. To improve glycemic control
b. To assist with weight maintenance
c. To reduce risk of CVD
d. All of the above

35. Aerobic exercise consists of rhythmic, repeated, and continuous movements of the same large muscle groups for at least 10 min at a time. Examples include _____.

a. walking
b. bicycling
c. swimming
d. All of the above

36. Before beginning a program of physical activity more vigorous than brisk walking, people with diabetes should be assessed for conditions that might be associated with increased likelihood of CVD or that might contraindicate certain types of exercise or predispose to injury, such as _____.

a. uncontrolled hypertension
b. severe autonomic neuropathy
c. severe peripheral neuropathy
d. All of the above

37. Decreased pain sensation in the extremities would result in increased risk of skin breakdown and infection and of Charcot joint destruction. Therefore, in the presence of severe peripheral neuropathy, it may be best to encourage non–weight-bearing activities such as _____.

a. swimming
b. bicycling
c. arm exercises
d. All of the above

38. All patients with diabetes and hypertension should be treated with a regimen that includes either an ACE inhibitor or an ARB.

a. True
b. False

39. Studies have demonstrated that a significant percentage of patients with diabetes who have no symptoms of CAD have abnormal stress tests, either by ECG or echo and nuclear perfusion imaging.

a. True
b. False

40. Diabetic nephropathy occurs in _____% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD).

a. 5-10
b. 10-20
c. 20-40
d. None of the above

41. It is recommended that caregivers perform a comprehensive foot examination and provide foot self care education annually on patients with diabetes to identify risk factors predictive of ulcers and amputations.

a. True
b. False

42. The foot examination can be accomplished in a primary care setting and should include the use of a _____.

a. monofilament
b. tuning fork
c. visual examination
d. All of the above

43. Amputation and foot ulceration are the most common consequences of diabetic neuropathy and major causes of morbidity and disability in people with diabetes. Early recognition and management of independent risk factors can prevent or delay adverse outcomes.

a. True
b. False

44. Children with diabetes differ from adults in many respects, including insulin sensitivity related to sexual maturity, physical growth, ability to provide self-care, and unique neurologic vulnerability to hypoglycemia.

a. True
b. False

45. Since a sizable portion of a child's day is spent in school, close communication with school or day care personnel is essential for optimal diabetes management.

a. True
b. False

46. Women contemplating pregnancy need to be seen frequently by a multidisciplinary team experienced in the management of diabetes before and during pregnancy.

a. True
b. False

47. Diabetes is an important health condition for the aging population; at least _____% of patients over the age of 65 years have diabetes.

a. 5
b. 10
c. 20
d. 40

48. The prevalence of diabetes in hospitalized adults is conservatively estimated at _____%, depending on the thoroughness used in identifying patients.

a. 5-17
b. 12-25
c. 26-39
d. 40-50

49. Many institutions use insulin infusion algorithms that can be implemented by nursing staff. Algorithms should incorporate the concept that maintenance requirements differ between patients and change over the course of treatment.

a. True
b. False

50. Teaching diabetes self-management (DSME) to patients in hospitals is a difficult and challenging task. Patients are hospitalized because they are ill, are under increased stress related to their hospitalization and diagnosis, and are in an environment that is not conducive to learning Ideally, people with diabetes should be taught at a time and place conducive to learning: as an outpatient in a nationally recognized program of diabetes education classes.

a. True
b. False

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