

GUIDING PRINCIPLES

FOR THE CARE OF PEOPLE WITH OR AT RISK FOR DIABETES



National Diabetes Education Program

A program of the National Institutes of Health and the Centers for Disease Control and Prevention

Supporting Organizations

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- Academy of Nutrition and Dietetics
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- American Association of Clinical Endocrinologists
- American Association of Diabetes Educators
- American Association of Nurse Practitioners
- American College of Obstetricians and Gynecologists
- American Diabetes Association
- American Heart Association
- American Optometric Association
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- National Council of Asian Pacific Islander Physicians and AANPHI Diabetes Coalition
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INTRODUCTION

Goal of this resource

The large health and financial impact of diabetes and the existing gaps in achievement of treatment and prevention goals prompted the National Diabetes Education Program (NDEP) to work with key partner organizations to develop these Guiding Principles. Several organizations have independently developed evidence-based guidelines for the care of people with diabetes. Attention is often focused on the relatively minor areas of disagreement among such guidelines. These Guiding Principles aim to identify and synthesize areas of general agreement among existing guidelines to help guide primary care providers and health care teams* to deliver quality care to adults with or at risk for diabetes. No evidence-based guidelines have been developed for this resource.

The 10 clinically useful principles presented here were developed by the NDEP and representatives from the American Academy of Family Physicians, the American Association of Clinical Endocrinologists, the American College of Physicians, the American Diabetes Association, the American Heart Association, the Endocrine Society, and The American Geriatrics Society. These and other organizations and professional societies, as well as the numerous government organizations that are members of the [Diabetes Mellitus Interagency Coordinating Committee \(http://go.usa.gov/8nG4\)](http://go.usa.gov/8nG4), participated in an extensive and substantive review process.

The diabetes problem

Today, 29.1 million people (9.3 percent of the U.S. population) have diabetes, including 8.1 million who are undiagnosed.^[1] A major cause of blindness, renal failure, amputation, and cardiovascular disease, diabetes also increases the risk of cancer and dementia and more than doubles individual health care costs. The total estimated cost of diagnosed diabetes in 2012 was \$245 billion, including \$176 billion in direct medical costs and \$69 billion in reduced productivity.^[2]

Twenty-one million U.S. adults have diagnosed diabetes, and of this population, about 90 to 95 percent have type 2 diabetes. Another 86 million Americans have prediabetes and are at high risk of developing type 2 diabetes.^[1]

Proper nutrition and physical activity are the cornerstone of treatment and prevention of type 2 diabetes.^[3, 4] In addition to lifestyle modifications, controlling blood glucose, blood pressure, and cholesterol dramatically improves health outcomes.^[5–6] As a result of improved risk factor control, rates of complications, particularly for cardiovascular disease, have declined.^[7]

Yet diabetes management is suboptimal, particularly in disproportionately affected poor and/or minority populations.^[8] Analysis of national survey data from 1999 to 2010 for adults with diabetes

found improvement in glycemic control, blood pressure, and blood lipids. However, for each measure, 33 to 49 percent of people with diabetes still did not meet target values, and one in five people with diabetes (20 percent) uses some form of tobacco. Only 14 percent met the targets for all three measures and did not use tobacco products.^[9]

The National Institutes of Health–sponsored Diabetes Prevention Program clinical trial proved that type 2 diabetes can be delayed or prevented in high-risk individuals with prediabetes through lifestyle changes, such as improved nutrition and physical activity that result in modest weight loss, or the drug metformin.^[10] An estimated 93 percent of Americans with prediabetes are unaware of the condition.^[11] People at high risk for type 2 diabetes must be identified and targeted for ongoing diabetes primary prevention efforts if society is to realize the benefits of therapies proven to delay or prevent the disease. Otherwise, diabetes prevalence will continue to rise; one study projected the lifetime risk of diabetes diagnosis for Americans adults is 40 percent, meaning 2 out of every 5 American adults may be diagnosed if current trends continue.^[12]

Focus on type 2 diabetes

Because type 2 diabetes comprises such a large proportion of people with or at risk of diabetes, these Guiding Principles focus primarily on prevention and management of type 2 diabetes in adults. While much of the material is also relevant to type 1 diabetes, gestational diabetes, type 2 diabetes in children, and other rarer forms of the disease, specific management of these forms is outside the scope of this resource. The principles highlight the generally agreed-upon elements of current evidence-based diabetes management and prevention. References are limited to major research findings. References and key resources are provided at the end of each section.

*Throughout this resource, the term “health care team” refers to the broad and multidisciplinary group of professionals who care for people with or at risk for diabetes, including (but not limited to) physicians, nurse practitioners, physician assistants, podiatrists, pharmacists, nurses, registered dietitians/registered dietitian nutritionists, diabetes educators, optometrists, ophthalmologists, psychiatrists, psychologists, case managers, social workers, dental professionals, community health workers, and other community partners.

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PRINCIPLE 1:

Identify People With Undiagnosed Diabetes and Prediabetes

Why test for diabetes and prediabetes

Glucose and cardiovascular disease risk factor control improves outcomes for people with diabetes, and diabetes is an important cardiovascular disease risk factor. Individuals with prediabetes can prevent or delay onset of type 2 diabetes with weight loss, increased activity, and/or metformin therapy. Detection of individuals with diabetes and prediabetes is essential for identification of individuals who can benefit from evidence-based therapies that can mitigate risk for progression to diabetes as well as modify micro- and macrovascular disease risk.^[1, 2]

Whom to test for diabetes and prediabetes, and how often

Because risk for type 2 diabetes increases substantially with age, and early in the disease's course most people do not have symptoms (polydipsia, polyuria, unexplained weight loss), screening should be considered in asymptomatic persons over 45 years old. Screening should be considered in adults of any age who are overweight or obese and have one or more additional risk factors listed in Table 1.^[3] Testing may be repeated at intervals of 1 to 3 years with the frequency determined by the degree of risk as assessed by risk factors and results of previous tests. For example, people with an A1C closer to 6.5 percent could be tested more frequently than those with an A1C in the normal or near-normal range.

About half of women with a history of gestational diabetes (GDM) will develop type 2 diabetes 2 to 3 decades after pregnancy.^[4] Because of this significant risk, testing should be done 6 to 12 weeks postpartum and every year thereafter if prediabetes is diagnosed, or every 3 years if the postpartum test is normal.^[3] Testing is particularly important for women prior to subsequent pregnancy because the risk of fetal abnormalities is higher in women with undetected preconception diabetes.

Generally, people with type 1 diabetes present with acute symptoms of diabetes and markedly elevated blood glucose levels, and some cases are diagnosed with life-threatening diabetic ketoacidosis (DKA). About one-third of children diagnosed with type 1 diabetes present with DKA.^[5] Participation in observational research is associated with lower risk of DKA in individuals at risk for type 1 diabetes.^[6] Consider informing people with type 1 diabetes that their first-degree relatives are eligible for clinical research projects that include islet antibody testing to determine risk for type 1 diabetes and test approaches for prevention (e.g., [Type 1 Diabetes TrialNet](https://www.clinicaltrials.gov/ct2/show/study/NCT01105102); bit.ly/1jqzS7N). Such testing and follow-up may alert people to the onset of type 1 diabetes and lower risk for DKA.^[6, 7]

How to test for diabetes and prediabetes

A1C and fasting glucose testing are less burdensome than the oral glucose challenge. A1C does not require fasting but is more costly than fasting blood glucose and may be unreliable in certain conditions. People in the early stages of diabetes or with prediabetes may be identified by one test but

not the other. Therefore, confirmation with the same test that is above the diagnostic threshold for diabetes should be considered.

The threshold for diagnosis of diabetes, defined by the cut points referenced in Table 2, reflects levels at which risk of microvascular disease increases. There is some variation among guidelines on the cut point for diagnosis of prediabetes and the preferred test. All agree, however, that the risk of diabetes is continuous, extending below the lower limit of the range and becoming disproportionately greater at the higher end of the range.

If health care professionals choose A1C testing for diagnostic purposes, it should be performed in a laboratory using a method that is NGSP certified. Point-of-care A1C tests and finger-stick blood glucose testing should not be used for diagnosis. The A1C test may not be accurate in people with anemia, kidney failure, or liver disease and should not be used for diagnosis of GDM or cystic fibrosis–related diabetes. Some A1C tests give false results in people with hemoglobin variants (e.g., sickle cell trait), but most are free from such interference.

Table 1. Risk Factors for Type 2 Diabetes

<ol style="list-style-type: none"> 1. Age ≥ 45 years 2. Overweight or obese—body mass index (BMI) ≥ 25 kg/m² or waist circumference in men > 40 inches (102 cm); in women > 35 inches (88 cm)^[8] 3. Family history of diabetes (i.e., parent or sibling) 4. Member of high-risk population: African American, Hispanic/Latino, American Indian, Alaska Native, Asian American, Pacific Islander 5. History of gestational diabetes mellitus (GDM) or giving birth to a baby weighing ≥ 9 lbs 6. Physical inactivity 7. Hypertension 	<ol style="list-style-type: none"> 8. High-density lipoprotein cholesterol (HDL-C) level ≤ 35mg/dL (0.90 mmol/L) 9. Fasting triglyceride (TG) level ≥ 250 mg/dL (2.82 mmol/L) 10. Acanthosis nigricans, nonalcoholic steatohepatitis, polycystic ovary syndrome, and other conditions associated with insulin resistance 11. Atherosclerotic cardiovascular disease 12. Depression 13. Treatment with atypical antipsychotics, glucocorticoids 14. Obstructive sleep apnea and chronic sleep deprivation (< 6 hours/day) are emerging risk factors.
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How to test for gestational diabetes

There are two approaches for GDM screening, as outlined in Table 2. GDM screening is recommended for all women, usually between 24 and 28 weeks gestation, who are not previously diagnosed with overt diabetes. Use of the one-step screening approach results in increased diagnosis of GDM.

Table 2. Test Criteria for Prediabetes, Diabetes, and Gestational Diabetes

<p>Prediabetes</p>	<ol style="list-style-type: none"> 1. A1C 5.7 percent–6.4 percent or 2. Fasting plasma glucose (FPG) 100–125 mg/dL [impaired fasting glucose (IFG)] or 3. Two hours after 75 g oral glucose challenge, plasma glucose 140–199 mg/dL [impaired glucose tolerance (IGT)] <p>For the three tests, the risk of diabetes is continuous, extending below the lower limit of the range and becoming disproportionately greater at higher end of the range.</p>
<p>Diabetes</p>	<ol style="list-style-type: none"> 1. A1C \geq 6.5 percent* or 2. FPG \geq 126 mg/dL or 3. Two-hour plasma glucose \geq 200 mg/dL after 75 g oral glucose challenge or 4. Random plasma glucose \geq 200 mg/dL with symptoms (such as polyuria, polydipsia, and unexplained weight loss) <p>For criteria 1–3: Repeat test to confirm unless symptoms are present. It is preferable to repeat the same test for confirmation. If two different tests are used (e.g., FPG and A1C), and both indicate diabetes, consider the diagnosis confirmed. If the two different tests are discordant, repeat the test above the diagnostic cut point.^[3]</p> <p><i>*This A1C recommendation is for type 2 diabetes. Use of A1C for diagnosis of type 1 diabetes is not recommended.^[9]</i></p>
<p>Gestational Diabetes</p>	<p>Two GDM screening approaches are presented below. GDM screening is recommended for all women, usually between 24 and 28 weeks gestation, who are not previously diagnosed with overt diabetes. Use professional judgment to select the most appropriate test for each woman.</p> <p>A. A two-step approach endorsed by the American College of Obstetricians and Gynecologists and a consensus panel convened by the National Institutes of Health^[10]</p> <ol style="list-style-type: none"> 1. Start with a 1-hour plasma glucose test after 50 g oral glucose challenge. Choose a cutoff of either \geq 135 mg/dL or \geq 140 mg/dL and ensure that this cutoff remains consistent. 2. For individuals who meet or exceed the screening threshold, administer a 3-hour 100 g oral glucose tolerance test. Diagnose GDM when two or more of the plasma glucose values are exceeded on the 3-hour test. Choose either of two methods: (1) National Diabetes Data Group cutoff values of Fasting \geq 105 mg/dL, 1-hour \geq 190 mg/dL, 2-hour \geq 165 mg/dL, or 3-hour \geq 145 mg/dL, or (2) Carpenter and Coustan cutoff values of Fasting \geq 95 mg/dL, 1-hour \geq 180 mg/dL, 2-hour \geq 155 mg/dL, or 3-hour \geq 140 mg/dL. <p>B. A one-step approach endorsed by the International Association of Diabetes and Pregnancy Study Groups^[11]</p> <ol style="list-style-type: none"> 1. Perform a 75 g oral glucose tolerance test. Diagnose GDM when one or more of the following plasma glucose values are exceeded: Fasting \geq 92 mg/dL, 1-hour \geq 180 mg/dL, or 2-hour \geq 153 mg/dL.

Resources

- National Diabetes Information Clearinghouse:
 - [The A1C Test and Diabetes](http://go.usa.gov/8nGP) (<http://go.usa.gov/8nGP>)
 - [Sickle Cell Trait and Other Hemoglobinopathies and Diabetes: Important Information for Providers](http://go.usa.gov/8nGz) (<http://go.usa.gov/8nGz>)
- Centers for Medicare & Medicaid Services: [Medicare coverage of diabetes screening tests](http://go.usa.gov/GMge) (<http://go.usa.gov/GMge>)
- Type 1 Diabetes TrialNet: [Free screening for islet cell antibodies](http://bit.ly/1jqzS7N) (bit.ly/1jqzS7N)
- NIH Consensus Development Conference: [Diagnosing Gestational Diabetes Mellitus, 2013](http://go.usa.gov/GSGB) (<http://go.usa.gov/GSGB>)

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PRINCIPLE 2:

Manage Prediabetes to Prevent or Delay the Onset of Type 2 Diabetes

Progression to type 2 diabetes among people with prediabetes is not inevitable. Modest, sustained weight loss, increased physical activity, and/or metformin therapy in these individuals can prevent or delay the onset of type 2 diabetes.

The National Institutes of Health (NIH)–led Diabetes Prevention Program (DPP)^[1] and the Finnish Diabetes Prevention Program^[2] aimed for and achieved a mean weight loss of 7 percent and 5 percent, respectively, in lifestyle intervention study participants. Both studies reduced the incidence of diabetes by 58 percent, compared with placebo, over 3 years. In the DPP, these results were similar in all groups, including men and women, all racial and ethnic groups, as well as in women with a history of gestational diabetes. The DPP intensive lifestyle intervention was particularly effective in older participants with 71 percent risk reduction at 3 years. Lifestyle participants followed a healthy low-calorie, low-fat diet and engaged in physical activity of moderate intensity, such as brisk walking, for at least 150 minutes per week. There is some evidence that interventions focused solely on increasing physical activity can contribute to the delay or prevention of type 2 diabetes.^[3]

In the DPP, metformin reduced type 2 diabetes incidence by 31 percent compared with placebo. Metformin was effective for both men and women, was most effective in younger (25–44 years old) and heavier (body mass index of 35 or higher) people, and was least effective in older people. The Study to Prevent Non-Insulin-Dependent Diabetes Mellitus^[4] found that treatment with acarbose, an alpha glucosidase inhibitor that slows the breakdown of complex carbohydrates in the gut, reduced the incidence of type 2 diabetes by 25 percent. Metformin and acarbose have better safety profiles than other diabetes medications that might be considered for prevention, but acarbose is infrequently used in the United States due to significant gastrointestinal side effects.

The follow-up study of the DPP, the Diabetes Prevention Program Outcomes Study,^[5] found that at 10 years, lifestyle intervention reduced type 2 diabetes onset by 34 percent and delayed the onset of type 2 diabetes by about 4 years compared with placebo. Because the placebo group received a modified lifestyle intervention at the end of the DPP, the 10-year results may underestimate the effect of lifestyle change. At 10 years, metformin reduced the rate of new diabetes by 18 percent and delayed diabetes onset by 2 years. The DPP lifestyle intervention was cost-effective at 10 years, and there was a very small cost savings with metformin.^[6]

Weight loss and physical activity for prevention of type 2 diabetes

- Lifestyle intervention that includes regular physical activity and dietary changes leading to sustained weight loss should be the cornerstone of treatment for people with prediabetes. Consider referral to a:
 - Registered dietitian/registered dietitian nutritionist or diabetes educator

- Structured lifestyle intervention, such as Centers for Disease Control and Prevention (CDC)–recognized sites in the National Diabetes Prevention Program, to help achieve lifestyle changes that include regular physical activity and dietary changes leading to substantial, sustained weight loss. (See Resources.)
- Recommend a weight loss goal that is 5 percent to 10 percent of the person’s body weight.
- Specify physical activity goals of at least 30 minutes of moderate activity at least 5 days per week.
- Recommend reduced calories, reduced fat (especially *trans* and saturated fat), and fewer calorie-dense foods.

For more information about dietary and physical activity therapy, refer to Principles 3, 4, and 5.

Medication for type 2 diabetes prevention

- Consider metformin for the prevention of diabetes, especially among those with prediabetes who have limited capacity to exercise or who have been unable to lose 7 percent of their weight. This treatment was most effective among women with prediabetes and a history of gestational diabetes and for younger, heavier persons with prediabetes.
- Acarbose therapy may also be considered.

Cardiovascular disease risk management

People with prediabetes are at increased risk for cardiovascular disease (CVD), but targets for blood pressure and lipid management specific to prediabetes have not been established through randomized clinical trials. Although lifestyle change has been shown to reduce CVD risk factors in people with prediabetes, studies are ongoing to see if it will affect cardiovascular outcomes.^[7] Regularly monitor CVD risk in children and adults with prediabetes, and treat risk factors appropriately based on general guidelines for prevention and management of CVD.

Resources

- National Diabetes Education Program:
 - [Diabetes HealthSense](http://go.usa.gov/8n7d) (<http://go.usa.gov/8n7d>)
 - [Small Steps. Big Rewards. Your GAME PLAN to Prevent Type 2 Diabetes: Information for Patients](http://go.usa.gov/8n7F) (<http://go.usa.gov/8n7F>)
- Centers for Disease Control and Prevention: [National Diabetes Prevention Program](http://go.usa.gov/8nA9) (<http://go.usa.gov/8nA9>)

- [2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines \(bit.ly/1FM6jAQ\)](#)
- [2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society \(bit.ly/1ww7afP\)](#)
- [2013 ACC/AHA Guideline on the Assessment of Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines \(bit.ly/1oBIMIS\)](#)
- [2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines \(bit.ly/1uPHNBF\)](#)
- [AHA/ACC/CDC Science Advisory: An Effective Approach to High Blood Pressure Control: A Science Advisory From the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention \(bit.ly/1sXKpiE\)](#)

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PRINCIPLE 3:

Provide Ongoing Self-Management Education and Support for People With or at Risk for Diabetes and Its Complications

Effective self-management education and ongoing self-management support are essential to enable people with or at risk for diabetes to make informed decisions and to assume responsibility for the day-to-day management of their disease or risk factors.^[1–3]

Definition and purpose of diabetes self-management education (DSME) and diabetes self-management support (DSMS)

DSME is an ongoing process to facilitate a person's knowledge, skill, and ability for self-care. This process incorporates the needs, goals, and life experiences of the person with diabetes and is guided by evidence-based standards. Objectives are to support informed and shared decision making, self-care behaviors, problem solving, and active collaboration with the health care team to improve clinical outcomes, health status, and quality of life.

DSMS involves health care providers in activities that help people with diabetes to implement and sustain ongoing behaviors needed to manage their diabetes. These activities include behavioral, educational, psychosocial, and clinical support.

What is self-management?

Self-management is an active, ongoing process that changes as the person's needs, priorities, and situations change. Diabetes educators and others in the health care team (see Resources) can help people with or at risk for diabetes to:

- Understand the diabetes disease process and the risks and benefits of treatment options.
- Incorporate healthy eating behaviors into their lifestyles.
- Incorporate physical activity into their lifestyles.
- Understand how to use medications safely and for their best effect.
- Perform self-monitoring of blood pressure when prescribed.
- Perform self-monitoring of blood glucose when prescribed and demonstrate how to interpret and use the results for self-management decision making.
- Understand how to prevent, detect, and treat high and low blood glucose.

- Understand self-management needs during illness or medical procedures.
- Prevent, detect, and treat chronic diabetes complications.
- Develop personal strategies to address psychosocial issues and concerns.
- Develop personal strategies to promote health and behavior change.

(Based on American Diabetes Association/American Association of Diabetes Educators National Standards^[4] and Standards of Practice and Standards of Professional Performance for Registered Dietitians [Generalist, Specialty, and Advanced] in Diabetes Care^[5])

How to provide self-management and support

People with diabetes should receive DSME according to national standards, as well as DSMS. There is no one “best” education program or approach; however, strategies such as self-directed behavioral goal setting and problem solving improve outcomes. Programs that address health literacy and are culturally and age appropriate improve outcomes. Family members can potentially support and reinforce self-management education if they are included in the process.

In addition to one-on-one encounters, approaches such as group visits, scheduled planned visits, telehealth, and other technologies have been used effectively to provide education to people with diabetes.

Amount and frequency of diabetes self-management education and support

Comprehensive self-management education should be provided at the time of diabetes diagnosis and subsequently as needed. The amount of education necessary depends on the needs of each individual and the complexity of the treatment regimen. Medicare and many health insurance companies pay for about 10 hours of initial education, including 3 hours of one-on-one medical nutrition therapy with a registered dietitian/registered dietitian nutritionist (RD/RDN) and annual follow-up education, including 2 hours of medical nutrition therapy with an RD/RDN each subsequent year. To be eligible for Medicare reimbursement, DSME must be provided through an accredited program. The content areas that need to be addressed are defined above.

Ongoing support is critical to implement and sustain the level of self-management needed to care for a person with diabetes over a lifetime. Although there is no definitive evidence to support specific frequencies of follow-up, frequency of reassessment should be based on the patient’s and the health care team’s perceptions of need. Medicare will cover 2 hours of prescribed follow-up education/training each year.

Services for people at risk for type 2 diabetes

Education and counseling to improve nutrition and increase physical activity are recommended for people with prediabetes. Provide access to an evidence-based program such as the Centers for Disease Control and Prevention (CDC)–recognized National Diabetes Prevention Program to support people in

making lifestyle changes to improve nutrition, increase physical activity, and lose weight. These services are covered by some state Medicaid programs or commercial payers, and new payment structures via accountable care organizations may increase the provision of this preventive care.

Community-based and other resources

Providing people with diabetes and prediabetes links to resources such as peers and community health workers, community-based health programs, and support groups can be beneficial. Consider using technology for assessment, instruction, monitoring, feedback, behavior change, coping strategies, and games or simulation experiences. More research is needed to determine the effectiveness of these technologies; however, many people with diabetes currently use them.

Resources

- National Diabetes Education Program:
 - [Redesigning the Health Care Team: Diabetes Prevention and Lifelong Management](http://go.usa.gov/8nSB) (<http://go.usa.gov/8nSB>)
 - [Diabetes HealthSense](http://go.usa.gov/8nSw) (<http://go.usa.gov/8nSw>)
- American Diabetes Association:
 - Local chapters provide [Community resources](http://bit.ly/1mA76q3) (bit.ly/1mA76q3)
 - [Find a Recognized Education Program](http://bit.ly/1kkYHqQ) (bit.ly/1kkYHqQ)
- American Association of Diabetes Educators:
 - [Find an Accredited Diabetes Education Program](http://bit.ly/1jqNEY3) (bit.ly/1jqNEY3)
 - [Find a Diabetes Educator](http://bit.ly/1pvlctb) (bit.ly/1pvlctb)
 - [Practice Documents](http://bit.ly/1oqepn2) (bit.ly/1oqepn2)
- Academy of Nutrition and Dietetics: [Find a Registered Dietitian Nutritionist](http://bit.ly/RxXIND) (bit.ly/RxXIND)
- Centers for Disease Control and Prevention:

- [Community Guide: Diabetes Prevention and Control: Self-Management Education \(bit.ly/1mA8M2N\)](http://bit.ly/1mA8M2N)
- [National Diabetes Prevention Program \(http://go.usa.gov/8nhV\)](http://go.usa.gov/8nhV)
- Centers for Medicare & Medicaid Services:
 - [Diabetes Self-Management Training \(http://go.usa.gov/GMge\)](http://go.usa.gov/GMge)
 - [Intensive Behavioral Therapy for Obesity \(http://go.usa.gov/8nhh\)](http://go.usa.gov/8nhh)

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PRINCIPLE 4:

Provide Individualized Nutrition Therapy for People With or at Risk for Diabetes

Nutrient intake and physical activity (discussed in Principle 5) are the key determinants of energy balance. Individualized nutrition therapy is an integral component of diabetes and prediabetes management. It helps people achieve blood glucose, blood pressure, blood lipid, and weight goals;^[1–3] prevent or delay the development of complications; address individual nutrition needs; and limit food choices when indicated by scientific evidence.

Reduced fat and caloric intake along with moderately intense physical activity was a key component of the lifestyle interventions in the Diabetes Prevention Program (DPP) and the Look AHEAD (Action for Health in Diabetes) study. DPP participants had prediabetes and achieved a mean 7 percent weight loss at 1 year. The lifestyle intervention reduced their risk of developing diabetes by 58 percent^[4] at the end of the study and by 34 percent at 10 years.^[5] Look AHEAD participants had type 2 diabetes and achieved a mean 8 percent weight loss at 1 year. Although the lifestyle intervention did not reduce cardiovascular events, benefits found in secondary analyses included reduced sleep apnea and need for diabetes medications, and improved mobility and quality of life.^[6]

Nutrition therapy providers

Ideally, people with diabetes are referred to a registered dietitian/registered dietitian nutritionist (RD/RDN) for medical nutrition therapy (MNT) at the time of diagnosis.^[3] Studies have shown that MNT leads to decreases in A1C ranging from 0.5 percent to 2.6 percent (average of approximately 1 to 2 percent), similar to the effects of many glucose-lowering medications.^[7]

Nutrition therapy in a broader sense may be provided by other health care team members, such as diabetes educators.^[8] Health care team members providing nutrition therapy should have adequate training and work within the scope of their practice and state regulations. All nutrition therapy should involve a nutrition assessment, nutrition diagnosis, individualized nutrition interventions, and nutrition monitoring and evaluation with ongoing follow-up to support long-term lifestyle changes, evaluate outcomes, and modify interventions as needed.^[8]

Macronutrient intake for people with or at risk for diabetes^[1–3, 8]

The following ranges for nutrients are provided for guidance, but specific therapy recommendations should be based on each person's health status, comorbidities, food preferences, and nutritional needs. It is also recommended that individualized meal plans include optimization of food choices to meet recommended daily allowances and dietary reference intakes for all micronutrients.

Adjust the mix of carbohydrate, protein, and fat to meet diabetes management goals and patient preferences. Consider reduction of caloric intake and emphasize portion control for weight management goals.

Fat

Limit calories from fat to reduce caloric intake as needed to achieve weight loss, and limit *trans* and saturated fat to reduce the risk of cardiovascular disease.

- Saturated fat should be less than 10 percent of total calories.
- Minimize intake of *trans* fat.
- Cholesterol intake should be less than 300 mg per day.
- Choose monounsaturated and polyunsaturated fats (including omega-3 fatty acids), such as those found in seafood, nuts, seeds, avocado, and oils (e.g., olive, canola, corn, safflower, and sunflower oils).

Carbohydrate

Select foods high in fiber, and limit foods with added sugars and refined grains.

- Eat a variety of fruits and vegetables each day.
- Eat at least 14 g fiber/1,000 kcal per day.
- At least half of all grains consumed should be whole grains.

Note: For people with diabetes on insulin, monitoring carbohydrate intake is a key strategy in achieving glycemic control, whether by carbohydrate counting, use of carbohydrate choices or exchanges, or experience-based estimation. For other people with diabetes, monitoring calories may be more important.

Protein

Recommended dietary intake of protein for individuals with diabetes is similar to that for the general public: 15 to 20 percent of calories.

- Choose low-fat animal- and plant-based protein sources (e.g., lean meat, fish, poultry without skin, eggs, dried beans and peas, and soy products).

Sodium, alcohol, and fluid intake

- Limit sodium intake to 2,300 mg per day for the general population. Intake as low as 1,500 mg per day may be appropriate for some people.^[1, 9]
- Limit alcohol intake (≤ 2 drinks for men and ≤ 1 drink for women per day).
- Drink water and other beverages with few or no calories. Sugar-sweetened beverages are a significant and often unrecognized source of calories.

Weight management for overweight and obese individuals

Weight loss is an important goal in overweight or obese individuals with or at risk for diabetes. Although the goal is to achieve and maintain a healthy body weight (i.e., body mass index [BMI] of 18.5 kg/m² to 24.9 kg/m²), even a 5 to 10 percent weight loss can improve health and lower the risk of type 2 diabetes for those at risk. In overweight and obese individuals with diabetes, calorie restriction and increased physical activity resulting in moderate weight loss (averaging 10 percent) led to improved glucose, blood pressure, and lipid control with less use of medication and also reduced mobility loss by half.^[6, 10]

Weight loss requires a reduction in energy intake and is enhanced by regular physical activity. A moderate decrease in caloric balance (500–1,000 kcal/day) will result in a slow but progressive weight loss (1–2 lbs/week). However, maintaining a smaller deficit can have a meaningful influence on body weight over time. Weight loss meal plans should be individualized, and for most people, they should supply at least 1,200 to 1,500 kcal/day for women and 1,500 to 1,800 kcal/day for men.^[11]

For weight loss, a low-carbohydrate, low-fat calorie-restricted, or Mediterranean diet may be effective in the short term (up to 2 years).^[12] A low-fat, low-calorie diet along with moderate-intensity physical activity for 150 minutes per week markedly reduced development of type 2 diabetes in the DPP^[4] and the Finnish Diabetes Prevention Study.^[13] Strong evidence shows that eating patterns that are low in calorie density improve weight loss and weight maintenance and also may be associated with a lower risk of type 2 diabetes in adults.^[1] A dietary pattern low in calorie density has a relatively high intake of vegetables, fruit, and dietary fiber and a relatively low intake of total fat, saturated fat, and added sugars. The U.S. Department of Agriculture (USDA) Food Patterns and the Dietary Approaches to Stop Hypertension (DASH) Eating Plan are examples of eating patterns that are low in calorie density. (See Resources.)

Helpful behaviors and practices for weight management^[1]

Several behaviors and practices have been shown to help people manage their food and beverage intake and calorie expenditure and, ultimately, body weight. The behaviors with the strongest evidence related to body weight that people can be encouraged to follow include:

Behaviors related to food intake

- Focus on the total number of calories consumed and portion sizes.
- Monitor food intake. Recording intake of calories can help individuals become more aware of what and how much they eat and drink.
- Choose smaller portions or lower-calorie options when eating out.

- Prepare, serve, and consume smaller portions of foods and beverages, especially those high in calories and sugar.
- Choose water to drink instead of sugar-sweetened beverages.
- Eat a healthy breakfast. Choose whole grains, fruit, and protein foods low in fat. Consider getting about 20 percent of daily calories at breakfast.

Other behaviors

- Record physical activity.
- Limit screen time and avoid eating while watching television, which can result in overeating.
- Improve nutrition literacy, gardening, and cooking skills to heighten enjoyment of preparing and consuming healthy foods.
- Self-weigh consistently—at least once per week.^[14]

Amount and frequency of medical nutrition therapy for diabetes^[7]

An initial series of three to four encounters with an RD/RDN, each lasting 45 to 90 minutes, is recommended. This series, beginning at diagnosis of diabetes or at first referral for therapy, should be completed within 3 to 6 months. The RD/RDN should determine whether additional therapy is needed based on an assessment of the patient's learning needs and progress toward desired outcomes. When delivered by an RD/RDN according to nutrition practice guidelines, medical nutrition therapy is covered by Medicare and other health insurance plans.

Coverage for obesity and nutrition therapy

The Centers for Medicare & Medicaid Services (CMS) cover intensive behavioral therapy and nutrition counseling for obesity (BMI ≥ 30 kg/m²). Counseling may be covered for up to 12 months if it is provided by a qualified primary care physician or other primary care practitioner in a primary care setting and if the person achieves certain weight loss goals. In addition, some state Medicaid programs or commercial payers provide health insurance coverage for nutrition therapy for people with prediabetes.

Patient follow-up and community resource referral^[1, 10]

- Follow-up and monitoring of a patient's progress is essential. Review the meal plan and discuss any related issues at each visit.
- A focus on improved glucose and cholesterol levels, blood pressure, and self-esteem can reinforce the importance of lifestyle changes that lead to improved well-being.

- Referral to weight control or wellness clinics can help overweight patients maintain lifestyle changes and achieve modest weight loss.
- For people at risk of diabetes, the National Diabetes Prevention Program (NDPP) offers structured lifestyle interventions.
- Family and community support are important for helping people with or at risk for diabetes to obtain and maintain proper nutrition.

Resources

- Centers for Medicare & Medicaid Services:
 - [Intensive Behavioral Therapy for Obesity](http://go.usa.gov/8QqG) (<http://go.usa.gov/8QqG>)
 - [Diabetes Self-Management Training](http://go.usa.gov/GMge) (<http://go.usa.gov/GMge>)
 - [Rules and Regulations – Medicare and Medicaid Programs; Regulatory Provisions To Promote Program Efficiency, Transparency, and Burden Reduction; Part II – Final Rule - Pages 27105-27157 \(FR DOC # 2014-10687\)](http://go.usa.gov/ADpe) (<http://go.usa.gov/ADpe>)
- Centers for Disease Control and Prevention: [National Diabetes Prevention Program](http://go.usa.gov/8Q3C) (<http://go.usa.gov/8Q3C>)
- National Heart, Lung, and Blood Institute: [DASH Eating Plan](http://go.usa.gov/GUZV) (<http://go.usa.gov/GUZV>)
- U.S. Department of Agriculture:
 - Dietary Guidelines for Americans, 2010: [Chapter 5: Building Healthy Eating Patterns](http://go.usa.gov/GUZH) (<http://go.usa.gov/GUZH>)
 - [ChooseMyPlate](http://go.usa.gov/8Qax) (<http://go.usa.gov/8Qax>)
- American Association of Diabetes Educators: [Find a Diabetes Educator](http://bit.ly/1pvlctb) (bit.ly/1pvlctb)
- Academy of Nutrition and Dietetics: [Find a Registered Dietitian Nutritionist](http://bit.ly/RxXIND) (bit.ly/RxXIND)
- [2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines](http://bit.ly/1FMbjAQ) (bit.ly/1FMbjAQ)
- [2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults:](http://bit.ly/1FMbjAQ)

[A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society \(bit.ly/1ww7afP\)](http://bit.ly/1ww7afP)

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PRINCIPLE 5:

Encourage Regular Physical Activity for People With or at Risk for Diabetes

For people with or at risk of diabetes, regular physical activity helps improve insulin sensitivity and glycemic control, positively affects lipids and blood pressure, assists with weight maintenance, and reduces the risk for cardiovascular disease (CVD).^[1, 2] It also can improve psychological well-being, health-related quality of life, and depression in individuals with type 2 diabetes, among whom depression is more common than in the general population.^[1] Muscle-strengthening activity can increase bone strength and muscular fitness and help maintain muscle mass during a program of weight loss.^[1, 2]

Physical activity (along with nutrition therapy) was a key component of the lifestyle interventions tested in the Diabetes Prevention Program (DPP) for prediabetes^[3, 4] and in the Look AHEAD (Action for Health in Diabetes) study for type 2 diabetes.^[5] These lifestyle interventions respectively achieved mean weight losses of 7 percent and 8 percent at 1 year and included 150 or 175 minutes per week of physical activity such as walking.^[5] As detailed in Principle 4, the combination of increased physical activity and reduced caloric intake dramatically reduced development of diabetes in the DPP and improved fitness, quality of life, and mobility in Look AHEAD.

Encourage physical activity^[1, 2]

Adults with or at risk for diabetes, in consultation with their health care team and in the absence of contraindications, benefit from:

- At least 150 minutes per week of moderate-intensity aerobic physical activity. Activity should be spread over at least 3 days per week, with no more than 2 consecutive days without exercise. Instead of 150 minutes, a person could substitute 75 minutes (1.25 hours) per week of vigorous aerobic exercise.
- Encourage adults who are unable to be active for 150 minutes per week to engage in regular physical activity according to their abilities. Inform them about the amounts and types of physical activity that are appropriate for their abilities.
- Advise older adults with limited mobility about safe ways to be more active, such as chair exercises, exercise classes designed for seniors, or aquatic exercise.
- Muscle-strengthening activity at least two to three times per week on nonconsecutive days, targeting all major muscle groups.

Although there is no specific ocular contraindication to moderate or intense physical activity for most people with diabetes or diabetic retinopathy, people with sight-threatening retinopathy should seek counsel from their eye care provider before initiating vigorous aerobic or muscle-strengthening

exercises.^[6] Mild to moderate nonproliferative diabetic retinopathy (NPDR) is not a contraindication to moderate or intense physical activity in the absence of diabetic macular edema.

People who engage in both aerobic and muscle-strengthening forms of exercise are likely to attain the greatest benefit. Adults with diabetes who exercise more than 150 minutes per week have even greater reductions in A1C than those who exercise less than 150 minutes per week.^[7]

Aerobic physical activity^[1, 2]

All types of aerobic activities are beneficial as long as they are of sufficient intensity and duration. Both moderate- and vigorous-intensity aerobic activity should be performed in episodes of at least 10 minutes.

As a rule of thumb, a person doing moderate-intensity aerobic activity can talk, but not sing, during the activity. A person doing vigorous-intensity activity cannot say more than a few words without pausing for a breath.

Examples of different aerobic physical activities and intensities include:

Moderate intensity

- Walking briskly (3 miles per hour or faster, but not race-walking)
- Water aerobics
- Bicycling slower than 10 miles per hour
- Tennis (doubles)
- Ballroom dancing
- General gardening

Vigorous intensity

- Race-walking, jogging, or running
- Swimming laps
- Tennis (singles)
- Aerobic dancing
- Bicycling 10 miles per hour or faster

- Jumping rope
- Heavy gardening (continuous digging or hoeing, with heart rate increases)
- Hiking uphill or with a heavy backpack

Muscle-strengthening activity^[1, 2]

Muscle-strengthening activities are beneficial if they work the major muscle groups of the body: the legs, hips, back, chest, abdomen, shoulders, and arms. Resistance training, including weight training, is a familiar example of muscle-strengthening activity. Other examples include working with resistance bands, doing calisthenics that use body weight for resistance (such as push-ups, pull-ups, and sit-ups), carrying heavy loads, and heavy gardening (such as digging or hoeing).

These activities should be done at least 2 days a week and performed to the point at which it would be difficult to do another repetition without help. When resistance training is used to enhance muscle strength, one set of 8 to 12 repetitions of each exercise is effective, although two or three sets may be more effective. Development of muscle strength and endurance is progressive over time.

Goal setting^[1, 2]

Encourage people with or at risk for diabetes to set a modest initial physical activity goal. Physical activity should be increased gradually over time, regardless of the person's current level of physical activity. Inactive people and those with low levels of physical activity should:

- Generally start with relatively light- to moderate-intensity aerobic activity, such as 5 to 15 minutes of walking per session, two to three times a week.
- First, gradually increase the number of minutes per session (duration) and the number of days per week (frequency) of moderate-intensity activity. Later, if desired, increase the intensity.
- Consider the person's age, level of fitness, and prior experience when individualizing the rate of increase.
- Focus on developing self-efficacy and fostering social support from family, friends, and the health care team.

Appropriate precautions^[1, 2]

- Evaluate people initially for contraindications and limitations to physical activity, and then, in consultation with them, develop an appropriate physical activity plan.
- Gradual initiation of moderate-intensity activity is safe for most people with diabetes. Risk of CVD or injury should be assessed by their primary care provider before beginning a vigorous physical activity program.
- Counsel people to pay special attention to blood glucose control and prevention of hypoglycemia when being active to help ensure that moderate-intensity activity is safe and beneficial. People taking medications that can cause hypoglycemia should be particularly cautious and test blood glucose before and after exercise to monitor for hypoglycemia.
- Encourage use of the right gear and equipment, including proper footwear; choosing safe environments in which to be active; and making sensible choices about how, when, and where to be active.

Resources

- Academy of Nutrition and Dietetics: [A Physical Activity Toolkit for Registered Dietitians](http://bit.ly/1jYeHyv) (bit.ly/1jYeHyv)
- U.S. Department of Health and Human Services: [Physical Activity Guidelines for Americans](http://go.usa.gov/8QC4) (<http://go.usa.gov/8QC4>)
- [2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines](http://bit.ly/1FMbjAQ) (bit.ly/1FMbjAQ)
- [2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society](http://bit.ly/1ww7afP) (bit.ly/1ww7afP)

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PRINCIPLE 6:

Control Blood Glucose to Prevent or Delay the Onset of Diabetes Complications and Avert Symptoms of Hyperglycemia and Hypoglycemia

Poor blood glucose control (A1C > 9.0 percent) is associated with symptoms that can include frequent urination, thirst, blurred vision, fatigue, and recurring infections. Treatment of adults with type 2 diabetes with poor glucose control to lower A1C to a mean of 7.5 percent has been shown to improve quality of life and work productivity.^[1] Beyond relief of immediate symptoms associated with poor control, the goal of blood glucose control is to reduce long-term complications of diabetes.

The Diabetes Control and Complications Trial (DCCT)^[2] found that measures of early microvascular complications were reduced 50 to 76 percent in participants with type 1 diabetes randomized to intensive control. The intensively controlled group achieved an average A1C of about 7 percent compared with controls with an average A1C of about 9 percent. The Epidemiology of Diabetes Interventions and Complications (EDIC)^[3] follow-up observational study of the DCCT showed that participants also had benefits that endured and grew over the following 2 decades despite equivalent subsequent A1C levels. During EDIC, the treatment group had major reductions in eye, nerve, kidney, and heart complications and less than half the number of cardiovascular disease (CVD) events than in the conventionally treated group.

Similarly, in people with newly diagnosed type 2 diabetes, the United Kingdom Prospective Diabetes Study^[4] and its 10-year follow-up observational study^[5] found that reduced complications persisted for at least a decade after a finite period of intensive glycemic control (average A1C of 7 percent compared with 7.9 percent with standard treatment). As in DCCT/EDIC, significant microvascular benefits persisted, and macrovascular benefits emerged with reduced myocardial infarction.

Three randomized trials designed to test the benefits of near-normalization of blood glucose on CVD in participants with long-standing type 2 diabetes found no benefit in the primary macrovascular outcome,^[6–8] and one found increased mortality.^[6] These trials did demonstrate reduction in some early microvascular disease measures, such as albuminuria, with lowering of A1C below 7 percent.

Risks of blood glucose control

Findings from the three clinical trials indicate that caution is needed in setting A1C goals lower than 7 percent in people with long-standing type 2 diabetes who have CVD or multiple CVD risk factors.^[6–8] All three trials showed that near-normal glucose control increased the risk of severe hypoglycemia. Moreover, the intensive blood glucose control group (A1C goal < 6.0 percent) of the Action to Control Cardiovascular Risk in Diabetes (ACCORD)^[6] trial was stopped early at 3.5 years due to a 20 percent relative risk increase in mortality in the intensive control group compared to standard glucose control (A1C goal 7.0–7.9 percent). The increase in mortality overshadowed the modest reduction in myocardial infarction risk. ACCORD studied older people (mean age 62 years) with a 10-year average duration of diabetes and known CVD or multiple CVD risk factors.

A randomized trial of early insulin replacement to normalize blood glucose in people with prediabetes or early type 2 diabetes found a neutral effect on CVD, increased hypoglycemia, and modest weight gain.^[9]

Hypoglycemia is the leading limiting factor in the glycemic management of type 1 and insulin-treated type 2 diabetes.^[10] Mild hypoglycemia may be inconvenient or frightening to people with diabetes, and more severe hypoglycemia can result in falls, seizures, machinery/motor vehicle accidents, or other injury. Treatment of hypoglycemia (plasma glucose < 70 mg/dL) requires ingestion of 15 to 20 grams of glucose- or carbohydrate-containing foods. An individual with severe hypoglycemia who is unable to ingest fast-acting carbohydrates should be treated using emergency glucagon kits, which require a prescription. Those in close contact with people who have hypoglycemia-prone diabetes should be instructed in the use of such kits.

Prevention of hypoglycemia is particularly critical for people treated with insulin and/or sulfonylureas. People with diabetes should understand factors (such as physical activity or missed meals) that increase their risk of hypoglycemia and ways to prevent and treat it.

In type 1 diabetes and severely insulin-deficient type 2 diabetes, the syndrome of hypoglycemia unawareness, or hypoglycemia-associated autonomic failure, can severely compromise stringent diabetes control and quality of life. The deficient counter-regulatory hormone release and autonomic responses in this syndrome are both risk factors for and caused by hypoglycemia. Temporary relaxation of glycemic control to avoid hypoglycemia may reverse hypoglycemia unawareness.^[10]

A1C treatment goals

Because the benefits of intensive glucose control emerge slowly and the risks associated with hypoglycemia are more immediate, people with longer life expectancy have more to gain from intensive glucose control. Treatment targets should be individualized based on duration of diabetes, age/life expectancy, comorbid conditions, known CVD or advanced microvascular complications, hypoglycemia unawareness, and discussion with the person of benefits and risks of specific levels of glycemic control.^[11]

- Consider A1C targets as close to non-diabetic levels (< 6.5 percent) as possible without significant hypoglycemia in people with short duration of diabetes, little comorbidity, and long life expectancy.
- Consider less stringent A1C targets (e.g., 8 percent) for people with a history of severe hypoglycemia, limited life expectancy, extensive comorbid conditions, advanced complications, major impairments to self-management (e.g., visual, cognitive, social), or long-standing diabetes where the A1C goal is difficult to attain despite optimal efforts.
- Reassess A1C targets and change (lower or higher) as appropriate.

Blood glucose management

The initiation and adjustment of therapy should target glucose values as close to an agreed-upon goal as possible without compromising the individual's safety. Medical nutrition therapy and physical activity are essential from diagnosis onward for people with diabetes. People on insulin or oral agents that stimulate insulin secretion are at increased risk for hypoglycemia.

- For people with type 1 diabetes, basal and meal-related insulin doses may be taken several times a day via multiple injections or an insulin pump in an attempt to normalize glucose metabolism and simulate normal insulin physiology.
- For people with type 2 diabetes, metformin (together with lifestyle modification) is recommended as the initial therapy at time of diagnosis unless metformin is contraindicated.
- Over time, people with type 2 diabetes may require combination therapy with other glucose-lowering medications to maintain the target A1C. Information about advantages and disadvantages of the available medication classes can help guide therapy selection.*^[12–14]

Use of strategies to help people with diabetes take their medicines as directed can improve adherence, clinical outcomes, productivity, and quality of life.^[15]

*Glucose-lowering medications differ in their mechanisms of action. Risks and side effects also vary. Comparative effectiveness studies provide insufficient evidence on long-term risks and benefits of other oral agents, glucagon-like peptide-1 receptor agonists, or insulin to guide the selection of a second agent when metformin is not sufficient to meet treatment goals.

Blood glucose assessment

- Use A1C values to guide therapy to achieve individualized glycemic targets.**^[16] Although point-of-care A1C tests give immediate results and may be useful for changing therapy, they are less accurate than clinical laboratory results, and there is no evidence that immediate results lead to better outcomes for people with diabetes than conventional laboratory testing.^[17]
- Regular self-monitoring of blood glucose (SMBG) or continuous glucose monitoring may help with self-management and therapy adjustment and with assessment of hypoglycemia and hyperglycemia. SMBG is useful for individuals taking insulin, but benefit has not been consistently shown in people not on insulin. Individual characteristics should determine how often self-monitoring is done; the specific testing method; and the way results are used, recorded, and reported.

- The following correlations between A1C values and mean plasma glucose may help health care providers set appropriate blood glucose targets for people required to self-monitor their blood glucose.

A1C percent	Mean plasma glucose, mg/dL
6	126
7	154
8	183
9	212
10	240
11	269
12	298

**See Principle 9 for information about variant hemoglobins that can alter some A1C test results.

Bariatric surgery

In obese people with uncontrolled type 2 diabetes, medical therapy plus bariatric surgery has been shown to induce short-term remission of diabetes^[18, 19] and to improve glycemic control at 3 years.^[20] Further study is necessary to assess the durability of these results over longer time periods. Bariatric surgery has been shown to delay the onset of type 2 diabetes^[21], but the long-term risks and benefits of the surgery are not yet known.

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PRINCIPLE 7:

Provide Blood Pressure and Cholesterol Screening and Control, Smoking Cessation, and Other Therapies to Reduce Cardiovascular Disease Risk

Hypertension and dyslipidemia commonly coexist with type 2 diabetes and are clear risk factors for cardiovascular disease (CVD), and diabetes itself confers independent risk. Because of their increased CVD risk, management of hypertension and cholesterol is particularly important for people with type 2 diabetes.^[1] Increased CVD risk also increases the importance of lifestyle modification, including abstinence from smoking. Extensive trial evidence shows the efficacy of targeted treatment of hypertension and statin therapy in the prevention and management of CVD in people with type 2 diabetes.

Although clinical trials to address blood pressure targets and statin therapy have not been conducted in people with type 1 diabetes, attention to CVD risk factors may be particularly important in people with type 1 diabetes because of their high CVD risk.

Evidence for blood pressure control

Although epidemiologic studies suggest that blood pressure higher than 115/75 mmHg is associated with progressive increases in CVD events and mortality in people with diabetes, randomized clinical trials have not demonstrated that lowering blood pressure to less than 140/80 mmHg provides a significant clinical benefit in type 2 diabetes. The United Kingdom Prospective Diabetes Study (UKPDS) found that blood pressure control that targeted less than 150/85 mmHg (achieved 144/82 mmHg) significantly reduced risk for diabetes-related deaths, stroke, heart failure, microvascular disease, retinopathy progression, and deterioration of vision in people with type 2 diabetes compared to a target of 180/105 mmHg.^[2] The Hypertension Optimal Treatment (HOT) trial found a 51 percent reduction in major CVD events in people with diabetes at a diastolic goal of 80 mmHg compared with 90 mmHg.^[3]

The Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial found no substantial advantage in lowering systolic blood pressure to less than 120 mmHg compared to less than 140 mmHg in people with type 2 diabetes, and found a higher risk of serious adverse events with lower blood pressure targets.^[4] A meta-analysis of randomized trials in adults with type 2 diabetes found that the use of intensive blood pressure targets (upper limit of 130 mmHg systolic and 80 mmHg diastolic) was associated with a small but significant reduction in stroke but no significant decrease in mortality or myocardial infarction.^[5]

The Systolic Hypertension in the Elderly Program (SHEP) study found that diuretics reduced CVD death in people with diabetes by 31 percent.^[6] Angiotensin converting enzyme (ACE) inhibitors have been shown to provide substantial benefits, including reduced risk of heart attack, stroke, and CVD death^[7, 8] and prevention of progression of nephropathy.^[9] The Action in Diabetes and Vascular Disease: Preterax and Diamicon MR Controlled Evaluation (ADVANCE) study assessed the effects

of the routine administration of an ACE inhibitor-diuretic combination in people with diabetes and found a significant reduction in relative risk of major macrovascular or microvascular events, death from CVD, and death from any cause.^[10]

Blood pressure management

- Blood pressure should be measured at every routine medical visit.
- Consider home blood pressure monitoring when office/clinic measurements are borderline or elevated.
- The following strategies may have antihypertensive effects similar to pharmacologic monotherapy:
 - Reduce sodium intake by selecting low-sodium foods, not adding sodium to food, and limiting processed foods.
 - Reduce excess body weight by increasing consumption of fruits, vegetables, and low-fat dairy products; avoiding excessive alcohol consumption; and increasing activity levels.
 - Follow the Dietary Approaches to Stop Hypertension (DASH) Eating Plan. (See Resources.)
 - Engage in 40 minutes of aerobic physical activity at a moderate to vigorous intensity, at least 3 days a week.^[11]
- Referral to a registered dietitian/registered dietitian nutritionist can also be helpful.

Therapy considerations

- People with a systolic blood pressure of 130 to 139 mmHg or a diastolic blood pressure of 80 to 89 mmHg may initially be treated with lifestyle therapy alone. Overweight people with higher blood pressure should receive both pharmacologic and lifestyle therapy at the time of diagnosis of hypertension.
- The primary goal of therapy is systolic blood pressure less than 140/90 mmHg. Lower blood pressure targets can be individualized, based upon shared decision making that addresses factors such as the level of CVD risk, presence of kidney disease, and burden of therapy.
- ACE inhibitors and angiotensin II receptor blockers (ARBs) are contraindicated in pregnancy.

Consider initial therapy with a thiazide, calcium channel blocker, ACE inhibitor, or an ARB. Multi-drug therapy (two or more agents at maximal doses) usually is required to achieve and maintain blood pressure targets. An ACE inhibitor or an ARB reduces progression of chronic kidney disease in people with albuminuria. Individualize further medication choices according to patient characteristics such as age, race, and response to therapy. Measure blood pressure at every health visit and adjust treatment as necessary.

Resources for blood pressure management

- National Heart, Lung, and Blood Institute: [DASH Eating Plan](http://go.usa.gov/GUZV) (<http://go.usa.gov/GUZV>)
- [AHA/ACC/CDC Science Advisory: An Effective Approach to High Blood Pressure Control: A Science Advisory From the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention](#) (bit.ly/1sXKpiE)

Evidence for statin therapy

People with type 2 diabetes commonly have lipid patterns characterized by elevated triglyceride and reduced high-density lipoprotein cholesterol levels. Although their low-density lipoprotein (LDL) cholesterol values are generally not higher than those in non-diabetic individuals, they often have a greater number of smaller, denser, and more atherogenic LDL particles.^[12] Studies using the HMG-CoA reductase inhibitors (statins) have clearly shown that moderate to intensive statin therapy can reduce CVD events in people with diabetes.^[13–16] Rather than targeting specific levels of LDL cholesterol, these studies have generally achieved 30 to 40 percent reductions from baseline LDL cholesterol levels.^[17] In people with diabetes over age 40 and with other CVD risk factors, moderate- to high-intensity statin therapy reduces CVD risk regardless of the baseline LDL cholesterol level.

Cholesterol management

- Lifestyle modification to improve lipid profiles is indicated to reduce the risk of CVD in all people with diabetes. This involves actions to reduce intake of saturated fat, *trans* fat, and cholesterol; to increase intake of omega-3 fatty acids, viscous fiber, and plant stanols/sterols; to increase physical activity; and to reduce weight (if indicated). See Principles 3, 4, and 5 for more information about nutrition and physical activity therapy.
- Statin therapy should be added to lifestyle therapy, regardless of baseline lipid levels, for people with diabetes who have overt CVD. Statin therapy should be considered in individuals with diabetes who are without overt CVD but are at substantial risk of developing CVD (e.g., over age 40).
- Risk of CVD is increased more in people with type 1 diabetes compared with type 2 diabetes, but it is not known if routine use of statins in people with type 1 diabetes under age 40 is useful for primary prevention of CVD.
- The strongest evidence for statin use is in people with diabetes who are 45 to 75 years old.
- Additional lipid-lowering medications have not been shown to reduce CVD risk in people with type 2 diabetes on statin therapy.^[18–20]
- Statins are contraindicated for women who are pregnant or considering pregnancy.^[21]

Statin therapy dosage should be carefully titrated according to individual responses to therapy and the occurrence of muscular and other side effects. Measurement of blood lipids may provide

information on adherence to therapy. The small increase in the relative risk of developing diabetes with high-dose statin therapy is outweighed by the major benefits of statin therapy in reducing CVD and mortality.^[22]

Resources for cholesterol management

- [2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4374557/) (bit.ly/1uPHNBF)

Multiple risk factor reduction

In the Steno-2 Study,^[23] a target-driven, long-term, intensified intervention aimed at multiple risk factors in people with type 2 diabetes and microalbuminuria, the risk of cardiovascular and microvascular events was reduced by about 50 percent. This study demonstrated the value of comprehensively addressing CVD risk factors. Long-term follow-up of the participants found significant reductions in CVD deaths.^[24]

Anti-platelet therapy

Aspirin has been shown to be effective in reducing cardiovascular morbidity and mortality in high-risk people with diabetes and previous myocardial infarction or stroke (secondary prevention). Daily low-dose aspirin therapy (e.g., 75–81 mg) appears to have a modest effect at best on primary CVD prevention in patients with diabetes. In adults with 10-year coronary heart disease (CHD) risk lower than 10 percent (e.g., women under age 60 and men under age 50 without other CVD risk factors), the risk of bleeding may outweigh the atherosclerotic CVD benefits. Studies have not found a clear benefit of low-dose aspirin for primary prevention of atherosclerotic CVD in people without prior disease events.^[25–27]

- Use low-dose aspirin in adults with diabetes and a history of atherosclerotic CVD.
- In men over 50 and women over 60 with diabetes and other major atherosclerotic CVD risk factors, low-dose aspirin may be considered as a prevention strategy for cardiovascular events.^[24]
- For primary prevention of atherosclerotic CVD for people with diabetes, consider aspirin therapy in those who have a 10-year CHD risk of more than 10 percent.^[28]

Resources for cardiovascular risk assessment

- Atherosclerosis Risk in Communities Study: [CHD Risk Calculator](https://www.cdc.gov/ncj110582/110582.htm) (bit.ly/1nR77VW)
- Diabetes Trials Unit: [UKPDS Risk Engine for assessment of CHD risk](https://www.ukpds.com/) (bit.ly/Ry64iQ)

- [2013 ACC/AHA Guideline on the Assessment of Cardiovascular Risk: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines \(bit.ly/1oBIMIS\)](#)

Tobacco use cessation

Smoking more than doubles the risk for CVD in people with diabetes.^[29] While smokeless tobacco poses a lesser risk for CVD than cigarette smoking, all forms of tobacco should be discouraged.^[30] People who stop using tobacco greatly reduce their risk of premature death. Medications, counseling, telephone help lines, and smoking cessation programs increase a person's chances of success at stopping tobacco use. Additional effective therapies include nicotine replacement products (e.g., gum, inhaler, and patch).

Resources for tobacco use cessation

- Community Preventive Services Task Force: [Cessation incentives \(bit.ly/1hvcLco\)](#)
- National Cancer Institute:
 - www.smokefree.gov
 - 1-877-44U-QUIT
 - 1-800-QUIT-NOW (1-800-784-8669)

Note: Failure to take medication regularly as directed should be considered in people who do not meet blood pressure targets or show evidence of cholesterol lowering. Using strategies to help people with diabetes take their medicines as directed can improve adherence and affect their clinical outcomes, productivity, and quality of life.^[31]

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PRINCIPLE 8:

Provide Regular Assessments to Detect and Monitor Diabetes Microvascular Complications and Treatment to Slow Their Progression

Nephropathy

Diabetes is the leading cause of end-stage renal disease (ESRD). Intensive glucose control and blood pressure reduction have been shown to reduce onset and progression of nephropathy in type 1 and type 2 diabetes.^[1–3] While blood pressure control is important for all people with diabetes, it is particularly imperative to achieve blood pressure control in people with diabetic nephropathy, both to prevent progression of nephropathy and because nephropathy is a risk factor for cardiovascular disease (CVD). Early recognition of kidney damage in people with diabetes allows for preventive measures to slow or prevent progressive loss of kidney function.

Use of angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) to lower systolic blood pressure in people with diabetes and albuminuria slows the rise in levels of albuminuria and the decline in glomerular filtration rate (GFR). ACE inhibitors also reduce major CVD outcomes in people with type 2 diabetes.^[4]

Persistent albuminuria is an early marker of diabetic kidney disease and is useful for monitoring progression and prognosis. Urine albumin excretion exceeding what is considered normal (< 30 mg/day), even when below what is detected by dipstick (equivalent to 300 mg/day), is an early marker of diabetic nephropathy and a risk factor for CVD. Albuminuria increases with diabetes progression. High levels of albuminuria are associated with rapid progression. However, decreased GFR can occur in the absence of albuminuria in people with diabetes.^[4]

Nephropathy assessment

- Annually assess urine albumin excretion in adults and children with type 1 diabetes with diabetes duration of more than 5 years and in adults and children with type 2 diabetes starting at diagnosis. Use the albumin-to-creatinine ratio in a random spot urine collection to assess urine albumin excretion. Results are reported as albumin in mg/g creatinine and are equivalent to albumin excretion in mg/day.
- Annually measure serum creatinine in all adults with diabetes regardless of the degree of urine albumin excretion. Use the serum creatinine to estimate GFR.

Nephropathy management

- Hyperglycemia and hypertension are major risk factors for the onset and progression of nephropathy. Multiple drugs are often required to control blood pressure. Therapy should be individualized based on risks and benefits. For more information about blood glucose and blood pressure control, refer to Principles 6 and 7.

- Use an ACE inhibitor or an ARB to manage nonpregnant people with hypertension and diabetes. Patients without hypertension and with urine albumin-to-creatinine ratio (UACR) higher than 300 mg/g should also receive an ACE inhibitor or ARB. Evidence for treatment of nonhypertensive people with lower levels of albuminuria (30–300 mg/g creatinine) is less well supported. Do not use these medications in pregnant women or women considering pregnancy.
- Refer people to a registered dietitian/registered dietitian nutritionist specializing in kidney disease to help moderate intake of dietary sodium, phosphorus, potassium, and protein as necessary.
- Screen for anemia, malnutrition (e.g., low serum albumin), and mineral and bone disease (potassium, bicarbonate, calcium, phosphorus, and vitamin D deficiency) when the estimated GFR is less than 60 mL per minute per 1.73 m².
- Consider referral to a physician experienced in the care of kidney disease when there is uncertainty about the etiology of kidney disease (active urine sediment, heavy proteinuria, absence of retinopathy, or rapid decline in GFR), difficult management issues, or advanced kidney disease.
- Educate people with diabetes about the progressive nature of kidney disease, the renal preservation benefits of optimal management of blood pressure and blood glucose, the importance of a low-sodium diet, and the potential need for renal replacement therapy.

Resources for nephropathy

- National Kidney Disease Education Program: [GFR Calculators](http://go.usa.gov/8QCP) (<http://go.usa.gov/8QCP>)
- National Kidney Foundation–Kidney Disease Outcomes Quality Initiative: [Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease](http://bit.ly/10rIxoZ) (bit.ly/10rIxoZ)

Neuropathy

Early recognition and appropriate management of neuropathy is important because a number of symptomatic treatment options exist for diabetic neuropathy.^[5] Most common among the neuropathies are chronic sensorimotor distal symmetric polyneuropathy (DPN) and autonomic neuropathy. Up to 50 percent of DPN patients may be asymptomatic and at risk of insensate injury to their feet. Autonomic neuropathy may involve every system in the body, and cardiovascular autonomic neuropathy causes substantial morbidity and mortality. Optimal glycemic control may slow progression of neuronal loss.

Neuropathy assessment

- Screen all people with diabetes for DPN at diagnosis of type 2 diabetes and 5 years after diagnosis of type 1 diabetes and at least annually thereafter, using simple clinical tests such as monofilament pressure sensation, pinprick sensation, vibration perception, and ankle reflexes.

- Assess people found to have peripheral neuropathy for vitamin deficiencies, alcoholism, hypothyroidism, and heavy metal or toxin exposure.
- Screen for signs and symptoms of cardiovascular autonomic neuropathy (such as resting tachycardia and orthostatic hypotension) at diagnosis of type 2 diabetes and 5 years after diagnosis of type 1 diabetes.
- Assess adults for symptoms of gastrointestinal neuropathy and genitourinary tract problems, including erectile dysfunction in men.

Foot assessment

Annually conduct a comprehensive foot examination, including skin (dryness, sweating, fungal infection, cracking, ulceration, calluses, and blistering), musculoskeletal, neurological, vascular, and footwear assessment.^[6]

Neuropathy management

- Optimize the control of blood glucose to reduce the risk for or slow the progression of neuropathy.
- Consider medications for the relief of specific symptoms related to DPN and autonomic neuropathy. Medication does not slow progression of neuropathy and must be carefully titrated, balancing reduction in symptoms against side effects with the goal of improving quality of life.^[5]
- Educate all adults with DPN about self-care of the feet:
 - Daily foot inspection, skin and nail care, use of emollients, treatment for callus, and selection of footwear.
 - For those with significant DPN, provide enhanced foot care education about their risk factors and appropriate management as well as referral for special footwear.
- Referral to specialists may improve the management of high-risk feet. When the patient or health care team detects a foot ulcer, prompt referral to a foot specialist may prevent the development of osteomyelitis.^[7]

Resources for neuropathy

- American Academy of Neurology: [Evidence-Based Guideline: Treatment of Painful Diabetic Neuropathy](http://go.usa.gov/8QCz) (<http://go.usa.gov/8QCz>)
- American Diabetes Association:
 - [Comprehensive Foot Examination and Risk Assessment](http://bit.ly/1ioUsWy) (bit.ly/1ioUsWy)

- [Inpatient Management of Diabetic Foot Disorders: A Clinical Guide](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4111111/) (bit.ly/1jYlqsc)

- Indian Health Service Division of Diabetes Treatment and Prevention: [Diabetes Foot Care Training](https://www.ihs.gov/diabetes/education/training/) (<http://go.usa.gov/8Q45>)

Retinopathy

Diabetic retinopathy is the leading cause of blindness in working-age adults. Optimal glycemic management and blood pressure control can reduce risk of retinopathy or slow its progression.^[1, 2, 8, 9] Regular screening for retinopathy is important to identify people with diabetes at risk for vision loss who can benefit from interventions.

Laser photocoagulation therapy reduces risk of vision loss in patients with high-risk proliferative diabetic retinopathy (PDR); clinically significant macular edema (CSME); and, in some cases, severe nonproliferative diabetic retinopathy (NPDR). The Diabetic Retinopathy Study^[10] showed that panretinal photocoagulation surgery reduced the risk of severe vision loss from PDR from 15.9 percent in untreated eyes to 6.4 percent in treated eyes. The Early Treatment Diabetic Retinopathy Study^[11] established the benefit of focal laser photocoagulation surgery in eyes with CSME. This study also verified the benefits of panretinal photocoagulation for high-risk PDR and in older-onset patients with severe NPDR or less-than-high-risk PDR. More recently, intravitreal treatment with a vascular endothelial growth factor (VEGF) inhibitor alone or in combination with laser therapy was shown to improve vision, retinal thickening, and patient quality of life more than laser alone in patients with CSME.^[12]

Retinopathy assessment

- For adults and children over 10 with type 1 diabetes, provide an initial dilated and comprehensive eye examination by an eye care professional (optometrist or ophthalmologist) within 3 to 5 years after the onset of diabetes.
- Provide people with type 2 diabetes with an initial dilated and comprehensive eye examination by an eye care professional shortly after the diagnosis of diabetes.
- Repeat dilated comprehensive eye examinations at least annually for persons with established retinopathy. Individualize the frequency and type of professional follow-up referral (such as to a retinal specialist) as needed. Less-frequent examinations (every 2–3 years) may be considered following one or more normal eye examinations based on individual risk factors for development of retinopathy, including diabetes duration, glycated hemoglobin, blood pressure, and patient understanding of and compliance with principles of good diabetes self-care.
- Because ocular complications of diabetes are myriad, including cataract, glaucoma, ocular surface disease, hypertensive retinopathy, retinal vascular occlusive disease, and ischemic optic neuropathy, all people with diabetes should have regular comprehensive eye examinations.

- Eye care providers should stress the importance of early, good glycemic control as a protective factor against the onset and progression of diabetic retinopathy and other ocular complications of diabetes, and should promptly communicate eye examination findings to the patient's PCP and/or endocrinologist.
- The use of retinal photography with remote reading by experts may improve detection and management of sight-threatening diabetic retinopathy and has great potential in areas where qualified eye care professionals are not available. Photos are not a substitute for a comprehensive eye examination, which should be performed at least initially and at intervals thereafter as recommended by an eye care professional.

Retinopathy management

- Optimize the control of blood glucose, blood pressure, and blood lipids to reduce the risk for or slow the progression of retinopathy.
- Promptly refer patients with any level of macular edema, severe NPDR, or any PDR to an eye care professional experienced in the management of retinal disease.
- Retinopathy is not a contraindication to low-dose aspirin use for CVD prevention.

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PRINCIPLE 9:

Consider the Needs of Special Populations—Children, Women of Childbearing Age, Older Adults, and High-Risk Racial and Ethnic Groups

Children and adolescents

Diabetes is one of the most common chronic conditions in school-age children in the United States. About 208,000 youth under 20 years old have diabetes, 0.25 percent of all in this age group.^[1] Type 1 diabetes accounts for nearly all diabetes in children under age 10. After age 10, type 1 is the most common form in U.S. youth overall, but type 2 is more common in new cases among minority groups, with the highest rates in American Indian youth. Distinction between type 1 and type 2 diabetes can be difficult but is important for determining appropriate treatment.^[2] Testing for type 2 diabetes should be considered in overweight or obese youth with additional risk factors, such as family history, race or ethnicity, acanthosis nigricans, or polycystic ovary syndrome.

Most newly diagnosed cases of type 1 diabetes occur in individuals younger than 18. More children and teens are now getting type 2 diabetes, and the incidence of both type 1 and type 2 diabetes in youth is increasing. Therefore, the unique requirements for this age group must be addressed. Care of this group requires integration of diabetes management with the complicated physical and emotional growth needs of children, adolescents, and their families, as well as consideration of teens' emerging autonomy and independence. Diabetes care for children and teens should be provided by a team that can deal with these special medical, educational, nutritional, and behavioral issues. The team usually consists of a physician, diabetes educator, dietitian, social worker or psychologist, and school nurse, along with the patient and family. Children should be seen by members of the team at diagnosis and follow-up, as determined by the primary care provider, the patient and family, and the team. Planning for transition of care from parents to self and from pediatric endocrinologists to adult care providers is essential during the vulnerable time as teens transition into adulthood.

Youth with diabetes need self-management support. This involves close communication and cooperation between the diabetes care team, school nurses, and other school personnel for optimal management, safety, and academic opportunities. The team, in partnership with the young person with diabetes and parents or other caregivers, needs to develop a personal diabetes management plan and daily schedule. The plan helps the child or teen follow a healthy meal plan, get regular physical activity (ideally, 60 minutes each day), check blood glucose levels, take insulin or oral medication as prescribed, and manage hyperglycemia and hypoglycemia. In children with type 1 diabetes, the most common problem encountered during physical activity is hypoglycemia. If possible, children and teens should check blood glucose levels before beginning a game or a sport and learn to prevent hypoglycemia. Family support for following the meal plan and setting up regular meal times is a key to success, especially if the child or teen is taking insulin.

Diabetes is stressful for both children and their families. Parents should be alert for signs of depression or eating disorders or insulin omission to lose weight and should seek appropriate

treatment. Depression is a common comorbidity, affecting youth with both type 1 and type 2 diabetes, and should be assessed at each visit. Mental health specialists with expertise in diabetes can support the health care team, assess young people with diabetes for depression and other psychosocial problems, and provide ongoing contact and support.

Camps and local peer groups for children and teens with diabetes can provide positive role models and group activities. Peer encouragement often helps children perform diabetes-related tasks that they had been afraid to do previously and encourages independence in diabetes management. Talking with other children who have diabetes helps young people feel less isolated and less alone in having to deal with the demands of diabetes. Online chat rooms, such as [Glu \(https://myglu.org\)](https://myglu.org), have been successful in building diabetes communities for children and adolescents.

Glycemic control is particularly challenging for adolescents. In selecting glycemic goals for youth with diabetes, health care teams should balance the long-term health outcome benefits of achieving a lower A1C against the risks of hypoglycemia and the burdens of intensive regimens in children and adolescents. Because the benefit of glycemic control may persist for decades with reduced rates of microvascular complications, it is important to provide access to and education about evolving technologies that support the management of type 1 diabetes. This includes advances in insulin pump and continuous subcutaneous glucose monitoring technologies.

Youth with diabetes in the United States carry a substantial burden of cardiovascular disease (CVD) risk factors, especially youth who are overweight or obese. Fourteen percent of youth with type 1 diabetes and 92 percent of youth with type 2 diabetes have more than two CVD risk factors.^[3] Overweight and obesity in children are strongly correlated with insulin resistance and associated hypertension and dyslipidemia, conditions that require intensive efforts to improve dietary intake and activity and to normalize body weight as a first-line approach. Pharmacologic treatment of hypertension should be initiated if blood pressure consistently exceeds the 95th percentile for age, sex, and height. Statin therapy is recommended as the preferred agent for treatment of dyslipidemia in children, but it is not approved for use in children less than 8 years old.

For children and teens at risk for type 2 diabetes, the health care team can encourage, support, and educate the entire family to make lifestyle changes that may delay or lower the risk for the onset of type 2 diabetes. Such lifestyle changes include keeping at a healthy weight and staying active.

Resources for care of children and adolescents

- Medical management recommendations for youth with or at risk for diabetes are summarized in several publications.^[4–8]
- National Diabetes Education Program (NDEP):
 - [Helping the Student with Diabetes Succeed: A Guide for School Personnel \(http://go.usa.gov/8Q4V\)](http://go.usa.gov/8Q4V)

- [Transitions From Pediatric to Adult Health Care](http://go.usa.gov/8Q4H) (<http://go.usa.gov/8Q4H>)

- American Academy of Pediatrics: [Management of Newly Diagnosed Type 2 Diabetes Mellitus \(T2DM\) in Children and Adolescents](http://bit.ly/1mArN53) (bit.ly/1mArN53)
- Academy of Nutrition and Dietetics: [Kids Eat Right](http://bit.ly/1jqWzIV) campaign (bit.ly/1jqWzIV)
- National Heart, Lung, and Blood Institute: [We Can! \(Ways to Enhance Children's Activity & Nutrition\)](http://go.usa.gov/8Q2P) (<http://go.usa.gov/8Q2P>)
- White House Task Force on Childhood Obesity: [Let's Move](http://www.letsmove.gov/) (<http://www.letsmove.gov/>)
- T1D Exchange: [Glu: an active and diverse type 1 diabetes online community](https://www.myglu.org/) (<https://www.myglu.org/>)

Women of childbearing age

Major congenital malformations remain the leading cause of mortality and serious morbidity in infants of mothers with pre-existing type 1 and type 2 diabetes. The risk of malformations appears to increase continuously with increasing maternal glycemia during the first 6 to 8 weeks of gestation. Intensive glycemic control and preconception planning have been shown to reduce the occurrence of these fetal losses and malformations. Therefore, all women with diabetes who have childbearing potential should receive:

- Counseling about the importance of planning pregnancies
- Preconception care to achieve glucose control and discontinuation of statins and angiotensin-converting enzyme (ACE) inhibitors prior to conception to reduce the risk of congenital malformations
- Care from a skilled multidisciplinary team including diabetes educators and registered dietitians/registered dietitian nutritionists experienced in the management of diabetes before and during pregnancy
- Support to maintain stable blood glucose values close to normal, as well as management of any existing long-term diabetic complications

Women of childbearing age with a history of gestational diabetes mellitus (GDM), prediabetes, or obesity or who are at very high risk for type 2 diabetes should be tested for diabetes prior to conception or very early in pregnancy.

Because of the risk of GDM to the mother and neonate, screening, diagnosis, and effective treatment are necessary. GDM increases infant macrosomia and adverse perinatal outcomes, including caesarean section, spontaneous preterm delivery, shoulder dystocia or birth injury, neonatal hypoglycemia, and need for intensive neonatal care.^[9] Women with a history of GDM are at lifelong increased risk for diabetes and need proactive long-term primary care management.^[10] The child of a GDM pregnancy is at increased risk for obesity and possible type 2 diabetes. See Principle 1 for testing recommendations for women with history of GDM.

Resources for women of childbearing age

- The American Congress of Obstetricians and Gynecologists:
 - Practice Bulletin #137: Gestational Diabetes Mellitus (*Obstet Gynecol* 2013;122:406–16), August 2013
 - Practice Bulletin #60: Pregestational Diabetes Mellitus (*Obstet Gynecol* 2005;105:675–85), March 2005
- American Diabetes Association:
 - [Standards of Medical Care in Diabetes](http://bit.ly/ScEica) (bit.ly/ScEica)
 - [Managing Preexisting Diabetes for Pregnancy](http://bit.ly/1oqphl0) (bit.ly/1oqphl0)

Older adults

Older adults are at high risk for both type 2 diabetes and prediabetes; surveillance data suggest that half of older adults have prediabetes.^[1] Almost 26 percent of people over the age of 65 (11.2 million) had diabetes in 2012.^[1] Older people with diabetes have higher rates of premature death, functional disability, and coexisting illnesses such as hypertension, coronary heart disease, and stroke than those without diabetes. Older adults with diabetes also are 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. Assessment of risk factors for hypoglycemia and ascertainment of hypoglycemia are an important part of the clinical care of older adults on insulin or sulfonylureas.

Management goals must be individualized. Consensus recommendations provide a framework incorporating consideration of health and life expectancy of older adults with diabetes in selecting treatment goals for glycemia, blood pressure, and cholesterol.^[11] For example, those who are healthy (few coexisting chronic illnesses, intact cognitive and functional status) could have an A1C goal of less than 7.5 percent, have a blood pressure goal of less than 140/90 mmHg, and be prescribed a statin. Those with intermediate health status could have an A1C goal of less than 8.0 percent, have a blood pressure goal of less than 140/90 mmHg, and be prescribed a statin, whereas those in the very complex/poor health group could have an A1C goal of less than 8.5 percent, have a blood pressure

goal of less than 150/90 mmHg, and be prescribed a statin if considered beneficial. Older adults with diabetes may be at increased risk of falls and other harm with overly aggressive blood pressure treatment. There is insufficient evidence to support the use of aspirin for primary prevention of CVD events among older adults with type 2 diabetes.^[12]

Older adults require special care in prescribing and monitoring therapy. Attention to patient preferences is important. Education and support, including nutrition therapy, can help older adults manage diabetes and coexisting chronic disease. Medications should be started at the lowest dose and titrated up gradually until targets are reached or side effects develop. While older adults can generally be treated with the same medications as younger people, glyburide and chlorpropamide should not be used because of the hypoglycemic activity of their metabolites. Metformin may be considered first-line therapy in the elderly, but its use is precluded if estimated glomerular filtration rate (eGFR) is below 30 mL/min, and it must be used with caution and at reduced dose if eGFR is below 45 mL/min.

Older adults with diabetes should maintain a current medication list for review by their clinicians. Polypharmacy increases the risk of drug side effects and drug interactions. Medication reconciliation, ongoing assessment of the indications for each medication, and assessment of medication adherence and barriers are needed at each visit. In addition, medications should be reviewed as a possible contributory factor if a person presents with depression, falls, cognitive impairment, or urinary incontinence.

Resources for care of older adults

- National Diabetes Education Program: [Diabetes Resources for Older Adults](https://yourdiabetesinfo.org/olderadults) ([Yourdiabetesinfo.org/olderadults](https://yourdiabetesinfo.org/olderadults))
- American Geriatrics Society/American Diabetes Association: [Diabetes in Older Adults: A Consensus Report](https://bit.ly/ScEo3w) (bit.ly/ScEo3w)
- American Diabetes Association: [Standards of Medical Care in Diabetes](https://bit.ly/ScEica) (bit.ly/ScEica)
- See Principle 10 for information about health literacy issues in older adults.

High-risk racial and ethnic groups

Certain racial and ethnic minorities have a higher prevalence and greater burden of diabetes compared with whites, and some minority groups also have higher rates of complications. Despite medical advances and increasing access to medical care, disparities in health and health care persist.^[13, 14]

To provide optimal diabetes care, the health care team needs to understand how patients view and treat diabetes within their respective cultures. A practical approach to avoid

stereotyping involves treating each patient encounter as unique and asking questions that elicit the patient’s perspective on diagnosis and management, such as “What is hardest for you about having diabetes?” or “Do you have any family beliefs or customs that affect how you care for your health?” This patient-centered approach enables collaboration and negotiation between the patient and health care team to develop and implement an effective diabetes management plan that addresses individual needs and customs. It is important to provide patients with appropriate and culturally sensitive diabetes education materials.

Members of some minority populations may be carriers of variant hemoglobins, which can alter some A1C test results. NGSP has information on which assays may have interference from variant hemoglobins. Members of some Asian populations have increased risk for type 2 diabetes at lower body mass indexes than the general population. However, all racial and ethnic groups studied had similar benefit from the Diabetes Prevention Program’s lifestyle intervention and metformin for diabetes prevention.

Resources for high-risk racial and ethnic groups

- National Diabetes Education Program: [Culturally tailored diabetes prevention and control materials](http://go.usa.gov/8QbT) (<http://go.usa.gov/8QbT>)
- Agency for Healthcare Research and Quality: [Honing Cultural and Linguistic Competence](http://go.usa.gov/GUBz) (<http://go.usa.gov/GUBz>)
- Indian Health Service: [Special Diabetes Program for Indians \(SDPI\)](http://go.usa.gov/8Qbm) (<http://go.usa.gov/8Qbm>)
- National Diabetes Information Clearinghouse: [Sickle Cell Trait and Other Hemoglobinopathies and Diabetes: Important Information for Providers](http://go.usa.gov/8QbJ) (<http://go.usa.gov/8QbJ>)
- Office of Minority Health: [Guides and Resources](http://go.usa.gov/GUKF) (<http://go.usa.gov/GUKF>)
- See Principle 10 for information about health literacy issues in high-risk racial and ethnic groups.

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PRINCIPLE 10:

Provide Patient-Centered Diabetes Care

Providing patient-centered care is defined as “providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions.”^[1] Shared decision making—eliciting patient perspectives and presenting options and information so patients can participate more actively in care—is a key component of patient-centered care.^[2, 3] Patient-centered care is also furthered by applying the medical home model that provides accessible, continuous, comprehensive, and coordinated care that is delivered by a health care team in the context of family and community.^[4]

Elements of patient-centered care for prevention and management of diabetes and its comorbidities include:

- A proactive approach to health promotion, disease prevention, and chronic disease management
- Respecting the patient’s values, preferences, and expressed needs
- Development of individualized care plans incorporating access to community resources^[5]
- Assessing the intersecting social, financial, clinical, and emotional needs of the patient
- Care coordination among providers, including effective use of health information systems^[6, 7]
- Communicating effectively and providing care in a culturally and linguistically appropriate manner

Collaborative multidisciplinary team care can enhance patient-centered care by providing continuous, supportive, and effective care for people with diabetes throughout the course of their disease. Well-implemented diabetes team care can be cost-effective or cost-neutral^[8] and the preferred method of care delivery, particularly when services include health promotion and disease prevention in addition to intensive clinical management. The person with diabetes (or family) plays a central role as self-care manager and decision maker. Team care integrates the skills of primary care providers, physician specialists, and other health care professionals, such as diabetes educators, registered dietitians/registered dietitian nutritionists, and pharmacists, with those of the patient and family into a comprehensive diabetes management program.^[9]

Patient-centered care is challenging but rewarding. The expansion of options for treatment and prevention of diabetes and its complications provides greater opportunities for choice. However, information for tailoring care based on individual patient characteristics is often lacking. Patient preferences may conflict with evidence-based guidelines. Although discussion of treatment options, pros and cons of these alternatives, and patients’ goals and preferences requires time and effort, the process is key to patient satisfaction and good outcomes. People who report having a better experience with their health care providers are more likely to take their medicines regularly and follow other components of treatment plans.

Consideration of health literacy and numeracy

Attention to health literacy is essential if people are to successfully contribute to their diabetes management. A range of skills and knowledge about health and health care are required, including literacy and numeracy; the ability to find, understand, interpret, and communicate health information; and the ability to seek appropriate care and make critical health decisions. Older people, non-whites, immigrants, and those with low incomes are disproportionately more likely to have trouble reading and understanding health-related information.^[10] Limited health literacy is associated with poorer health outcomes and higher health care costs.^[11]

Resources that address health literacy and numeracy

- National Diabetes Education Program (NDEP): [Practice Transformation for Physicians and Health Care Teams](http://www.yourdiabetesinfo.org/practicetransformation) (www.yourdiabetesinfo.org/practicetransformation)
- American Medical Association: [Health Literacy](http://bit.ly/1nRcBQk) (bit.ly/1nRcBQk)
- Centers for Disease Control and Prevention (CDC): [Health Literacy: Accurate, Accessible and Actionable Health Information for All](http://go.usa.gov/8Qje) (<http://go.usa.gov/8Qje>)
- Health.gov:
 - [Health Literacy](http://go.usa.gov/8QDV) (<http://go.usa.gov/8QDV>)
 - [Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies](http://go.usa.gov/GnMC) (<http://go.usa.gov/GnMC>)

Comorbid conditions that involve team care coordination

In addition to increased risk of macrovascular and microvascular complications of diabetes, people with diabetes are at increased risk for many comorbid conditions, including depression, cancer, infectious disease, periodontal disease, liver disease, osteoarthritis, osteoporosis, sleep disorders, cognitive impairment, hearing loss, erectile dysfunction and hypogonadism in men, and urinary incontinence in older adults. Comorbid conditions can worsen diabetes control and outcomes through a variety of mechanisms, including limiting the time and resources available for diabetes care and prevention.

Nearly half of adults with diabetes have diagnosed arthritis,^[12] which may limit physical activity. Inflammation associated with periodontal disease can worsen diabetes control, and both diabetes and periodontal disease are associated with increased cardiovascular disease (CVD) risk. Depression, which affects about one-quarter of those with diabetes, also increases the risk for CVD and can impede diabetes self-management. People with diabetes are at increased risk for pneumonia and

influenza and have worse outcomes, heightening the importance of preventive vaccination. Hip fracture risk is increased in both type 1 and type 2 diabetes, despite higher bone mineral density in people with type 2 diabetes.

Hearing loss is doubled in adults with diabetes and can impair communication with health care providers. Cognitive impairment is also doubled and may precipitate medication errors and hypoglycemia risk. Severe vision loss is 29 times more common in patients with diabetes and may impose significant obstacles to good self-care. Diabetes is associated with increased risk of cancers of the liver, pancreas, endometrium, colon/rectum, breast, and bladder.^[13] Shared risk factors between type 2 diabetes and cancer (obesity and physical inactivity) may contribute to the association, and addressing these risk factors can lower risk for both type 2 diabetes and cancer.^[14]

Patient-centered care of common comorbidities

Patient-centered care of common comorbidities associated with diabetes requires the health care team to regularly conduct a number of clinical assessments and related interventions, as outlined below.

Medications

- Provide a comprehensive assessment of symptoms and medications at every visit. This is particularly important as people age and comorbidities and medication use increase.
- Assess for ability to afford medications. Offer generic medications, if possible.

Self-care

- Involve family or friends or access community resources to assist people with self-management tasks if appropriate.^[15]
- Consider cognitive impairment as a factor limiting diabetes self-management.
- Refer to self-management education programs for joint disease and physical activity programs to help teach people the skills they need to engage in effective, joint-friendly physical activity.^[16]

Screening

- Screen for and attend to depression, diabetes-related distress, or anxiety; integrate the services of behavioral health professionals.^[7]
- Ask about urinary incontinence and erectile dysfunction and refer as necessary.
- Ask about symptoms of sleep apnea and refer those with symptoms for testing.
- Encourage people with diabetes to undergo recommended age- and sex-appropriate cancer screenings and to reduce their modifiable cancer risk factors (obesity, smoking, physical inactivity).^[14]

- Evaluate people with elevated alanine aminotransferase or aspartate aminotransferase for nonalcoholic steatohepatitis in the absence of excessive use of alcohol, viral hepatitis, or medications that cause liver disease.

Falls

- Assess gait and balance, fracture history, and risk factors; refer for bone mineral density testing if appropriate; ensure adequate calcium and vitamin D intake; and recommend strategies to reduce falls.

Dental and eye care

- Ensure that people with diabetes receive regular professional dental care and brush and floss teeth daily to help prevent the oral complications of diabetes. Well-controlled diabetes can reduce the risk for periodontal disease.
- Ensure that people with diabetes receive regular eye care from an optometrist or ophthalmologist experienced with diabetes and that they understand good vision does not preclude the presence of sight-threatening diabetic eye disease like proliferative retinopathy, macular edema, or glaucoma, three substantial causes of vision loss and blindness. Referring people with vision loss to a low-vision specialist for rehabilitative eye care can greatly improve capacity for independent living and good diabetes self-care.^[17, 18]

Vaccinations

- Provide annual influenza vaccine to all people with diabetes older than 6 months, pneumococcal polysaccharide vaccine to all people with diabetes older than 2, and a one-time revaccination for individuals older than 64 if the pneumococcal vaccine was administered more than 5 years previously. The CDC recommends hepatitis B vaccination for unvaccinated adults with diabetes ages 19 to 59.

Resources

- National Diabetes Education Program:
 - [Practice Transformation for Physicians and Health Care Teams \(www.yourdiabetesinfo.org/practicetransformation\)](http://www.yourdiabetesinfo.org/practicetransformation)
 - [Redesigning the Health Care Team: Diabetes Prevention and Lifelong Management \(http://go.usa.gov/8QW4\)](http://go.usa.gov/8QW4)
- National Diabetes Information Clearinghouse: [Financial Help for Diabetes Care \(http://go.usa.gov/8QWk\)](http://go.usa.gov/8QWk)

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