5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes—2023*

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The American Diabetes Association (ADA) "Standards of Care in Diabetes" includes the ADA's current clinical practice recommendations and is intended to provide the components of diabetes care, general treatment goals and guidelines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee, are responsible for updating the Standards of Care annually, or more frequently as warranted. For a detailed description of ADA standards, statements, and reports, as well as the evidence-grading system for ADA's clinical practice recommendations and a full list of Professional Practice Committee members, please refer to Introduction and Methodology. Readers who wish to comment on the Standards of Care are invited to do so at professional.diabetes.org/SOC.

Building positive health behaviors and maintaining psychological well-being are foundational for achieving diabetes treatment goals and maximizing quality of life (1,2). Essential to achieving these goals are diabetes self-management education and support (DSMES), medical nutrition therapy (MNT), routine physical activity, tobacco cessation counseling when needed, health behavior counseling, and psychosocial care. Following an initial comprehensive medical evaluation (see Section 4, "Comprehensive Medical Evaluation and Assessment of Comorbidities"), people with diabetes and health care professionals are encouraged to engage in person-centered collaborative care (3–6), which is guided by shared decision-making in treatment plan selection; facilitation of obtaining medical, behavioral, psychosocial, and technology resources as needed; and shared monitoring of agreed-upon treatment plans and behavioral goals (7,8). Reevaluation during routine care should include assessment of medical, behavioral, and mental health outcomes, especially during times of change in health and well-being.

DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT

Recommendations

5.1 All people with diabetes should participate in diabetes self-management education and support to facilitate the knowledge, decision-making, and skills mastery for diabetes self-care. **A**

5.2 There are four critical times to evaluate the need for diabetes self-management education and support to promote skills acquisition to aid treatment plan implementation, medical nutrition therapy, and well-being: at diagnosis, annually

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and/or when not meeting treatment targets, when complicating factors develop (medical, physical, psychosocial), and when transitions in life and care occur. **E**

5.3 Clinical outcomes, health status, and well-being are key goals of diabetes self-management education and support that should be measured as part of routine care. **C**

5.4 Diabetes self-management education and support should be person-centered, may be offered in group or individual settings, and should be communicated with the entire diabetes care team. **A**

5.5 Digital coaching and digital self-management interventions can be effective methods to deliver diabetes self-management education and support. **B**

5.6 Reimbursement by third-party payers is recommended **C** because diabetes self-management education and support can improve outcomes and reduce costs. **B**

5.7 Identify and address barriers to diabetes self-management education and support that exist at the health system, payer, health care professional, and individual levels. **E**

5.8 Include social determinants of health of the target population in guiding design and delivery of diabetes self-management education and support **C** with the ultimate goal of health equity across all populations.

5.9 Consider addressing barriers to diabetes self-management education and support access through telehealth delivery of care **B** and other digital health solutions. **C**

The overall objectives of diabetes self-management education and support (DSMES) are to support informed decision-making, self-care behaviors, problem-solving, and active collaboration with the health care team to improve clinical outcomes, health status, and well-being in a cost-effective manner (2). DSMES services facilitate the knowledge, decision-making, and skills mastery necessary for optimal diabetes self-care and incorporate the needs, goals, and life experiences of the person with diabetes. Health care professionals are encouraged to consider the burden of treatment (9) and the person's level of confidence and self-efficacy for management behaviors as well as the level of social and family support when providing DSMES. An individual's engagement in self-management behaviors and the effects on clinical outcomes, health status, and quality of life, as well as the psychosocial factors impacting the person's ability to self-manage, should be monitored as part of routine clinical care. A randomized controlled trial (RCT) testing a decision-making education and skill-building program (10) showed that addressing these targets improved health outcomes in a population in need of health care resources. Furthermore, following a DSMES curriculum improves quality of care (11).

Additionally, in response to the growing body of evidence that associates potentially judgmental words with increased feelings of shame and guilt, health care professionals are encouraged to consider the impact that language has on building therapeutic relationships and to choose positive, strength-based words and phrases that put people first (4,12). Please see Section 4, "Comprehensive Medical Evaluation and Assessment of Comorbidities," for more on use of language.

In accordance with the national standards for DSMES (13), all people with diabetes should participate in DSMES as it helps people with diabetes to identify and implement effective self-management strategies and cope with diabetes (2). Ongoing DSMES helps people with diabetes to maintain effective self-management throughout the life course as they encounter new challenges and as advances in treatment become available (14).

There are four critical time points when the need for DSMES should be evaluated by the health care professional and/or multidisciplinary team, with referrals made as needed (2):

1. At diagnosis
2. Annually and/or when not meeting treatment targets
3. When complicating factors (health conditions, physical limitations, emotional factors, or basic living needs) develop that influence self-management
4. When transitions in life and care occur

DSMES focuses on empowering individuals with diabetes by providing people with diabetes the tools to make informed self-management decisions (15). DSMES should be person-centered. This is an approach that places the person with diabetes and their family and/or support system at the center of the care model, working in collaboration with health care professionals. Person-centered care is respectful of and responsive to individual preferences, needs, and values. It ensures that the values of the person with diabetes guide all decision-making (16).

Evidence for the Benefits

DSMES is associated with improved diabetes knowledge and self-care behaviors (17), lower A1C (17–21), lower self-reported weight (22), improved quality of life (19,23,24), reduced all-cause mortality risk (25), positive coping behaviors (5,26), and reduced health care costs (27–29). DSMES is associated with an increased use of primary care and preventive services (27,30,31) and less frequent use of acute care and inpatient hospital services (22). People with diabetes who participate in DSMES are more likely to follow best practice treatment recommendations, particularly those with Medicare, and have lower Medicare and insurance claim costs (28,31). Better outcomes were reported for DSMES interventions that were more than 10 h over the course of 6–12 months (20), included ongoing support (14,32), were culturally (33–35) and age appropriate (36,37), were tailored to individual needs and preferences, addressed psychosocial issues, and incorporated behavioral strategies (15,26,38,39). Individual and group approaches are effective (40–42), with a slight benefit realized by those who engage in both (20). Strong evidence now exists on the benefits of virtual, telehealth, or internet-based DSMES services for diabetes prevention and management in a wide variety of populations (43–54).

Technologies such as mobile apps, simulation tools, digital coaching, and digital self-management interventions can also be used to deliver DSMES (55–60). These methods provide comparable or even improved outcomes compared with traditional in-person care (61). Greater A1C reductions are demonstrated with

increased patient engagement (62), although data from trials are considerably heterogeneous.

Technology-enabled diabetes self-management solutions improve A1C most effectively when there is two-way communication between the person with diabetes and the health care team, individualized feedback, use of person-generated health data, and education (46). Continuous glucose monitoring, when combined with individualized diabetes education or behavioral interventions, has demonstrated greater improvement on glycemic and psychosocial outcomes compared with continuous glucose monitoring alone (63,64). Incorporating a systematic approach for technology assessment, adoption, and integration into the care plan may help ensure equity in access and standardized application of technology-enabled solutions (8, 30,65–67).

Research supports diabetes care and education specialists (DCES), including nurses, registered dietitian nutritionists (RDNs), and pharmacists as providers of DSMES who may also tailor curriculum to the person's needs (68–70). Many other health disciplines can also become DCES. Members of the DSMES team should have specialized clinical knowledge in diabetes and behavior change principles. In addition, a DCES needs to be knowledgeable about technology-enabled services and may serve as a technology champion within their practice (65). Certification as a DCES (cbdce.org/) and/or board certification in advanced diabetes management (diabeteseducator.org/education/certification/bc_adm) demonstrates an individual's specialized training in and understanding of diabetes management and support (43), and engagement with qualified professionals has been shown to improve disease-related outcomes. Additionally, there is growing evidence for the role of community health workers (71,72), as well as peer (71–76) and lay leaders (77), in providing ongoing support.

Given individual needs and access to resources, a variety of culturally adapted DSMES programs need to be offered in a variety of settings. The use of technology to facilitate access to DSMES services, support self-management decisions, and decrease therapeutic inertia suggests that these approaches need broader adoption (78). Additionally, it is important to include social determinants of health (SDOH) of the target population in guiding design and delivery of DSMES. The DSMES team should take into account demographic characteristics such as race, ethnic/cultural background, sex/gender, age, geographic location, technology access, education, literacy, and numeracy (43,79).

Despite the benefits of DSMES, reports indicate that only 5–7% of individuals eligible for DSMES through Medicare or a private insurance plan actually receive it (80,81). Barriers to DSMES exist at the health system, payer, health care professional, and individual levels. This low participation may be due to lack of referral or other identified barriers, such as logistical issues (accessibility, timing, costs) and the lack of a perceived benefit (81). Health system, programmatic, and payer barriers include lack of administrative leadership support, limited numbers of DSMES professionals, not having referral to DSMES services effectively embedded in the health system service structure, and limited reimbursement rates (82). Thus, in addition to educating referring health care professionals about the benefits of DSMES and the critical times to refer, efforts need to be made to identify and address all of the various potential barriers (2). Support from institutional leadership is foundational for the success of DSMES services. Expert stakeholders should also support DSMES by providing input and advocacy (43). Alternative and innovative models of DSMES delivery (56) need to be explored and evaluated, including the integration of technology-enabled diabetes and cardiometabolic health services (8,65). Barriers to equitable access to DSMES may be addressed through telehealth delivery of care and other digital health solutions (43).

Reimbursement

Medicare reimburses DSMES when that service meets the national standards (2,43) and is recognized by the American Diabetes Association (ADA) through the Education Recognition Program (professional.diabetes.org/diabetes-education) or Association of Diabetes Care & Education Specialists (diabeteseducator.org/practice/diabetes-education-accreditation-program). DSMES is also covered by most health insurance plans. Ongoing support has been shown to be instrumental for improving outcomes when it is implemented after the completion of education services. DSMES is frequently reimbursed when performed in person. However, although DSMES can also be provided via phone calls and telehealth, these remote versions may not always be reimbursed (13). Medicare reimburses remote physiologic monitoring for glucose and other cardiometabolic data if certain conditions are met (83).

Changes in reimbursement policies that increase DSMES access and utilization will result in a positive impact to beneficiaries' clinical outcomes, quality of life, health care utilization, and costs (13,84–86). During the time of the coronavirus disease 2019 (COVID-19) pandemic, reimbursement policies were revised (professional.diabetes.org/content-page/dsmes-and-mnt-during-covid-19-national-pandemic), and these changes may provide a new reimbursement paradigm for future provision of DSMES through telehealth channels.

MEDICAL NUTRITION THERAPY

Please refer to the ADA consensus report "Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report" for more information on nutrition therapy (70). Despite agreement in nutrition recommendations from large scientific bodies, including the American Heart Association, American College of Lifestyle Medicine, and the U.S. Dietary Guidelines (87–93), confusion and controversy remain. For many individuals with diabetes, the most challenging part of the treatment plan is determining what to eat. There is not a "one-size-fits-all" eating pattern for individuals with diabetes, and meal planning should be individualized. Nutrition therapy plays an integral role in overall diabetes management, and each person with diabetes should be actively engaged in education, self-management, and treatment planning with the health care team, including the collaborative development of an individualized eating plan (70,94). All health care professionals should refer people with diabetes for individualized MNT provided by an RDN who is knowledgeable and skilled in providing diabetes-specific MNT (21,95,96) at diagnosis and as needed throughout the life span, similar to DSMES. MNT delivered by an RDN is associated with A1C absolute decreases of 1.0–1.9% for people

with type 1 diabetes (97) and 0.3–2.0% for people with type 2 diabetes (97). See **Table 5.1** for specific nutrition recommendations. Because of the progressive nature of type 2 diabetes, behavior modification alone may not be adequate to maintain euglycemia over time. However, after medication is initiated, nutrition therapy continues to be an important component, and RDNs providing MNT in diabetes care should assess and monitor medication changes in relation to the nutrition care plan (70,94).

Goals of Nutrition Therapy for Adults With Diabetes

1. To promote and support healthful eating patterns, emphasizing a variety of nutrient-dense foods in appropriate portion sizes, to improve overall health and:
   - achieve and maintain body weight goals
   - attain individualized glycemic, blood pressure, and lipid goals
   - delay or prevent the complications of diabetes
2. To address individual nutrition needs based on personal and cultural preferences, health literacy and numeracy, access to healthful foods, willingness and ability to make behavioral changes, and existing barriers to change
3. To maintain the pleasure of eating by providing nonjudgmental messages about food choices while limiting food choices only when indicated by scientific evidence
4. To provide an individual with diabetes the practical tools for developing healthy eating patterns rather than focusing on individual macronutrients, micronutrients, or single foods

Weight Management

Management and reduction of weight is important for people with type 1 diabetes, type 2 diabetes, or prediabetes with overweight or obesity. To support weight loss and improve A1C, cardiovascular disease (CVD) risk factors, and well-being in adults with overweight/obesity and prediabetes or diabetes, MNT and DSMES services should include an individualized eating plan in a format that results in an energy deficit in combination with enhanced physical activity (70). Lifestyle intervention programs should be intensive and have frequent follow-up to achieve significant reductions in excess body weight and improve clinical indicators. There is strong and consistent evidence that modest, sustained weight loss can delay the progression from prediabetes to type 2 diabetes (97–99) (see Section 3, "Prevention or Delay of Type 2 Diabetes and Associated Comorbidities") and is beneficial for the management of type 2 diabetes (see Section 8, "Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes").

In prediabetes, the weight loss goal is 7–10% for preventing progression to type 2 diabetes (100). In conjunction with support for healthy lifestyle behaviors, medication-assisted weight loss can be considered for people at risk for type 2 diabetes when needed to achieve and sustain 7–10% weight loss (101,102) (see Section 8, "Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes"). People with prediabetes at a healthy weight should also be considered for behavioral interventions to help establish routine aerobic and resistance exercise (100,103,104) as well as to establish healthy eating patterns. Services delivered by practitioners familiar with diabetes and its management, such as an RDN, have been found to be effective (95).

For many individuals with overweight and obesity with type 2 diabetes, 5% weight loss is needed to achieve beneficial outcomes in glycemic control, lipids, and blood pressure (105). It should be noted, however, that the clinical benefits of weight loss are progressive, and more intensive weight loss goals (i.e., 15%) may be appropriate to maximize benefit depending on need, feasibility, and safety (106,107). Long-term durability of weight loss remains a challenge; however, newer medications (beyond metabolic surgery) may have potential for sustainability, impact on cardiovascular outcomes, and weight reduction beyond 10–15% (108–111).

In select individuals with type 2 diabetes, an overall healthy eating plan that results in energy deficit in conjunction with weight loss medications and/or metabolic surgery should be considered to help achieve weight loss and maintenance goals, lower A1C, and reduce CVD risk (101,112,113). Overweight and obesity are also increasingly prevalent in people with type 1 diabetes and present clinical challenges regarding diabetes treatment and CVD risk factors (114,115). Sustaining weight loss can be challenging (105,116) but has long-term benefits; maintaining weight loss for 5 years is associated with sustained improvements in A1C and lipid levels (117). MNT guidance from an RDN with expertise in diabetes and weight management throughout the course of a structured weight loss plan is strongly recommended.

Along with routine medical management visits, people with diabetes and prediabetes should be screened during DSMES and MNT encounters for a history of dieting and past or current disordered eating behaviors. Nutrition therapy should be individualized to help address maladaptive eating behavior (e.g., purging) or compensatory changes in medical treatment plan (e.g., overtreatment of hypoglycemic episodes, reduction in medication dosing to reduce hunger) (70) (see DISORDERED EATING BEHAVIOR, below). Disordered eating, eating disorders, and/or disrupted eating can increase challenges for weight and diabetes management. For example, caloric restriction may be essential for glycemic management and weight maintenance, but rigid meal plans may be contraindicated for individuals who are at increased risk of clinically significant maladaptive eating behaviors (118). If eating disorders are identified during screening with diabetes-specific questionnaires, individuals should be referred to a qualified mental health professional (1).

Studies have demonstrated that a variety of eating plans, varying in macronutrient composition, can be used effectively and safely in the short term (1–2 years) to achieve weight loss in people with diabetes. These plans include structured low-calorie meal plans with meal replacements (106,117,119), a Mediterranean eating pattern (120), and low-carbohydrate meal plans with additional support (121,122). However, no single approach has been proven to be consistently superior (70,123–125), and more data are needed to identify and validate those meal plans that are optimal with respect to long-term outcomes and acceptability. The importance of providing guidance on an individualized meal plan containing nutrient-dense foods, such as vegetables, fruits, legumes, dairy, lean sources of protein (including plant-based sources as well as lean meats, fish, and poultry), nuts, seeds, and whole grains, cannot be overemphasized (124), as well as guidance on achieving the

Table 5.1—Medical nutrition therapy recommendations

	Recommendations
Effectiveness of nutrition therapy	**5.10** An individualized medical nutrition therapy program as needed to achieve treatment goals, provided by a registered dietitian nutritionist, preferably one who has comprehensive knowledge and experience in diabetes care, is recommended for all people with type 1 or type 2 diabetes, prediabetes, and gestational diabetes mellitus. **A** **5.11** Because diabetes medical nutrition therapy can result in cost savings **B** and improved cardiometabolic outcomes **A**, medical nutrition therapy should be adequately reimbursed by insurance and other payers. **E**
Energy balance	**5.12** For all people with overweight or obesity, behavioral modification to achieve and maintain a minimum weight loss of 5% is recommended. **A**
Eating patterns and macronutrient distribution	**5.13** There is no ideal macronutrient pattern for people with diabetes; meal plans should be individualized while keeping nutrient quality, total calorie, and metabolic goals in mind. **E** **5.14** A variety of eating patterns can be considered for the management of type 2 diabetes and to prevent diabetes in individuals with prediabetes. **B** **5.15** Reducing overall carbohydrate intake for individuals with diabetes has demonstrated the most evidence for improving glycemia and may be applied to a variety of eating patterns that meet individual needs and preferences. **B**
Carbohydrates	**5.16** Carbohydrate intake should emphasize nutrient-dense carbohydrate sources that are high in fiber (at least 14 g fiber per 1,000 kcal) and minimally processed. Eating plans should emphasize nonstarchy vegetables, fruits, legumes, and whole grains, as well as dairy products, with minimal added sugars. **B** **5.17** People with diabetes and those at risk are advised to replace sugar-sweetened beverages (including fruit juices) with water or low calorie, no calorie beverages as much as possible to manage glycemia and reduce risk for cardiometabolic disease **B** and minimize consumption of foods with added sugar that have the capacity to displace healthier, more nutrient-dense food choices. **A** **5.18** When using a flexible insulin therapy program, education on the glycemic impact of carbohydrate **A**, fat, and protein **B** should be tailored to an individual's needs and preferences and used to optimize mealtime insulin dosing. **5.19** When using fixed insulin doses, individuals should be provided with education about consistent patterns of carbohydrate intake with respect to time and amount while considering the insulin action time, as it can result in improved glycemia and reduce the risk for hypoglycemia. **B**
Protein	**5.20** In individuals with type 2 diabetes, ingested protein appears to increase insulin response without increasing plasma glucose concentrations. Therefore, carbohydrate sources high in protein should be avoided when trying to treat or prevent hypoglycemia. **B**
Dietary fat	**5.21** An eating plan emphasizing elements of a Mediterranean eating pattern rich in monounsaturated and polyunsaturated fats may be considered to improve glucose metabolism and lower cardiovascular disease risk. **B** **5.22** Eating foods rich in long-chain n-3 fatty acids, such as fatty fish (EPA and DHA) and nuts and seeds (ALA), is recommended to prevent or treat cardiovascular disease. **B**
Micronutrients and herbal supplements	**5.23** There is no clear evidence that dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices (such as cinnamon or aloe vera) can improve outcomes in people with diabetes who do not have underlying deficiencies, and they are not generally recommended for glycemic control. **C** There may be evidence of harm for certain individuals with β carotene supplementation. **B**
Alcohol	**5.24** Adults with diabetes who drink alcohol should do so in moderation (no more than one drink per day for adult women and no more than two drinks per day for adult men). **C** **5.25** Educating people with diabetes about the signs, symptoms, and self-management of delayed hypoglycemia after drinking alcohol, especially when using insulin or insulin secretagogues, is recommended. The importance of glucose monitoring after drinking alcoholic beverages to reduce hypoglycemia risk should be emphasized. **B**
Sodium	**5.26** Sodium consumption should be limited to <2,300 mg/day. **B**
Nonnutritive sweeteners	**5.27** The use of nonnutritive sweeteners as a replacement for sugar-sweetened products may reduce overall calorie and carbohydrate intake as long as there is not a compensatory increase in energy intake from other sources. There is evidence that low- and no-calorie sweetened beverages are a viable alternative to water. **B**

desired energy deficit (126–129). Any approach to meal planning should be individualized, considering the health status, personal preferences, and ability of the person with diabetes to sustain the recommendations in the plan.

Eating Patterns and Meal Planning

Evidence suggests that there is not an ideal percentage of calories from carbohydrate, protein, and fat for people with diabetes. Therefore, macronutrient distribution should be based on an individualized assessment of current eating patterns, preferences, and metabolic goals. Dietary guidance should emphasize the importance of a healthy dietary pattern as a whole rather than focusing on individual nutrients, foods, or food groups, given that individuals rarely eat foods in isolation. Personal preferences (e.g., tradition, culture, religion, health beliefs and goals, economics), as well as metabolic goals, need to be considered when working with individuals to determine the best eating pattern (70,97,130). Members of the health care team should complement MNT by providing evidence-based guidance that helps people with diabetes make healthy food choices that meet their individualized needs and improve overall health. A variety of eating patterns are acceptable for the management of diabetes (70,97,131,132). Health care professionals should focus on the core dimensions common among the patterns: *1*) emphasize nonstarchy vegetables, *2*) minimize added sugars and refined grains, and *3*) choose whole foods over highly processed foods to the extent possible (70). An individualized eating pattern also considers the individual's health status, food and numeracy skills, resources, food preferences, health goals, and food access. Any member of the health care team can screen for food insecurity using The Hunger Vital Sign. Households are considered at risk if they answer either or both of the following statements as "often true" or "sometimes true" (compared with "never true") (133):

- "Within the past 12 months, we worried whether our food would run out before we got money to buy more."
- "Within the past 12 months, the food we bought just didn't last, and we didn't have money to get more."

Referral to an RDN is essential to assess the overall nutrition status of, and to work collaboratively with, the person with diabetes to create a personalized meal plan that coordinates and aligns with the overall treatment plan, including physical activity and medication use. The Mediterranean (130,134–136), low-carbohydrate (137–139), and vegetarian or plant-based (135,136,140,141) eating patterns are all examples of healthful eating patterns that have shown positive results in research for individuals with type 2 diabetes, but individualized meal planning should focus on personal preferences, needs, and goals. There is currently inadequate research in type 1 diabetes to support one eating pattern over another. Moreover, there is a paucity of evidence and agreement as it relates to nutrition management among children and adolescents with type 1 diabetes. There remains a significant gap in the literature as it relates to the efficacy and long-term management implications of nutrition interventions for young children with type 1 diabetes (142).

For individuals with type 2 diabetes not meeting glycemic targets or for whom reducing glucose-lowering drugs is a priority, reducing overall carbohydrate intake with a low- or very-low-carbohydrate eating pattern is a viable option (137–139). As research studies on low-carbohydrate eating plans generally indicate challenges with long-term sustainability (143), it is important to reassess and individualize meal plan guidance regularly for those interested in this approach. In response to questions regarding implementation of low-carbohydrate and very-low-carbohydrate eating patterns, the ADA has developed a guide for health care professionals that may assist in the practical implementation of these eating patterns (144). Most individuals with diabetes report a moderate intake of carbohydrates (44–46% of total calories) (97,144). Efforts to modify habitual eating patterns are often unsuccessful in the long term; people generally go back to their usual macronutrient distribution (97). Thus, the recommended approach is to individualize meal plans with a macronutrient distribution that is more consistent with personal preference and usual intake to increase the likelihood for long-term maintenance.

An RCT found that two meal-planning approaches (diabetes plate method and carbohydrate counting) were effective in helping achieve improved A1C (145). The diabetes plate method is a commonly used visual approach for providing basic meal planning guidance. This simple graphic (featuring a 9-inch plate) shows how to portion foods (1/2 of the plate for nonstarchy vegetables, 1/4 of the plate for protein, and 1/4 of the plate for carbohydrates). Carbohydrate counting is a more advanced skill that helps plan for and track how much carbohydrate is consumed at meals and snacks. Meal planning approaches should be customized to the individual, including their numeracy (145) and food literacy level. Food literacy generally describes proficiency in food-related knowledge and skills that ultimately impact health, although specific definitions vary across initiatives (146,147).

There has been an increased interest in time-restricted eating and intermittent fasting as strategies for weight management. Intermittent fasting is an umbrella term which includes three main forms of restricted eating: alternate-day fasting (energy restriction of 500–600 calories on alternate days), the 5:2 diet (energy restriction of 500–600 calories on consecutive or nonconsecutive days) with usual intake the other five, and time-restricted eating (daily calorie restriction based on window of time of 8–15 h). Each produces mild to moderate weight loss (3–8% loss from baseline) over short durations (8–12 weeks) with no significant differences in weight loss when compared with continuous calorie restriction (148–151). A few studies have extended up to 52 weeks and show similar findings (152–155). Time-restricted eating (shortening the eating window) is generally easier to follow compared with alternative-day fasting or the 5:2 plan, largely due to ease, no need to count calories, sustainability, and feasibility. This may have implications as people with diabetes are looking for practical eating management tools.

Carbohydrates

Studies examining the ideal amount of carbohydrate intake for people with diabetes are inconclusive, although monitoring carbohydrate intake and considering the blood glucose response to dietary carbohydrate are key for improving postprandial glucose management

(156,157). The literature concerning glycemic index and glycemic load in individuals with diabetes is complex, often with varying definitions of low- and high-glycemic-index foods (158,159). The glycemic index ranks carbohydrate foods on their postprandial glycemic response, and glycemic load takes into account both the glycemic index of foods and the amount of carbohydrate eaten. Studies have found mixed results regarding the effect of glycemic index and glycemic load on fasting glucose levels and A1C, with one systematic review finding no significant impact on A1C (160) while others demonstrated A1C reductions of 0.15% (158) to 0.5% (161,162).

Reducing overall carbohydrate intake for individuals with diabetes has demonstrated evidence for improving glycemia and may be applied in a variety of eating patterns that meet individual needs and preferences (70). For people with type 2 diabetes, low-carbohydrate and very-low-carbohydrate eating patterns in particular have been found to reduce A1C and the need for antihyperglycemic medications (70,130,143,163–165). Systematic reviews and meta-analyses of RCTs found carbohydrate-restricted eating patterns, particularly those considered low carbohydrate (<26% total energy), were effective in reducing A1C in the short term (<6 months), with less difference in eating patterns beyond 1 year (125,126, 137,138,164). Questions still remain about the optimal degree of carbohydrate restriction and the long-term effects of those meal patterns on cardiovascular disease. A systematic review and meta-analysis of RCTs investigating the dose-dependent effect of carbohydrate restriction on metabolic control found each 10% decrease in carbohydrate intake had reductions in levels of A1C, fasting plasma glucose, body weight, lipids, and systolic blood pressure at 6 months, but favorable effects diminished and were not maintained at follow-up or at greater than 12 months. This systematic review highlights the metabolic complexity of response to dietary intervention in type 2 diabetes as well as the need to better understand longer-term sustainability and results (166). Part of the challenge in interpreting low-carbohydrate research has been due to the wide range of definitions for a low-carbohydrate eating plan (139,161). Weight reduction was also a goal in many low-carbohydrate studies, which further complicates evaluating the distinct contribution of the eating pattern (47,121,125,167).

The quality of carbohydrate and/or what is absent from the diet may contribute to confounding results. However, when core dimensions of the comparative diets are similar, there is little difference in outcome measures. When Gardner et al. (168) tested a low-carbohydrate ketogenic diet and a low-carbohydrate Mediterranean diet, in a randomized crossover design, metabolic improvements were seen in both diets without significant differences between them. Each of the interventions avoided added sugars and refined grains and included nonstarchy vegetables. Legumes, fruits, and whole intact grains were included in the Mediterranean but not in the ketogenic diet. The improvements (fasting glucose, insulin, HDL cholesterol, and A1C) were likely due to the nutritional quality of both interventions. However, the ketogenic plan led to a greater decrease in triglycerides (168) but also a greater increase in LDL cholesterol.

As studies on low-carbohydrate eating plans generally indicate challenges with long-term sustainability (143), it is important to reassess and individualize meal plan guidance regularly for those interested in this approach. Health care professionals should maintain consistent medical oversight and recognize that insulin and other diabetes medications may need to be adjusted to prevent hypoglycemia, and blood pressure will need to be monitored. In addition, very-low-carbohydrate eating plans are not currently recommended for individuals who are pregnant or lactating, children, people who have renal disease, or people with or at risk for disordered eating, and these plans should be used with caution in those taking sodium–glucose cotransporter 2 inhibitors because of the potential risk of ketoacidosis (169,170).

Regardless of amount of carbohydrate in the meal plan, focus should be placed on high-quality, nutrient-dense carbohydrate sources that are high in fiber and minimally processed. The addition of dietary fiber modulates composition of gut microbiota and increases gut microbial diversity. Although there is still much to be elucidated with the gut microbiome and chronic disease, higher-fiber diets are advantageous (171). Both children and adults with diabetes are encouraged to minimize intake of refined carbohydrates with added sugars, fat, and sodium and instead focus on carbohydrates from vegetables, legumes, fruits, dairy (milk and yogurt), and whole grains. People with diabetes and those at risk for diabetes are encouraged to consume a minimum of 14 g of fiber/1,000 kcal, with at least half of grain consumption being whole, intact grains, according to the Dietary Guidelines for Americans (172). Regular intake of sufficient dietary fiber is associated with lower all-cause mortality in people with diabetes (173,174), and prospective cohort studies have found dietary fiber intake is inversely associated with risk of type 2 diabetes (175–177). The consumption of sugar-sweetened beverages and processed food products with large amounts of refined grains and added sugars is strongly discouraged (172,178,179), as these have the capacity to displace healthier, more nutrient-dense food choices.

Individuals with type 1 or type 2 diabetes taking insulin at mealtime should be offered intensive and ongoing education on the need to couple insulin administration with carbohydrate intake. For people whose meal schedule or carbohydrate consumption is variable, regular education to increase understanding of the relationship between carbohydrate intake and insulin needs is important. In addition, education on using insulin-to-carbohydrate ratios for meal planning can assist individuals with effectively modifying insulin dosing from meal to meal to improve glycemic management (97,156,180–183). Studies have shown that dietary fat and protein can impact early and delayed postprandial glycemia (184–187), and it appears to have a dose-dependent response (188–191). Results from high-fat, high-protein meal studies highlight the need for additional insulin to cover these meals; however, more studies are needed to determine the optimal insulin dose and delivery strategy. The results from these studies also point to individual differences in postprandial glycemic response; therefore, a cautious approach to increasing insulin doses for high-fat and/or high-protein mixed meals is recommended to address delayed hyperglycemia that may occur 3 h or more after eating (70). If using an insulin pump, a split bolus feature (part of the bolus delivered immediately, the remainder over a programmed duration of time) may provide

better insulin coverage for high-fat and/or high-protein mixed meals (185,192).

The effectiveness of insulin dosing decisions should be confirmed with a structured approach to blood glucose monitoring or continuous glucose monitoring to evaluate individual responses and guide insulin dose adjustments. Checking glucose 3 h after eating may help to determine if additional insulin adjustments are required (i.e., increasing or stopping bolus) (185,192,193). Refining insulin doses to account for high-fat and/or -protein meals requires determination of anticipated nutrient intake to calculate the mealtime dose. Food literacy, numeracy, interest, and capability should be evaluated (70). For individuals on a fixed daily insulin schedule, meal planning should emphasize a relatively fixed carbohydrate consumption pattern with respect to both time and amount while considering insulin action. Attention to resultant hunger and satiety cues will also help with nutrient modifications throughout the day (70,194).

Protein

There is no evidence that adjusting the daily level of protein intake (typically 1–1.5 g/kg body wt/day or 15–20% total calories) will improve health, and research is inconclusive regarding the ideal amount of dietary protein to optimize either glycemic management or CVD risk (159,195). Therefore, protein intake goals should be individualized based on current eating patterns. Some research has found successful management of type 2 diabetes with meal plans including slightly higher levels of protein (20–30%), which may contribute to increased satiety (196).

Historically, low-protein eating plans were advised for individuals with diabetic kidney disease (DKD) (with albuminuria and/or reduced estimated glomerular filtration rate); however, current evidence does not suggest that people with DKD need to restrict protein to less than the generally recommended protein intake (70). Reducing the amount of dietary protein below the recommended daily allowance of 0.8 g/kg is not recommended because it does not alter glycemic measures, cardiovascular risk measures, or the rate at which glomerular filtration rate declines and may increase risk for malnutrition (197,198).

In individuals with type 2 diabetes, protein intake may enhance or increase the insulin response to dietary carbohydrates (199). Therefore, use of carbohydrate sources high in protein (e.g., nuts) to treat or prevent hypoglycemia should be avoided due to the potential concurrent rise in endogenous insulin. Health care professionals should counsel patients to treat hypoglycemia with pure glucose (i.e., glucose tablets) or carbohydrate-containing foods at the hypoglycemia alert value of $<$70 mg/dL. See Section 6, "Glycemic Targets," for more information.

Fats

Evidence suggests that there is not an ideal percentage of calories from fat for people with or at risk for diabetes and that macronutrient distribution should be individualized according to the patient's eating patterns, preferences, and metabolic goals (70). The type of fats consumed is more important than total amount of fat when looking at metabolic goals and CVD risk, and it is recommended that the percentage of total calories from saturated fats should be limited (120,172,200–202). Multiple RCTs including people with type 2 diabetes have reported that a Mediterranean eating pattern (120,203–208) can improve both glycemic management and blood lipids. The Mediterranean eating pattern is based on the traditional eating habits in the countries bordering the Mediterranean Sea. Although eating styles vary, they share a number of common features, including consumption of fresh fruits and vegetables, whole grains, beans, and nuts/seeds; olive oil as the primary fat source; low to moderate amounts of fish, eggs, and poultry; and limited added sugars, sugary beverages, sodium, highly processed foods, refined carbohydrates, saturated fats, and fatty or processed meats.

Evidence does not conclusively support recommending n-3 (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) supplements for all people with diabetes for the prevention or treatment of cardiovascular events (70,209,210). In individuals with type 2 diabetes, two systematic reviews with n-3 and n-6 fatty acids concluded that the dietary supplements did not improve glycemic management (159,211). In the ASCEND trial (A Study of Cardiovascular Events iN Diabetes), when compared with placebo, supplementation with n-3 fatty acids at the dose of 1 g/day did not lead to cardiovascular benefit in people with diabetes without evidence of CVD (212). However, results from the Reduction of Cardiovascular Events With Icosapent Ethyl–Intervention Trial (REDUCE-IT) found that supplementation with 4 g/day of pure EPA significantly lowered the risk of adverse cardiovascular events. This trial of 8,179 participants, in which over 50% had diabetes, found a 5% absolute reduction in cardiovascular events for individuals with established atherosclerotic CVD taking a preexisting statin with residual hypertriglyceridemia (135–499 mg/dL) (213). See Section 10, "Cardiovascular Disease and Risk Management," for more information. People with diabetes should be advised to follow the guidelines for the general population for the recommended intakes of saturated fat, dietary cholesterol, and *trans* fat (172). *Trans* fats should be avoided. In addition, as saturated fats are progressively decreased in the diet, they should be replaced with unsaturated fats and not with refined carbohydrates (207).

Sodium

As for the general population, people with diabetes are advised to limit their sodium consumption to $<$2,300 mg/day (70). Restriction to $<$1,500 mg, even for those with hypertension, is generally not recommended (214–216). Sodium recommendations should take into account palatability, availability, affordability, and the difficulty of achieving low-sodium recommendations in a nutritionally adequate diet (217).

Micronutrients and Supplements

There continues to be no clear evidence of benefit from herbal or nonherbal (i.e., vitamin or mineral) supplementation for people with diabetes without underlying deficiencies (70). Metformin is associated with vitamin B12 deficiency per a report from the Diabetes Prevention Program Outcomes Study (DPPOS), suggesting that periodic testing of vitamin B12 levels should be considered in people taking metformin, particularly in those with anemia or peripheral neuropathy (218). Routine supplementation with antioxidants, such as vitamins E and C, is not advised due to lack of evidence of efficacy and

concern related to long-term safety. Based on the recent U.S. Preventative Services Task Force statement, the harms of β-carotene outweigh the benefits for the prevention of CVD or cancer. β-Carotene was significantly associated with increased lung cancer and cardiovascular mortality risk (219).

In addition, there is insufficient evidence to support the routine use of herbal supplements and micronutrients, such as cinnamon (220), curcumin, vitamin D (221), aloe vera, or chromium, to improve glycemia in people with diabetes (70,222).

Although the Vitamin D and Type 2 Diabetes Study (D2d) prospective RCT showed no significant benefit of vitamin D versus placebo on the progression to type 2 diabetes in individuals at high risk (223), post hoc analyses and meta-analyses suggest a potential benefit in specific populations (223–226). Further research is needed to define individual characteristics and clinical indicators where vitamin D supplementation may be of benefit.

For special populations, including pregnant or lactating individuals, older adults, vegetarians, and people following very-low-calorie or low-carbohydrate diets, a multivitamin may be necessary.

Alcohol

Moderate alcohol intake does not have major detrimental effects on long-term blood glucose management in people with diabetes. Risks associated with alcohol consumption include hypoglycemia and/or delayed hypoglycemia (particularly for those using insulin or insulin secretagogue therapies), weight gain, and hyperglycemia (for those consuming excessive amounts) (70,222). People with diabetes should be educated about these risks and encouraged to monitor glucose frequently after drinking alcohol to minimize such risks. People with diabetes can follow the same guidelines as those without diabetes. For women, no more than one drink per day, and for men, no more than two drinks per day is recommended (one drink is equal to a 12-oz beer, a 5-oz glass of wine, or 1.5 oz of distilled spirits).

Nonnutritive Sweeteners

The U.S. Food and Drug Administration has approved many nonnutritive sweeteners for consumption by the general public, including people with diabetes (70,227). For some people with diabetes who are accustomed to regularly consuming sugar-sweetened products, nonnutritive sweeteners (containing few or no calories) may be an acceptable substitute for nutritive sweeteners (those containing calories, such as sugar, honey, and agave syrup) when consumed in moderation (228,229). Nonnutritive sweeteners do not appear to have a significant effect on glycemic management (97,230,231), and they can reduce overall calorie and carbohydrate intake (97,228) as long as individuals are not compensating with additional calories from other food sources (70,232). There is mixed evidence from systematic reviews and meta-analyses for nonnutritive sweetener use with regard to weight management, with some finding benefit in weight loss (233–235) while other research suggests an association with weight gain (236,237). This may be explained by reverse causality and residual confounding variables (237). The addition of nonnutritive sweeteners to diets poses no benefit for weight loss or reduced weight gain without energy restriction (238). In a recent systematic review and meta-analysis using low-calorie and no-calorie sweetened beverages as an intended substitute for sugar-sweetened beverages, a small improvement in body weight and cardiometabolic risk factors was seen without evidence of harm and had a direction of benefit similar to that seen with water. Health care professionals should continue to recommend water, but people with overweight or obesity and diabetes may also have a variety of no-calorie or low-calorie sweetened products so that they do not feel deprived (239).

PHYSICAL ACTIVITY

Recommendations

5.28 Children and adolescents with type 1 diabetes **C** or type 2 diabetes or prediabetes **B** should engage in 60 min/day or more of moderate- or vigorous-intensity aerobic activity, with vigorous muscle-strengthening and bone-strengthening activities at least 3 days/week.

5.29 Most adults with type 1 diabetes **C** and type 2 diabetes **B** should engage in 150 min or more of moderate- to vigorous-intensity aerobic activity per week, spread over at least 3 days/week, with no more than 2 consecutive days without activity. Shorter durations (minimum 75 min/week) of vigorous-intensity or interval training may be sufficient for younger and more physically fit individuals.

5.30 Adults with type 1 diabetes **C** and type 2 diabetes **B** should engage in 2–3 sessions/week of resistance exercise on nonconsecutive days.

5.31 All adults, and particularly those with type 2 diabetes, should decrease the amount of time spent in daily sedentary behavior. **B** Prolonged sitting should be interrupted every 30 min for blood glucose benefits. **C**

5.32 Flexibility training and balance training are recommended 2–3 times/week for older adults with diabetes. Yoga and tai chi may be included based on individual preferences to increase flexibility, muscular strength, and balance. **C**

5.33 Evaluate baseline physical activity and sedentary time. Promote increase in nonsedentary activities above baseline for sedentary individuals with type 1 diabetes **E** and type 2 diabetes. **B** Examples include walking, yoga, housework, gardening, swimming, and dancing.

Physical activity is a general term that includes all movement that increases energy use and is an important part of the diabetes management plan. Exercise is a more specific form of physical activity that is structured and designed to improve physical fitness. Both physical activity and exercise are important. Exercise has been shown to improve blood glucose levels, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being (240). Physical activity is as important for those with type 1 diabetes as it is for the general population, but its specific role in the prevention of diabetes complications and the management of blood glucose is not as clear as it is for those with type 2 diabetes. Many individuals with type 2 diabetes do not meet the recommended exercise level per week (150 min).

Objective measurement by accelerometer in 871 individuals with type 2 diabetes showed that 44.2%, 42.6%, and 65.1% of White, African American, and Hispanic individuals, respectively, met the recommended threshold of exercise (241). An RCT in 1,366 individuals with prediabetes combined a physical activity intervention with text messaging and telephone support, which showed improvement in daily step count at 12 months compared with the control group. Unfortunately, this was not sustained at 48 months (242). Another RCT, including 324 individuals with prediabetes, showed increased physical activity at 8 weeks with supportive text messages, but by 12 weeks there was no difference between groups (243). It is important for diabetes care management teams to understand the difficulty that many people have reaching recommended treatment targets and to identify individualized approaches to improve goal achievement, which may need to change over time.

Moderate to high volumes of aerobic activity are associated with substantially lower cardiovascular and overall mortality risks in both type 1 and type 2 diabetes (244). A prospective observational study of adults with type 1 diabetes suggested that higher amounts of physical activity led to reduced cardiovascular mortality after a mean follow-up time of 11.4 years for people with and without chronic kidney disease (245). Additionally, structured exercise interventions of at least 8 weeks' duration have been shown to lower A1C by an average of 0.66% in people with type 2 diabetes, even without a significant change in BMI (246). There are also considerable data for the health benefits (e.g., increased cardiovascular fitness, greater muscle strength, improved insulin sensitivity) of regular exercise for those with type 1 diabetes (247). Exercise training in type 1 diabetes may also improve several important markers such as triglyceride level, LDL cholesterol, waist circumference, and body mass (248). In adults with type 2 diabetes, higher levels of exercise intensity are associated with greater improvements in A1C and in cardiorespiratory fitness (249); sustained improvements in cardiorespiratory fitness and weight loss have also been associated with a lower risk of heart failure (250). Other benefits include slowing the decline in mobility among overweight people with diabetes (251). The ADA position statement "Physical Activity/Exercise and Diabetes" reviews the evidence for the benefits of exercise in people with type 1 and type 2 diabetes and offers specific recommendations (252). Increased physical activity (soccer training) has also been shown to be beneficial for improving overall fitness in Latino men with obesity, demonstrating feasible methods to increase physical activity in an often hard-to-engage population (253). Physical activity and exercise should be recommended and prescribed to all individuals who are at risk for or with diabetes as part of management of glycemia and overall health. Specific recommendations and precautions will vary by the type of diabetes, age, activity, and presence of diabetes-related health complications. Recommendations should be tailored to meet the specific needs of each individual (252).

Exercise and Children

All children, including children with diabetes or prediabetes, should be encouraged to engage in regular physical activity. Children should engage in at least 60 min of moderate to vigorous aerobic activity every day, with muscle- and bone-strengthening activities at least 3 days per week (254). In general, youth with type 1 diabetes benefit from being physically active, and an active lifestyle should be recommended to all (255). Youth with type 1 diabetes who engage in more physical activity may have better health outcomes and health-related quality of life (256,257). See Section 14, "Children and Adolescents," for details.

Frequency and Type of Physical Activity

People with diabetes should perform aerobic and resistance exercise regularly (209). Aerobic activity bouts should ideally last at least 10 min, with the goal of ~30 min/day or more most days of the week for adults with type 2 diabetes. Daily exercise, or at least not allowing more than 2 days to elapse between exercise sessions, is recommended to decrease insulin resistance, regardless of diabetes type (258,259). A study in adults with type 1 diabetes found a dose-response inverse relationship between self-reported bouts of physical activity per week and A1C, BMI, hypertension, dyslipidemia, and diabetes-related complications such as hypoglycemia, diabetic ketoacidosis, retinopathy, and microalbuminuria (260). Over time, activities should progress in intensity, frequency, and/or duration to at least 150 min/week of moderate-intensity exercise. Adults able to run at 6 miles/h (9.7 km/h) for at least 25 min can benefit sufficiently from shorter-intensity activity (75 min/week) (252). Many adults, including most with type 2 diabetes, may be unable or unwilling to participate in such intense exercise and should engage in moderate exercise for the recommended duration. Adults with diabetes should engage in 2–3 sessions/week of resistance exercise on nonconsecutive days (261). Although heavier resistance training with free weights and weight machines may improve glycemic control and strength (262), resistance training of any intensity is recommended to improve strength, balance, and the ability to engage in activities of daily living throughout the life span. Health care professionals should help people with diabetes set stepwise goals toward meeting the recommended exercise targets. As individuals intensify their exercise program, medical monitoring may be indicated to ensure safety and evaluate the effects on glucose management. (See PHYSICAL ACTIVITY AND GLYCEMIC CONTROL, below.)

Evidence supports that all individuals, including those with diabetes, should be encouraged to reduce the amount of time spent being sedentary—waking behaviors with low energy expenditure (e.g., working at a computer, watching television)—by breaking up bouts of sedentary activity (>30 min) by briefly standing, walking, or performing other light physical activities (263,264). Participating in leisure-time activity and avoiding extended sedentary periods may help prevent type 2 diabetes for those at risk (265,266) and may also aid in glycemic management for those with diabetes.

A systematic review and meta-analysis found higher frequency of regular leisure-time physical activity was more effective in reducing A1C levels (267). A wide range of activities, including yoga, tai chi, and other types, can have significant impacts on A1C, flexibility, muscle strength, and balance (240,268–270). Flexibility and balance exercises may be particularly important in older adults with diabetes to maintain range of motion, strength, and balance (252) (**Fig. 5.1**).

Physical Activity and Glycemic Management

Clinical trials have provided strong evidence for the A1C-lowering value of resistance training in older adults with type 2 diabetes (252) and for an additive benefit of combined aerobic and resistance exercise in adults with type 2 diabetes (271). If not contraindicated, people with type 2 diabetes should be encouraged to do at least two weekly sessions of resistance exercise (exercise with free weights or weight machines), with each session consisting of at least one set (group of consecutive repetitive exercise motions) of five or more different resistance exercises involving the large muscle groups (272).

For people with type 1 diabetes, although exercise, in general, is associated with improvement in disease status, care needs to be taken in titrating exercise with respect to glycemic management. Each individual with type 1 diabetes has a variable glycemic response to exercise. This variability should be taken into consideration when recommending the type and duration of exercise for a given individual (247).

Individuals of childbearing potential with preexisting diabetes, particularly type 2 diabetes, and those at risk for or presenting with gestational diabetes mellitus should be advised to engage in regular moderate physical activity prior to and during their pregnancies as tolerated (252).

Pre-exercise Evaluation

As discussed more fully in Section 10, "Cardiovascular Disease and Risk Management," the best protocol for assessing asymptomatic people with diabetes for coronary artery disease remains unclear. The ADA consensus report "Screening for Coronary Artery Disease in Patients With Diabetes" (273) concluded that routine testing is not recommended. However, health care professionals should perform a careful history, assess cardiovascular risk factors, and be aware of the atypical presentation of coronary artery disease, such as recent reported or tested decrease in exercise tolerance in people with diabetes. Certainly, those with high risk should be encouraged to start with short periods of low-intensity exercise and slowly increase the intensity and duration as tolerated. Health care professionals should assess for conditions that might contraindicate certain types of exercise or predispose to injury, such as uncontrolled hypertension, untreated proliferative retinopathy, autonomic neuropathy, peripheral neuropathy, and a history of foot ulcers or Charcot foot. Age and previous physical activity level should be considered when customizing the exercise plan to the individual's needs. Those with complications may need a more thorough evaluation prior to starting an exercise program (247).

Hypoglycemia

In individuals taking insulin and/or insulin secretagogues, physical activity may cause hypoglycemia if the medication dose or carbohydrate consumption is not adjusted for the exercise bout and postbout impact on glucose. Individuals on these therapies may need to ingest some added carbohydrate if pre-exercise glucose levels are $<$90 mg/dL (5.0 mmol/L), depending on whether they are able to lower insulin doses during the workout (such as with an insulin pump or reduced pre-exercise insulin dosage), the time of day exercise is done, and the intensity and duration of the activity (247). In some people with diabetes, hypoglycemia after exercise may occur and last for several hours due to increased insulin sensitivity. Hypoglycemia is less common in those who are not treated with insulin or insulin secretagogues, and no routine preventive measures for hypoglycemia are usually advised in these cases. Intense activities may actually raise blood glucose levels instead of lowering them, especially if pre-exercise glucose levels are elevated (247). Because of the variation in glycemic response to exercise bouts, people with diabetes need to be educated to check blood glucose levels before and after periods of exercise and about the potential prolonged effects (depending on intensity and duration).

Exercise in the Presence of Microvascular Complications

See Section 11, "Chronic Kidney Disease and Risk Management," and Section 12, "Retinopathy, Neuropathy, and Foot Care," for more information on these long-term complications.

Retinopathy

If proliferative diabetic retinopathy or severe nonproliferative diabetic retinopathy is present, then vigorous-intensity aerobic or resistance exercise may be contraindicated because of the risk of triggering vitreous hemorrhage or retinal detachment (274). Consultation with an ophthalmologist prior to engaging in an intense exercise plan may be appropriate.

Peripheral Neuropathy

Decreased pain sensation and a higher pain threshold in the extremities can result in an increased risk of skin breakdown, infection, and Charcot joint destruction with some forms of exercise. Therefore, a thorough assessment should be done to ensure that neuropathy does not alter kinesthetic or proprioceptive sensation during physical activity, particularly in those with more severe neuropathy. Studies have shown that moderate-intensity walking may not lead to an increased risk of foot ulcers or reulceration in those with peripheral neuropathy who use proper footwear (275). In addition, 150 min/week of moderate exercise was reported to improve outcomes in people with prediabetic neuropathy (276). All individuals with peripheral neuropathy should wear proper footwear and examine their feet daily to detect lesions early. Anyone with a foot injury or open sore should be restricted to non–weight-bearing activities.

Autonomic Neuropathy

Autonomic neuropathy can increase the risk of exercise-induced injury or adverse events through decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, impaired night vision due to impaired papillary reaction, and greater susceptibility to hypoglycemia (277). Cardiovascular autonomic neuropathy is also an independent risk factor for cardiovascular death and silent myocardial ischemia (278). Therefore, individuals with diabetic autonomic neuropathy should undergo cardiac investigation before beginning physical activity more intense than that to which they are accustomed.

Diabetic Kidney Disease

Physical activity can acutely increase urinary albumin excretion. However, there is no evidence that vigorous-intensity exercise accelerates the rate of progression of DKD, and there appears to be no need for specific exercise restrictions for people with DKD in general (274).

SMOKING CESSATION: TOBACCO AND E-CIGARETTES

Recommendations

5.34 Advise all individuals not to use cigarettes and other tobacco products or e-cigarettes. **A**

5.35 After identification of tobacco or e-cigarette use, include smoking cessation counseling and other forms of treatment as a routine component of diabetes care. **A**

5.36 Address smoking cessation as part of diabetes education programs for those in need. **B**

Results from epidemiologic, case-control, and cohort studies provide convincing evidence to support the causal link between cigarette smoking and health risks (279). Data show tobacco use is higher among adults with chronic conditions (280) as well as in adolescents and young adults with diabetes (281). People with diabetes who smoke (and people with diabetes exposed to second-hand smoke) have a heightened risk of CVD, premature death, microvascular complications, and worse glycemic outcomes when compared with those who do not smoke (282–284). Smoking may have a role in the development of type 2 diabetes (285–287).

The routine and thorough assessment of tobacco use is essential to prevent smoking or encourage cessation. Numerous large RCTs have demonstrated the efficacy and cost-effectiveness of brief counseling in smoking cessation, including the use of telephone quit lines, in reducing tobacco use. Pharmacologic therapy to assist with smoking cessation in people with diabetes has been shown to be effective (288), and for people who are motivated to quit, the addition of pharmacologic therapy to counseling is more effective than either treatment alone (289). Special considerations should include assessment of level of nicotine dependence, which is associated with difficulty in quitting and relapse (290). Although some people may gain weight in the period shortly after smoking cessation (291), recent research has demonstrated that this weight gain does not diminish the substantial CVD benefit realized from smoking cessation (292). One study in people who smoke who had newly diagnosed type 2 diabetes found that smoking cessation was associated with amelioration of metabolic parameters and reduced blood pressure and albuminuria at 1 year (293).

In recent years, e-cigarettes have gained public awareness and popularity because of perceptions that e-cigarette use is less harmful than regular cigarette smoking (294,295). However, in light of recent Centers for Disease Control and Prevention evidence (296) of deaths related to e-cigarette use, no individuals should be advised to use e-cigarettes, either as a way to stop smoking tobacco or as a recreational drug.

Diabetes education programs offer potential to systematically reach and engage individuals with diabetes in smoking cessation efforts. A cluster randomized trial found statistically significant increases in quit rates and long-term abstinence rates (>6 months) when smoking cessation interventions were offered through diabetes education clinics, regardless of motivation to quit at baseline (297).

SUPPORTING POSITIVE HEALTH BEHAVIORS

Recommendation

5.37 Behavioral strategies should be used to support diabetes self-management and engagement in health behaviors (e.g., taking medications, using diabetes technologies, physical activity, healthy eating) to promote optimal diabetes health outcomes. **A**

Given associations with glycemic outcomes and risk for future complications (298,299), it is important for diabetes care professionals to support people with diabetes to engage in health-promoting behaviors (preventive, treatment, and maintenance), including blood glucose monitoring, taking insulin and medications, using diabetes technologies, engaging in physical activity, and making nutritional changes. Evidence supports using a variety of behavioral strategies and multicomponent interventions to help people with diabetes and their caregivers or family members develop health behavior routines and overcome barriers to self-management behaviors (300–302). Behavioral strategies with empirical support include motivational interviewing (303–305), patient activation (306), goal setting and action planning (305,307–309), problem-solving (308,310), tracking or self-monitoring health behaviors with or without feedback from a health care professional (305,307–309), and facilitating opportunities for social support (305,308,309). Multicomponent intervention packages have the highest efficacy for behavioral and glycemic outcomes (300,309,311). For youth with diabetes, family-based behavioral intervention packages and multisystem interventions that facilitate health behavior change demonstrate benefit for increasing management behaviors and improving glycemic outcomes (301). Health behavior change strategies may be delivered by mental health professionals, DCES, or other trained health care professionals (307,312–314) or qualified community health workers (307,308). These approaches may be delivered via digital health tools (309,313,315).

PSYCHOSOCIAL CARE

Recommendations

5.38 Psychosocial care should be provided to all people with diabetes, with the goal of optimizing health-related quality of life and health outcomes. Such care should be integrated with routine medical care and delivered by trained health care professionals using a collaborative, person-centered, culturally informed approach. **A** When indicated and available, qualified mental health professionals should provide additional targeted mental health care. **B**

5.39 Diabetes care teams should implement psychosocial screening protocols that may include but are not limited to attitudes about diabetes, expectations for treatment and outcomes, general and diabetes-related mood, stress and/or quality of life, available resources (financial, social, family, and emotional), and/or psychiatric history. Screening should occur at periodic intervals and when there is a change in disease, treatment, or life circumstances. **C**

5.40 When indicated, refer to mental health professionals or other trained health care professionals for further assessment and

treatment for symptoms of diabetes distress, depression, suicidality, anxiety, treatment-related fear of hypoglycemia, disordered eating, and/or cognitive capacities. Such specialized psychosocial care should use age-appropriate standardized and validated tools and treatment approaches. **B**

5.41 Consider screening older adults (aged ≥65 years) with diabetes for cognitive impairment, frailty, and depressive symptoms. Monitoring of cognitive capacity, i.e., the ability to actively engage in decision-making regarding treatment plan behaviors, is advised. **B**

Please refer to the ADA position statement "Psychosocial Care for People With Diabetes" for a list of assessment tools and additional details (1) and the ADA Mental Health Toolkit for assessment questionnaires and surveys (professional.diabetes.org/mental-health-toolkit).

Complex environmental, social, family, behavioral, and emotional factors, known as psychosocial factors, influence living with diabetes, both type 1 and type 2, and achieving optimal health outcomes and psychological well-being. Thus, individuals with diabetes and their families are challenged with complex, multifaceted issues when integrating diabetes care into daily life (183). Clinically significant mental health diagnoses are considerably more prevalent in people with diabetes than in those without (316,317). Emotional well-being is an important part of diabetes care and self-management. Psychological and social problems can impair the individual's (43,318–322) or family's (321) ability to carry out diabetes care tasks and, therefore, potentially compromise health status. Therefore, psychological symptoms, both clinical and subclinical, must be addressed. In addition to impacting a person's ability to carry out self-management and the association of mental health diagnosis with poorer short-term glycemic stability, symptoms of emotional distress are associated with mortality risk (316,323).

There are opportunities for diabetes health care professionals to routinely monitor and screen psychosocial status in a timely and efficient manner for referral to appropriate services (324,325). Various health care professionals working with people with diabetes may contribute to psychosocial care in different ways based on training, experience, need, and availability (313,326,327). Ideally, qualified mental health professionals with specialized training and experience in diabetes should be integrated with or provide collaborative care as part of diabetes care teams (328–331), or referrals for in-depth assessment and treatment for psychosocial concerns should be made to such mental health professionals when indicated (314,332,333). A systematic review and meta-analysis showed that psychosocial interventions modestly but significantly improved A1C (standardized mean difference –0.29%) and mental health outcomes (334). There was a limited association between the effects on A1C and mental health, and no intervention characteristics predicted benefit on both outcomes. However, cost analyses have shown that behavioral health interventions are both effective and cost-efficient approaches to the prevention of diabetes (335).

Screening

Health care teams should develop and implement psychosocial screening protocols to ensure routine monitoring of psychosocial well-being and concerns among people with diabetes, following published guidance and recommendations (336–340). Topics to screen for may include, but are not limited to, attitudes about diabetes, expectations for treatment and outcomes (especially related to starting a new treatment or technology), general and diabetes-related mood, stress, and/or quality of life (e.g., diabetes distress, depressive symptoms, anxiety symptoms, and/or fear of hypoglycemia), available resources (financial, social, family, and emotional), and/or psychiatric history. A list of age-appropriate screening and evaluation measures is provided in the ADA position statement "Psychosocial Care for People with Diabetes" (1). Key opportunities for psychosocial screening occur at diabetes diagnosis, during regularly scheduled management visits, during hospitalizations, with new onset of complications, during significant transitions in care such as from pediatric to adult care teams (341), at the time of medical treatment changes, or when problems with achieving A1C goals, quality of life, or self-management are identified. People with diabetes are likely to exhibit psychological vulnerability at diagnosis, when their medical status changes (e.g., end of the honeymoon period), when the need for intensified treatment is evident, and when complications are discovered. Significant changes in life circumstances and SDOH are known to considerably affect a person's ability to self-manage their condition. Thus, screening for SDOH (e.g., loss of employment, birth of a child, or other family-based stresses) should also be incorporated into routine care (342). In circumstances where individuals other than the person with diabetes are significantly involved in diabetes management (e.g., caregivers or family members), these issues should be monitored and treated by appropriate professionals (341,343,344).

Standardized, validated, age-appropriate tools for psychosocial monitoring and screening can also be used (1). Health care professionals may also use informal verbal inquires, for example, by asking whether there have been persistent changes in mood during the past 2 weeks or since the individual's last appointment and whether the person can identify a triggering event or change in circumstances. Diabetes care professionals should also ask whether there are new or different barriers to treatment and self-management, such as feeling overwhelmed or stressed by having diabetes (see DIABETES DISTRESS, below), changes in finances, or competing medical demands (e.g., the diagnosis of a comorbid condition).

Psychological Assessment and Treatment

When psychosocial concerns are identified, referral to a qualified behavioral and/or mental health professional, ideally one specializing in diabetes, should be made for comprehensive evaluation, diagnosis, and treatment (313,314,332,333). Indications for referral may include positive screening for overall stress related to work-life balance, diabetes distress, diabetes management difficulties, depression, anxiety, disordered eating, and cognitive dysfunction (see **Table 5.2** for a complete list). It is preferable to incorporate psychosocial assessment and treatment into routine care rather than waiting for a specific problem or deterioration in metabolic or psychological status to occur (38,321).

Table 5.2—Situations that warrant referral of a person with diabetes to a qualified behavioral or mental health professional for evaluation and treatment

• A positive screen on a validated screening tool for depressive symptoms, diabetes distress, anxiety, fear of hypoglycemia, or cognitive impairment
• The presence of symptoms or suspicions of disordered eating behavior, an eating disorder, or disrupted patterns of eating
• Intentional omission of insulin or oral medication to cause weight loss is identified
• A serious mental illness is suspected
• In youth and families with behavioral self-care difficulties, repeated hospitalizations for diabetic ketoacidosis, failure to achieve expected developmental milestones, or significant distress
• Declining or impaired ability to perform diabetes self-care behaviors
• Before undergoing bariatric or metabolic surgery and after surgery, if assessment reveals an ongoing need for adjustment support

Health care professionals should identify behavioral and mental health professionals, knowledgeable about diabetes treatment and the psychosocial aspects of diabetes, to whom they can refer patients. The ADA provides a list of mental health professionals who have specialized expertise or who have received education about psychosocial and behavioral issues related to diabetes in the ADA Mental Health Professional Directory Listing (professional.diabetes.org/mhp_listing). Ideally, mental health professionals should be embedded in diabetes care settings. In recognition of limited behavioral health resources and to optimize availability, other health care professionals who have been trained in behavioral and mental health interventions may also provide this specialized psychosocial care (326,329,345,346). Although some health care professionals may not feel qualified to treat psychological problems (347), optimizing the relationship between a person with diabetes and health care professional may increase the likelihood of the individual accepting referral for other services. Collaborative care interventions and a team approach have demonstrated efficacy in diabetes self-management, outcomes of depression, and psychosocial functioning (5,6).

Evidence supports interventions for people with diabetes and psychosocial concerns, including issues that affect mental and behavioral health. Successful therapeutic approaches include cognitive behavioral (330,332,348,349) and mindfulness-based therapies (346,350,351). See the sections below for details about interventions for specific psychological concerns. Behavioral interventions may also be indicated in a preventive manner even in the absence of positive psychosocial screeners, such as resilience-promoting interventions to prevent diabetes distress in adolescence (352,353) and behavioral family interventions to promote collaborative family diabetes management in early adolescence (354,355) or to support adjustment to a new treatment plan or technology (64). Psychosocial interventions can be delivered via digital health platforms (356). Group-based or shared diabetes appointments that address both medical and psychosocial issues relevant to living with diabetes are a promising model to consider (327,357).

Although efficacy has been demonstrated with psychosocial interventions, there has been varying success regarding sustained increases in engagement in health behaviors and improved glycemic outcomes associated with behavioral and mental health issues. Thus, health care professionals should systematically monitor these outcomes following implementation of current evidence-based psychosocial treatments to determine ongoing needs.

Diabetes Distress

Recommendation

5.42 Routinely monitor people with diabetes, caregivers, and family members for diabetes distress, particularly when treatment targets are not met and/or at the onset of diabetes complications. Refer to a qualified mental health professional or other trained health care professional for further assessment and treatment if indicated. **B**

Diabetes distress is very common (321, 358–360). While it shares some features with depression, diabetes distress is distinct and has unique relationships with glycemic and other outcomes (359,361). Diabetes distress refers to significant negative psychological reactions related to emotional burdens and worries specific to an individual's experience in having to manage a severe, complicated, and demanding chronic condition such as diabetes (358,359,362). The constant behavioral demands of diabetes self-management (medication dosing, frequency, and titration; monitoring of glucose, food intake, eating patterns, and physical activity) and the potential or actuality of disease progression are directly associated with reports of diabetes distress (358). The prevalence of diabetes distress is reported to be 18–45%, with an incidence of 38–48% over 18 months in people with type 2 diabetes (362). In the second Diabetes Attitudes, Wishes, and Needs (DAWN2) study, significant diabetes distress was reported by 45% of the participants, but only 24% reported that their health care teams asked them how diabetes affected their lives (321). Similar rates have been identified among adolescents with type 1 diabetes (360) and in parents of youth with type 1 diabetes. High levels of diabetes distress significantly impact medication-taking behaviors and are linked to higher A1C, lower self-efficacy, and less optimal eating and exercise behaviors (5,358,362). Diabetes distress is also associated with symptoms of anxiety, depression, and reduced health-related quality of life (363).

Diabetes distress should be routinely monitored (364) using diabetes-specific validated measures (1). If diabetes

distress is identified, it should be acknowledged and addressed. If indicated, the person should be referred for follow-up care (333). This may include specific diabetes education to address areas of diabetes self-care causing distress and impacting clinical management and/or behavioral intervention from a qualified mental health professional, ideally with expertise in diabetes, or from another trained health care professional. Several educational and behavioral intervention strategies have demonstrated benefits for diabetes distress and, to a lesser degree, glycemic outcomes, including education, psychological therapies such as cognitive behavioral therapy and mindfulness-based therapies, and health behavior change approaches such as motivational interviewing (348,349,365,366). Data support diabetes distress interventions delivered using technology (356). DSMES has been shown to reduce diabetes distress (5) and may also benefit A1C when combined with peer support (367). It may be helpful to provide counseling regarding expected diabetes-related versus generalized psychological distress, both at diagnosis and when disease state or treatment changes occur (368). A multisite RCT with adults with type 1 diabetes and elevated diabetes distress and A1C demonstrated large improvements in diabetes distress and small reductions in A1C through two 3-month intervention approaches: a diabetes education intervention with goal setting and a psychological intervention that included emotion regulation skills, motivational interviewing, and goal setting (369). Among adults with type 2 diabetes in the Veterans Affairs system, an RCT demonstrated benefits of integrating a single session of mindfulness intervention into DSMES, followed by a booster session and mobile app-based home practice over 24 weeks, with the strongest effects on diabetes distress (370). An RCT of cognitive behavioral therapy demonstrated positive benefits for diabetes distress, A1C, and depressive symptoms for up to 1 year among adults with type 2 diabetes and elevated symptoms of distress or depression (371). An RCT among people with type 1 and type 2 diabetes found mindful self-compassion training increased self-compassion, reduced depression and diabetes distress, and improved A1C (372). An RCT of a resilience-focused cognitive behavioral and social problem-solving intervention compared with diabetes education (353) in teens with type 1 diabetes showed that diabetes distress and depressive symptoms were significantly reduced for up to 3 years post-intervention, though neither A1C nor self-management behaviors improved over time. These recent studies support that a combination of educational, behavioral, and psychological intervention approaches is needed to address distress, depression, and A1C.

As with treatment of other diabetes-associated behavioral and psychosocial factors affecting disease outcomes, there is little outcome data on long-term systematic treatment of diabetes distress integrated into routine care. As the diabetes disease course and its management are fluid, it can be expected that related distress may fluctuate and may need different methods of remediation at different points in the life course and as disease progression occurs.

Anxiety

Recommendations

5.43 Consider screening people with diabetes for anxiety symptoms or diabetes-related worries. Health care professionals can discuss diabetes-related worries and may refer to a qualified mental health professional for further assessment and treatment if anxiety symptoms indicate interference with diabetes self-management behaviors or quality of life. **B**

5.44 Refer people with hypoglycemia unawareness, which can co-occur with fear of hypoglycemia, to a trained professional to receive evidence-based intervention to help re-establish awareness of symptoms of hypoglycemia and reduce fear of hypoglycemia. **A**

Anxiety symptoms and diagnosable disorders (e.g., generalized anxiety disorder, body dysmorphic disorder, obsessive compulsive disorder, specific phobias, and posttraumatic stress disorder) are common in people with diabetes (373). The Behavioral Risk Factor Surveillance System estimated the lifetime prevalence of generalized anxiety disorder to be 19.5% in people with either type 1 or type 2 diabetes (374). A common diabetes-specific concern is fears related to hypoglycemia (375,376), which may explain avoidance of behaviors associated with lowering glucose, such as increasing insulin doses or frequency of monitoring. Other common sources of diabetes-related anxiety include not meeting blood glucose targets (373), insulin injections or infusion (377), and onset of complications (1). People with diabetes who exhibit excessive diabetes self-management behaviors well beyond what is prescribed or needed to achieve glycemic targets may be experiencing symptoms of obsessive-compulsive disorder (378). General anxiety is a predictor of injection-related anxiety and is associated with fear of hypoglycemia (376,379).

Psychological and behavioral care can be helpful to address symptoms of anxiety in people with diabetes. Among adults with type 2 diabetes and elevated depressive symptoms, an RCT of collaborative care demonstrated benefits on anxiety symptoms for up to 1 year (380). Fear of hypoglycemia and hypoglycemia unawareness often co-occur, so interventions aimed at treating one often benefit both (381). If fear of hypoglycemia is identified and a person does not have symptoms of hypoglycemia, a structured program of blood glucose awareness training delivered in routine clinical practice can improve A1C, reduce the rate of severe hypoglycemia, and restore hypoglycemia awareness (382,383). If not available within the practice setting, a structured program targeting both fear of hypoglycemia and unawareness should be sought out and implemented by a qualified behavioral practitioner (381,383–385). An RCT comparing blood glucose awareness training with a cognitively focused psychoeducation program in adults with type 1 diabetes and impaired awareness of hypoglycemia that has been treatment resistant suggested that both approaches were beneficial for reducing hypoglycemia (386). Thus, specialized behavioral intervention from a trained health care professional is needed to treat hypoglycemia-related anxiety and unawareness.

Depression

Recommendations

5.45 Consider at least annual screening of depressive symptoms in

all people with diabetes, especially those with a self-reported history of depression. Use age-appropriate, validated depression screening measures, recognizing that further evaluation will be necessary for individuals who have a positive screen. **B**

5.46 Beginning at diagnosis of complications or when there are significant changes in medical status, consider assessment for depression. **B**

5.47 Refer to qualified mental health professionals or other trained health care professionals with experience using evidence-based treatment approaches for depression in conjunction with collaborative care with the diabetes treatment team. **A**

History of depression, current depression, and antidepressant medication use are risk factors for the development of type 2 diabetes, especially if the individual has other risk factors such as obesity and family history of type 2 diabetes (387–389). Elevated depressive symptoms and depressive disorders affect one in four people with type 1 or type 2 diabetes (320). Thus, routine screening for depressive symptoms is indicated in this high-risk population, including people with type 1 or type 2 diabetes, gestational diabetes mellitus, and postpartum diabetes. Regardless of diabetes type, women have significantly higher rates of depression than men (390).

Routine monitoring with age-appropriate validated measures (1) can help to identify if referral is warranted (333,339). Multisite studies have demonstrated feasibility of implementing depressive symptom screening protocols in diabetes clinics and published practical guides for implementation (336–339,391). Adults with a history of depressive symptoms need ongoing monitoring of depression recurrence within the context of routine care (387). Integrating mental and physical health care can improve outcomes. When a person with diabetes is receiving psychological therapy, the mental/behavioral health professional should be incorporated into or collaborate with the diabetes treatment team (392). As with DSMES, person-centered collaborative care approaches have been shown to improve both depression and medical outcomes (392). Depressive symptoms may also be a manifestation of reduced quality of life secondary to disease burden (also see DIABETES DISTRESS, above) and resultant changes in resource allocation impacting the person and their family. When depressive symptoms are identified, it is important to query origins, both diabetes-specific and due to other life circumstances (363,393).

Trials have shown consistent evidence of improvements in depressive symptoms and variable benefits for A1C when depression is simultaneously treated (331,392,394), whether through pharmacological treatment, group therapy, psychotherapy, or collaborative care (328,348,349,395,396). Psychological interventions targeting depressive symptoms have shown efficacy when delivered via digital technologies (397). Physical activity interventions also demonstrate benefits for depressive symptoms and A1C (398). It is important to note that medical treatment plan should also be monitored in response to reduction in depressive symptoms. People may agree to or adopt previously refused treatment strategies (improving ability to follow recommended treatment behaviors), which may include increased physical activity and intensification of treatment plan behaviors and monitoring, resulting in changed glucose profiles.

Disordered Eating Behavior

Recommendations

5.48 Consider screening for disordered or disrupted eating using validated screening measures when hyperglycemia and weight loss are unexplained based on self-reported behaviors related to medication dosing, meal plan, and physical activity. In addition, a review of the medical treatment plan is recommended to identify potential treatment-related effects on hunger/caloric intake. **B**

5.49 Consider reevaluating the treatment plan of people with diabetes who present with symptoms of disordered eating behavior, an eating disorder, or disrupted patterns of eating, in consultation with a qualified professional as available. Key qualifications include familiarity with the diabetes disease physiology, treatments for diabetes and disordered eating behaviors, and weight-related and psychological risk factors for disordered eating behaviors. **B**

Estimated prevalence of disordered eating behavior and diagnosable eating disorders in people with diabetes varies (399–401). For people with type 1 diabetes, insulin omission causing glycosuria in order to lose weight is the most commonly reported disordered eating behavior (402,403); in people with type 2 diabetes, bingeing (excessive food intake with an accompanying sense of loss of control) is most commonly reported. For people with type 2 diabetes treated with insulin, intentional omission is also frequently reported (404). People with diabetes and diagnosable eating disorders have high rates of comorbid psychiatric disorders (405). People with type 1 diabetes and eating disorders have high rates of diabetes distress and fear of hypoglycemia (406).

Diabetes care professionals should monitor for disordered eating behaviors using validated measures (407). When evaluating symptoms of disordered or disrupted eating (when the individual exhibits eating behaviors that appear maladaptive but are not volitional, such as bingeing caused by loss of satiety cues), etiology and motivation for the behavior should be evaluated (401,408). Mixed intervention results point to the need for treatment of eating disorders and disordered eating behavior in the context of the disease and its treatment. Given the complexities of treating disordered eating behaviors and disrupted eating patterns in people with diabetes, it is recommended that multidisciplinary care teams include or collaborate with a health professional trained to identify and treat eating behaviors with expertise in disordered eating and diabetes (409). Key qualifications for such professionals include familiarity with the diabetes disease physiology, weight-related and psychological risk factors for disordered eating behaviors, and treatments for diabetes and disordered eating behaviors. More rigorous methods to identify underlying mechanisms of action that drive change in eating and treatment behaviors, as well as associated mental distress, are

needed (410). Health care teams may consider the appropriateness of technology use among people with diabetes and disordered eating behaviors, although more research on the risks and benefits is needed (411). Caution should be taken in labeling individuals with diabetes as having a diagnosable psychiatric disorder, i.e., an eating disorder, when disordered or disrupted eating patterns are found to be associated with the disease and its treatment. In other words, patterns of maladaptive food intake that appear to have a psychological origin may be driven by physiologic disruption in hunger and satiety cues, metabolic perturbations, and/or secondary distress because of the individual's inability to control their hunger and satiety (401,408).

The use of incretin therapies may have potential implications and relevance for the treatment of disrupted or disordered eating (see Section 8, "Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes"). These medications promote substantial weight loss and maintenance of lost weight beyond conventional nutrition therapies (412), which may improve quality of life. Incretin therapies work in the appetite and reward circuitries to modulate food intake and energy balance, reducing uncontrollable hunger, overeating, and bulimic symptoms (413), although mechanisms are not completely understood. Health care professionals may see expanded use of these medications as data become available (401). This therapy has the potential to improve psychosocial outcomes and control overeating behaviors in people with diabetes, which may ultimately benefit engagement with medical nutrition therapy recommendations (414). More research is needed about adjunctive use of incretins and other medications affecting physiologically based eating behavior in people with diabetes.

Serious Mental Illness

Recommendations

5.50 Provide an increased level of support for people with diabetes and serious mental illness through enhanced monitoring of and assistance with diabetes self-management behaviors. **B**

5.51 In people who are prescribed atypical antipsychotic medications, screen for prediabetes and diabetes 4 months after medication initiation and sooner if clinically indicated, at least annually. **B**

5.52 If a second-generation antipsychotic medication is prescribed for adolescents or adults with diabetes, changes in weight, glycemia, and cholesterol levels should be carefully monitored, and the treatment plan should be reassessed accordingly. **C**

Studies of individuals with serious mental illness, particularly schizophrenia and other thought disorders, show significantly increased rates of type 2 diabetes (415). People with schizophrenia should be monitored for type 2 diabetes because of the known comorbidity. Disordered thinking and judgment can be expected to make it difficult to engage in behavior that reduces risk factors for type 2 diabetes, such as restrained eating for weight management. Further, people with serious mental health disorders and diabetes frequently experience moderate psychological distress, suggesting pervasive intrusion of mental health issues into daily functioning (416).

Coordinated management of diabetes or prediabetes and serious mental illness is recommended to achieve diabetes treatment targets. The diabetes care team, in collaboration with other care professionals, should work to provide an enhanced level of care and self-management support for people with diabetes and serious mental illness based on individual capacity and needs. Such care may include remote monitoring, facilitating health care aides, and providing diabetes training for family members, community support personnel, and other caregivers. Qualitative research suggests that educational and behavioral intervention may provide benefit via group support, accountability, and assistance with applying diabetes knowledge (417). In addition, those taking second-generation (atypical) antipsychotics, such as olanzapine, require greater monitoring because of an increase in risk of type 2 diabetes associated with this medication (418–420). Because of this increased risk, people should be screened for prediabetes or diabetes 4 months after medication initiation and at least annually thereafter. Serious mental illness is often associated with the inability to evaluate and utilize information to make judgments about treatment options. When a person has an established diagnosis of a mental illness that impacts judgment, activities of daily living, and ability to establish a collaborative relationship with care professionals, it is wise to include a nonmedical caretaker in decision-making regarding the medical treatment plan. This person can help improve the patient's ability to follow the agreed-upon treatment plan through both monitoring and caretaking functions (421).

Cognitive Capacity/Impairment

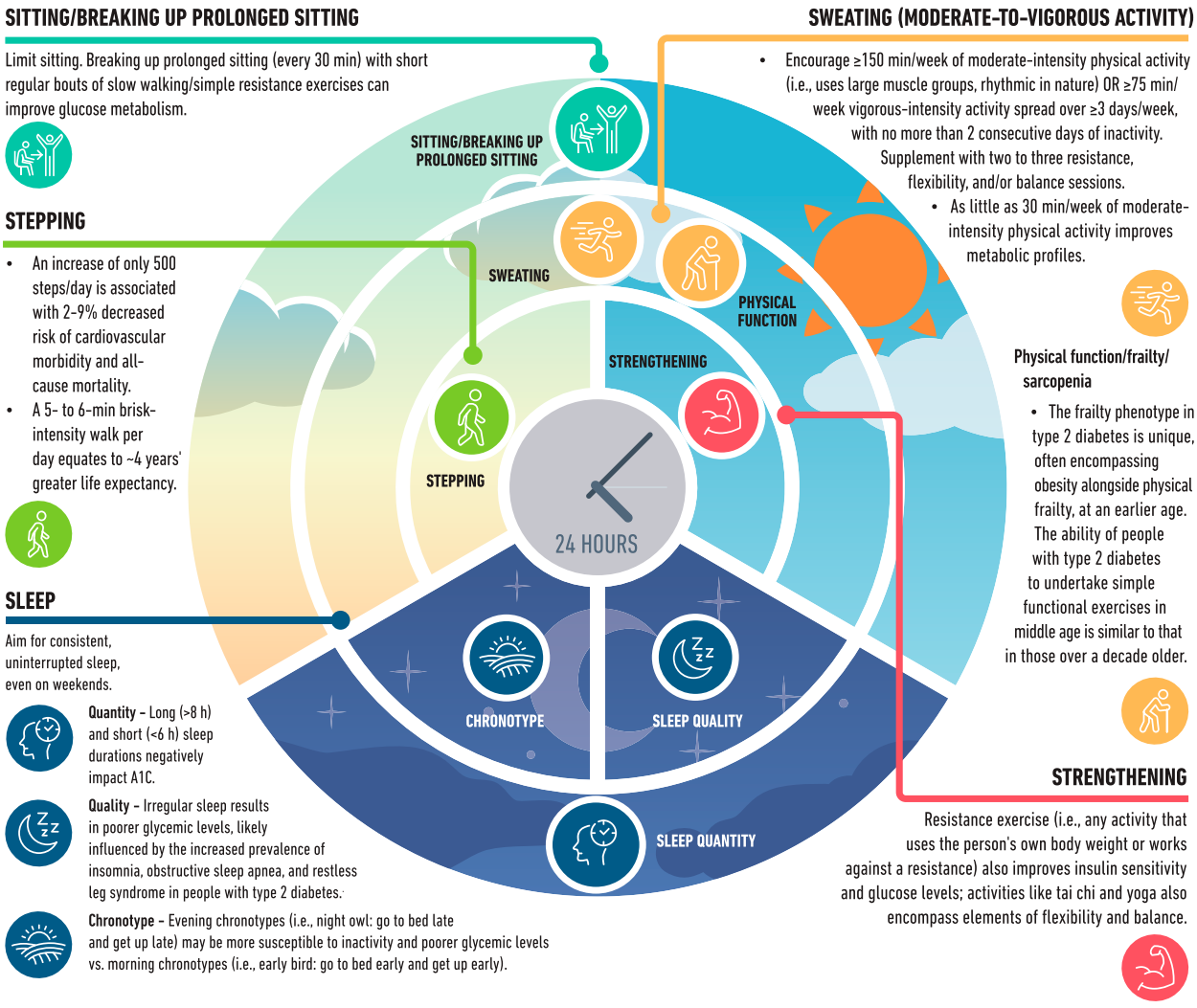
Recommendations

5.53 Cognitive capacity should be monitored throughout the life span for all individuals with diabetes, particularly in those who have documented cognitive disabilities, those who experience severe hypoglycemia, very young children, and older adults. **B**

5.54 If cognitive capacity changes or appears to be suboptimal for patient decision-making and/or behavioral self-management, referral for a formal assessment should be considered. **E**

Cognitive capacity is generally defined as attention, memory, logic and reasoning, and auditory and visual processing, all of which are involved in diabetes self-management behavior (422). Having diabetes over decades—type 1 and type 2—has been shown to be associated with cognitive decline (423–425). Declines have been shown to impact executive function and information processing speed; they are not consistent between people, and evidence is lacking regarding a known course of decline (426). Diagnosis of dementia is also more prevalent among people with diabetes, both type 1 and type 2 (427). Thus, monitoring of cognitive capacity of individuals is recommended, particularly regarding their ability to self-monitor and make judgments about their symptoms, physical status, and needed alterations to their self-management behaviors, all of which are mediated by executive function (427). As with other disorders affecting mental capacity (e.g., major psychiatric disorders), the key issue is

IMPORTANCE OF 24-HOUR PHYSICAL BEHAVIORS FOR TYPE 2 DIABETES



	Glucose/insulin	Blood pressure	A1C	Lipids	Physical function	Depression	Quality of life
SITTING/BREAKING UP PROLONGED SITTING	↓	↓	↓	↓	↑	↓	↑
STEPPING	↓	↓	↓	↓	↑	↓	↑
SWEATING (MODERATE-TO-VIGOROUS ACTIVITY)	↓	↓	↓	↓	↑	↓	↑
STRENGTHENING	↓	↓	↓	↓	↑	↓	↑
ADEQUATE SLEEP DURATION	↓	↓	↓	↓	?	↓	↑
GOOD SLEEP QUALITY	↓	↓	↓	↓	?	↓	↑
CHRONOTYPE/CONSISTENT TIMING	↓	?	↓	?	?	↓	?

IMPACT OF PHYSICAL BEHAVIORS ON CARDIOMETABOLIC HEALTH IN PEOPLE WITH TYPE 2 DIABETES

↑ **Higher levels/improvement** (physical function, quality of life); ↓ **Lower levels/improvement** (glucose/insulin, blood pressure, A1C, lipids, depression); ? no data available; ↑ Green arrows = **strong evidence**; ↑ Yellow arrows = **medium-strength evidence**; ↑ Red arrows = **limited evidence**.

Figure 5.1—Importance of 24-h physical behaviors for type 2 diabetes. Reprinted from Davies et al. (88).

whether the person can collaborate with the care team to achieve optimal metabolic outcomes and prevent complications, both short and long term (416). When this ability is shown to be altered, declining, or absent, a lay care professional should be introduced into the care team who serves in the capacities of day-to-day monitoring as well as a liaison with the rest of the care team (1). Cognitive capacity also contributes to ability to benefit from diabetes education and

may indicate the need for alternative teaching approaches as well as remote monitoring. Youth will need second-party monitoring (e.g., parents and adult caregivers) until they are developmentally able to evaluate necessary information for self-management decisions and to inform resultant behavior changes.

Episodes of severe hypoglycemia are independently associated with decline, as well as the more immediate symptoms of mental confusion (428). Early-onset type 1 diabetes has been shown to be associated with potential deficits in intellectual abilities, especially in the context of repeated episodes of severe hypoglycemia (429). (See Section 14, "Children and Adolescents," for information on early-onset diabetes and cognitive abilities and the effects of severe hypoglycemia on children's cognitive and academic performance.) Thus, for myriad reasons, cognitive capacity should be assessed during routine care to ascertain the person's ability to maintain and adjust self-management behaviors, such as dosing of medications, remediation approaches to glycemic excursions, etc., and to determine whether to enlist a caregiver in monitoring and decision-making regarding management behaviors. If cognitive capacity to carry out self-maintenance behaviors is questioned, an age-appropriate test of cognitive capacity is recommended (1). Cognitive capacity should be evaluated in the context of the person's age, for example, in very young children who are not expected to manage their disease independently and in older adults who may need active monitoring of treatment plan behaviors.

Sleep Health

Recommendation

5.55 Consider screening for sleep health in people with diabetes, including symptoms of sleep disorders, disruptions to sleep due to diabetes symptoms or management needs, and worries about sleep. Refer to sleep medicine and/or a qualified behavioral health professional as indicated. **B**

The associations between sleep problems and diabetes are complex: sleep disorders are a risk factor for developing type 2 diabetes (430,431) and possibly gestational diabetes mellitus (432,433). Moreover, sleep disturbances are associated with less engagement in diabetes self-management and may interfere with the achievement of glycemic targets among people with type 1 and type 2 diabetes (434–439). Disrupted sleep and sleep disorders, including obstructive sleep apnea (440), insomnia, and sleep disturbances (435), are common among people with diabetes. In type 1 diabetes, estimates of poor sleep range from 30% to 50% (441), and estimates of moderate to severe obstructive sleep apnea are >50% (436). In type 2 diabetes, 24–86% of people are estimated to have obstructive sleep apnea (442), 39% to have insomnia, and 8–45% to have restless leg syndrome (439). Risk of hypoglycemia poses specific challenges for sleep in people with type 1 diabetes and may require targeted assessment and treatment approaches (443). People with diabetes and their family members also describe diabetes management needs interfering with sleep and experiencing worries about poor sleep; technology has been described as both a help and challenge in relation to sleep (444). Cognitive behavioral therapy shows benefits for sleep in people with diabetes (348), including cognitive behavioral therapy for insomnia, which demonstrates improvements in sleep outcomes and possible small improvements in A1C and fasting glucose (445). There is also evidence that sleep extension and pharmacological treatments for sleep can improve sleep outcomes and possibly insulin resistance (443,445). Thus, referral to sleep specialists to address the medical and behavioral aspects of sleep is recommended, ideally in collaboration with the diabetes care professional (**Fig. 5.1**).

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