5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes—2024*

*American Diabetes Association Professional Practice Committee**

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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, an interprofessional 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 management 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, counseling and treatment to support cessation of tobacco products and vaping, health behavior counseling, and psychosocial care. Following an initial comprehensive health evaluation (see Section 4, "Comprehensive Medical Evaluation and Assessment of Comorbidities"), health care professionals are encouraged to engage in person-centered collaborative care with people with diabetes (3–6), an approach that is guided by shared decision-making in treatment plan selection; facilitation of obtaining medical, behavioral, psychosocial, and technology resources and support; and shared monitoring of agreed-upon diabetes care plans and behavioral goals (7,8). Reevaluation during routine care should include assessment of medical and behavioral health outcomes, especially during times of change in health and well-being.

DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT

Recommendations

5.1 Strongly encourage all people with diabetes to participate in diabetes self-management education and support (DSMES) to facilitate informed decision-making, self-care behaviors, problem-solving, and active collaboration with the health care team. **A**

5.2 In addition to annually, there are critical times to evaluate the need for DSMES to promote skills acquisition to aid treatment plan implementation, medical

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nutrition therapy, and well-being: at diagnosis, when not meeting treatment goals, when complicating factors develop (medical, physical, and psychosocial), and when transitions in life and care occur. E

5.3 Clinical outcomes, health status, and well-being are key goals of DSMES that should be assessed as part of routine care. C

5.4 DSMES should be culturally sensitive and responsive to individual preferences, needs, and values and may be offered in group or individual settings. A Such education and support should be documented and made available to members of the entire diabetes care team. E

5.5 Consider offering DSMES via telehealth and/or digital interventions to address barriers to access and improve satisfaction. B

5.6 Since DSMES can improve outcomes and reduce costs, reimbursement by third-party payers is recommended. B

5.7 Identify and address barriers to DSMES that exist at the payer, health system, clinic, health care professional, and individual levels. E

5.8 Include social determinants of health of the target population in guiding design and delivery of DSMES C with the ultimate goal of health equity across all populations.

The overall objectives of 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).

As the use of judgmental words is associated with increased feelings of shame and guilt, health care professionals are encouraged to consider the impact that language has on building therapeutic relationships and should 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).

In addition to annually, there are critical time points when the need for DSMES should be evaluated by the health care professional and/or interprofessional team, with referrals made as needed (2):

- At diagnosis
- When not meeting treatment goals
- When complicating factors (e.g., health conditions, physical limitations, emotional factors, or basic living needs) that influence self-management develop
- When transitions in life and care occur

DSMES focuses on empowering individuals with diabetes by providing them with 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 and cultural 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 (17–22), lower self-reported weight (23), improved quality of life (19,24,25), reduced all-cause mortality risk (26), positive coping behaviors (5,27), and lower health care costs (28–30). DSMES is associated with an increased use of primary care and preventive services (28,31,32) and less frequent use of acute care and inpatient hospital services (23). 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 (29,32). Better outcomes were reported for DSMES interventions that were >10 h over the course of 6–12 months (20), included ongoing support (14,33), were culturally (34–36) and age appropriate (37,38), were tailored to individual needs and preferences, addressed psychosocial issues, and incorporated behavioral strategies (15,27,39,40). Individual and group approaches are effective (41–43), with a slight benefit realized by those who engage in both (20).

Strong evidence now exists on the benefits of virtual, telehealth, telephone-based, or internet-based DSMES for diabetes prevention and management in a wide variety of populations and age-groups of people with diabetes (44–56). Technologies such as mobile apps, simulation tools, digital coaching, and digital self-management interventions can also be used to deliver DSMES (57–62). These methods provide comparable or even improved outcomes compared with traditional in-person care (63). Greater A1C reductions are demonstrated with increased engagement (64), 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 (47). Continuous glucose monitoring (CGM), when combined with individualized diabetes education or behavioral interventions, has demonstrated greater improvement on glycemic and psychosocial outcomes compared with CGM alone (64,65). Similarly, DSMES plus intermittently scanned CGM has demonstrated increased time in range (70–180 mg/dL [3.9–10.0 mmol/L]), less time above range,

and a greater reduction in A1C compared with DSMES alone (66). 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 (www.diabeteseducator.org/danatech/home) (8,31,67–70).

Research supports diabetes care and education specialists (DCES), including nurses (registered nurses and nurse practitioners), registered dietitian nutritionists (RDNs), pharmacists, and other health professionals as providers of DSMES who can also tailor curricula to individual needs (71–73). Members of the DSMES team should have specialized clinical knowledge of 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 (68). 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 (56), and engagement with qualified professionals has been shown to improve diabetes-related outcomes (74). Additionally, there is growing evidence for the role of community health workers (75,76), as well as peer (75–80) and lay leaders (81), 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, support self-management decisions, and decrease therapeutic inertia calls for broader adoption of these approaches (82). 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 consider demographic characteristics such as race, ethnic/cultural background, sex/gender, age, geographic location, technology access, education, literacy, and numeracy (56,83). For example, a systematic review and meta-analysis of telehealth DSMES interventions with Black and Hispanic people with diabetes showed a 0.465% decrease in A1C, demonstrating the importance of considering demographic factors in relation to DSMES interventions (53).

Despite the benefits of DSMES, data from the 2017 and 2018 Behavioral Risk Factor Surveillance System of 61,424 adults with self-reported diabetes indicate that only 53% of individuals eligible for DSMES through their health insurance receive it (84). Barriers to DSMES exist at the health system, payer, clinic, health care professional, and individual levels. Low participation may be due to lack of referral or other identified barriers, such as logistical issues (accessibility, timing, and costs) and the lack of a perceived benefit (85). Health system, clinic, programmatic, and payer barriers include lack of administrative leadership support, limited numbers of DSMES professionals, not having a referral to DSMES effectively embedded in the health system service structure, and limited reimbursement rates (86). 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 potential barriers at each level (2). For example, a multilevel diabetes care intervention that combined clinical outreach, standardized protocols, and DSMES with SDOH screening and referrals to social needs support documented a 15% increase in receipt of DSMES, including among people on Medicaid (87). Support from institutional leadership is foundational for the success of DSMES. Expert stakeholders should also support DSMES by providing input and advocacy (56). Alternative and innovative models of DSMES delivery (58) need to be explored and evaluated, including the integration of technology-enabled diabetes and cardiometabolic health services (8,68). One potential model is virtual environments, which allow people with diabetes to self-represent as avatars and interact in a world with embedded informational resources accessed using principles of gamification. An RCT testing DSMES in a virtual environment demonstrated greater weight loss but similar decreases in A1C, blood pressure, cholesterol, and triglycerides compared with DSMES via a standard website (88). Barriers to equitable access to DSMES may be addressed through telehealth delivery of care, virtual environments, and other digital health solutions (56).

Reimbursement

Medicare reimburses DSMES when that service meets the national standards (2,56) and is recognized by the American Diabetes Association (ADA) through the Education Recognition Program (professional.diabetes.org/diabetes-education) or by the 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. Medicare reimburses remote physiologic monitoring for glucose and other cardiometabolic data if certain conditions are met (89). For Medicare Part B, the basics of the DSMES benefit include individual encounters reimbursable for the first 10 h (1 h of individual training and 9 h of group training); if special needs that would interfere with effective group participation are identified on the referral order, individual DSMES encounters are reimbursable for the initial 10 h. For Medicaid, DSMES coverage varies by state.

Although DSMES is frequently reimbursed when performed in person, DSMES can also be provided via telehealth and phone calls (13). These versions may not always be reimbursed; however, changes in reimbursement policies that increase DSMES access and utilization will result in a positive impact on beneficiaries' clinical outcomes, quality of life, health care utilization, and costs (13,90–92). 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. Per updated guidance from the Centers for Medicare & Medicaid Services, DSMES telehealth reimbursements remain the same as they were during the public health emergency for most practice settings. Both ADA-recognized and Association of Diabetes Care & Education Specialists–accredited programs were added to the list of approved telehealth professionals via the Consolidated Appropriations Act, 2023. The reimbursement of DSMES telehealth services was extended through the end of 2024. Importantly, DSMES is paid on the physician fee schedule and not the outpatient prospective payment system. Per the Consolidated Appropriations Act, 2023, distant-site health care professionals may

be able to bill DSMES as a Medicare telehealth service through 31 December 2024.

MEDICAL NUTRITION THERAPY

When the first ADA Standards of Care guidelines were published in 1989, nutrition was mentioned in two sentences in the entire 4-page document (93). Even now, in 2024, the science of nutrition for diabetes continues to evolve. At the same time, there has been change of emphasis from nutrients (macronutrients and micronutrients) to a focus on foods and, more broadly, dietary patterns. This integrative approach aligns with the 2021 American Heart Association dietary guidance to improve cardiovascular health (94), the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines (95), the European Association for the Study of Diabetes/ADA type 1 consensus report (96) and type 2 consensus report (97), and the Dietary Guidelines for Americans, 2020–2025 (98). Simply put, people eat food, not nutrients, and nutrient recommendations need to be applied to what people eat. Additionally, macronutrients are not interchangeable entities and vary by nutrient type and quality. As an example, carbohydrates include legumes, whole grains, and fruits and are in the same category as refined grains, but their health effects are very different (99).

For more detailed information on nutrition therapy, please refer to the ADA consensus report on nutrition therapy (73). Contained in the report is an important and often repeated tenet, i.e., 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 (73,100). 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 (101–103) 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 (104) and 0.3–2.0% for people with type 2 diabetes (104). 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 (73,100).

Goals of Nutrition Therapy for All People 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 (73). Lifestyle intervention programs should be intensive and have frequent follow-up to achieve significant reductions in excess body weight and improve clinical indicators. Behavior modification targets include physical activity, calorie restriction, weight management strategies, and motivation. There is strong and consistent evidence that modest, sustained weight loss can delay the progression from prediabetes to type 2 diabetes (103,105,106) (see Section 3, "Prevention or Delay of 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 5–7% or higher for reducing risk of progression to type 2 diabetes (107). 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 (108,109) (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 (107,110,111) as well as to establish healthy eating patterns. Services delivered by health care professionals familiar with diabetes and its management, such as an RDN, have been found to be effective (102).

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 (112,113). 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 (114,115). 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% (116–120).

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 (108,121,122). Overweight and obesity are also increasingly prevalent in people with type 1 diabetes and present clinical challenges regarding diabetes treatment

Table 5.1—Medical nutrition therapy recommendations

	Recommendations
Effectiveness of nutrition therapy	**5.9** 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** **5.10** 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	**5.11** 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	**5.12** For diabetes prevention and management of people with prediabetes or diabetes, recommend individualized meal plans that keep nutrient quality, total calories, and metabolic goals in mind, **B** as data do not support a specific macronutrient pattern. **5.13** Food-based dietary patterns should emphasize key nutrition principles (inclusion of nonstarchy vegetables, whole fruits, legumes, whole grains, nuts/seeds, and low-fat dairy products and minimizing consumption of meat, sugar-sweetened beverages, sweets, refined grains, and ultraprocessed foods) in people with prediabetes and diabetes. **B** **5.14** Consider reducing overall carbohydrate intake for adults with diabetes to improve glycemia, as this approach may be applied to a variety of eating patterns that meet individual needs and preferences. **B**
Carbohydrates	**5.15** Emphasize minimally processed, nutrient-dense, high-fiber sources of carbohydrate (at least 14 g fiber per 1,000 kcal). **B** **5.16** People with diabetes and those at risk are advised to replace sugar-sweetened beverages (including fruit juices) with water or low-calorie or 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** **5.17** Provide education on the glycemic impact of carbohydrate, **A** fat, and protein **B** tailored to an individual's needs, insulin plan, and preferences to optimize mealtime insulin dosing. **5.18** 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	**5.19** For people with type 2 diabetes, consider avoiding carbohydrate sources high in protein when treating or preventing hypoglycemia, as ingested protein appears to increase insulin response without increasing plasma glucose concentrations. **B**
Dietary fat	**5.20** Counsel people with diabetes to consider an eating plan emphasizing elements of a Mediterranean eating pattern, which is rich in monounsaturated and polyunsaturated fats and long-chain fatty acids such as fatty fish, nuts, and seeds, to reduce cardiovascular disease risk **A** and improve glucose metabolism. **B**
Micronutrients and herbal supplements	**5.21** Dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices (such as cinnamon or aloe vera) are not recommended for glycemic benefits. Health care professionals should inquire about intake of supplements and counsel as needed. **C** **5.22** Counsel against β-carotene supplementation, as there is evidence of harm for certain individuals and it confers no benefit. **B**
Alcohol	**5.23** Advise adults with diabetes who consume alcohol to not exceed the recommended daily limits (one drink per day for adult women and two drinks per day for adult men). **C** Advise abstainers to not start to drink, even in moderation, solely for the purpose of improving health outcomes. **C** **5.24** 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 monitoring glucose after drinking alcoholic beverages to reduce hypoglycemia risk should be emphasized. **B**
Sodium	**5.25** Counsel people with diabetes to limit sodium consumption to <2,300 mg/day. **B**
Nonnutritive sweeteners	**5.26** Counsel people with prediabetes and diabetes that water is recommended over nutritive and nonnutritive sweetened beverages. However, the use of nonnutritive sweeteners as a replacement for sugar-sweetened products in moderation is acceptable if it reduces overall calorie and carbohydrate intake. **B**

and CVD risk factors (123,124). Sustaining weight loss can be challenging (112,125) but has long-term benefits; maintaining weight loss for 5 years is associated with sustained improvements in A1C and lipid levels (126). 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 and reduction in medication dosing to reduce hunger) (73) (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 (127). If eating disorders are identified during screening with diabetes-specific questionnaires, individuals should be referred to a qualified behavioral 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 (114,126,128), a Mediterranean eating pattern (129), and low-carbohydrate meal plans with additional support (130,131). However, no single approach has been proven to be consistently superior (73, 132–134), and more data are needed to identify and validate those meal plans that are optimal with respect to long-term outcomes and acceptability. Any approach to meal planning should be individualized, considering the health status, personal and cultural preferences, health goals, ability to sustain the recommendations, and ultimately food access and nutrition security (73).

Food Insecurity and Access

Food insecurity is defined as a lack of consistent access to enough food for an active, healthy life (135). Food insecurity affects 16% of adults with diabetes compared with 9% of adults without diabetes (136). There is a complex bidirectional association between food insecurity and cooccurring diabetes. Food security screening should happen at all levels of the health care system. 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") (137):

- "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."

If screening is positive for food insecurity, efforts should be made to make referrals to appropriate programs and resources. For more information on efforts and policy recommendations, see "The Biden-Harris Administration National Strategy on Hunger, Nutrition, and Health" (138).

Eating Patterns and Meal Planning

For an understanding of nutrition and diabetes, it is important to clarify the differences between food patterns, eating plans, and approaches. These are terms that are often used interchangeably, but they are different and relevant in individualizing nutrition care plans (139).

- **Eating pattern(s) or food pattern(s).** The totality of all foods and beverages consumed over a given period of time. An eating pattern can be ascribed to an individual, but it is also the term used in prospective cohort and observational nutrition studies to classify and study nutrition patterns. Examples of eating patterns include Mediterranean style, Dietary Approaches to Stop Hypertension (DASH), low-carbohydrate vegetarian, and plant based (139).
- **Eating/meal plan (historically referred to as a diet).** An individualized guide to help plan when, what, and how much to eat on a daily basis, completed by the person with diabetes and the RDN. The eating plan could incorporate an eating pattern combined with a strategy or method to direct some of the choices. Eating plans are based on the individual's usual eating style.
- **Dietary approach.** Method or strategy to individualize a desired eating pattern and provide a practical tool(s) for developing healthy eating patterns. Examples of dietary approaches include the plate method, carbohydrate choice, carbohydrate counting, and highly individualized behavioral approaches (140).

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. 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.

Research confirms that a variety of eating patterns are acceptable for the management of diabetes (73,104,141,142). Until the evidence around benefits of different eating patterns is strengthened, health care professionals should focus on the core dimensions common among patterns: inclusion of nonstarchy vegetables, whole fruits, legumes, whole grains, nuts, seeds, and low-fat dairy products and minimizing consumption of meat, sugar-sweetened beverages, sweets, refined grains, and ultraprocessed foods (143,144).

Evidence for eating patterns has been informed by RCTs, prospective cohort studies, systematic reviews, and network meta-analysis. Those most frequently referenced include Mediterranean, DASH, low-fat, carbohydrate-restricted, vegetarian, and vegan eating patterns. As stated previously, there is insufficient evidence to select one over the other (137,141,142,145–154). Ultimately, ongoing diabetes and nutrition education paired with appropriate support to implement and sustain health behaviors is recommended (103).

Meal Planning

Referral to and ongoing support from 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 lifestyle treatment plan, including physical activity and medication use. Using shared decision-making to collaboratively select a method for how to execute the plan may be part of the nutrition care process.

Dietary Approaches/Methods

Few head-to-head studies have compared different dietary approaches. In a systematic review and meta-analysis of carbohydrate counting versus other forms of dietary advice (standard education, low glycemic index, and fixed carbohydrate quantities), no significant differences were seen in A1C levels compared with standard education (145). In another RCT, a simplified carbohydrate counting tool based on individual glycemic response was noninferior to conventional carbohydrate counting in 85 adults with type 1 diabetes (146). In a randomized crossover trial, carbohydrate counting and qualitative meal size (low, medium, and high carbohydrate) were compared. Time in range was 74% for carbohydrate counting and 70.5% for the quantitative meal size estimates. Noninferiority was not confirmed for the qualitative method (147). Newer technologies (smart phone apps and CGM), including automated insulin delivery, may decrease the need for precise carbohydrate counting and allow for personalized nutrition approaches (148,149).

An RCT found that two meal-planning approaches (diabetes plate method and carbohydrate counting) were effective in helping achieve improved A1C (150). The diabetes plate method is a commonly used visual approach for providing basic meal planning guidance in type 1 and type 2 diabetes. This simple graphic (featuring a 9-inch plate) shows how to portion foods (one-half of the plate for nonstarchy vegetables, one-quarter of the plate for protein, and one-quarter 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 (150) and food literacy level. Health numeracy refers to understanding and using numbers and numerical concepts in relation to health and self-management (155). Food literacy generally describes proficiency in food-related knowledge and skills that ultimately impact health, although specific definitions vary across initiatives (151,152).

Intermittent fasting or time-restricted eating as strategies for weight and glucose management have been studied and have gained popularity. Intermittent fasting is an umbrella term that 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 (153,154,156,157). A few studies have extended up to 52 weeks and show similar findings (158–162) with diverse populations. Generally, time-restricted eating or shortening the eating window can be adapted to any eating pattern and has been shown to be safe for adults with type 1 or type 2 diabetes (161). People with diabetes who are on insulin and/or secretagogues should be medically monitored during the fasting period (163). Because of the simplicity of intermittent fasting and time-restricted eating, these may be useful strategies for people with diabetes who are looking for practical eating management tools.

Use of partial meal replacements or total meal replacements is an additional tool or strategy for energy restriction. Meal replacements are prepackaged foods (bars, shakes, and soups) that contain a fixed amount of macroutrients and micronutrients. They have been shown to improve nutrient quality and glycemic management and to reduce portion size and consequent energy intake. In a meta-analysis involving 17 studies incorporating both partial and total meal replacements, greater weight loss and improvement in A1C and fasting blood glucose were demonstrated compared with conventional diets (164). Meal replacements have been used in several landmark clinical trials, including Look AHEAD (Action for Health in Diabetes) (165), DiRECT (Diabetes Remission Clinical Trial) (166), and PREVIEW (Prevention of Diabetes Through Lifestyle Intervention and Population Studies in Europe and Around the World) (167), showing partial or total meal replacements can be a potential short-term strategy for weight loss.

Regardless of the eating pattern, meal plan, and/or dietary approach selected, long-term follow-up and support from members of the diabetes care team are needed to optimize self-efficacy and maintain behavioral changes (140).

Chrononutrition is a growing and emerging specialty in the field of nutrition and biology that tries to understand how the timing of food ingestion affects metabolic health (168). Glucose metabolism follows a circadian rhythm through diurnal variation of glucose tolerance, peaking during daylight hours when food is consumed. Some preliminary studies show cardiometabolic benefits when food is consumed earlier (169). Similarly, circadian disruptions found in shift workers increase risk of type 2 diabetes (170). Although more research needs to be done, this evolving area of research may show promise to improve glucose regulation.

Religious Fasting

Although intermittent fasting and time-restricted eating are specific dietary strategies for energy restriction, religious fasting has been practiced for thousands of years and is part of many faith-based traditions. Duration, frequency, and type of fast vary among different religions (171). For example, Jewish people abstain from any intake for ~24 h during Yom Kippur (172,173). For Muslims, Ramadan fasting lasts for a full month, when abstinence from any food or drink is required from dawn to dusk (174). Individuals with diabetes who fast have an increased risk for hypoglycemia, dehydration, hyperglycemia, and ketoacidosis. Risk can vary depending on the type of diabetes, type of therapy, and presence and severity of diabetes-related complications (175). Health care professionals, including RDNs, certified DCES, and others, should inquire about any religious fasting for people with diabetes and provide education and support to accommodate their choice. Education regarding glucose checking, medication/fluid adjustment, timing and intensity of physical activity, and meal choices pre- and post-fast should be provided (176). Treatment pre- and post-fast should be culturally sensitive and individualized (177). Specific recommendations for diabetes management during Ramadan (175) and Yom Kippur (172) are available.

Carbohydrates

Studies examining the optimal amount of carbohydrate intake for people with diabetes are inconclusive, although monitoring carbohydrate intake is a key strategy in reaching glucose goals in people with type 1 and type 2 diabetes (178, 179).

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 (139,180–184). 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 (134,182,185–187). Questions still remain about the optimal degree of carbohydrate restriction and the long-term effects of those meal patterns on CVD. A systematic review and meta-analysis of RCTs investigating the dose-dependent effects of carbohydrate restriction 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 (188). Part of the challenge in interpreting low-carbohydrate research has been due to the wide range of definitions for a low-carbohydrate eating plan (189,190). Weight reduction was also a goal in many low-carbohydrate studies, which further complicates evaluating the distinct contribution of the eating pattern (48,130,134,188). As studies on low-carbohydrate eating plans generally indicate challenges with long-term sustainability (180), 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 (191–193).

Regardless of the 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 (194). 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 (98). Regular intake of sufficient dietary fiber is associated with lower all-cause mortality in people with diabetes (195,196), and prospective cohort studies have found dietary fiber intake is inversely associated with risk of type 2 diabetes (197–199). The consumption of sugar-sweetened beverages and processed food products with large amounts of refined grains and added sugars is strongly discouraged (98,200,201), as these have the capacity to displace healthier, more nutrient-dense food choices.

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 (202,203). 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 (204) while others demonstrated A1C reductions of 0.15% (202) to 0.5% (190,205).

Individuals with type 1 or type 2 diabetes taking insulin at mealtime should be offered comprehensive and ongoing education about nutrition content and 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 (104,178,206–208). Studies have shown that dietary fat and protein can impact early and delayed postprandial glycemia (209–212), and it appears to have a dose-dependent response (213–216). 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 after eating (73,217,218). 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 (210,219).

The effectiveness of insulin dosing decisions should be confirmed with a structured approach to blood glucose monitoring or CGM 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) (210,219,220). Adjusting insulin doses to account for high-fat and/or high-protein meals requires determination of anticipated nutrient intake to calculate the mealtime dose. Food literacy, numeracy, interest, and capability should be evaluated (73). 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 (73,221). Commercially available automated insulin delivery systems still require basic diabetes management skills, including carbohydrate

counting and understanding of the impact of protein and fat on postprandial glucose response (222).

Protein

There is no evidence that adjusting the daily level of protein intake (typically 1–1.5 g/kg body weight/day or 15–20% of total calories) will improve health, and research is inconclusive regarding the ideal amount of dietary protein to optimize either glycemic management or CVD risk (203,223). 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 (224).

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 (73). 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 (225–227).

Strong evidence suggests higher plant protein intake and replacement of animal protein with plant protein is associated with lower risk of all-cause and cardiovascular mortality in the Women's Health Initiative cohort study (228). A meta-analysis of 13 RCTs showed replacing animal with plant proteins leads to small improvements in A1C and fasting glucose in individuals with type 2 diabetes (229). Plant proteins are lower in saturated fat and support planetary health (230).

Fats

Evidence suggests that there is not an optimal percentage of calories from fat for people with or at risk for diabetes and that macronutrient distribution should be individualized according to the individual's eating patterns, preferences, and metabolic goals (73). 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 (98,129,231–233). Multiple RCTs including people with type 2 diabetes have reported that a Mediterranean eating pattern (95,129,234–239) 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 by country or culture, 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 and docosahexaenoic acid) supplements for all people with diabetes for the prevention or treatment of cardiovascular events (73,240,241). 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 (203,242). In the ASCEND (A Study of Cardiovascular Events iN Diabetes) trial, when compared with placebo, supplementation with n-3 fatty acids at a dose of 1 g/day did not lead to cardiovascular benefit in people with diabetes without evidence of CVD (243). However, results from the Reduction of Cardiovascular Events With Icosapent Ethyl-Intervention Trial (REDUCE-IT) found that supplementation with 4 g/day of pure eicosapentaenoic acid 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 [1.52–5.63 mmol/L]) (244). 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 (98). *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 (238).

Sodium

As for the general population, people with diabetes are advised to limit their sodium consumption to <2,300 mg/day (73). Restriction to <1,500 mg, even for those with hypertension, is generally not recommended (245–247). Sodium recommendations should take into account palatability, availability, affordability, and the difficulty of achieving low-sodium recommendations in a nutritionally adequate eating plan (248,249).

Micronutrients and Supplements

Despite lack of evidence of benefit from dietary supplements, consumers continue to take them. Estimates show that up to 59% of people with diabetes in the U.S. use supplements (250). Without underlying deficiency, there is no benefit from herbal or nonherbal (i.e., vitamin or mineral) supplementation for people with diabetes (73,251). Federal law in the U.S. broadly defines dietary supplements as having one or more dietary ingredients, including vitamins, minerals, herbs or other botanicals, amino acids, enzymes, tissues from organs or glands, or extracts of these (252).

Routine antioxidant supplementation (such as vitamins E and C) is not recommended due to lack of evidence of efficacy and concern related to long-term safety. Based on the 2022 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 associated with increased lung cancer and cardiovascular mortality risk (253).

In addition, there is insufficient evidence to support the routine use of herbal supplements and micronutrients, such as cinnamon (254), curcumin, vitamin D (255), aloe vera, or chromium, to improve glycemia in people with diabetes (73,256).

Although the Vitamin D and Type 2 Diabetes Study (D2d) prospective RCT and Diabetes Prevention and Active Vitamin D (DPVD) showed no significant benefit of vitamin D versus placebo on the progression to type 2 diabetes in individuals at high risk (257,258), post hoc analyses and meta-analyses suggest a potential benefit in specific populations (257,259–261).

Further research is needed to define individual characteristics and clinical indicators where vitamin D supplementation may be of benefit.

Metformin is associated with vitamin B12 deficiency per a report from the Diabetes Prevention Program Outcomes Study (DPPOS), which suggests that periodic testing of vitamin B12 levels should be considered in people taking metformin, particularly in those with anemia or peripheral neuropathy (262,263) (see Section 9, "Pharmacologic Approaches to Glycemic Treatment"). Consumers can consult the U.S. Food and Drug Administration (FDA) Dietary Supplement Ingredient Directory to locate information about ingredients used in dietary supplements and any action taken by the agency with regard to that ingredient (264).

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 (265).

Alcohol

Moderate alcohol intake ingested with food 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) (73,256). 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 consistent with Dietary Guidelines for Americans, 2020–2025 (98). The available evidence does not support recommending alcohol consumption in people who do not currently drink (266). To reduce risk of alcohol-related harms, adults can choose not to drink or to drink in moderation by limiting intake to $\leq$2 drinks a day for men or $\leq$1 drink a day for women (one drink is equal to a 12-oz beer, a 5-oz glass of wine, or 1.5 oz of distilled spirits) (266). There is growing evidence for psychoeducational interventions that may increase knowledge about alcohol use and diabetes, may enhance perceived risks, and may reduce alcohol use among young people with type 1 diabetes (267).

Nonnutritive Sweeteners

The FDA has approved many nonnutritive sweeteners (NNS) for consumption by the general public, including people with diabetes (73,268). However, the safety and role of NNS continue to be sources of concern and confusion for the public (269). This confusion has been heightened with the World Health Organization's conditional recommendation (270) against NNS for weight management, the Cleveland Clinic study on erythritol and its relationship to CVD (271), and the International Agency for Research on Cancer classifying aspartame as a possible carcinogen to humans (272). It should be noted the systematic analysis that informed the World Health Organization recommendation excluded individuals with diabetes. In an editorial from the *Journal of Clinical Investigation*, Nobs and Elinav (273) from the Weizmann Institute described the impact these recent studies have had on the public perception of safety of NNS: "The burden of proof has shifted from a need to prove that NNS are unsafe to a necessity of understanding their potential scope of effects on humans in order to optimize their recommended use by populations at risk."

Despite FDA approval and generally recognized as safe (GRAS) status for NNS, as well as established acceptable daily intake (ADI), questions remain. Implementation and interpretation of human NNS studies are inherently challenging. Each of the sweeteners are their own distinct compounds with different molecular structures, although they are often considered together in studies. Issues of duration of exposure (short or long), different physical forms (packets/powder or in beverages), cardiometabolic health of the host, personalized individual response, presence of other nutrient components, the emerging evidence about the microbiome, and limited RCTs complicate the science (273).

For some people with diabetes who are accustomed to regularly consuming sugar-sweetened products, NNS (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 (274,275). NNS do not appear to have a significant effect on glycemic management (104,276,277), and they can reduce overall calorie and carbohydrate intake (104,274) as long as individuals are not compensating with additional calories from other food sources (73,278). There is mixed evidence from systematic reviews and meta-analyses for NNS use with regard to weight management, with some finding benefit in weight loss (279–281) while other research suggests an association with weight gain (282,283). This may be explained by reverse causality and residual confounding variables (283). The addition of NNS to eating plans poses no benefit for weight loss or reduced weight gain without energy restriction (284). 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 (285).

Health care professionals should continue to recommend reductions in sugar intake and calories with or without the use of NNS. Assuring people with diabetes that NNS have undergone extensive safety evaluation by regulatory agencies and are continually monitored can allay unnecessary concern for harm. Health care professionals can regularly assess individual use of NNS based on the acceptable daily intake (amount of a substance considered safe to consume each day over a person's life) and recommend moderation. See the chart from the FDA on safe levels of sweeteners found at fda.gov/food/food-additives-petitions/aspartame-and-other-sweeteners-food.

PHYSICAL ACTIVITY

Recommendations

5.27 Counsel youth with type 1 diabetes **C** or type 2 diabetes **B** to 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.

5.28 Counsel most adults with type 1 diabetes **C** and type 2 diabetes **B** to 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.

5.29 Counsel adults with type 1 diabetes **C** and type 2 diabetes **B** to engage in 2–3 sessions/week of resistance exercise on nonconsecutive days.

5.30 Recommend flexibility training and balance training 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**

5.31 For all people with diabetes, evaluate baseline physical activity and time spent in sedentary behavior (i.e., quiet sitting, lying, and leaning). For people who do not meet activity guidelines, encourage increase in physical activities (e.g., walking, yoga, housework, gardening, swimming, and dancing) above baseline (type 1 diabetes **E** and type 2 diabetes **B**). Counsel that prolonged sitting should be interrupted every 30 min for blood glucose benefits. **C**

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 (286). 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 (287). 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 (288). 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 (289). It is important for diabetes care management teams to understand the difficulty that many people have reaching recommended treatment goals 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 (290). 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 (291). 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 (292). 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 (293). Exercise training in type 1 diabetes may also improve several important markers such as triglyceride level, LDL cholesterol, waist circumference, and body mass (294). In adults with type 2 diabetes, higher levels of exercise intensity are associated with greater improvements in A1C and in cardiorespiratory fitness (295); sustained improvements in cardiorespiratory fitness and weight loss have also been associated with a lower risk of heart failure (258). Other benefits include slowing the decline in mobility among overweight people with diabetes (296). 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 (297). 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 this population (298). 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 (297).

Exercise and Youth

Youth with diabetes or prediabetes should be encouraged to engage in regular physical activity, including at least 60 min of moderate to vigorous aerobic activity every day and muscle- and bone-strengthening activities at least 3 days per week (299). In general, youth with type 1 diabetes benefit from being physically active, and meta-analyses have demonstrated a significant association between physical activity and lower A1C (300). Thus, an active lifestyle should be recommended to all (301). Youth with type 1 diabetes who engage in more physical activity may have better health outcomes and health-related quality of life (302,303). See Section 14, "Children and Adolescents," for details.

Frequency and Type of Physical Activity

For all people with diabetes, evaluate baseline physical activity and time spent in sedentary behavior (quiet sitting, lying, and leaning). For people who do not meet activity guidelines, encourage an increase in physical activity (walking, yoga, housework, gardening, swimming, and dancing) above baseline (304). Health care professionals should counsel people with diabetes to engage in aerobic and resistance exercise regularly (240). Aerobic activity bouts should 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 (305,306). 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 (307).

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 durations of vigorous-intensity activity or interval training (75 min/week) (297). 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 are encouraged to engage in 2–3 sessions/week of resistance exercise on nonconsecutive days (308). Although heavier resistance training with free weights or weight machines may improve glycemia and strength (309), 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 support people with diabetes to set stepwise goals toward meeting the recommended exercise goals. 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 MANAGEMENT, 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., seated work at a computer or watching television)—by breaking up bouts of sedentary activity (>30 min) by briefly standing, walking, or performing other light physical activities (310,311). Participating in leisure-time activity and avoiding extended sedentary periods may help prevent type 2 diabetes for those at risk and may also aid in glycemic management for those with diabetes (312,313).

A systematic review and meta-analysis found higher frequency of regular leisure-time physical activity was more effective in reducing A1C levels (314). A wide range of activities, including yoga, tai chi, and other types, can have significant impacts on A1C, flexibility, muscle strength, and balance (286,315–317). Flexibility and balance exercises may be particularly important in older adults with diabetes to maintain range of motion, strength, and balance (297) (**Fig. 5.1**). There is strong evidence that exercise interventions in individuals with type 2 diabetes improve depression, A1C, and overall psychosocial well-being (318).

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 (297) and for an additive benefit of combined aerobic and resistance exercise in adults with type 2 diabetes (319). If not contraindicated, people with type 2 diabetes should be encouraged to do at least two weekly sessions of resistance exercise (free weights, machines, elastic bands, or body weight as resistance), 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 (320).

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 (293).

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 (297).

High-Intensity Interval Training

High-intensity interval training (HIIT) is a plan that involves aerobic training done between 65% and 90% VO_{2peak} or 75% and 95% heart rate peak for 10 s to 4 min with 12 s to 5 min of active or passive recovery. HIIT has gained attention as a potentially time-efficient modality that can elicit significant physiological and metabolic adaptations for individuals with type 1 and type 2 diabetes (321,322). Higher intensities of aerobic training are generally considered superior to low-intensity training (323). HIIT showed reductions in A1C and BMI and improvement in fitness levels in individuals with type 2 diabetes. Because HIIT can lead to transient increases in post-exercise hyperglycemia, individuals with type 2 diabetes are encouraged to monitor blood glucose when starting (320). In type 1 diabetes, HIIT is associated with reductions in A1C levels, reduction in insulin requirements, and improvement in cardiometabolic risk profiles (322). Variability in glucose may occur with an increased risk in delayed hypoglycemia, so careful monitoring of glucose during and after HIIT is advised (322).

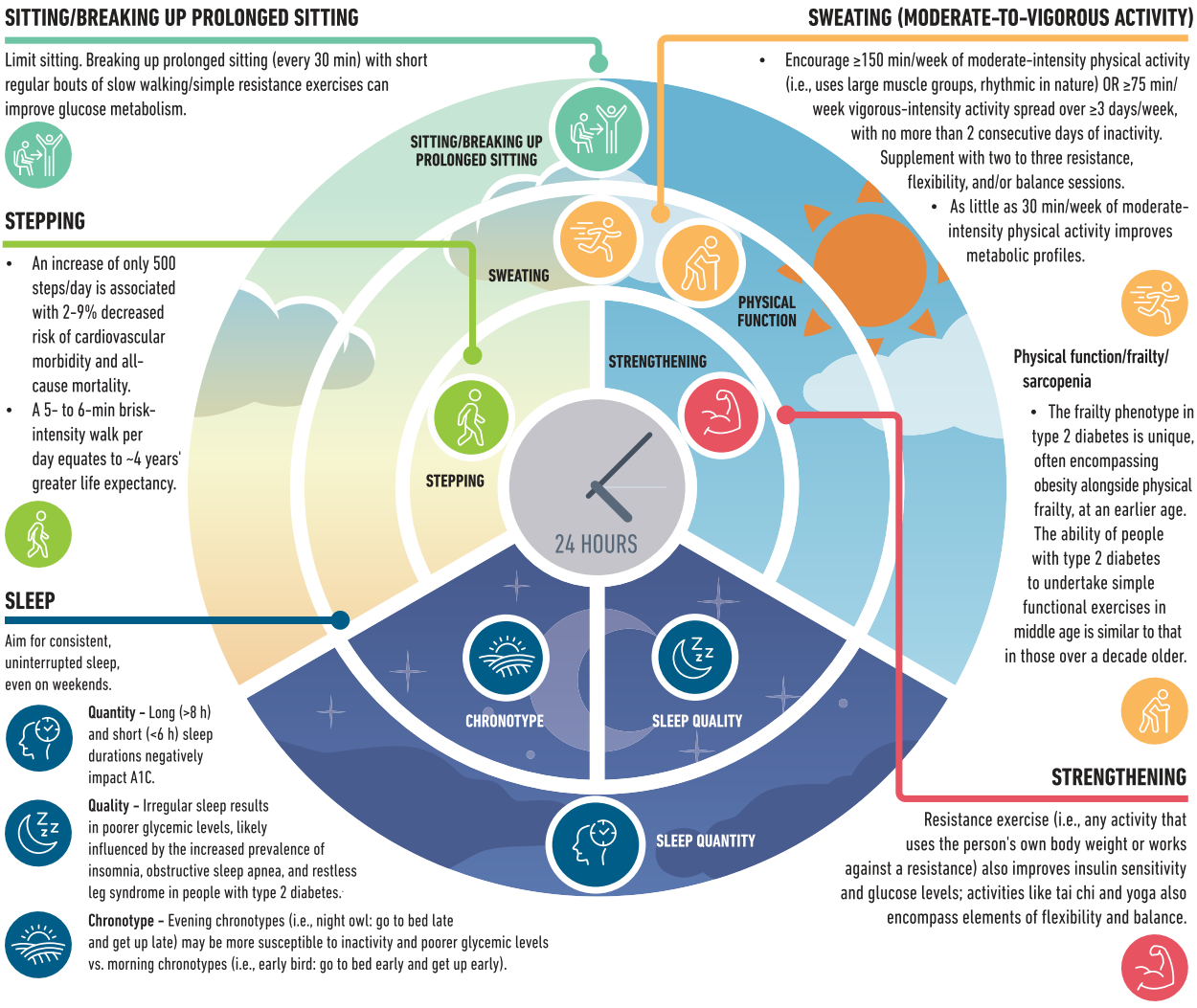
Pre-exercise Evaluation

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" (324) 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 duration and intensity 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, balance impairment, 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 (293).

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 post-bout 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

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. (97).

and duration of the activity (293). 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

(293). Because of the variation in glycemic response to exercise bouts, people with diabetes need to be educated to check blood glucose levels or consult sensor glucose values before and after periods of exercise and about the potential prolonged effects (depending on intensity and duration) (325).

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. A meta-analysis on this topic demonstrated moderate certainty of evidence that high versus low levels of physical activity were associated with lower CVD incidence and mortality (summary risk ratio 0.84 [95% CI 0.77–0.92], *n* = 7, and 0.62 [0.55–0.69], *n* = 11) and fewer microvascular complications (0.76 [0.67–0.86], *n* = 8). Dose-response meta-analyses showed that physical activity was associated with lower risk of diabetes-related complications even at lower levels (326).

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 (327). 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 (328). In addition, 150 min/week of moderate exercise was reported to improve outcomes in people with prediabetic neuropathy (329). 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 (330). Cardiovascular autonomic neuropathy is also an independent risk factor for cardiovascular death and silent myocardial ischemia (331). 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 (327).

SMOKING CESSATION: TOBACCO, E-CIGARETTES, AND CANNABIS

Recommendations

5.32 Advise all people with diabetes not to use cigarettes and other tobacco products or e-cigarettes. **A**

5.33 As a routine component of diabetes care and education, ask people with diabetes about the use of cigarettes or other tobacco products. After identification of use, recommend and refer for combination treatment consisting of both tobacco/smoking cessation counseling and pharmacological therapy. **A**

A causal link between cigarette smoking and diabetes has been established and reported on by the Surgeon General for over a decade (332). Results from epidemiologic, case-control, and cohort studies provide convincing evidence to support the causal link between cigarette smoking and multiple health risks that can have a profound impact on morbidity and mortality for people with diabetes (332). People with diabetes who smoke and are exposed to second-hand smoke have a heightened risk of macrovascular complications (e.g., cardiovascular and peripheral vascular disease), microvascular complications (e.g., kidney disease and visual impairment), worse glycemic outcomes, and premature death compared with those who do not smoke (333–336). Emerging data suggest smoking has a role in the development of type 2 diabetes, and quitting has been shown to significantly decrease this risk over time (337–340).

The routine (every visit with every person), thorough assessment of all types of tobacco use is essential to prevent tobacco product initiation and promote cessation. Evidence demonstrates significant benefits to quitting smoking for all people, resulting in a reduction and even reversal of adverse health effects in addition to an increase in life expectancy by as much as a decade (341). However, data show tobacco use prevalence among adults with chronic conditions has remained persistently higher than that in the general population (342), with recent declines in smoking in middle-aged people with diabetes but not in adolescents and young adults (342). Numerous large RCTs have demonstrated the efficacy and cost-effectiveness of both intensive and brief counseling in smoking cessation, including the use of telephone quit lines and web-based interventions, in reducing tobacco use and maintaining abstinence from smoking (341,343,344). Current recommendations include both counseling and pharmacologic therapy to assist with smoking cessation in nonpregnant adults (345); however, more than two-thirds of people trying to quit do not receive treatment following evidence-based guidelines (341).

Weight gain after smoking cessation has been a concern related to diabetes management and risk for new onset of disease (346). While post-cessation weight gain is an identified issue, studies have found that an average weight gain of 3–5 kg does not necessarily persist long term or diminish the substantial cardiovascular benefit realized from smoking cessation (337). These findings highlight the need for tobacco cessation treatment that addresses eating and physical activity needs. One study in people with newly diagnosed type 2 diabetes who smoke found that smoking cessation was associated with amelioration of microalbuminuria and reduction in blood pressure after 1 year (347).

In recent years, there has been an increase in the use and availability of multiple noncigarette nicotine products. The

evidence regarding the effect of these products on diabetes is not as clear as that for combustible cigarettes. It is known that smokeless tobacco products, such as dip and chew, pose an increased risk for CVD (348). E-cigarettes and vaping have gained public awareness and popularity because of perceptions that e-cigarette use is less harmful than regular cigarette smoking (349,350). While combustible tobacco products are clearly the most harmful, electronic products should not be characterized as harmless, as health risks with use that affect the cardiovascular and respiratory systems have been identified (351,352). Individuals with diabetes should be advised to avoid vaping and using e-cigarettes, either as a way to stop smoking combustible cigarettes or as a recreational drug. If people are using e-cigarettes to quit, they should be advised to avoid using both combustible and electronic cigarettes, and if using only e-cigarettes, they should be advised to have a plan to quit these also (344).

Increased legalization and multiple formulations of cannabis products have resulted in increased prevalence in the use of these products in all age-groups (353, 354). Significant increases in tetrahydrocannabinol (THC) concentrations and use of additional psychoactive cannabinoid products, such as delta-8 THC, are of specific concern (355). Most of these products are currently unregulated by the FDA, and public health warnings regarding use have been issued (356). The FDA reports adverse effects related to delta-8 THC, some of which may have health implications for people with diabetes (e.g., vomiting) (356). Evidence of specific increased risk of diabetic ketoacidosis and hyperglycemic ketosis associated with cannabis use and cannabis hyperemesis syndrome in adults with type 1 diabetes has been recently reported (357–359).

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 (360). The increased prevalence in use of an expanding landscape of both tobacco and cannabis products and the impact on the health of people with diabetes highlights the need to ask about use of these products, educate individuals regarding the associated risks, and provide support for cessation.

SUPPORTING POSITIVE HEALTH BEHAVIORS

Recommendation

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

Given associations with glycemic outcomes and risk for future complications (361,362), 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 (363–365). Behavioral strategies with empirical support include motivational interviewing (366–368), patient activation (369), goal setting and action planning (368,370–372), problem-solving (371,373), tracking or self-monitoring health behaviors with or without feedback from a health care professional (368,370–372), and facilitating opportunities for social support (368, 371,372). There is mixed evidence about behavioral economics strategies (e.g., financial incentives and exposure to information about social norms) to promote engagement in health behaviors among people with diabetes; such strategies tend to enhance intentions and demonstrate short-term benefits for behavior change, although there is less evidence about sustained effects (374). Multicomponent behavior change intervention packages have the highest efficacy for behavioral and glycemic outcomes (363,372,375). 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 (364). As with all diabetes health care, it is important to adapt and tailor behavior change strategies to the characteristics and needs of the individual and population (376–378). Health behavior change strategies may be delivered by behavioral health professionals, DCES, other trained health care professionals (370, 379–381), or qualified community health workers (370,371). These approaches may be delivered via digital health tools (372, 380,382). There are effective strategies to train diabetes care professionals to use such methods (e.g., motivational interviewing) (383).

PSYCHOSOCIAL CARE

Recommendations

5.35 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**

5.36 Diabetes care teams should implement psychosocial screening protocols for general and diabetes-related mood concerns as well as other topics such as stress, quality of life, available resources (financial, social, family, and emotional), and/or psychiatric history. Screening should occur at least annually or when there is a change in disease, treatment, or life circumstances. **C**

5.37 When indicated, refer to behavioral health professionals or other trained health care professionals, ideally those with experience in diabetes, 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**

5.38 Consider developmental factors and use age-appropriate validated tools for psychosocial screening in people with diabetes. **E**

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 Behavioral Health Toolkit for assessment questionnaires and surveys (professional.diabetes.org/meetings/behavioral-health-toolkit). Throughout the Standards of Care, the broad term "behavioral health" is used to encompass both *1*) health behavior engagement and relevant factors and *2*) behavioral health concerns and care related to living with diabetes.

Complex environmental, social, family, behavioral, and emotional factors, known as psychosocial factors, influence living with type 1 and type 2 diabetes 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 (384). Clinically significant behavioral health diagnoses are considerably more prevalent in people with diabetes than in those without (385–387). Emotional well-being is an important part of diabetes care and self-management. Psychological and social problems can impair the individual's (57,388–392) or family's (391) ability to carry out diabetes care tasks and 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 behavioral health diagnoses with poorer short-term glycemic stability, symptoms of emotional distress are associated with increased mortality risk (386,393).

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 (394,395). Various health care professionals working with people with diabetes may contribute to psychosocial care in different ways based on training, experience, need, and availability (380,396,397). Ideally, qualified behavioral health professionals with specialized training and experience in diabetes should be integrated with or provide collaborative care as part of diabetes care teams (398–401). Referrals for in-depth assessment and treatment for psychosocial concerns should be made to such behavioral health professionals when indicated (381, 402,403). A systematic review and meta-analysis showed that psychosocial interventions modestly but significantly improved A1C and behavioral health outcomes (404). There was a limited association between the effects on A1C and behavioral 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 (405).

Screening

Health care teams should develop and implement psychosocial screening protocols to ensure routine monitoring of psychosocial well-being and to identify potential concerns among people with diabetes, following published guidance and recommendations (406–411). 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. Given elevated rates of suicidality among people with diabetes (412–415), screening for suicidality may also be appropriate (416–418), similar to U.S. Preventive Services Task Force statements regarding screening for some adolescents and adults in the general population (419,420). A list of age-appropriate screening and evaluation measures is provided in the ADA position statement "Psychosocial Care for People with Diabetes" (1), and guidance has been published about selection of screening tools, clinical thresholds, and frequency of screening (408,421). 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 (422), 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 (423). In cir-cumstances 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 (422,424,425).

Standardized, validated, age-appropriate tools for psychosocial monitoring and screening can also be used (1). The ADA provides access to tools for screening specific psychosocial topics, such as diabetes distress, fear of hypoglycemia, and other relevant psychological symptoms at professional.diabetes.org/sites/default/files/media/ada_mental_health_toolkit_questionnaires.pdf. Additional information about developmentally specific psychosocial screening topics is available in Section 14, "Children and Adolescents," and Section 13, "Older Adults." 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 health professional, ideally one specializing in diabetes, should be made for comprehensive evaluation, diagnosis, and treatment (380,381,402,403). 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 (39,391). Health care professionals should identify behavioral health professionals, knowledgeable about diabetes treatment and the psychosocial aspects of diabetes, to whom they can refer individuals. The ADA provides a list of behavioral 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 (professional.diabetes.org/ada-mental-health-provider-directory). Ideally, behavioral 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 health interventions may also provide this specialized psychosocial care (396,399,426,427). Although some health care professionals may not feel qualified to treat psychological problems (428), strengthening the relationship between a person with diabetes and the 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). The ADA provides resources for a range of health professionals to support behavioral health in people with diabetes at professional.diabetes.org/meetings/behavioral-health-toolkit.

Evidence supports interventions for people with diabetes and psychosocial concerns, including issues that affect behavioral health. Successful therapeutic approaches include cognitive behavioral (400,402,429,430) and mindfulness-based therapies (427,431,432). 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 (433,434) and behavioral family interventions to promote collaborative family diabetes management in early adolescence (435,436) or to support adjustment to a new treatment plan or technology (65). Psychosocial interventions can be delivered via digital health platforms (437). Group-based or shared diabetes appointments that address both medical and psychosocial issues relevant to living with diabetes are a promising model to consider (397,438).

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 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

5.39 Screen people with diabetes, caregivers, and family members for diabetes distress at least annually, and consider more frequent monitoring when treatment targets are not met, at transitional times, and/or in the presence of diabetes complications. Health care professionals can address diabetes distress and may consider referral to a qualified behavioral health professional, ideally one with experience in diabetes, for further assessment and treatment if indicated. **B**

Diabetes distress is very common (391, 439–441). While it shares some features with depression, diabetes distress is distinct and has unique relationships with glycemic and other outcomes (440,442). 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 (439,440,443). The constant behavioral demands of diabetes self-management (medication dosing, frequency, and titration as well as 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 (439). 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 (443). 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 (391). Similar rates have been identified among adolescents with type 1 diabetes (441) 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

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

• A positive screen on a validated screening tool for depressive symptoms, diabetes distress, anxiety, fear of hypoglycemia, suicidality, 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
• Low engagement in diabetes self-management behaviors, including declining or impaired ability to perform diabetes self-management behaviors
• Before undergoing bariatric or metabolic surgery and after surgery, if assessment reveals an ongoing need for adjustment support

eating and exercise behaviors (5,439,443). Diabetes distress is also associated with symptoms of anxiety, depression, and reduced health-related quality of life (444).

Diabetes distress should be routinely monitored (445) using diabetes-specific validated measures (1), such as those available through the ADA's website (professional.diabetes.org/sites/default/files/media/ada_mental_health_toolkit_questionnaires.pdf). As there are diabetes distress measures that are validated for people with type 1 and type 2 diabetes at different life stages, it is important to select a tool that is appropriate for each person or population. If diabetes distress is identified, it should be acknowledged and addressed. If indicated, the person should be referred for follow-up care (403). 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 behavioral health professional, ideally one 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 (CBT) and mindfulness-based therapies, and health behavior change approaches, such as motivational interviewing (429,430,446,447). Data support diabetes distress interventions delivered using technology to reduce diabetes distress (437), including phone-delivered CBT combined with a smartphone application for CBT (448). DSMES has been shown to reduce diabetes distress (5) and may also benefit A1C when combined with peer support (449). 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 (450). 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 (451). 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 (452). An RCT of CBT 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 (453). 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 (454). An RCT of a resilience-focused cognitive behavioral and social problem-solving intervention compared with diabetes education (434) in teens with type 1 diabetes showed that diabetes distress and depressive symptoms were significantly reduced for up to 3 years post-intervention, although 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 are few 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

Recommendation

5.40 Consider screening people with diabetes for anxiety symptoms, fear of hypoglycemia, or diabetes-related worries. Health care professionals can discuss diabetes-related worries and should consider referral to a qualified behavioral health professional for further assessment and treatment if anxiety symptoms indicate interference with diabetes self-management behaviors or quality of life. **B**

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 (455). 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 (456). A common diabetes-specific concern is fear related to hypoglycemia (457–459), which may explain avoidance of behaviors associated with lowering glucose, such as increasing insulin doses or frequency of monitoring. Factors related to greater fear of hypoglycemia in people with diabetes and family members include history of nocturnal hypoglycemia, presence of other psychological concerns, and sleep concerns (460). See Section 6, "Glycemic Goals and Hypoglycemia," for more information about impaired awareness of hypoglycemia and related fear of hypoglycemia. Other common sources of diabetes-related anxiety include not meeting blood glucose targets (455), insulin injections or infusion (461), 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 goals may be experiencing symptoms of obsessive-compulsive disorder (462). General anxiety is a predictor of injection-related anxiety and is associated with fear of hypoglycemia (458,463).

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 (464). An RCT of CBT for adults with type 2 diabetes showed a reduction in health anxiety, with CBT accounting for 77% of the reduction in health anxiety at 16 weeks of follow-up; this trial also found decreased depressive symptoms and diabetes distress (465). Additionally, an RCT showed switching from intermittently scanned CGM without alerts to real-time CGM with alert functionality in adults with type 1 diabetes decreased hypoglycemia-related anxiety at 24 months of follow-up while reducing A1C (466). Thus, specialized behavioral intervention from a qualified professional is needed to treat hypoglycemia-related anxiety.

Depression

Recommendations

5.41 Conduct at least annual screening of depressive symptoms in all people with diabetes and more frequently among 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**

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

5.43 Refer to qualified behavioral 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 (467–469). Elevated depressive symptoms and depressive disorders are common among people with diabetes (385,459), affecting approximately one in four people with type 1 or type 2 diabetes (390), and among parents of youth with diabetes (470). 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 (471).

Routine monitoring with age-appropriate validated measures (1) can help to identify if referral is warranted (403,410). Multisite studies have demonstrated feasibility of implementing depressive symptom screening protocols in diabetes clinics and published practical guides for implementation (407–410,472). Adults with a history of depressive symptoms need ongoing monitoring of depression recurrence within the context of routine care (467). Integrating behavioral and physical health care can improve outcomes. When a person with diabetes is receiving psychological therapy, the behavioral health professional should be incorporated into or collaborate with the diabetes treatment team (473). As with DSMES, person-centered collaborative care approaches have been shown to improve both depression and medical outcomes (473). 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 ones and those due to other life circumstances (444,474).

Trials have shown consistent evidence of improvements in depressive symptoms and variable benefits for A1C when depression is simultaneously treated (401,473, 475), whether through pharmacological treatment, group therapy, psychotherapy, or collaborative care (398,429,430,476, 477). Psychological interventions targeting depressive symptoms have shown efficacy when delivered via digital technologies (478). A systematic review of internet-delivered CBT studies indicated benefits across chronic health conditions, including diabetes (479). For people with diabetes, an RCT comparing internet plus telephonic CBT to usual care found moderate to large improvements in depressive symptoms at 12 months (480). Physical activity interventions also demonstrate benefits for depressive symptoms and A1C (318). It is important to note that the medical treatment plan should also be monitored in response to reduction in depressive symptoms.

Disordered Eating Behavior

Recommendations

5.44 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**

5.45 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. Key qualifications include familiarity with 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 (481–483). For people with type 1 diabetes, insulin omission causing glycosuria in order to lose weight is the most commonly reported disordered eating behavior (484,485); 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 (486). People with diabetes and diagnosable eating disorders have high rates of comorbid psychiatric disorders (487). People with type 1 diabetes and eating disorders often have high rates of diabetes distress and fear of hypoglycemia (488).

Diabetes care professionals should monitor for disordered eating behaviors using validated measures (489). 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 (483,490). 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 interprofessional care teams include or collaborate with a health professional trained to identify and treat eating behaviors with expertise in disordered eating and diabetes (491). Key qualifications for such professionals include familiarity with 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 (492). 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 (493). 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 (483,490).

The use of incretin therapies may have potential relevance to the treatment of disrupted or disordered eating (see Section 8, "Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes"). Incretin therapies work in the appetite and reward circuitries to modulate food intake and energy balance, reducing uncontrollable hunger, overeating, and bulimic symptoms (494), although mechanisms are not completely understood (495). Weight loss from these medications (496) may also improve quality of life. More research is needed about whether use of incretins and other medications affects physiologically based eating behavior in people with diabetes.

Serious Mental Illness

Recommendations

5.46 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**

5.47 Monitor changes in body weight, glycemia, and lipids in adolescents and adults with diabetes who are prescribed second-generation antipsychotic medications; adjust the treatment plan accordingly, if needed. **C**

Studies of individuals with serious mental illness, particularly schizophrenia and other thought disorders, show significantly increased rates of type 2 diabetes (497). People with schizophrenia and other thought disorders who are prescribed antipsychotics should be monitored for prediabetes and type 2 diabetes because of the known comorbidity. Changes in body weight, glycemia, and lipids should be monitored every 12–16 weeks, unless clinically indicated sooner (498). 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 behavioral health disorders and diabetes frequently experience moderate psychological distress, suggesting pervasive intrusion of behavioral health issues into daily functioning (499). Serious mental illness is often associated with the inability to evaluate and apply 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 helpful to include a nonmedical caretaker in decision-making regarding the medical treatment plan. This caretaker can help improve the person's ability to follow the agreed-upon treatment plan through both monitoring and caretaking functions (500).

Coordinated management of prediabetes or diabetes 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 (501).

Cognitive Capacity/Impairment

Recommendations

5.48 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**

5.49 If cognitive capacity changes or appears to be suboptimal for 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 (502). Having diabetes (type 1 or type 2) over decades has been shown to be associated with cognitive decline (503–505). A host of factors have been linked with cognitive impairment in people with type 1 diabetes, including diabetes-specific (e.g., younger age at diagnosis, longer disease duration, more time in glycemic extremes, recurrent diabetic ketoacidosis, higher A1C, and presence of microvascular complications), other medical (e.g., dyslipidemia, intestinal flora, and poorer sleep quality), and sociodemographic (e.g., female gender and lower educational level) factors (506). 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 (507). Diagnosis of dementia is more prevalent among people with diabetes, both type 1 and type 2 (508). Executive functioning is an aspect of cognitive capacity that has particular relevance to diabetes management. Attention deficit hyperactivity disorder has been linked with twice the risk of type 2 diabetes (509). Among youth and young adults with type 1 diabetes, lower executive functioning has been linked with more difficulties with diabetes self-management and higher A1C (510). In contrast, higher self-regulation has been linked with better emotional and diabetes-specific functioning (511). Thus, monitoring of cognitive capacity and skills among individuals with or at risk for diabetes 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 (508).

As with other disorders affecting mental capacity (e.g., major psychiatric

disorders), the key issue is whether the person can collaborate with the care team to achieve optimal metabolic outcomes and prevent complications, both short and long term (499). 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 a day-to-day monitor 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 (512). Early-onset type 1 diabetes has been shown to be associated with potential long-term deficits in intellectual abilities, especially in the context of repeated episodes of severe hypoglycemia (513), and is correlated with higher A1C and sensor glucose values (514). (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.

Cognitive decline is more severe in older adults with type 2 diabetes (515). Longitudinal epidemiological studies have documented that chronic hyperglycemia, older age, less education, retinopathy, and nephropathy are associated with diabetes-related cognitive dysfunction (516). Importantly, the risk of cognitive decline can be reduced through improved A1C (517). Exercise may be a potential nonpharmacological treatment pathway for cognitive impairment in older adults with type 2 diabetes (518,519).

Sleep Health

Recommendations

5.50 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 specialists and/or qualified behavioral health professionals as indicated. **B**

5.51 Counsel people with diabetes to practice sleep-promoting routines and habits (e.g., maintaining consistent sleep schedule and limiting caffeine in the afternoon). **A**

The associations between sleep problems and diabetes are complex: sleep disorders are a risk factor for developing type 2 diabetes (520,521) and possibly gestational diabetes mellitus (522,523). People with diabetes across the life span often experience sleep disruptions and reduced sleep quality (524,525), and sleep problems are also common in parents of youth with diabetes, especially soon after diagnosis (526,527). Disrupted sleep and sleep disorders, including obstructive sleep apnea (528), insomnia, and sleep disturbances (529), are common among people with diabetes. In type 1 diabetes, estimates of poor sleep range from 30% to 50% (530), and estimates of moderate to severe obstructive sleep apnea are >50% (531). In type 2 diabetes, 24–86% of people are estimated to have obstructive sleep apnea (532), 39% to have insomnia, and 8–45% to have restless leg syndrome (i.e., an uncontrollable urge to move legs) (533). Further, people with type 2 diabetes and restless leg syndrome are more likely to experience microvascular and macrovascular complications (534) as well as depression (535). Additionally, people with diabetes who perform shift work increase their risk for circadian rhythm disorders, which are associated with higher A1C (536), neuropathy (537), and decreased psychological well-being (537). Health care professionals should consider a comprehensive evaluation of the daily lifestyles of people with diabetes to decrease risk factors, including low sleep duration, shift work, and days off, given their associations with hyperglycemia, hypertension, dyslipidemia, and weight gain (538).

Sleep disturbances are associated with less engagement in diabetes self-management and may interfere with glucose levels within the target range among people with type 1 and type 2 diabetes (525,529,531,533,539,540). Risk of hypoglycemia poses specific challenges for sleep in people with type 1 diabetes and may require targeted assessment and treatment approaches (541). People with type 1 diabetes and their family members also describe diabetes management needs interfering with sleep and experiencing worries about poor sleep (542). Both helpful and challenging aspects of diabetes technology use have been described in relation to sleep (542), with the greatest perceived benefits being related to automated insulin delivery systems (543–545). For these reasons, detection and treatment of sleep disorders should be considered a part of standardized care for people with type 1 and type 2 diabetes.

As for the general population, there are evidence-based strategies to improve sleep for people with diabetes. CBT shows benefits for sleep in people with diabetes (429), including CBT for insomnia, which demonstrates improvements in sleep outcomes and possible small improvements in A1C and fasting glucose (546). There is also evidence that sleep extension and pharmacological treatments for sleep can improve sleep outcomes and possibly insulin resistance (541,546). Lastly, sleep education, or sleep hygiene, improves sleep quality, reduces A1C, and decreases insulin resistance in adults with type 2 diabetes (547). Thus, diabetes care professionals are encouraged to counsel people with diabetes to use sleep-promoting routines and practices, such as establishing a regular bedtime and rise time, creating a dark, quiet area for sleep with temperature and humidity control, establishing a pre-sleep routine, putting electronic devices (except diabetes management devices) in silent/off mode, exercising during the day, avoiding daytime naps, limiting caffeine and nicotine in the evening,

avoiding spicy foods at night, and avoiding alcohol before bedtime (548). For people with diabetes who have significant sleep difficulties, 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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