



1. Improving Care and Promoting Health in Populations: *Standards of Medical Care in Diabetes—2022*

American Diabetes Association
Professional Practice Committee*

Diabetes Care 2022;45:S8–S16 | <https://doi.org/10.2337/dc22-S001>

The American Diabetes Association (ADA) “Standards of Medical Care in Diabetes” includes the ADA’s current clinical practice recommendations and is intended to provide the components of diabetes care, general treatment goals and guidelines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee (<https://doi.org/10.2337/dc22-SPPC>), 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, please refer to the Standards of Care Introduction (<https://doi.org/10.2337/dc22-SINT>). Readers who wish to comment on the Standards of Care are invited to do so at professional.diabetes.org/SOC.

DIABETES AND POPULATION HEALTH

Recommendations

- 1.1 Ensure treatment decisions are timely, rely on evidence-based guidelines, include social community support, and are made collaboratively with patients based on individual preferences, prognoses, comorbidities, and informed financial considerations. **B**
- 1.2 Align approaches to diabetes management with the Chronic Care Model. This model emphasizes person-centered team care, integrated long-term treatment approaches to diabetes and comorbidities, and ongoing collaborative communication and goal setting between all team members. **A**
- 1.3 Care systems should facilitate team-based care, including those knowledgeable and experienced in diabetes management as part of the team, and utilization of patient registries, decision support tools, and community involvement to meet patient needs. **B**
- 1.4 Assess diabetes health care maintenance (see **Table 4.1**) using reliable and relevant data metrics to improve processes of care and health outcomes, with attention to care costs. **B**

Population health is defined as “the health outcomes of a group of individuals, including the distribution of health outcomes within the group”; these outcomes can be measured in terms of health outcomes (mortality, morbidity, health, and functional status), disease burden (incidence and prevalence), and behavioral and metabolic factors (exercise, diet, A1C, etc.) (1). Clinical practice recommendations for health care providers are tools that can ultimately improve health across

*A complete list of members of the American Diabetes Association Professional Practice Committee can be found at <https://doi.org/10.2337/dc22-SPPC>.

Suggested citation: American Diabetes Association Professional Practice Committee. 1. Improving care and promoting health in populations: Standards of Medical Care in Diabetes—2022. *Diabetes Care* 2022;45(Suppl. 1):S8–S16

© 2021 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. More information is available at <https://diabetesjournals.org/journals/pages/license>.

populations; however, for optimal outcomes, diabetes care must also be individualized for each patient. Thus, efforts to improve population health will require a combination of policy-level, system-level, and patient-level approaches. With such an integrated approach in mind, the American Diabetes Association (ADA) highlights the importance of *patient-centered care*, defined as care that considers individual patient comorbidities and prognoses; is respectful of and responsive to patient preferences, needs, and values; and ensures that patient values guide all clinical decisions (2). Furthermore, social determinants of health (SDOH)—often out of direct control of the individual and potentially representing lifelong risk—contribute to medical and psychosocial outcomes and must be addressed to improve all health outcomes (3). Clinical practice recommendations, whether based on evidence or expert opinion, are intended to guide an overall approach to care. The science and art of medicine come together when the clinician makes treatment recommendations for a patient who may not meet the eligibility criteria used in the studies on which guidelines are based. Recognizing that one size does not fit all, the standards presented here provide guidance for when and how to adapt recommendations for an individual. This section provides guidance for providers as well as health systems and policy makers.

Care Delivery Systems

The proportion of patients with diabetes who achieve recommended A1C, blood pressure, and LDL cholesterol levels has fluctuated in recent years (4). Glycemic control and control of cholesterol through dietary intake remain challenging. In 2013–2016, 64% of adults with diagnosed diabetes met individualized A1C target levels, 70% achieved recommended blood pressure control, 57% met the LDL cholesterol target level, and 85% were nonsmokers (4). Only 23% met targets for glycemic, blood pressure, and LDL cholesterol measures while also avoiding smoking (4). The mean A1C nationally among people with diabetes increased slightly from 7.3% in 2005–2008 to 7.5% in 2013–2016 based on the National Health and Nutrition Examination

Survey (NHANES), with younger adults, women, and non-Hispanic Black individuals less likely to meet treatment targets (4). Certain segments of the population, such as young adults and patients with complex comorbidities, financial or other social hardships, and/or limited English proficiency, face particular challenges to goal-based care (5–7). Even after adjusting for these patient factors, the persistent variability in the quality of diabetes care across providers and practice settings indicates that substantial system-level improvements are still needed.

Diabetes poses a significant financial burden to individuals and society. It is estimated that the annual cost of diagnosed diabetes in the U.S. in 2017 was \$327 billion, including \$237 billion in direct medical costs and \$90 billion in reduced productivity. After adjusting for inflation, the economic costs of diabetes increased by 26% from 2012 to 2017 (8). This is attributed to the increased prevalence of diabetes and the increased cost per person with diabetes. Therefore, ongoing population health strategies are needed in order to reduce costs and provide optimized care.

Chronic Care Model

Numerous interventions to improve adherence to the recommended standards have been implemented. However, a major barrier to optimal care is a delivery system that is often fragmented, lacks clinical information capabilities, duplicates services, and is poorly designed for the coordinated delivery of chronic care. The Chronic Care Model (CCM) takes these factors into consideration and is an effective framework for improving the quality of diabetes care (9).

Six Core Elements. The CCM includes six core elements to optimize the care of patients with chronic disease:

1. Delivery system design (moving from a *reactive* to a *proactive* care delivery system where planned visits are coordinated through a team-based approach)
2. Self-management support
3. Decision support (basing care on evidence-based, effective care guidelines)

4. Clinical information systems (using registries that can provide patient-specific and population-based support to the care team)
5. Community resources and policies (identifying or developing resources to support healthy lifestyles)
6. Health systems (to create a quality-oriented culture)

A 5-year effectiveness study of the CCM in 53,436 primary care patients with type 2 diabetes suggested that the use of this model of care delivery reduced the cumulative incidence of diabetes-related complications and all-cause mortality (10). Patients who were enrolled in the CCM experienced a reduction in cardiovascular disease risk by 56.6%, microvascular complications by 11.9%, and mortality by 66.1% (10). In addition, the same study suggested that health care utilization was lower in the CCM group, which resulted in health care savings of \$7,294 per individual over the study period (11).

Redefining the roles of the health care delivery team and empowering patient self-management are fundamental to the successful implementation of the CCM (12). Collaborative, multidisciplinary teams are best suited to provide care for people with chronic conditions such as diabetes and to facilitate patients' self-management (13–15). There are references to guide the implementation of the CCM into diabetes care delivery, including opportunities and challenges (16).

Strategies for System-Level Improvement

Optimal diabetes management requires an organized, systematic approach and the involvement of a coordinated team of dedicated health care professionals working in an environment where patient-centered, high-quality care is a priority (7,17,18). While many diabetes processes of care have improved nationally in the past decade, the overall quality of care for patients with diabetes remains suboptimal (4). Efforts to increase the quality of diabetes care include providing care that is concordant with evidence-based guidelines (19); expanding the role of teams to implement more intensive disease management strategies (7,20,21); tracking medication-taking behavior at a systems level (22); redesigning the organization of the care process (23);

implementing electronic health record tools (24,25); empowering and educating patients (26,27); removing financial barriers and reducing patient out-of-pocket costs for diabetes education, eye exams, diabetes technology, and necessary medications (7); assessing and addressing psychosocial issues (28,29); and identifying, developing, and engaging community resources and public policies that support healthy lifestyles (30). The National Diabetes Education Program maintains an online resource (<https://www.cdc.gov/diabetes/professional-info/training.html>) to help health care professionals design and implement more effective health care delivery systems for those with diabetes. Given the pluralistic needs of patients with diabetes and how the constant challenges they experience vary over the course of disease management (complex insulin regimens, new technology, etc.), a diverse team with complementary expertise is consistently recommended (31).

Care Teams

The care team, which centers around the patient, should avoid therapeutic inertia and prioritize timely and appropriate intensification of behavior change (diet and physical activity) and/or pharmacologic therapy for patients who have not achieved the recommended metabolic targets (32–34). Strategies shown to improve care team behavior and thereby catalyze reductions in A1C, blood pressure, and/or LDL cholesterol include engaging in explicit and collaborative goal setting with patients (35,36); identifying and addressing language, numeracy, or cultural barriers to care (37–39); integrating evidence-based guidelines and clinical information tools into the process of care (19,40,41); soliciting performance feedback, setting reminders, and providing structured care (e.g., guidelines, formal case management, and patient education resources) (7); and incorporating care management teams including nurses, dietitians, pharmacists, and other providers (20,42). In addition, initiatives such as the Patient-Centered Medical Home show promise for improving health outcomes by fostering comprehensive primary care and offering new opportunities for team-based chronic disease management (43).

Telemedicine

Telemedicine is a growing field that may increase access to care for patients with diabetes. The American Telemedicine Association defines telemedicine as the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status. Telemedicine includes a growing variety of applications and services using two-way video, smartphones, wireless tools, and other forms of telecommunications technology (44). Increasingly, evidence suggests that various telemedicine modalities may facilitate reducing A1C in patients with type 2 diabetes compared with usual care or in addition to usual care (45), and findings suggest that telemedicine is a safe method of delivering type 1 diabetes care to rural patients (46). For rural populations or those with limited physical access to health care, telemedicine has a growing body of evidence for its effectiveness, particularly with regard to glycemic control as measured by A1C (47–49). Interactive strategies that facilitate communication between providers and patients, including the use of web-based portals or text messaging and those that incorporate medication adjustment, appear more effective. Telemedicine and other virtual environments can also be used to offer diabetes self-management education and clinical support and remove geographic and transportation barriers for patients living in underresourced areas or with disabilities (50). However, there is limited data available on the cost-effectiveness of these strategies.

Behaviors and Well-being

Successful diabetes care also requires a systematic approach to supporting patients' behavior-change efforts. High-quality diabetes self-management education and support (DSMES) has been shown to improve patient self-management, satisfaction, and glucose outcomes. National DSMES standards call for an integrated approach that includes clinical content and skills, behavioral strategies (goal setting, problem-solving), and engagement with psychosocial concerns (29). Increasingly, such support is being adapted for online platforms that have the potential to improve patient access to this important resource. These curriculums need to be tailored to the

needs of the intended populations, including addressing the "digital divide," i.e., access to the technology required for implementation (51–54).

For more information on DSMES, see Section 5, "Facilitating Behavior Change and Well-being to Improve Health Outcomes" (<https://doi.org/10.2337/dc22-S005>).

Cost Considerations for Medication-Taking Behaviors

The cost of diabetes medications and devices is an ongoing barrier to achieving glycemic goals. Up to 25% of patients who are prescribed insulin report cost-related insulin underuse (55). Insulin underuse due to cost has also been termed cost-related medication nonadherence. The cost of insulin has continued to increase in recent years for reasons that are not entirely clear. There are recommendations from the ADA Insulin Access and Affordability Working Group for approaches to this issue from a systems level (56). Recommendations including concepts such as cost-sharing for insured people with diabetes should be based on the lowest price available, the list price for insulins that closely reflects net price, and health plans that ensure that people with diabetes can access insulin without undue administrative burden or excessive cost (56).

The cost of medications (not only insulin) influences prescribing patterns and cost-related medication nonadherence because of patient burden and lack of secondary payer support (public and private insurance) for effective approved glucose-lowering, cardiovascular disease risk-reducing, and weight management therapeutics. Although not usually addressed as a social determinant of health, financial barriers remain a major source of health disparities, and costs should be a focus of treatment goals (57). (See TAILORING TREATMENT FOR SOCIAL CONTEXT AND TREATMENT CONSIDERATIONS.) Reduction in cost-related medication nonadherence is associated with better biologic and psychologic outcomes, including quality of life.

Access to Care and Quality Improvement

The Affordable Care Act and Medicaid expansion have resulted in increased access to care for many individuals with diabetes, emphasizing the protection

of people with preexisting conditions, health promotion, and disease prevention (58). In fact, health insurance coverage increased from 84.7% in 2009 to 90.1% in 2016 for adults with diabetes aged 18–64 years. Coverage for those ≥ 65 years remained nearly universal (59). Patients who have either private or public insurance coverage are more likely to meet quality indicators for diabetes care (60). As mandated by the Affordable Care Act, the Agency for Healthcare Research and Quality developed a National Quality Strategy based on triple aims that include improving the health of a population, overall quality and patient experience of care, and per capita cost (61,62). As health care systems and practices adapt to the changing landscape of health care, it will be important to integrate traditional disease-specific metrics with measures of patient experience, as well as cost, in assessing the quality of diabetes care (63,64). Information and guidance specific to quality improvement and practice transformation for diabetes care is available from the National Institute of Diabetes and Digestive and Kidney Diseases guidance on diabetes care and quality (65). Using patient registries and electronic health records, health systems can evaluate the quality of diabetes care being delivered and perform intervention cycles as part of quality improvement strategies (66). Improvement of health literacy and numeracy is also a necessary component to improve care (67,68). Critical to these efforts is provider adherence to clinical practice recommendations (see **Table 4.1**) and the use of accurate, reliable data metrics that include sociodemographic variables to examine health equity within and across populations (69).

In addition to quality improvement efforts, other strategies that simultaneously improve the quality of care and potentially reduce costs are gaining momentum and include reimbursement structures that, in contrast to visit-based billing, reward the provision of appropriate and high-quality care to achieve metabolic goals (70) and incentives that accommodate personalized care goals (7,71). (Also see *COST CONSIDERATIONS FOR MEDICATION-TAKING BEHAVIOR*, above, regarding cost-related medication nonadherence reduction.)

TAILORING TREATMENT FOR SOCIAL CONTEXT

Recommendations

- 1.5** Assess food insecurity, housing insecurity/homelessness, financial barriers, and social capital/social community support to inform treatment decisions, with referral to appropriate local community resources. **A**
- 1.6** Provide patients with self-management support from lay health coaches, navigators, or community health workers when available. **A**

Health inequities related to diabetes and its complications are well documented, are heavily influenced by SDOH, and have been associated with greater risk for diabetes, higher population prevalence, and poorer diabetes outcomes (72–76). SDOH are defined as the economic, environmental, political, and social conditions in which people live and are responsible for a major part of health inequality worldwide (77). Greater exposure to adverse SDOH over the life course results in worse health (78). The ADA recognizes the association between social and environmental factors and the prevention and treatment of diabetes and has issued a call for research that seeks to better understand how these social determinants influence behaviors and how the relationships between these variables might be modified for the prevention and management of diabetes (79,80). While a comprehensive strategy to reduce diabetes-related health inequities in populations has not been formally studied, general recommendations from other chronic disease management and prevention models can be drawn upon to inform systems-level strategies in diabetes (81). For example, the National Academy of Medicine has published a framework for educating health care professionals on the importance of SDOH (82). Furthermore, there are resources available for the inclusion of standardized sociodemographic variables in electronic medical records to facilitate the measurement of health inequities as well as the impact of interventions designed to reduce those inequities (63,82,83).

SDOH are not consistently recognized and often go undiscussed in the clinical encounter (75). For example, a study by Piette et al. (84) found that among patients with chronic illnesses, two-thirds of those who reported not taking medications as prescribed due to cost-related medication nonadherence never shared this with their physician. In a study using data from the National Health Interview Survey (NHIS), Patel et al. (75) found that one-half of adults with diabetes reported financial stress and one-fifth reported food insecurity. One population in which such issues must be considered is older adults, where social difficulties may impair the quality of life and increase the risk of functional dependency (85) (see Section 13, “Older Adults,” <https://doi.org/10.2337/dc22-S013>, for a detailed discussion of social considerations in older adults). Creating systems-level mechanisms to screen for SDOH may help overcome structural barriers and communication gaps between patients and providers (75,86). In addition, brief, validated screening tools for some SDOH exist and could facilitate discussion around factors that significantly impact treatment during the clinical encounter. Below is a discussion of assessment and treatment considerations in the context of food insecurity, homelessness, limited English proficiency, limited health literacy, and low literacy.

Food Insecurity

Food insecurity is the unreliable availability of nutritious food and the inability to consistently obtain food without resorting to socially unacceptable practices. Over 18% of the U.S. population reported food insecurity between 2005 and 2014 (87). The rate is higher in some racial/ethnic minority groups, including African American and Latino populations, low-income households, and homes headed by a single mother. The rate of food insecurity in individuals with diabetes may be up to 20% (88). Additionally, the risk for type 2 diabetes is increased twofold in those with food insecurity (79) and has been associated with low adherence to taking medications appropriately and recommended self-care behaviors, depression, diabetes distress, and worse glycemic control when compared with individuals who

are food secure (89,90). Older adults with food insecurity are more likely to have emergency department visits and hospitalizations compared with older adults who do not report food insecurity (91). Risk for food insecurity can be assessed with a validated two-item screening tool (91) that includes the statements: 1) "Within the past 12 months we worried whether our food would run out before we got money to buy more" and 2) "Within the past 12 months the food we bought just didn't last, and we didn't have money to get more." An affirmative response to either statement had a sensitivity of 97% and specificity of 83%. Interventions such as food prescription programs are considered promising practices to address food insecurity by integrating community resources into primary care settings and directly deal with food deserts in underserved communities (92,93).

Treatment Considerations

In those with diabetes and food insecurity, the priority is mitigating the increased risk for uncontrolled hyperglycemia and severe hypoglycemia. Reasons for the increased risk of hyperglycemia include the steady consumption of inexpensive carbohydrate-rich processed foods, binge eating, financial constraints to filling diabetes medication prescriptions, and anxiety/depression leading to poor diabetes self-care behaviors. Hypoglycemia can occur as a result of inadequate or erratic carbohydrate consumption following the administration of sulfonylureas or insulin. See **Table 9.2** for drug-specific and patient factors, including cost and risk of hypoglycemia, which may be important considerations for adults with food insecurity and type 2 diabetes. Providers should consider these factors when making treatment decisions in people with food insecurity and seek local resources that might help patients with diabetes and their family members obtain nutritious food more regularly (94).

Homelessness and Housing Insecurity

Homelessness/housing insecurity often accompanies many additional barriers to diabetes self-management, including food insecurity, literacy and numeracy deficiencies, lack of insurance, cognitive dysfunction, and mental health issues (95). The prevalence of diabetes in the

homeless population is estimated to be around 8% (96). Additionally, patients with diabetes who are homeless need secure places to keep their diabetes supplies and refrigerator access to properly store their insulin and take it on a regular schedule. The risk for homelessness can be ascertained using a brief risk assessment tool developed and validated for use among veterans (97). Housing insecurity has also been shown to be directly associated with a person's ability to maintain their diabetes self-management (98). Given the potential challenges, providers who care for either homeless or housing-insecure individuals should be familiar with resources or have access to social workers who can facilitate stable housing for their patients as a way to improve diabetes care (99).

Migrant and Seasonal Agricultural Workers

Migrant and seasonal agricultural workers may have a higher risk of type 2 diabetes than the overall population. While migrant farmworker-specific data are lacking, most agricultural workers in the U.S. are Latino, a population with a high rate of type 2 diabetes. In addition, living in severe poverty brings with it food insecurity, high chronic stress, and increased risk of diabetes; there is also an association between the use of certain pesticides and the incidence of diabetes (100).

Data from the Department of Labor indicate that there are 2.5–3 million agricultural workers in the U.S. These agricultural workers travel throughout the country, serving as the backbone for a multibillion-dollar agricultural industry. According to 2018 health center data, 174 health centers across the U.S. reported that they provided health care services to 579,806 adult agricultural patients, and 78,332 had encounters for diabetes (13.5%) (101).

Migrant farmworkers encounter numerous and overlapping barriers to receiving care. Migration, which may occur as frequently as every few weeks for farmworkers, disrupts care. In addition, cultural and linguistic barriers, lack of transportation and money, lack of available work hours, unfamiliarity with new communities, lack of access to resources, and other barriers prevent migrant farmworkers from accessing

health care. Without regular care, those with diabetes may suffer severe and often expensive complications that affect quality of life.

Health care providers should be attuned to the working and living conditions of all patients. For example, if a migrant farmworker with diabetes presents for care, appropriate referrals should be initiated to social workers and community resources, as available, to assist with removing barriers to care.

Language Barriers

Providers who care for non-English speakers should develop or offer educational programs and materials in multiple languages with the specific goals of preventing diabetes and building diabetes awareness in people who cannot easily read or write in English. The National Standards for Culturally and Linguistically Appropriate Services in Health and Health Care (National CLAS Standards) provide guidance on how health care providers can reduce language barriers by improving their cultural competency, addressing health literacy, and ensuring communication with language assistance (102). In addition, the National CLAS Standards website (<https://thinkculturalhealth.hhs.gov>) offers several resources and materials that can be used to improve the quality of care delivery to non-English-speaking patients (102).

Health Literacy and Numeracy

Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate decisions (67). Health literacy is strongly associated with patients being able to engage in complex disease management and self-care (103). Approximately 80 million adults in the U.S. are estimated to have limited or low health literacy (68). Clinicians and diabetes care and education specialists should ensure they provide easy-to-understand information and reduce unnecessary complexity when developing care plans with patients. Interventions addressing low health literacy in populations with diabetes seem effective in improving diabetes outcomes, including ones focusing primarily on patient education, self-care training,

or disease management. Combining easily adapted materials with formal diabetes education demonstrates effectiveness on clinical and behavioral outcomes in populations with low literacy (104). However, evidence supporting these strategies is largely limited to observational studies, and more research is needed to investigate the most effective strategies for enhancing both acquisition and retention of diabetes knowledge, as well as to examine different media and strategies for delivering interventions to patients (37).

Health numeracy is also important in diabetes prevention and management. Health numeracy requires primary numeric skills, applied health numeracy, and interpretive health numeracy. There is also an emotional component that affects a person's ability to understand concepts of risk, probability, and communication of scientific evidence (105). People with prediabetes or diabetes often need to perform numeric tasks such as interpreting food labels and blood glucose levels to make treatment decisions such as medication dosing. Thus, both health literacy and numeracy are necessary for enabling effective communication between patient and provider, arriving at a treatment regimen, and making diabetes self-management task decisions. If patients appear not to understand concepts associated with treatment decisions, both can be assessed using standardized screening measures (106). Adjunctive education and support may be indicated if limited health literacy and numeracy are barriers to optimal care decisions (28).

Social Capital/Community Support

Social capital, which comprises community and personal network instrumental support, promotes better health, whereas lack of social support is associated with poorer health outcomes in individuals with diabetes (80). Of particular concern are the SDOH including racism and discrimination, which are likely to be lifelong (107). These factors are rarely addressed in routine treatment or disease management but may drive underlying causes of nonadherence to regimen behaviors and medication use. Identification or development of community resources to support healthy lifestyles is a core element of the

CCM (9) with particular need to incorporate relevant social support networks. There is currently a paucity of evidence regarding enhancement of these resources for those most likely to benefit from such intervention strategies.

Health care community linkages are receiving increasing attention from the American Medical Association, the Agency for Healthcare Research and Quality, and others as a means of promoting translation of clinical recommendations for diet and physical activity in real-world settings (108). Community health workers (CHWs) (109), peer supporters (110–112), and lay leaders (113) may assist in the delivery of DSMES services (82,114), particularly in underserved communities. A CHW is defined by the American Public Health Association as a “frontline public health worker who is a trusted member of and/or has an unusually close understanding of the community served” (115). CHWs can be part of a cost-effective, evidence-based strategy to improve the management of diabetes and cardiovascular risk factors in underserved communities and health care systems (116). The CHW scope of practice in areas such as outreach and communication, advocacy, social support, basic health education, referrals to community clinics, etc., has been successful in providing social and primary preventive services to underserved populations in rural and hard-to-reach communities. Even though CHWs' core competencies are not clinical in nature, in some circumstances clinicians may delegate limited clinical tasks to CHWs. If such is the case, these tasks must always be performed under the direction and supervision of the delegating health professional and following state health care laws and statutes (117).

References

- Kindig D, Stoddart G. What is population health? *Am J Public Health* 2003;93:380–383
- Institute of Medicine, Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC, National Academies Press, 2001. PMID: 25057539
- Haire-Joshu D, Hill-Briggs F. The next generation of diabetes translation: a path to health equity. *Annu Rev Public Health* 2019;40:391–410
- Kazemian P, Shebl FM, McCann N, Walensky RP, Wexler DJ. Evaluation of the cascade of diabetes care in the United States, 2005–2016. *JAMA Intern Med* 2019;179:1376–1385

- Kerr EA, Heisler M, Krein SL, et al. Beyond comorbidity counts: how do comorbidity type and severity influence diabetes patients' treatment priorities and self-management? *J Gen Intern Med* 2007;22:1635–1640
- Fernandez A, Schillinger D, Warton EM, et al. Language barriers, physician-patient language concordance, and glycemic control among insured Latinos with diabetes: the Diabetes Study of Northern California (DISTANCE). *J Gen Intern Med* 2011;26:170–176
- TRIAD Study Group. Health systems, patients factors, and quality of care for diabetes: a synthesis of findings from the TRIAD study. *Diabetes Care* 2010;33:940–947
- American Diabetes Association. Economic costs of diabetes in the U.S. in 2017. *Diabetes Care* 2018;41:917–928
- Stellefson M, Dipnarine K, Stopka C. The chronic care model and diabetes management in US primary care settings: a systematic review. *Prev Chronic Dis* 2013;10:E26
- Wan EYF, Fung CSC, Jiao FF, et al. Five-year effectiveness of the multidisciplinary Risk Assessment and Management Programme—Diabetes Mellitus (RAMP-DM) on diabetes-related complications and health service uses—a population-based and propensity-matched cohort study. *Diabetes Care* 2018;41:49–59
- Jiao FF, Fung CSC, Wan EYF, et al. Five-year cost-effectiveness of the Multidisciplinary Risk Assessment and Management Programme—Diabetes Mellitus (RAMP-DM). *Diabetes Care* 2018;41:250–257
- Coleman K, Austin BT, Brach C, Wagner EH. Evidence on the Chronic Care Model in the new millennium. *Health Aff (Millwood)* 2009;28:75–85
- Piatt GA, Anderson RM, Brooks MM, et al. 3-year follow-up of clinical and behavioral improvements following a multifaceted diabetes care intervention: results of a randomized controlled trial. *Diabetes Educ* 2010;36:301–309
- Katon WJ, Lin EHB, Von Korff M, et al. Collaborative care for patients with depression and chronic illnesses. *N Engl J Med* 2010;363:2611–2620
- Parchman ML, Zeber JE, Romero RR, Pugh JA. Risk of coronary artery disease in type 2 diabetes and the delivery of care consistent with the chronic care model in primary care settings: a STARNet study. *Med Care* 2007;45:1129–1134
- Del Valle KL, McDonnell ME. Chronic care management services for complex diabetes management: a practical overview. *Curr Diab Rep* 2018;18:135
- Tricco AC, Ivers NM, Grimshaw JM, et al. Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis. *Lancet* 2012;379:2252–2261
- Schmittiel JA, Gopalan A, Lin MW, Banerjee S, Chau CV, Adams AS. Population health management for diabetes: health care system-level approaches for improving quality and addressing disparities. *Curr Diab Rep* 2017;17:31
- O'Connor PJ, Bodkin NL, Fradkin J, et al. Diabetes performance measures: current status and future directions. *Diabetes Care* 2011;34:1651–1659
- Jaffe MG, Lee GA, Young JD, Sidney S, Go AS. Improved blood pressure control associated

- with a large-scale hypertension program. *JAMA* 2013;310:699–705
21. Peikes D, Chen A, Schore J, Brown R. Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries: 15 randomized trials. *JAMA* 2009;301:603–618
 22. Raebel MA, Schmittiel J, Karter AJ, Konieczny JL, Steiner JF. Standardizing terminology and definitions of medication adherence and persistence in research employing electronic databases. *Med Care* 2013;51(Suppl. 3):S11–S21
 23. Feifer C, Nemeth L, Nietert PJ, et al. Different paths to high-quality care: three archetypes of top-performing practice sites. *Ann Fam Med* 2007;5:233–241
 24. Reed M, Huang J, Graetz I, et al. Outpatient electronic health records and the clinical care and outcomes of patients with diabetes mellitus. *Ann Intern Med* 2012;157:482–489
 25. Cebul RD, Love TE, Jain AK, Hebert CJ. Electronic health records and quality of diabetes care. *N Engl J Med* 2011;365:825–833
 26. Battersby M, Von Korff M, Schaefer J, et al. Twelve evidence-based principles for implementing self-management support in primary care. *Jt Comm J Qual Patient Saf* 2010;36:561–570
 27. Grant RW, Wald JS, Schnipper JL, et al. Practice-linked online personal health records for type 2 diabetes mellitus: a randomized controlled trial. *Arch Intern Med* 2008;168:1776–1782
 28. Young-Hyman D, de Groot M, Hill-Briggs F, Gonzalez JS, Hood K, Peyrot M. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. *Diabetes Care* 2016;39:2126–2140
 29. Beck J, Greenwood DA, Blanton L, et al.; 2017 Standards Revision Task Force. 2017 national standards for diabetes self-management education and support. *Diabetes Care* 2017;40:1409–1419
 30. Pullen-Smith B, Carter-Edwards L, Leathers KH. Community health ambassadors: a model for engaging community leaders to promote better health in North Carolina. *J Public Health Manag Pract* 2008;14(Suppl.):S73–S81
 31. Handlow NE, Nolton B, Winter SE, Wessel CM, Pennock J. 180-LB: Impact of a multidisciplinary diabetes care team in primary care settings on glycemic control (Late-breaking poster presentation). *Diabetes* 2019; 68(Suppl. 1). Accessed 4 October 2021. Available from <https://doi.org/10.2337/db19-180-LB>
 32. Davidson MB. How our current medical care system fails people with diabetes: lack of timely, appropriate clinical decisions. *Diabetes Care* 2009;32:370–372
 33. Selby JV, Uratsu CS, Fireman B, et al. Treatment intensification and risk factor control: toward more clinically relevant quality measures. *Med Care* 2009;47:395–402
 34. Raebel MA, Ellis JL, Schroeder EB, et al. Intensification of antihyperglycemic therapy among patients with incident diabetes: a Surveillance Prevention and Management of Diabetes Mellitus (SUPREME-DM) study. *Pharmacoepidemiol Drug Saf* 2014;23:699–710
 35. Grant RW, Pabon-Nau L, Ross KM, Youatt EJ, Pandiscio JC, Park ER. Diabetes oral medication initiation and intensification: patient views compared with current treatment guidelines. *Diabetes Educ* 2011;37:78–84
 36. Tamhane S, Rodriguez-Gutierrez R, Hargraves I, Montori VM. Shared decision-making in diabetes care. *Curr Diab Rep* 2015;15:112
 37. Schillinger D, Piette J, Grumbach K, et al. Closing the loop: physician communication with diabetic patients who have low health literacy. *Arch Intern Med* 2003;163:83–90
 38. Rosal MC, Ockene IS, Restrepo A, et al. Randomized trial of a literacy-sensitive, culturally tailored diabetes self-management intervention for low-income Latinos: Latinos en Control. *Diabetes Care* 2011;34:838–844
 39. Osborn CY, Cavanaugh K, Wallston KA, et al. Health literacy explains racial disparities in diabetes medication adherence. *J Health Commun* 2011;16(Suppl. 3):268–278
 40. Garg AX, Adhikari NKJ, McDonald H, et al. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. *JAMA* 2005;293:1223–1238
 41. Smith SA, Shah ND, Bryant SC, et al.; Evidens Research Group. Chronic care model and shared care in diabetes: randomized trial of an electronic decision support system. *Mayo Clin Proc* 2008;83:747–757
 42. Stone RA, Rao RH, Sevick MA, et al. Active care management supported by home telemonitoring in veterans with type 2 diabetes: the DiaTel randomized controlled trial. *Diabetes Care* 2010;33:478–484
 43. Bojadzievski T, Gabbay RA. Patient-centered medical home and diabetes. *Diabetes Care* 2011;34:1047–1053
 44. Telligen and gpTRAC (Great Plains Telehealth Resource & Assistance Center). Telehealth Start-Up and Resource Guide Version 1.1, October 2014. Accessed 9 August 2021. Available from https://www.healthit.gov/sites/default/files/telehealthguide_final_0.pdf
 45. Lee SWH, Chan CKY, Chua SS, Chaiyakunapruk N. Comparative effectiveness of telemedicine strategies on type 2 diabetes management: a systematic review and network meta-analysis. *Sci Rep* 2017;7:12680
 46. Xu T, Pujara S, Sutton S, Rhee M. Telemedicine in the management of type 1 diabetes. *Prev Chronic Dis* 2018;15:170168
 47. Faruque LI, Wiebe N, Ehteshami-Afshar A, et al.; Alberta Kidney Disease Network. Effect of telemedicine on glycosylated hemoglobin in diabetes: a systematic review and meta-analysis of randomized trials. *CMAJ* 2017;189:E341–E364
 48. Marcolino MS, Maia JX, Alkimm MBM, Boersma E, Ribeiro AL. Telemedicine application in the care of diabetes patients: systematic review and meta-analysis. *PLoS One* 2013;8:e79246
 49. Heitkemper EM, Mamykina L, Travers J, Smaldone A. Do health information technology self-management interventions improve glycemic control in medically underserved adults with diabetes? A systematic review and meta-analysis. *J Am Med Inform Assoc* 2017;24:1024–1035
 50. Reagan L, Pereira K, Jefferson V, et al. Diabetes self-management training in a virtual environment. *Diabetes Educ* 2017;43:413–421
 51. Dack C, Ross J, Stevenson F, et al. A digital self-management intervention for adults with type 2 diabetes: combining theory, data and participatory design to develop HeLP-Diabetes. *Internet Interv* 2019;17:100241
 52. Lee M-K, Lee DY, Ahn H-Y, Park C-Y. A novel user utility score for diabetes management using tailored mobile coaching: secondary analysis of a randomized controlled trial. *JMIR Mhealth Uhealth* 2021;9:e17573
 53. Denning J, Islam SMS, George E, Maddison R. Web-based interventions for dietary behavior in adults with type 2 diabetes: systematic review of randomized controlled trials. *J Med Internet Res* 2020;22:e16437
 54. Omar MA, Hasan S, Palaia S, Mahameed S. The impact of a self-management educational program coordinated through WhatsApp on diabetes control. *Pharm Pract (Granada)* 2020; 18:1841
 55. Herkert D, Vijayakumar P, Luo J, et al. Cost-related insulin underuse among patients with diabetes. *JAMA Intern Med* 2019;179:112–114
 56. Cefalu WT, Dawes DE, Gavlak G, et al.; Insulin Access and Affordability Working Group. Insulin Access and Affordability Working Group: conclusions and recommendations. *Diabetes Care* 2018;41:1299–1311
 57. Taylor SI. The high cost of diabetes drugs: disparate impact on the most vulnerable patients. *Diabetes Care* 2020;43:2330–2332
 58. Myerson R, Laiteerapong N. The Affordable Care Act and diabetes diagnosis and care: exploring the potential impacts. *Curr Diab Rep* 2016;16:27
 59. Casagrande SS, McEwen LN, Herman WH. Changes in health insurance coverage under the Affordable Care Act: a national sample of U.S. adults with diabetes, 2009 and 2016. *Diabetes Care* 2018;41:956–962
 60. Doucette ED, Salas J, Scherrer JF. Insurance coverage and diabetes quality indicators among patients in NHANES. *Am J Manag Care* 2016; 22:484–490
 61. Stiefel M, Nolan K. Measuring the triple aim: a call for action. *Popul Health Manag* 2013;16: 219–220
 62. Agency for Healthcare Research and Quality. About the National Quality Strategy. Content last reviewed March 2017. Accessed 4 October 2021. Available from <https://www.ahrq.gov/workingforquality/about/index.html>
 63. National Quality Forum. National voluntary consensus standards for ambulatory care—measuring healthcare disparities. 2008. Accessed 4 October 2021. Available from https://www.qualityforum.org/Publications/2008/03/National_Voluntary_Consensus_Standards_for_Ambulatory_Care%E2%80%94Measuring_Healthcare_Disparities.aspx
 64. Burstin H, Johnson K. Getting to better care and outcomes for diabetes through measurement. Evidence-based diabetes management. *Am J Manag Care* 2016;22(SP4):SP145–SP146
 65. National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes for health professionals. Accessed 9 August 2021. Available from <https://www.niddk.nih.gov/health-information/professionals/clinical-tools-patient-management/diabetes>

66. O'Connor PJ, Sperl-Hillen JM, Fazio CJ, Averbeck BM, Rank BH, Margolis KL. Outpatient diabetes clinical decision support: current status and future directions. *Diabet Med* 2016;33:734–741
67. Institute of Medicine, Committee on Health Literacy. *Health Literacy: A Prescription to End Confusion*. Nielsen-Bohlman L, Panzer AM, Kindig DA, Eds. Washington, DC, National Academies Press, 2004. PMID: 25009856
68. Schaffler J, Leung K, Tremblay S, et al. The effectiveness of self-management interventions for individuals with low health literacy and/or low income: a descriptive systematic review. *J Gen Intern Med* 2018;33:510–523
69. Centers for Medicare & Medicaid Services. CMS equity plan for Medicare. Accessed 4 October 2021. Available from <https://www.cms.gov/About-CMS/Agency-Information/OMH/equity-initiatives/equity-plan.html>
70. Rosenthal MB, Cutler DM, Feder J. The ACO rules—striking the balance between participation and transformative potential. *N Engl J Med* 2011;365:e6
71. Washington AE, Lipstein SH. The Patient-Centered Outcomes Research Institute—promoting better information, decisions, and health. *N Engl J Med* 2011;365:e31
72. Hutchinson RN, Shin S. Systematic review of health disparities for cardiovascular diseases and associated factors among American Indian and Alaska Native populations. *PLoS One* 2014;9:e80973
73. Borschuk AP, Everhart RS. Health disparities among youth with type 1 diabetes: a systematic review of the current literature. *Fam Syst Health* 2015;33:297–313
74. Walker RJ, Strom Williams J, Egede LE. Influence of race, ethnicity and social determinants of health on diabetes outcomes. *Am J Med Sci* 2016;351:366–373
75. Patel MR, Piette JD, Resnicow K, Kowalski-Dobson T, Heisler M. Social determinants of health, cost-related nonadherence, and cost-reducing behaviors among adults with diabetes: findings from the National Health Interview Survey. *Med Care* 2016;54:796–803
76. Steve SL, Tung EL, Schlichtman JJ, Peek ME. Social disorder in adults with type 2 diabetes: building on race, place, and poverty. *Curr Diab Rep* 2016;16:72
77. Commission on Social Determinants of Health. *Closing the gap in a generation: health equity through action on the social determinants of health*. Geneva, World Health Organization, 2008. Accessed 4 October 2021. Available from https://www.who.int/social_determinants/final_report/csdh_finalreport_2008.pdf
78. Dixon B, Peña M-M, Taveras EM. Lifecourse approach to racial/ethnic disparities in childhood obesity. *Adv Nutr* 2012;3:73–82
79. Hill JO, Galloway JM, Goley A, et al. Scientific statement: socioecological determinants of prediabetes and type 2 diabetes. *Diabetes Care* 2013;36:2430–2439
80. Hill-Briggs F, Adler NE, Berkowitz SA, et al. Social determinants of health and diabetes: a scientific review. *Diabetes Care* 2020;44:258–279
81. The Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2020. Phase I report: recommendations for the framework and format of Healthy People 2020. Accessed 4 October 2021. Available from <https://www.healthypeople.gov/2010/hp2020/advisory/PhaseI/default.htm>
82. National Academies of Sciences, Engineering, and Medicine. *A Framework for Educating Health Professionals to Address the Social Determinants of Health*. Washington, DC, National Academies Press, 2016. PMID: 27854400
83. Chin MH, Clarke AR, Nocon RS, et al. A roadmap and best practices for organizations to reduce racial and ethnic disparities in health care. *J Gen Intern Med* 2012;27:992–1000
84. Piette JD, Heisler M, Wagner TH. Cost-related medication underuse among chronically ill adults: the treatments people forgo, how often, and who is at risk. *Am J Public Health* 2004;94:1782–1787
85. Laiteerapong N, Karter AJ, Liu JY, et al. Correlates of quality of life in older adults with diabetes: the Diabetes & Aging Study. *Diabetes Care* 2011;34:1749–1753
86. O'Gurek DT, Henke C. A practical approach to screening for social determinants of health. *Fam Pract Manag* 2018;25:7–12
87. Walker RJ, Grusnick J, Garacci E, Mendez C, Egede LE. Trends in food insecurity in the USA for individuals with prediabetes, undiagnosed diabetes, and diagnosed diabetes. *J Gen Intern Med* 2019;34:33–35
88. Berkowitz SA, Karter AJ, Corbie-Smith G, et al. Food insecurity, food “deserts,” and glycemic control in patients with diabetes: a longitudinal analysis. *Diabetes Care* 2018;41:1188–1195
89. Heerman WJ, Wallston KA, Osborn CY, et al. Food insecurity is associated with diabetes self-care behaviours and glycaemic control. *Diabet Med* 2016;33:844–850
90. Silverman J, Krieger J, Kiefer M, Hebert P, Robinson J, Nelson K. The relationship between food insecurity and depression, diabetes distress and medication adherence among low-income patients with poorly-controlled diabetes. *J Gen Intern Med* 2015;30:1476–1480
91. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics* 2010;126:e26–e32
92. Goddu AP, Roberson TS, Raffel KE, Chin MH, Peek ME. Food Rx: a community-university partnership to prescribe healthy eating on the South Side of Chicago. *J Prev Interv Community* 2015;43:148–162
93. Feinberg AT, Hess A, Passaretti M, Coolbaugh S, Lee TH. Prescribing food as a specialty drug. *NEJM Catalyst*. 10 April 2018. Accessed 4 October 2021. Available from <https://catalyst.nejm.org/doi/abs/10.1056/CAT.18.0212>
94. Seligman HK, Schillinger D. Hunger and socioeconomic disparities in chronic disease. *N Engl J Med* 2010;363:6–9
95. White BM, Logan A, Magwood GS. Access to diabetes care for populations experiencing homelessness: an integrated review. *Curr Diab Rep* 2016;16:112
96. Bernstein RS, Meurer LN, Plumb EJ, Jackson JL. Diabetes and hypertension prevalence in homeless adults in the United States: a systematic review and meta-analysis. *Am J Public Health* 2015;105:e46–e60
97. Montgomery AE, Fargo JD, Kane V, Culhane DP. Development and validation of an instrument to assess imminent risk of homelessness among veterans. *Public Health Rep* 2014;129:428–436
98. Stahre M, VanEenwyk J, Siegel P, Njai R. Housing insecurity and the association with health outcomes and unhealthy behaviors, Washington State, 2011. *Prev Chronic Dis* 2015;12:E109
99. Baxter AJ, Tweed EJ, Katikireddi SV, Thomson H. Effects of Housing First approaches on health and well-being of adults who are homeless or at risk of homelessness: systematic review and meta-analysis of randomised controlled trials. *J Epidemiol Community Health* 2019;73:379–387
100. Evangelou E, Ntritsos G, Chondrogiorgi M, et al. Exposure to pesticides and diabetes: a systematic review and meta-analysis. *Environ Int* 2016;91:60–68
101. Health Resources & Services Administration. 2020 Health Center Data. Accessed 4 October 2021. Available from <https://data.hrsa.gov/tools/data-reporting/program-data/national>
102. U.S. Department of Health & Human Services. National Standards for Culturally and Linguistically Appropriate Services (CLAS) in Health and Health Care. Accessed 4 October 2021. Available from <https://www.thinkculturalhealth.hhs.gov/assets/pdfs/enhancednationalclasstandards.pdf>
103. Aaby A, Friis K, Christensen B, Rowlands G, Maindal HT. Health literacy is associated with health behaviour and self-reported health: a large population-based study in individuals with cardiovascular disease. *Eur J Prev Cardiol* 2017;24:1880–1888
104. White RO, Eden S, Wallston KA, et al. Health communication, self-care, and treatment satisfaction among low-income diabetes patients in a public health setting. *Patient Educ Couns* 2015;98:144–149
105. Schapira MM, Fletcher KE, Gilligan MA, et al. A framework for health numeracy: how patients use quantitative skills in health care. *J Health Commun* 2008;13:501–517
106. Carpenter CR, Kaphingst KA, Goodman MS, Lin MJ, Melson AT, Griffey RT. Feasibility and diagnostic accuracy of brief health literacy and numeracy screening instruments in an urban emergency department. *Acad Emerg Med* 2014;21:137–146
107. Williams DR, Lawrence JA, Davis BA. Racism and Health: Evidence and Needed Research. *Annu Rev Public Health* 2019;40:105–125
108. Agency for Healthcare Research and Quality. *Clinical-community linkages*. Content last reviewed December 2016. Accessed 4 October 2021. Available from <https://www.ahrq.gov/professionals/prevention-chronic-care/improve/community/index.html>
109. Egbujie BA, Delobelle PA, Levitt N, Puoane T, Sanders D, van Wyk B. Role of community health workers in type 2 diabetes mellitus self-management: a scoping review. *Plos One* 2018;13:e01998424
110. Heisler M, Vijan S, Makki F, Piette JD. Diabetes control with reciprocal peer support versus nurse care management: a randomized trial. *Ann Intern Med* 2010;153:507–515
111. Long JA, Jahnle EC, Richardson DM, Loewenstein G, Volpp KG. Peer mentoring and

financial incentives to improve glucose control in African American veterans: a randomized trial. *Ann Intern Med* 2012;156:416–424

112. Fisher EB, Boothroyd RI, Elstad EA, et al. Peer support of complex health behaviors in prevention and disease management with special reference to diabetes: systematic reviews. *Clin Diabetes Endocrinol* 2017;3:4

113. Foster G, Taylor SJ, Eldridge SE, Ramsay J, Griffiths CJ. Self-management education programmes by lay leaders for people with chronic conditions. *Cochrane Database Syst Rev* 2007;4:CD005108

114. Piatt GA, Rodgers EA, Xue L, Zgibor JC. Integration and utilization of peer leaders for diabetes self-management support: results from Project SEED (Support, Education, and Evaluation in Diabetes). *Diabetes Educ* 2018;44:373–382

115. Rosenthal EL, Rush CH, Allen CG. Understanding scope and competencies: a contemporary look at the United States community health worker field. *CHW Central*, 2016. Accessed 4 October 2021. Available from <https://www.chwcentral.org/understanding-scope-and-competencies-contemporary-look-united-states-community-health-worker-field>

116. Guide to Community Preventive Services. Community health workers help patients manage diabetes. Page last updated 2018. Accessed 4 October 2021. Available from <https://www.thecommunityguide.org/content/community-health-workers-help-patients-manage-diabetes>

117. The Network for Public Health Law. Legal considerations for community health workers and their employers. Accessed 4 October 2021. Available from <https://www.networkforphl.org/wp-content/uploads/2020/01/Legal-Considerations-Community-Health-Workers.pdf>