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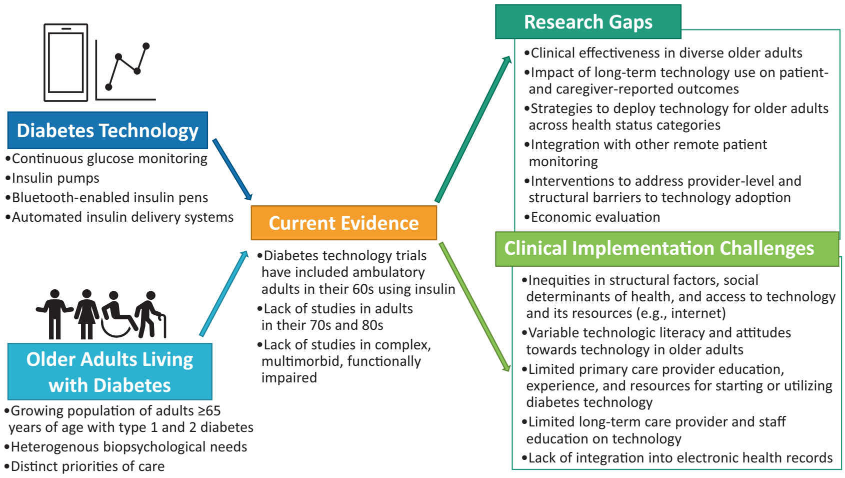

ARTICLE HIGHLIGHTS

- Technology in diabetes management has the potential to improve diabetes care, lower costs, and empower people.
- Growing evidence demonstrates the efficacy of diabetes technology for adults in their 60s, but data are limited for the oldest and sickest patients.
- Future research regarding diabetes technology in older adults should address whether technology improves patient-centered outcomes, when technology should be deployed, and how to overcome patient, provider, and system barriers to adoption.

REVIEW

The Growing Role of Technology in the Care of Older Adults With Diabetes

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The integration of technologies such as continuous glucose monitors, insulin pumps, and smart pens into diabetes management has the potential to support the transformation of health care services that provide a higher quality of diabetes care, lower costs and administrative burdens, and greater empowerment for people with diabetes and their caregivers. Among people with diabetes, older adults are a distinct subpopulation in terms of their clinical heterogeneity, care priorities, and technology integration. The scientific evidence and clinical experience with these technologies among older adults are growing but are still modest. In this review, we describe the current knowledge regarding the impact of technology in older adults with diabetes, identify major barriers to the use of existing and emerging technologies, describe areas of care that could be optimized by technology, and identify areas for future research to fulfill the potential promise of evidence-based technology integrated into care for this important population.

Integrating technology in diabetes management has the potential to provide a higher quality of diabetes care, lower costs and administrative burdens, and greater empowerment for people with diabetes and their caregivers. However, this integration of technology remains at an early stage, and the clinical experience with these technologies among older adults is modest.

One of the overarching questions in the field of geriatric diabetes is to what extent the role of diabetes technology varies across subgroups of older adults (≥65 years of age) with diabetes. This population is heterogenous concerning disease pathophysiology, diabetes-related complications, overall health status, where they reside, and their dependency on others (1). Most older adults with diabetes have type 2 diabetes, while approximately 5% have type 1 diabetes (2). Insulin is an essential life-preserving therapy for people with type 1 diabetes. As a result, the availability of technology such as insulin pumps for insulin delivery is particularly relevant for the population with type 1 diabetes. Due to their reliance on external insulin and elevated risk for both hyperglycemia and hypoglycemia, continuous glucose monitoring (CGM) has the potential to improve glycated hemoglobin (HbA_{1c}), reduce glycemic variability, and reduce the risk of hypoglycemia in type 1 diabetes. For a segment of older adults with type 2 diabetes who become insulin requiring, these technologies can play a role very similar to the one they play in type 1 diabetes. Any discussion regarding diabetes technology among older adults requires consideration of the care setting and caregivers. Most older adults are community dwelling, but an important subpopulation resides in long-term care (LTC) (3). In both settings, caregivers are involved in administering the various

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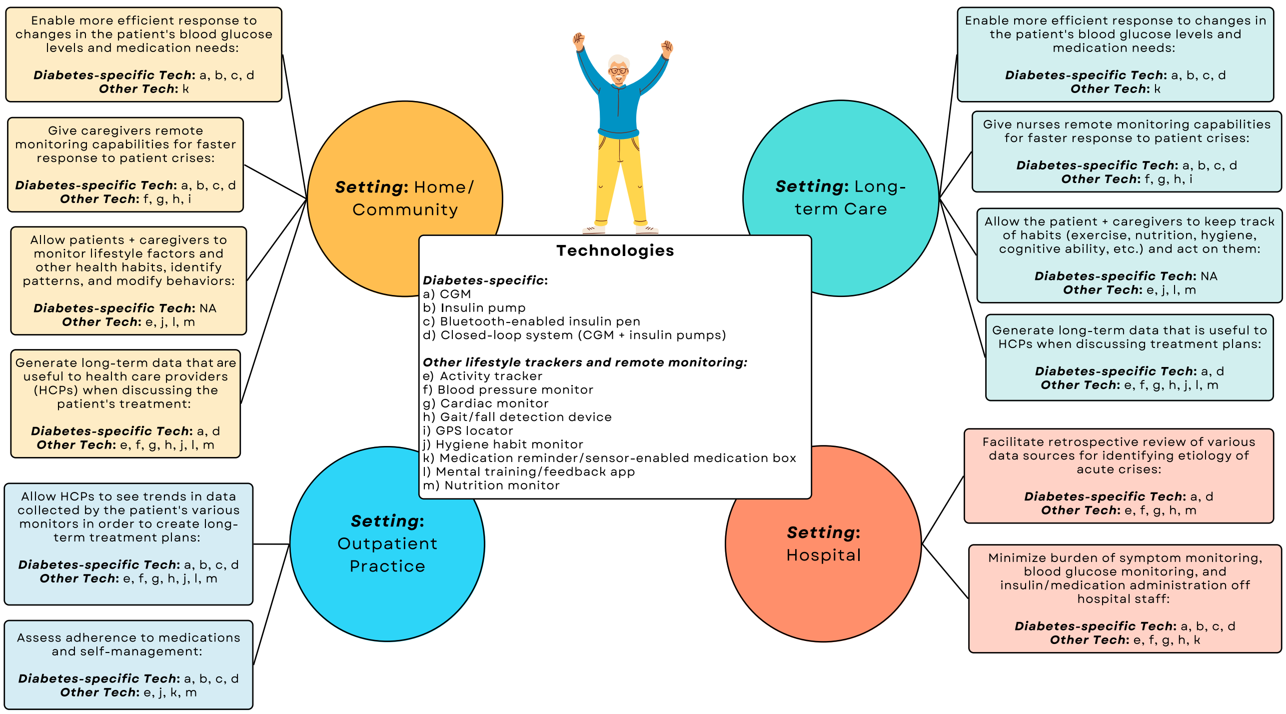

Figure 1—Potential roles of technology in the care of older adults with diabetes across settings. NA, not applicable; Tech, technology.

components of diabetes self-care management for older adults who have developed cognitive or physical functional impairments.

Across this heterogeneous population, the evidence and experience with diabetes technology is steadily growing. With this background, the International Geriatric Diabetes Society assembled a workshop of interdisciplinary experts who have had leading roles in developing national and international guidance on geriatric diabetes to discuss the current state of technology use in this infrequently studied population and to outline needed advances to improve the use and adoption of diabetes-related technology in older adults. This review aims to provide an overview of the evidence regarding the benefits of existing technologies in older people with diabetes and to provide a framework for the multiple aspects of geriatric diabetes care where technology may have a role in the future.

WHAT ARE THE OPPORTUNITIES AND RISKS FOR DIABETES TECHNOLOGY AMONG OLDER ADULTS?

Many of the potential opportunities of diabetes technology are based on the hope that the current public health burden of diabetes for older adults and their caregivers can be reduced. Diabetes is associated with high morbidity and mortality, a reduction in quality of life, and increased health care services utilization rates (4). A major component of the diabetes public health challenge is the changing needs of older adults as they age and as the disease progresses (5) and where the inherent complexity of diabetes self-care management requires tremendous resources in terms of clinical, technical, and social support. Diabetes may be viewed as an aging accelerant, as it is a risk factor for the development of cognitive dysfunction (6), dementia (7–10), depression (11), physical disability, frailty, and sarcopenia (12–19). The development of these geriatric conditions may in turn impact diabetes self-care management capacities, such as dosing and administering insulin and other diabetes medications, adjusting treatment regimens related to life situations, and preventing and treating hypoglycemic events (20–22).

Given the burdens of diabetes, the introduction of diabetes technology as a part of glucose monitoring and management may help to reduce hypoglycemia and hyperglycemia, thereby potentially contributing to a reduction of diabetes-related complications, slowing of functional decline, and enhancement of quality of life. Future technology may also play an important role in setting treatment targets according to functional/cognitive state, enhancing of self-care capacity, and alleviating functional and cognitive dysfunction in older adults. Technology may also have potential health care delivery benefits such as simplifying clinical workflows and reducing costs related to care and complications (Fig. 1).

While diabetes technology has potential benefits, there are also potential harms of introducing technology. Data-driven technology raises concerns regarding the unintended adverse effects, including data overload (23) and alarm fatigue (24,25). The availability of new technologies also introduces new ethically challenging clinical scenarios, such as determining when to discontinue technology as older adults approach the end of life (26). Further, the introduction of technology can increase overall costs of health care, despite cost offsets (27), and exacerbate health disparities if there is differential uptake of technology.

WHAT IS THE CURRENT KNOWLEDGE REGARDING USE OF CGM TECHNOLOGY IN OLDER ADULTS?

Earlier clinical trials of CGM did not include older adults, and they excluded those with cognitively and functional impairments. More recently, a series of

CGM trials have included adults over the age of 60 and have provided some important data regarding the technology in the so-called young old but leave evidence gaps for adults over 70 and 80 as well as for those with medical complexity. The senior Multiple Daily Injections and Continuous Glucose Monitoring in Diabetes (DIAMOND) trial randomized 116 individuals over the age of 60 with type 1 or type 2 diabetes using multiple daily insulin injections (MDI) to either CGM or capillary blood glucose monitoring (BGM). After 24 weeks, the CGM arm had a statistically significant 0.4% reduction in HbA_{1c}, a reduction in glycemic variability and time spent >250 mg/dL, and an increase in time spent in range (TIR) compared with the BGM arm (28). Individuals randomized to the CGM group reported high satisfaction with the use of the device (28). The Wireless Innovations for Seniors with Diabetes Mellitus (WISDM) trial randomized 203 individuals with type 1 diabetes over the age of 60 years to CGM versus BGM. An analysis of the baseline data of the WISDM study showed that over half of trial participants spent at least 4% of the time with glucose levels <70 mg/dL and 37% of the time with values >180 mg/dL (29). After 6 months of follow-up, they reported a 90% reduction in incident severe hypoglycemic events. They also reported a reduction in the incidence of glucose values below 70 mg/dL and below 54 mg/dL as well as a reduction in glucose values above 300 mg/dL and an increase in TIR. No significant difference was reported between the groups for patient-reported outcomes or cognitive function (30). Other trials in individuals with type 2 diabetes receiving MDI have included individuals over the age of 60 (∼50%) and demonstrated a reduction in HbA_{1c} ranging from 0.3 to 0.5% (31,32).

CGM has assumed an important role in the prevention of hypoglycemia and hyperglycemia in people with type 1 and type 2 diabetes who are treated with either insulin or other hypoglycemic agents. Apart from influencing glucose control, CGM has other attributes that may be relevant to older people, such as *1*) allowing the individual to continuously share glucose readings with family members or other caregivers; *2*) reducing the number of capillary (BGM) tests required—a task that may be especially difficult in individuals with a physical disability, cognitive impairment, or vision impairment or may not be feasible in certain care settings, such as assisted living; and *3*) conferring "technologic awareness" of hypoglycemia on those with reduced or impaired awareness of hypoglycemia.

WHAT IS THE CURRENT KNOWLEDGE REGARDING USE OF INSULIN ADMINISTRATION TECHNOLOGY IN OLDER ADULTS?

Despite robust evidence in younger individuals with type 1 diabetes for the efficacy and safety of insulin pump use, limited data exist concerning older adults (33,34). As with CGM, a series of insulin pump trials have included adults over the age of 60, but they left an evidence gap for the oldest adults and for those with medical complexity. Studies using sensor-augmented pump therapy (i.e., the hybrid closed-loop 670G system) that included individuals over the age of 60 reported a similar improvement in glucose indices for the older adult subgroup compared with the adolescent subgroup (35,36). Real-world data from another study of 649 individuals 60 years of age or older using the hybrid closed-loop 670G demonstrated improvements in glucose indices similar to those of the younger cohort after initiating Auto Mode, a setting where the system automatically adjusts basal insulin delivery based on sensor glucose to maintain blood glucose levels as close to a specific target as possible, with a reported 75% mean TIR and 0.4% of time spent below 54 mg/dL (37). In the Older Adult Closed-Loop (ORACL) trial, 30 individuals over the age of 60 participated in a 4-month randomized crossover trial that compared a hybrid closed-loop system (670G) with sensor-augmented pump therapy. During the hybrid closed-loop phase, there was a reduction in hypoglycemia incidence and an increase in TIR (38). Similarly, Boughton et al. (39) reported an open-label, crossover study of 37 older adults (≥60 years) with type 1 diabetes who were randomized to either 16 weeks of treatment with a hybrid closed-loop insulin delivery system (CamAPS FX) or sensor-augmented pump therapy. The hybrid closed-loop algorithm improved the proportion of TIR by 8.6% (or over 2 h a day) due primarily to decreases in the proportion of time spent in the hyperglycemic range. In this study, there were no significant differences in hypoglycemia.

There are additional data that demonstrate that pump therapy may be beneficial in older people with type 2 diabetes who use MDI. The OpT2mise trial tested the effect of insulin pump therapy versus MDI in individuals with type 2 diabetes inadequately controlled on MDI. The study included individuals aged 30–75 years and demonstrated an improvement in HbA_{1c} that was independent of diabetes duration and cognitive score (as measured by the Montreal Cognitive Assessment [MoCA]) (40).

The evidence base regarding insulin administration technology now includes growing data for adults over the age of 60. While these studies have not been inclusive of the oldest adults and the medically complex, this technology appears to be similarly effective for adults in their 60s and for younger patients.

WHAT ARE THE MAJOR BARRIERS TO USE OF TECHNOLOGY BY OLDER ADULTS?

While technology offers many advantages for diabetes care, it also risks worsening disparities unless the barriers to adoption that affect diverse populations of older adults are directly confronted. The major barrier domains include structural inequities, technology literacy, interpersonal factors, provider adoption, and health policy.

Structural Inequities

There are groups of socially marginalized adults with diabetes, particularly members of racial and ethnic minorities and low-income people, whose exposure to structural inequities have affected their life course and, subsequently, their health. Structural inequities include segregated schools, residential segregation, discriminatory practices in banking and lending, unfair criminal justice policies, and unequal access to food, health care, transportation, and now technology (e.g., devices and the internet). These structural inequities are directly correlated with poor long-term health, including hypertension, cardiovascular disease, and diabetes outcomes (41–44).

While technology has the potential to benefit older adults, structural inequities may contribute to the uneven access to and uptake of technology. Subgroups such as those of advanced age, lower education and health literacy, lower income, racial and ethnic minorities, and low levels of social support have limited access to the internet and broadband (45–47).

These characteristics intersect and compound observed disparities; older adults from racial and ethnic minority groups and the lowest-income groups have single-digit rates of internet use compared with older adults from the wealthy and White subgroup, where the rate of use is 66% (48). The current disparities in access to broadband are tied to historical structural inequities of the built environment. For example, depression-era federal housing policies of residential redlining prevented people in majority Black neighborhoods (designated "high risk") from getting mortgages and moving into majority White neighborhoods (49). Addressing structural inequities requires reforming the built and the social environment to be more equitable across populations (50,51). The ability of people with diabetes to draw upon resources in their surrounding built and social environment helps determine their ability to access care and manage their disease. This is particularly true for older adults who require more community support for diabetes management (52,53).

Technology Literacy, Digital Literacy, eHealth Literacy, and Technology Confidence

For older adults, technology in health care may be beneficial if there is equitable access and if the design features are adapted to individual and interpersonal user needs. Given the increasing importance of technology in health care, it is important to assess new dimensions of patient literacy. First, patients vary in terms of technology and digital literacy. Technology literacy refers to one's ability to safely use, manage, and understand technology devices and is a potentially modifiable characteristic of people that we can change through education. Digital literacy is the ability to *1*) locate and consume digital content, *2*) create digital content, and *3*) communicate digital content (47). Second, patients also vary regarding eHealth literacy, a skill that bridges both health and technology literacy. eHealth literacy is the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem (48,49). Another consideration for ensuring successful health care technology use in older people with diabetes is to address one's technology confidence. Older adults, on average, are less confident using technology than younger adults; however, $\sim$25% of older adults are just as confident as young adults (54). When designing technology targeting older adult users, it is important to anticipate and design for a wide range of confidence levels with technology. In addition, it is important that new technology studies formally collect data on health literacy, technology literacy, eHealth literacy, and technology confidence to understand potential barriers.

Interpersonal Factors

Most older adults are not accessing and using technology without assistance at some point (54). Therefore, technology programs that target older adults paired with a family member, caregiver, or an individual from the community may represent more effective interventional approaches than programs that target older adults on their own (55). Community health workers, navigators, and case managers may serve as cultural bridges to technology interventions. The presence of a navigator or case manager can support the tailoring of information based on culture, literacy/numeracy, and personal beliefs in real time. Technology programs that integrate a social component may also have better retention (56).

WHAT ARE THE MAJOR BARRIERS TO USE OF TECHNOLOGY BY PROVIDERS?

Provider Adoption

Health care providers are important stakeholders in facilitating the adoption of technology in the care of older adults with diabetes. Some common practices can make the management of diabetes in older adults more challenging. These practices include excessive reliance on HbA_{1c} to assess diabetes control, lack of awareness of factors that can elevate or reduce HbA_{1c} levels, inconsistent review of blood glucose logs, infrequent downloading of glucose meters, and lack of comfort with managing multidose (basal/bolus) insulin therapy. Some primary care providers have adopted a practice of referring all people with poor glucose control to endocrinologists, but access to these specialists and their support teams is limited. These referrals are needed in part because frontline providers lack experience with adjusting insulin dosing in people receiving insulin via a pump and have not been trained in the use of CGM and associated data, and there is a lack of staff able to train people with diabetes and their caregivers on the use of diabetes technology. It should also be acknowledged that there are many communities without an endocrinologist with either expertise or an office infrastructure to manage diabetes technology.

In addition to provider practice barriers, there are numerous related system barriers to the adoption of diabetes technology within clinical settings and as part of routine care encounters. These include *1*) limited time for patient visits (15–20 min is usual), *2*) lack of comprehensive support staff (nurses, pharmacists, nutritionists, and medical assistants), *3*) burden of documentation in electronic health records (EHR), *4*) legal, financial, and security barriers to incorporating diabetes software into health system computers (e.g., Clarity, Libreview, T-Connect, Carelink, Glooko, and Tidepool), *5*) lag in incorporating CGM codes for reimbursement, *6*) provider perceptions that CGM technologies are cumbersome, and *7*) complexity of coverage of CGM by payers.

In the postacute and long-term settings, there are additional barriers. These barriers include *1*) variable health care provider knowledge and comfort regarding diabetes technology, *2*) belief that higher glycemic goals protect against symptomatic hypoglycemia, *3*) greater reliance on nurse practitioners and physician assistants as providers who may have less experience managing newer diabetes technology, and *4*) inadequate assisted living and LTC facility staffing. Assisted living facilities may not have a registered nurse or licensed practical nurse on site, and nursing homes are only required to have a single registered nurse per shift. In the wake of the coronavirus disease 2019 (COVID-19) pandemic, current staffing policies are being reexamined in view of the recognition that residents of these facilities have a higher level of medical acuity than they previously experienced.

Many of these barriers can be overcome with changes at the health system level and at the provider education level. There should be greater sharing of patient data across health systems and among consultants and interprofessional providers. In terms of training, it may be necessary to identify or train a diabetes champion in larger practices and hospitals who can serve as a content expert to lead training within organizations. From a clinical perspective, there is a great need to identify optimal approaches to identify when and when not to deploy a technology like CGM.

CAN OTHER REMOTE MONITORING TECHNOLOGIES HELP TO IMPROVE OTHER OUTCOMES OF INTEREST TO OLDER ADULTS?

Beyond glucose management, technology may benefit many other aspects of the lives of older people with diabetes (Fig. 1). Clinical practice guidelines from diabetes organizations have stressed the importance of routine cognitive and physical capacity assessments in older people with diabetes in order to determine the appropriate medical and physical treatment plan (20,57–59). Despite this recommendation, health systems currently provide these assessments only when an individual presents with significant functional impairment. This is partly due to the cost and time such evaluations require. The development of apps that would be able to collect cognitive and functional assessment data (in the home or in the clinic) and physician support systems that would integrate the data and give health care providers recommendations could improve the care of this population. Several studies have also demonstrated the efficacy of multidisciplinary (personalized physical activity, cognitive rehabilitation, nutritional and maximal risk factor reduction, etc.) interventions in improving physical capacity, cognitive function, and quality of life and prevention of disability and hospitalizations in older people with diabetes (60–62). Adaptation of these resource-intensive interventions to technology-based systems could enable widespread dissemination of efficacious multidisciplinary interventions. Additional examples of technologies that may reduce risk factors associated with complications include remote blood pressure monitoring/management, cardiac monitoring, medication reminders/sensor-enabled medication boxes, connected insulin pens, gait/fall detection devices, activity and sleep sensors, technologies that support those with depression, anxiety, and sleep disorders and address needs related to social determinants of health, and mental training with feedback. Devices that can assist monitoring of older adult functional outcomes over time include activity trackers (to measure steps, sedentary time, and sleep time), monitors related to nutrition (e.g., operation of ovens/microwave, Bluetooth weight and bioimpedance scales, and live Wi-Fi in refrigerators to monitor food use), temperature/humidity sensors in bathrooms (to indicate showering or bathing), and GPS locators.

To better serve older adults, particularly those with multimorbidity and declining health, remote monitoring devices need to be adapted to address challenges that develop with aging and changing needs due to the development or progression of comorbidities and loss of function. These include hearing loss (availability of high volume and closed captions), reduced vision (availability of large font, voice recognition, and voice control), reduced dexterity (easy to use and adapted for arthritic limbs), and cognitive impairment (simple to use). In addition to having devices that are adapted to the changing needs of older adults, it is not realistic or wise to expect older adults to learn to use multiple different devices. Ideally, there would be one customizable device, easy to use, with the ability to select different applications (e.g., CGM, connected insulin pens, and cardiac monitors) to match changing needs and disabilities.

To fulfill the potential for remote monitoring to help reduce and better manage complications, there is also the need for adequate training for the older adult with diabetes and their caregivers. Most importantly, for these devices to fulfill their potential, the data generated need to be reviewed and acted upon by the individual, family, caregivers, provider, remote monitoring services (e.g., televisits with certified diabetes care and education specialists), and/or community organizations, all working together for the benefit of the older adult with diabetes. As research regarding the integration and deployment of multiple devices proceeds, it will be important to quantify the benefits of such integrated systems and evaluate the extent to which the increased costs of these technologies are offset by cost savings for older adults, their caregivers, and the health system.

HOW SHOULD DIABETES TECHNOLOGY BE DEPLOYED ACROSS CLINICALLY DIVERSE OLDER ADULT SUBGROUPS AND CARE SETTINGS?

Older adults with type 1 and type 2 diabetes tend to be cared for by different providers, which will alter approaches to the deployment of technology and the education of providers. Older adults with type 1 diabetes are more often cared for by endocrinologists, and these specialists are more likely to have had training in insulin pumps and CGM. In contrast, the vast majority of older adults with type 2 diabetes and many with type 1 diabetes are cared for by primary care providers (including advanced practice nurses) who are less likely to have formal training in the use of diabetes-related technology. These providers are also charged with addressing multiple health care priorities above and beyond diabetes, which again may reduce the focus needed to successfully deploy such a technology when it is needed. In the LTC setting, the diagnosis of type 1 diabetes may not be clear due to multiple care transitions and lack of contiguous records. The absolute need for insulin may not be recognized, and the occurrence of diabetic ketoacidosis may be confused with other acute medical complications, such as sepsis (63).

Apart from the major distinctions between types of diabetes, the older adult population can be further subdivided by health status. Current care guidelines emphasize the importance of individualizing glycemic goals based on clinical health status (64) but vary in their endorsement of the use of CGM. The 2018 Diabetes Canada guidelines highlighted 13 recommendations, including a range of glycemic targets that vary by degrees of frailty, and the 2021 update provided recommendations concerning CGM use in type 2 diabetes (65,66). Given the uncertainty regarding the benefits of CGM for many older adult subgroups, the guidelines emphasize the importance of engaging with patients to identify outcomes of greatest importance to the individual. The Department of Veterans Affairs (VA)/Department of Defense Clinical Practice Guideline for diabetes recommends a range of glycemic targets by life expectancy (longer life expectancy leads to lower glycemic targets) and presence of diabetes complications (fewer complications leads to lower glycemic targets) (67,68). The VA has launched the VA–Choosing Wisely Hypoglycemia Safety Initiative, which has the goal of identifying people at high risk of hypoglycemia (A1C $<7\%$, age >75 years, cognitive impairment, and use of insulin or sulfonylureas) and prompting their primary care clinicians to screen for hypoglycemia and consider deintensification if hypoglycemia is identified. Preliminary results from this initiative show that, through shared decision-making, 48% of veterans decided to relax treatment. The VA guidelines in the U.S. raised concerns regarding the unintended adverse effects of technology described earlier in this review.

Questions remain concerning the appropriate CGM metrics and thresholds for healthy, prefrail, and frail older adults to guide glycemic treatment to achieve targeted glycemic outcomes. Unfortunately, there is a lack of data to determine what levels of glycemic control lead to decreases in common geriatric outcomes, such as falls, cognitive impairment, or incontinence. Adding to the complexity of identifying optimal outcomes is that there is individual variability concerning glucose thresholds that lead to symptoms, with some older adults becoming symptomatic with glucose <80 mg/dL but others not becoming symptomatic until glucose <60 mg/dL. Mounting evidence points to the frequent substantial discordance between laboratory A1C and CGM-derived glucose management indicator (GMI) (69,70), suggesting that GMI should augment A1C in guiding glycemic management decisions.

LTC is an important setting that may uniquely benefit from technology such as CGM for their particularly vulnerable older adult population (71,72). In a recently published study on French LTCs, investigators found that 45% of residents experienced severe hypoglycemia (<54 mg/dL) (73). In addition to providing more comprehensive glucose monitoring, CGM may also allow monitoring without discomfort for assisted living or nursing home residents with dementia, which may decrease behavioral and psychological symptoms (74). In addition, CGM may require less staff time than fingerstick glucose monitoring. Additional research is needed to quantify these potential benefits associated with CGM use in LTC.

Many older patients with type 1 diabetes require placement in LTC, and unfortunately, these patients can encounter staff who are less familiar with insulin pumps or CGM. Some staff may be less knowledgeable about the differences between type 1 and type 2 diabetes, and some facilities do not permit the use of CGM or insulin pumps. In these instances, the person with diabetes or their family may be more familiar with their diabetes management plan than the staff or providers. Education of relevant support staff and providers in rehabilitation and LTC settings regarding insulin dosing and use of pumps and CGM, and changes in policies that restrict uses of these devices, are recommended.

Among older adults at the end of life, CGM has provided new insights regarding the epidemiology of hypoglycemia and hyperglycemia. In a study of hospice patients with type 2 diabetes in VA LTC facilities, 12% had episodes of hypoglycemia (defined as glucose <70 mg/dL) while 9% had episodes of hyperglycemia (defined as glucose >400 mg/dL) (75). Patients who used insulin (8% of sample) were more likely to experience both hypoglycemia and hyperglycemia. Avoiding symptomatic hypo- and hyperglycemia in people nearing the end of life is challenging because these individuals are frequently eating less and losing weight. In the U.S., it is often difficult to get CGM paid for once the person enrolls in hospice, reinforcing the need for research to provide evidence of benefits to inform care guidelines and insurance coverage decisions. Potential scenarios for CGM during hospice include patients with type 1 diabetes or type 2 diabetes using insulin.

As diabetes technology is integrated into systems of care, it will be beneficial in these efforts to adopt the framework introduced by the Institute for Healthcare Improvement's 4M Age-Friendly Healthcare framework (76). The 4Ms include "what matters," "medication," "mentation," and "mobility." What matters means to know and align care with each older adult's specific health outcome goals and care preferences, including, but not limited to, end-of-life care and across settings of care. If medication is necessary, use age-friendly medication that does not interfere with goals, mobility, or mentation across settings of care. Mentation refers to the prevention, identification, treatment, and management of delirium and dementia across settings of care. Mobility reinforces the importance of ensuring that each older adult moves safely every day to maintain function and accomplish their goals. The 4M framework is highly applicable to older adults with diabetes, since all four domains may be affected directly or interactively.

SUMMARY

Growing evidence demonstrates the efficacy of CGM, insulin pumps, and closed-loop systems in reducing hypoglycemia, hyperglycemia, and glucose variability in community-dwelling adults with diabetes in their 60s, but such evidence does not exist for individuals in their 70s and 80s. Current data on technology for insulin administration are mostly limited to cognitively/functionally intact individuals. In particular, far less evidence is available on any diabetes-related technology use in complex, multimorbid, functionally impaired older adults and for those with diverse social backgrounds. There is currently low uptake of this technology among older adults due to a variety of individual, health care, and system barriers. There is a need for studies to address the following questions:

- Technology and patient-centered outcomes. What is the efficacy of CGM, insulin pump therapy, and use of hybrid closed-loop systems in reducing outcomes important in older age (falls, infections, dehydration, dizziness/falls, urinary incontinence, emergency department visits, and hospitalizations)? What is the overall effect of device use on quality of life?
- Technology integration. How can glucose-related technology be integrated with other technologies, such as remote blood pressure monitoring, cardiac monitoring, medication reminders, and behavioral health technologies, to support the needs of older adults with diabetes? What are the combined effects of multiple technologies?
- Technology in type 1 diabetes. How should utilization of CGM and insulin administration technology be adapted in older adults living with type 1 diabetes as complications, cognitive impairment, and functional impairment arise?
- Technology in type 2 diabetes. What role should technology play for non-insulin-requiring older adults with type 2 diabetes regarding behavior change and disease management?
- New metrics and targets for healthy, prefrail, and frail older adults. What are specific CGM metrics and targets for older adults with different health statuses?
- Technology deployment across health status categories. What is the efficacy and safety of diabetes technologies in clinically diverse older adult populations, including those with cognitive/functional impairment, those living in supervised facilities, and those enrolled in hospice? What are the optimal

clinical scenarios for the deployment of technology? How can we leverage caregiver support when using technology to manage diabetes in older, frailer adults?

- Barriers to adoption (providers). What interventions can increase use of technologies such as CGM in the subpopulation of older people with diabetes where technologies have been proven to be efficacious, including multilevel approaches to address barriers and integrate caregivers and community members for increased effectiveness and equitable outcomes?
- Barriers to adoption (policy). How do alternative coverage policies for diabetes technologies influence technology adoption among older adults?
- Barriers to adoption (structural inequities). What are the most impactful approaches to addressing structural inequities to reduce disparities in technology adoption in older adults? How should governmental agencies, nongovernmental organizations, and stakeholders be engaged?
- Cost implications of new technology. What is the societal and health system cost-effectiveness of incorporating new technology as part of the care of older adults with diabetes?

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