

Review Article

Reducing Health Disparities and Inequities in the Prescription and Adoption of Continuous Glucose Monitoring (CGM) Technology in Underserved Populations

David G Marrero^{1*} and James R Gavin III²

¹School of Public Health, Indiana University, USA

²Healing our Village Inc, Emory University, USA

***Corresponding author**

David G Marrero, School of Public Health, Indiana University, USA

Submitted: 23 March 2023

Accepted: 28 March 2023

Published: 29 March 2023

ISSN: 2378-9344

Copyright

© 2023 Marrero DG, et al.

OPEN ACCESS

Abstract

In this paper, we discuss issues of health disparity and health inequity that impact the prescription and use of continuous glucose monitoring (CGM) technology in populations characterized as being underserved.

INTRODUCTION

In this context, we emphasize both disparity and inequity as aligned factors that have been shown to have a negative impact of use of advanced technology in the treatment of diabetes particularly among minority populations. Health disparity is defined by the Institute of Medicine as “racial or ethnic differences in the quality of health care that are not due to access-related factors or clinical needs, preferences, and appropriateness of intervention.” Health inequity, on the other hand, was concisely defined by Margaret Whitehead as differences. In health that “are not only unnecessary and avoidable but, in addition, are considered. Unfair and unjust.” Equity in healthcare is based on the principle of making high-quality healthcare accessible to all [1].

There is increasing need to focus on identifying health disparities when considering increasing utilization of technologies that have been shown to improve clinical outcomes. Health disparities have been shown to result in poorer health outcomes for marginalized populations. They lead to increased costs for healthcare, insurers, employers, and individuals and families, as well as decreased productivity due to higher rates of sickness.² The economic burden of these health disparities in the US is staggering and projected to increase health disparities remain unchanged. Fortunately, there is increasing evidence that use of CGM can improve clinical outcomes that results in

improvements in quality of life, diabetes distress, and reductions in health care costs. Unfortunately, there is still significant health equity that inhibits the utilization of this technology in disadvantaged populations that are disproportionately burdened by diabetes [2].

CGM- THE PATH TO MANAGING DIABETES

Continuous glucose monitoring (CGM) has become the gold standard for the evidence-based assistance it provides in the clinical management of type 1 diabetes (T1D) [3,4]. Several studies have shown that using CGM results in glycemic improvements and reductions in both ketoacidosis and incidence of episodes of severe hypoglycemia. Moreover, using CGM has also been shown to improve diabetes self-management, the individual's perception of quality of life, and lessen diabetes distress [5-7]. There is rapidly growing evidence that similar benefits are realized in persons with type 2 diabetes (T2D) as well (refs). In a narrative review of studies that investigated the role that CGM might play in the management of T2D, Taylor and colleagues showed that in multiple studies, CGM use was associated with greater reductions in HbA1c, bodyweight and improvements in several indices of therapeutic self-management when compared to using older self-monitoring of blood glucose (SMBG) technology [8]. 1GM use has also been associated with reductions in diabetes -related hospitalizations and in utilization of emergency room services [8,9].

Despite these positive observations, there are significant healthcare disparities in the utilization of CGM, notably in populations who face significant socioeconomic adversity. This is of particular concern in that racially and ethnically diverse populations report greater prevalence rates of risk factors and burden from diabetes and associated complications than White populations [10-13].

The reasons for CGM use in high disparity populations are not well understood and therefore difficult to explain [11-14]. In a study by Wirunsawanya, racial differences in the use of CGM and CSII in a minority -serving and safety-net hospital were assessed [15]. Among a sample of adults with T1D, differences in the proportions of CGM users were significantly biased towards White, versus Hispanic, or Black users. In addition, beneficiaries covered by government health insurance plans had lower odds of using technology compared with individuals with private health insurance. In a review of 2020 CMS data, Issacs and colleagues reported a disproportionately low percentage of eligible African American and Hispanic beneficiaries were using CGM technology to help manage their diabetes [11]. Among the Medicare beneficiaries who acquired a CGM device between July and December 2020 ($n = 3022$), a significantly lower proportion of CGM use by African American and Hispanic beneficiaries was observed compared with White and other beneficiaries [11].

FACTORS THAT MAY CONTRIBUTE TO DISPARITIES IN USING CGM BY DIFFERENT POPULATIONS

How these disparities are best explained? The research literature addressing this issue, while growing, is still scant. However, there are reports that illuminate racial-ethnic disparities in technology use, notably with Black and Hispanic young persons with T1D reporting far less use of CGM than White persons.¹⁶⁻¹⁷ A paucity of literature exists about potential inequities in the prescription or use of CGM in adults with T2D. There are studies, however, that have suggested possible factors contributing to health disparities associated with the use of new healthcare technologies that may contribute to possible interventions when considering diverse populations these can be divided into individual, provider, and system factors.

INDIVIDUAL FACTORS

Awareness, and perceived value of CGM

Two factors that have been discussed are whether populations that have been marginalized are aware of newer care options and, if so, perceive any value to their use, especially when factoring in cost [18-20]. As new healthcare technologies are introduced, they are initially distributed to a very small number of people who are treated in healthcare facilities that participate in the experimental evaluation of such devices. There is also invariably a significant learning curve needed to optimize use of a new technology. This may be the case when considering CGM.

Historically, the adequacy of insulin treatment by people with diabetes (PWD) was determined by urine testing. This procedure was at best marginally accurate and not terribly reliable for making therapeutic decisions about insulin regulation. This was eclipsed by the introduction of self-monitoring of blood glucose

(SMBG), using test strips and glucose reading meters. Initially, this was not a widely distributed technology, and many individuals were not aware of it. This was also the case for many providers. There were also concerns about accuracy. Early systems were plagued by errors in individual technique in obtaining a proper sample, and most clinicians did not have training or experience in using self-reported glucose data to make therapeutic decisions [21-24]. For example, there was no consensus on sampling frequency or timing. In this context, most PWD were simply not aware of SMBG until the healthcare provider community accepted it, clearly understood its utility, and promoted its use. Even then, the perceived value was often questioned, especially for people with T2D. For example, for a considerable time, CMS did not provide coverage for glucose test strips for persons with T2D based on the belief that their utility in making therapeutic decisions was not well established. This belief was supported by studies showing little or no benefit of SMBG in individuals with type 2 diabetes who were treated with non-insulin therapies [22]. Thus, persons with T2D were not largely informed about SMBG.

CGM is now emerging from its early implementation and utility value phase. The first marketable transdermal implantable glucose sensors occurred in 1999 and early 2000. As was the case in SMBG, early sensors had limited clinical utility and were plagued by significant drift in sensitivity over the initial FDA-approved three-day implantation period [23,24]. As Didyuk and colleagues noted, noted, "Given the superior in vitro performance, this in vivo sensor output drift was unexpected such that enthusiasm waned even within the scientific community in these early continuous glucose monitoring days" [25]. As a result, most persons with diabetes (PWD) were not aware of CGM until the technology evolved. Increasing research has shown that CGM accuracy has significantly improved [26]. It is now accepted by most providers and supported by a growing body of literature that that CGM can improve quality of life by allowing informed diabetes management decisions. In this context, a lack of awareness about the potential value of CGM is rapidly diminishing [27].

Personal perceptions impacting acceptance

Many individuals' experience a variety of personal factors that can impact their willingness to use therapeutic technologies like CGM but are not routinely associated with standard health inequity issues. This includes the presence of different physical disabilities such as poor vision or impaired hand function that can affect both education and device placement [27]. Others may have concerns with having a device attached to their body or had a negative experience with a previous trial of diabetes technology [27,28]. Declining cognitive function and memory loss can also impair CGM adoption that requires connectivity to an external device to see and utilize the glucose data generated [29].

Some factors that do contribute decisions about utilizing CGM technology are more frequently observed in underserved populations. These include limited health literacy/numeracy or limited digital literacy, and reduced access to either smart phone or computer access [30,31]. In addition, there is often discordance in language between PWDs and providers. This complicates both explanation s about the potential benefits of CGM and education about its appropriate use [32].

Low socioeconomic status

The prevalence of diabetes and its associated complications has repeatedly been shown to be correlated with race, ethnicity, and socioeconomic status (SES) [33-37]. This is true for any system that conducts surveillance of diabetes incidence and prevalence including the Centers for Medicare and Medicaid services (CMS) and the Kaiser Foundation [38-40]. The Kaiser Foundation reported in 2021 that over 50% of their beneficiaries who were either Black or Hispanic had family income below the poverty threshold [40]. Naturally, low family incomes challenge the acquisition of CGM technology.

Cost

The expense of CGM is also an important factor that can inhibit its adoption, particularly among persons with low economic status. This was initially the case with SMBG technologies, which were expensive and required ongoing costs for obtaining glucose testing strips. Cost was (and continues to be) particularly an issue in disenfranchised communities that frequently suffer from poor economic status and often must make hard economic decisions about how they must use their money. When considering SMBG technology, in many cases, even though people understood the value of the technology, they simply could not afford it. It is still not uncommon to see in low-income communities posted handbills advertising sale on individual or small quantities of glucose test strips [41].

CGM costs more than SMBG technology. As a result, cost remains a barrier to adoption of CGM by low-income populations. CGM clearly requires a higher initial investment than SMBG, however, the greater health benefits of improved glucose values present an argument that long-term health benefits of CGM are cost-effective when compared to daily use of test strips [42-45]. Nevertheless, a consensus on CGM and cost-effectiveness has not yet been reached [46]. Complicating this situation is the fact that SMBG technology can still be effectively used to support clinical decision making and thus, can be viewed as a cheaper alternative to CGM. Of course, SMBG relies on appropriate use by the PWD to enable their providers to extract actionable information from the data. Thus, in many ways, there is greater dependence on user behavior for SMBG than for CGM, increasing the challenge of generating comprehensive glucose data routinely for promotion of optimal clinical decision-making.

Access to appropriate healthcare providers

From a population health perspective, even the best diabetes technology does not meet its purpose if those who need it most are not able to access appropriate healthcare to either access it or utilize its data. There is considerable literature demonstrating that low socioeconomic status has a negative impact on obtaining optimal medical services [38,39,47-53]. This is linked to a lack of insurance coverage and ultimately cost associated with treatment. Compounding this problem is a growing lack of healthcare providers within low-income communities. It has been reported that persons living in low-income areas tend to have fewer primary care physicians in their communities than persons residing in higher-income areas [47-53]. This problem according to the Association of American Medical Colleges is

expected to get worse with a national shortfall of physicians by 2032 [54]. In light of the ongoing shortage of medical students from underrepresented minority populations, who disproportionately tend to practice in underserved communities, this projected shortfall may have even greater impact in low-income communities [54].

Quality of healthcare received

A compounding issue that may intensify the health disparity resulting from fewer healthcare providers is the quality of care delivered in communities that have been marginalized. An early indicator of this was reported by Pihoker et al. who showed that people with T1D covered by Medicaid were more likely to be treated with less-intensive insulin therapy [55]. Moreover, there was evidence of fewer adjustments to their insulin when compared to persons with private insurance, and a significant disparity between White people and individuals of color. Similar observations of disparities in quality of clinical outcomes in youth with T1D have been reported for individuals with low SES and poor coverage by Public Health plans. The outcomes include diminished quality of life [37,56]. Previous studies have also shown that individuals in lower income racially and ethnically diverse populations receive lower quality of healthcare, fewer preventive health services, compared with those who are White [56,57].

HEALTHCARE PROVIDER FACTORS

Health care providers also contribute to disparities in the utilization of CGM, especially with regards to populations experiencing disadvantage. Providers may not be sufficiently aware of CGM or the value of CGM data in the therapeutic decision process. There is a growing awareness that there is a need to provide provider training to integrate CGM into their clinical management options offered to PWD [58-60]. CGM utilization can also be inhibited by perceived barriers to prescribing CGM and the impact of implicit bias on CGM prescribing practices [60].

Awareness and perceived value

CGM has been embraced by endocrinologists [4]. Indeed, the American Diabetes Association (ADA) in its Standards of Medical Care in Diabetes recommends CGM for people with any form of diabetes and a variety of insulin regimens, and even for some people with T2D on non-insulin regimens [61]. The Endocrine Society Clinical Practice Guidelines and the American Association of Clinical Endocrinology also recommend CGM for all people with diabetes to maximize ability to achieve therapeutic goals [4,60].

There is encouraging growth in acceptance of CGM among primary care providers, who care for most persons with T2D, but utilization levels are still not universal. In a survey of 632 primary care providers, the majority who were family practice physicians, only 1.0% had never heard of CGM. However, 46.6% had seen people using CGM and only 38% had ever prescribed a CGM device. Consistent with the growing acceptance of CGM technology, 89.5% of the sample reported they were at least somewhat likely to prescribe CGM in the future [62].

The same survey explored PCP confidence in using CGM to

manage T1D and T2D. Investigators reported that previous experience with CGM prescribing, years since training, and payer mix were predictive of increased confidence using CGM for PWD. In addition, working in a practice with more than 50% of people covered by Medicare significantly increased provider confidence using CGM to manage T1D and T2D compared with those in practices with 25% or less individuals with Medicare coverage. When considering the management of T2D, having >16 years in practice was significantly related to greater confidence using CGM to manage T2D compared to those with fewer years since training [62].

Using the data in the therapeutic decision process; the need for training

The ability of CGM to present almost continuous glucose data and to enable calculation of such diagnostic and decision-making tools as time in glucose range has expanded and challenged how providers make therapeutic decisions [63]. This is significantly different than what has been the standard in assessing adequacy of self-management; the use of self-recorded SMBG measures. The sudden expansion of data does require a new learning paradigm to be utilized optimally in clinical management. It is therefore not surprising that in the Osler survey, most respondents (72.3%) indicated that they would be moderately or very likely to prescribe CGM with CGM education training/workshops [62]. Respondents reported conferences and meetings to be most effective for learning. Moreover, the American Association of Family Physicians (AAFP) was identified as a top educational resource. As Osler et al note: "The AAFP was identified as a top resource. The AAFP's Transformation In Practice Series online educational module on CGM is designed to help clinicians and teams learn how to identify individuals who would qualify for and benefit from CGM, develop shared decision-making plans for those people, and use CGM data to inform treatment [64]. Given the prevalence of respondents who turn to the AAFP for information about diabetes, this may be a valuable tool to address this training need."

Implicit bias and attitudes about technology implementation among healthcare providers

When considering the adoption of new, complex, and expensive technologies in healthcare, racial, ethnic, and SES stereotypes may impact healthcare providers' attitudes and behaviors. There is a robust literature showing that such stereotypes can result in biases in healthcare regarding treatment [65]. Given that diabetes clinical management is a significantly influenced by patient lifestyle, stigma may be influencing how people view the disease and, in turn, how the disease is treated. A common stigma in diabetes is the perception that people with diabetes are responsible for developing their diabetes [66]. This can result in negative perceived attributions by health care professionals, friends, and family and often include the attribution that persons with diabetes are "not terribly intelligent" [67]. Such attributions may impact provider's willingness to prescribe diabetes technologies that require greater knowledge and skill to learn and utilized. Moreover, such biases may be implicit. In a

meta-analysis conducted by Fitzgerald and Hurst, several studies illuminated evidence of implicit biases among physicians and nurses [65].

While difficult to measure, there is increasing recognition of and concern about implicit bias in healthcare provider and patient interactions. For example, it has been shown that African American individuals perceived poorer treatment related to patient-centeredness and communications with their healthcare provider [65,68,69].

The extent to which implicit bias impacts individuals' receptivity to adopting new treatment methods such as using CGM or provider decisions to prescribe CGM is not known. Still the potential impact needs to be considered. In an interesting study by Agarwal and colleagues that investigated provider attitudes towards prescribing new technologies to underserved populations, they reported that "providers detailed their own possible biases, noting real unconscious bias specifically related to the ability of to "handle technology." They detailed several barriers to traditional self-management for individuals who are underserved that made them hesitant to prescribe technology, such as education gaps, literacy limitations, inconsistent clinic attendance rates, and management of social determinants" [61]. In addition to provider's views about individual capacity, most reported that limited clinical time made the time they felt necessary to fully introduce technology and that "the perceived extra outreach they would need to provide to underserved patients to use technology" was also a major barrier to prescribing [70].

SYSTEM FACTORS: BARRIERS FOR CGM PRESCRIPTIONS

Difficulty in obtaining CGM for PWD

A growing number of studies have suggested that many healthcare systems and notably insurance companies provided little to no support with insurance paperwork needed for PWD to qualify for appropriate technology use that prevented them from pursuing this technology for many people [71,72]. Other nonphysician members and many provider groups, notably social workers and community health workers point out that individuals from underserved communities needed extra clinical and administrative support that was not available. This was particularly the case in adult healthcare systems [70]. Importantly, most healthcare providers did not feel equipped to screen for or manage social needs necessary for individuals facing social adversity to successfully initiate or continue use of technology.

Restrictive coverage eligibility criteria

A significant obstacle to CGM use is requirements for some people to meet to obtain insurance coverage for CGM. This is particularly the case for Medicaid beneficiaries that provide insurance coverage for a significant proportion of underrepresented populations. According to the Centers for Medicare & Medicaid Services (CMS), 87,384,715 individuals are enrolled in Medicaid and Children's Health Insurance Programs (CHIP); [73] and a significant percentage are from underrepresented populations; Black (32.0%) and Hispanic

(30.0%) beneficiaries comprise the largest percentage of the Medicaid population [74].

Of concern, despite advances in diabetes technologies, like CGM, that are associated with improved glycemic status that improve both clinical and patient quality of life, there are higher rates of glucose variability, disability, depression, and comorbidities among Medicaid beneficiaries compared with individuals covered by Medicare or commercial health plans [75,76]. Requirements in place by CMS for receiving CGM coverage present a unique barrier to utilization by many populations that suffer from access to more optimal healthcare. In many states, a person with diabetes who is covered by Medicaid can only qualify for CGM if they are under the care of a board-certified endocrinologist who is enrolled in the Medicaid program [77]. Unfortunately, in some states the underrepresented populations do not have such healthcare providers residing in proximity to their communities; there is simply limited or lack of access to a board-certified endocrinologist. Moreover, although Medicaid is administered through CMS, there is no consistent Medicaid policy for CGM coverage in the U.S [78].

Excessive documentation requirements for demonstrating medical necessity

As noted by Isaacs and colleagues, "Obtaining approval for CGM coverage requires the prescribing healthcare provider to submit extensive data to support their claim for medical necessity. Although most endocrinology practices are equipped to provide this documentation, many primary care physicians are hesitant or lack the staffing to meet these requirements. Because most PWD with lower socioeconomic status are not treated by an endocrinologist, they are at a further disadvantage for obtaining CGM [11].

This observation was supported by a 2017 survey by the American Medical Association. Of 1000 primary care physicians, 92% reported that the documentation required to obtain authorization for medications and medical devices both delays treatment and negatively affects clinical outcomes [79]. It was also noted that the perceived extra outreach they would need to provide to individuals who are underserved to use technology was also a major barrier to prescribing new technologies. Clearly changes in documentation requirements are needed to reduce some of the disparities observed in using CGM technology [78].

Solutions for reducing disparities in utilization of CGM technology

Considerable research and clinical experience demonstrate that using CGM in diabetes has several advantages for PWD and providers. As a result, CGM is now considered the Gold Standard for the management of T1D and for T2D treated with intensive insulin therapy [61,80,81]. Health disparities, however, continue to influence the utilization of CGM, particularly in populations that are under-resourced. This continues a long history of inequities based on race/ethnicity. Moreover, socioeconomic status appears to contribute to health disparities, with implicit bias affecting individuals living in poverty. This is certainly the case prescribing

CGM technology, where those from ethnic minority backgrounds and those in areas of highest deprivation are least able to access or benefit from such technological advancements.

What are strategies that should be considered to reduce or even eliminate such disparities? There is a dearth of research that addresses this important topic. Agarwal and colleagues implemented user-centered design principles in a series of workshops comprised of multidisciplinary collaborators in diabetes treatment [70]. These included PWD with histories of health disparities; endocrinology and primary care physicians; nurses; diabetes care and education specialists; psychologists; and community health workers. There were two goals of these workshops. First was to review barriers reported by PWD to accessing diabetes technology, including social determinants of health [82-85], low social support [86-88], structural racism [89-91], and inequities in healthcare delivery [92,93], lost opportunities for building rapport with providers, and inability to follow traditional diabetes care guidelines [70]. The second goal was to get the mixed groups to co-create interventions to increase technology use among populations that are underserved with T1D.

This multifaceted group of partners had several suggestions to reduce disparities in the prescription and adoption of technology in diabetes. These included:

- Address provider bias, however, bias training would not suffice. Partners discussed that the approach to educate and discuss technology had to be changed dramatically to include more hands-on and visual instructions and demos to bypass bias.
- Partnering with device companies to obtain product demonstrations and device trials was suggested to help "demystify technology for patients" and enhance practice ability to make technology feel more accessible.
- Have industry partners provide healthcare members with staff training and onboarding onto devices to increase provider ability to offer and support technology use.
- Provide training opportunities for providers to role play technology introductory conversations so that they could identify language or presentation formats that inadvertently promotes implicit bias. Further, it was suggested that bilingual low-literacy visual educational aids on diabetes technology devices be utilized. Although some of these materials are available in English and Spanish, they are used sparingly in practice.
- Health Insurance Companies: Partner with company executives to discuss research to support CGM use to optimize diabetes management, lower risk factors and cost savings data

This group acknowledged social determinants of health have significant impact on care strategies and often receive lower quality care and suffer from worse health outcomes [61,62]. This observation varied with the role of a specific partner in the clinical environment. Providers acknowledged that they often

lacked the expertise to assess or help manage social needs that act as barriers to technology use [97]. Community health workers however, noted that they were better positioned to help assess social needs and introduce technology in a culturally responsive and less time-pressured way. In this context, effective solutions may benefit from transformations in the clinical setting by effective collaboration among the health care team

This group also suggested that system-level interventions were needed to eliminate current practices that make providers prone to prescribing biases. It was suggested that promoting a “mission of equity” into the clinical setting that both standardized care approaches and offered specialized tailoring to populations that are underserved was needed [94-98].

Additionally, this group emphasized the positive influence of social support, especially from family to increase receptivity to new technologies. This observation is supported by several studies that have demonstrated that inclusion of diabetes support networks in medical care results in higher engagement, improved medical and psychological outcomes, and better cultural competency [99,100]. The authors of this study noted: “Thus, across the lifespan, it may be imperative to include family members and other support systems for diabetes technology initiation and management, especially given the real-time and complex self-management demands a new technological treatment may require.”

A recent work by Mathias and colleagues also used multilevel partner input to assess whether addressing structural healthcare barriers would change provider prescribing behaviors to make CGM access more equitable.⁵⁹ Their focus on enhancing prescriptions assumed that in order to reduce disparities in CGM use, they first needed to increase the prescription of CGM in disadvantaged populations. To accomplish this, they developed a new T1D clinic with a mandate of reducing health disparities, conducted social needs assessments and management with a cohort that included many persons experiencing disadvantage, provided training of support staff to place trial CGMs at the point of care, educated providers on CGM, and attempted to optimize CGM prescription workflows. They examined the impact of these system interventions by assessing aggregate data from the electronic medical record (EMR) and performing multiple linear regressions to examine and compare change in CGM prescriptions over the 3 years period.

Their study included a cohort of 1,357 adults with T1D, which included extensive representation of 406 Black (30%), 612 Hispanic (45%), and 164 White (12%) individuals; 1,004 (74%) were publicly insured. The efforts to improve prescriptions were significantly effective; CGM prescription rates increased overall from 15% to 69%. Moreover, improvements were seen equally among Black (12% to 72%), Hispanic (15% to 74%), and White adults (20% to 48%).

Based on this experience, the authors offered multiple recommendations as to how to reduce CGM disparities. These included:

- starting a specialty T1D clinic to centralize expertise,
- embedding a social needs coordinator shared with

primary care to address social barriers

- training support staff on CGM placement to offload provider burden and enable a device trial program,
- changing prescribing workflows to become more efficient,
- Expanding provider CGM education and awareness of bias.

Based on their data, they concluded that “despite having limited resources and caring for a diverse population, the majority of whom are underserved with complex social and psychological needs, our practice transformations resulted in a fourfold increase in CGM prescription rates over 3 years. Importantly, these changes were not grant funded and, hence, were carried out through repurposing existing resources and leveraging outside support to enable and sustain these transformations over time.”

This study attacked inequities beyond managing or adjusting care for social determinants and socioeconomic status. Instead, it focused at both the healthcare system and provider levels. The authors suggest that these transformations are easily translatable to primary care settings with the potential to reduce disparities in CGM use in the real world on a larger scale.

8. Conclusion

Diabetes continues to be a major public health problem that exerts significant burden on both public and private health systems. Of particular concern, it has also been documented that the prevalence of diabetes and its comorbidities is greatest in populations that experience medical disadvantages; people of color and/or low socioeconomic status. Thus, it is increasingly important that these individuals have access to high quality care for their diabetes.

In this context, there is substantial evidence that CGM technology improves the clinical outcomes of both type 1 and 2 diabetes and reduces costs associated with poor control [97-101]. In spite of this, CGM use is disproportionately low among individuals in racial/ethnic and low socioeconomic populations.

There are several factors that contribute to this. Some center on the individual patient, others by their health care providers, and the systems which support their care. They collectively argue for a more social ecological approach to address these discrepancies. At the individual level, there is a greater need to tailor education and training to meet the social determinants that are known to impact care decisions among medically disadvantaged and culturally distinctive populations. In addition, there remains a digital divide that limits access technology dependent systems to those who do not have access to smart phone technology or computers. There are also issues related to language and cultural congruence between many patients and providers.

At the provider level, greater training is needed to address implicit biases, which continue to impact medical decisions about therapy and inhibit optimal shared decision making. There is also greater need for providing training in the utilization of CGM data, which, due to the sheer volume and frequency of glucose data, that if well understood, provides unprecedented ability to conceptualize treatment effectiveness and to make more precise decisions about therapeutic options.

At the system level, there is clearly a need to simplify the process for prescribing CGM technology. This includes reductions in the restrictive eligibility requirements and changes in the documentation requirements required for prescriptions. A study by the American Medical Association showed that, 92% of the 1,000 clinicians surveyed reported that the documentation required to get authorization for medications and medical technology delayed patient treatment and negatively affected clinical outcomes.⁷⁹ Moreover, there needs to be greater emphasis on providing CGM to the populations that would have the greatest benefit: individuals in racial/ethnic and low socioeconomic populations that suffer disproportionately from the prevalence of diabetes and its complications but have significantly lower utilization of CGM. In many cases, this will require significant policy changes in patient benefit status.

Diabetes is a pervasive and serious disease that inflicts considerable fiscal, community, and personal burden. The good news is that there have been considerable advances in the treatment of diabetes that have made significant reductions in these burdens. There remain, however, considerable health inequities in the U.S. that prevent many persons, especially minority and low SES populations, to access newer technologies that would benefit their overall wellbeing. In this context, limiting access to CGM to any population with diabetes is neither cost-effective or clinically efficacious.

Who should lead the charge?

There is a long history of factors that have contributed to the development of health disparities so reducing them will not be a simple or quick process. There is clearly a growing need to mount a coordinated, multifaceted effort to reduce health inequities, especially as they relate to the adoption of new clinical technologies. We need to develop more focused and tailored education about best practices that targets both the diverse populations of persons with diabetes and to their providers. This will require using new educational approaches such as social media and using more traditional approaches such as in office education, seminars, and presentations at national meetings. In this context, a variety of organizations that focus on patient and provider support need to increase their involvement, including the American Diabetes Association and Juvenile Diabetes Research Foundation, the Diabetes Care and the Diabetes Technology Society. In addition, pharmaceutical organizations can play a greater role in supporting the reduction of health disparities. Finally, there needs to be greater emphasis on lobbying third party payment systems to create policies to reduce structural barriers that continue to impede adoption of new technologies such as CGM.

ACKNOWLEDGMENTS

The authors wish to thank Wahida Karmally and Jasmine Conzalvo for their review and helpful comments for this manuscript

REFERENCES

- Whitehead M. The concepts and principles of equity and health. *Int J Health Serv.* 1992; 22: 429-45.
- Sentinel Event Alert: Addressing health care disparities by improving quality and safety. A complimentary publication of The Joint Commission. 2021.
- Beck RW, Hirsch IB, Laffel L, Tamborlane WV, Bode BW, Buckingham B, et al. The effect of continuous glucose monitoring in well controlled type 1 diabetes. *Diabetes Care* 2009; 32: 1378-1383.
- Peters AL, Ahmann AJ, Battelino T, Evert A, Hirsch IB, Murad MH, et al. Diabetes technology—continuous subcutaneous insulin infusion therapy and continuous glucose monitoring in adults: an Endocrine Society Clinical Practice Guideline. 2016; 101: 3922-3937.
- Ruedy KJ, Parkin CG, Riddelsworth TD, Graham C, Diamond Study Group. Continuous glucose monitoring in older adults with type 1 and T2D using multiple daily injections of insulin: results from the DIAMOND Trial. *J Diabetes Sci Technol.* 2017; 11: 1138-1146.
- Laffel LM, Kanapka LG, Beck RW, Bergamo K, Clements MA, Criego A, et al; CGM intervention in teens and young adults with type 1 diabetes (CITY) Study Group; CDE10. Effect of continuous glucose monitoring in glycemic control in adolescents and young adults with type 1 diabetes: a randomized control trial. *JAMA.* 2020; 323: 2388-2396.
- Hommel E, Olsen B, Battelino T, Conget I, Schütz-Fuhrmann I, Hoogma R, et al. Impact of continuous glucose monitoring on quality of life, treatment satisfaction, and use of medical care resources: analyses from the SWITCH study. *Acta Diabetol.* 2014; 51: 845-851.
- Taylor PJ, Thompson CH, Brinkworth GD. Effectiveness and acceptability of continuous glucose monitoring for T2D management: A narrative review. *J Diabetes Investig.* 2018; 9: 713-725.
- Karter AJ, Parker MM, Moffet HH, Gilliam LK, Dlott R. Association of Real-time Continuous Glucose Monitoring With Glycemic Control and Acute Metabolic Events Among Patients With Insulin-Treated Diabetes. *JAMA.* 2021; 325: 2273-2284.
- Reaven P, Newell M, Rivas S, Zhou X, Norman GJ, Zhou J. 1138-P: Impact of Continuous Glucose Monitoring (CGM) on Glycemic Control and Acute Complications in T2D (T2D) in the Veterans Health Administration (VHA). *Diabetes.* 2022; 71: 1138-P.
- Issacs D, Bellini NJ, Biba U, Cai A, Close KL. Health Care Disparities in Use of Continuous Glucose Monitoring. *Diabetes Technol Ther.* 2021; 23: S-81-S-87.
- Lai CW, Lipman TH, Willi SM, Hawkes CP. Racial and Ethnic Disparities in Rates of Continuous Glucose Monitor Initiation and Continued Use in Children with type 1 diabetes. *Diabetes Care.* 2021; 44: 255-257.
- Agarwal S, Schechter C, Gonzalez J, Long JA. Racial-Ethnic Disparities in Diabetes Technology use Among Young Adults with type 1 diabetes. *Diabetes Technol Ther.* 2021; 23: 306-313.
- Burnside MJ, Williman JA, Davies HM, Jeffries CA, Paul RG, Wheeler BJ, et al. Inequity in access to continuous glucose monitoring funding: A cross sectional population study of children with type 1 diabetes in New Zealand. *Lancet Reg Health West Pac.* 2022; 31: 100644.
- Wirunsawanya K, Rizo I, Fantasia K. OR30-03 Racial differences in technology use among type 1 diabetes in a safety-net hospital. *J Endocr Soc.* 2020; 4: OR30-03.

16. Agarwal S, Schechter C, Gonzalez J, Long JA: Racial-ethnic disparities in diabetes technology use among young adults with type 1 diabetes. *Diabetes Technol Ther.* 2021; 23: 306–313.
17. Foster NC, Beck RW, Miller KM, Clements MA, Rickels MR, DiMeglio LA, et al. State of type 1 diabetes management and outcomes from the type 1 diabetes exchange in 2016–2018. *Diabetes Technol Ther.* 2019; 21: 66–72.
18. Agarwal S, Crespo-Ramos G, Long JA, Miller VA. “I Didn’t Really Have a Choice”: Qualitative Analysis of Racial-Ethnic Disparities in Diabetes Technology Use Among Young Adults with type 1 diabetes. *Diabetes Technol Ther.* 2021; 23: 616–622.
19. Fantasia KL, Wirunsawanya K, Lee C, Rizo I. Racial Disparities in Diabetes Technology use and outcomes in type 1 diabetes in a Safety-Net Hospital. *J Diabetes Sci Technol.* 2021; 15: 1010–1017.
20. Franklin V. Influences on Technology Use and Efficacy in type 1 diabetes. *J Diabetes Sci Technol.* 2016; 10: 647–55.
21. Tonyushkina K, Nichols JH. Glucose meters: a review of technical challenges to obtaining accurate results. *J Diabetes Sci Technol.* 2009; 3: 971–80.
22. Farmer A, Wade A, Goyder E, Yudkin P, Frenh D, Craven A, et al. Impact of self monitoring of blood glucose in the management of patients with non-insulin treated diabetes: open parallel group randomised trial. *BMJ.* 2007; 335: 132.
23. Gerritsen M, Jansen JA, Kros A, Vriezema DM, Sommerdijk NA, Nolte RJ, et al. Influence of inflammatory cells and serum on the performance of implantable glucose sensors. *J Biomed Mater Res.* 2001; 54: 69–75.
24. Gerritsen M, Jansen JA, Lutterman JA. Performance of subcutaneously implanted glucose sensors for continuous monitoring. *Neth J Med.* 1999; 54: 167–179.
25. Didyuk O, Econom N, Guardia A, Livingston K, Klueh U. Continuous Glucose Monitoring Devices: Past, Present, and Future Focus on the History and Evolution of Technological Innovation. *J Diabetes Sci Technol.* 2021; 15: 676–683.
26. Gerritsen M. Problems associated with subcutaneously implanted glucose sensors. *Diabetes Care.* 2000; 23: 143–145.
27. Wisniewski N, Klitzman B, Miller B, Reichert WM. Decreased analyte transport through implanted membranes: differentiation of biofouling from tissue effects. *J Biomed Mater Res.* 2001; 57: 513–521.
28. Abel PU, Woedtke TV. Biosensors for in vivo glucose measurement: can we cross the experimental stage. *Biosens Bioelectron.* 2002; 17: 1059–1070.
29. Pearce KL, Noakes M, Wilson C, Clifton P. Continuous Glucose Monitoring and Cognitive performance in Type 2 Diabetes. *Diabetes Technol Ther.* 2012; 14: 1123–33.
30. Chehregosha H, Khamseh ME, Malek M, Hosseinpanah F, Ismail-Beigi F. A view beyond HbA1c: role of continuous glucose monitoring. *Diabetes Ther.* 2019; 10: 853–863.
31. Karakuş KE, Sakarya S, Mutlu GY, Berkkan M, Can E, Eviz E, et al. Benefits and Drawbacks of Continuous Glucose Monitoring (CGM) Use in Young Children With type 1 diabetes: A Qualitative Study From a Country Where the CGM Is Not Reimbursed. *J Patient Exp.* 2021; 8.
32. Liu C, Wang D, Liu C, Jiang J, Wang X, Chen H, et al. What is the meaning of health literacy? A systematic review and qualitative synthesis. *Fam Med Community Health.* 2020; 8: e000351.
33. Mayberry LS, Kripalani S, Rothman RL, Osborn CY. Bridging the digital divide in diabetes: family support and implications for health literacy. *Diabetes Technol Ther.* 2011; 13: 1005–12.
34. Fernandez A, Schillinger D, Warton EM, Adler N, Moffet HH, Schenker Y, 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.
35. Howard G, Anderson RT, Russell G, Howard VJ, Burke GL. Race, socioeconomic status, and cause-specific mortality. *Ann Epidemiol.* 2000; 10: 214–223.
36. Wong MD, Shapiro MF, Boscardin WJ, Ettner SL. Contribution of major diseases to disparities in mortality. *N Engl J Med.* 2002; 347: 1585–1592.
37. Golden SH, Brown A, Cauley JA, Chin MH, Gary-Webb TL, Kim C, et al. Health disparities in endocrine disorders: biological, clinical, and nonclinical factors--An Endocrine Society Scientific Statement. *J Clin Endocrinol Metab.* 2012; 97: E1579–63.
38. Hassan K, Loar R, Anderson BJ, Heptulla RA. The role of socioeconomic status, depression, quality of life, and glycemic control in type 1 diabetes mellitus. *J Pediatr.* 2006; 149: 526–531.
39. Nguyen KH, Sommers BD. Access and Quality of Care by Insurance Type for Low-Income Adults Before the Affordable Care Act. *Am J Public Health.* 2016; 106: 1409–1415.
40. Nguyen CA, Chernew ME, Ostrer I, Beaulieu ND. Comparison of healthcare delivery systems in low- and high-income communities. *AMJC* 2019; 7: 11–18.
41. Racial and Ethnic Health Inequities and Medicare. Kaiser Family Foundation. February 2021.
42. “The strange Marketplace for Diabetes Test Strips” the New York Times. January 14, 2019.
43. Wan W, Skandari MR, Minc A, Nathan Ag, Winn A, Zarei P, O’Grady M, et al. Cost-effectiveness of continuous glucose monitoring for adults with type 1 diabetes compared with self-monitoring of blood glucose: the DIAMOND randomized trial. *Diabetes Care.* 2018; 41: 1227–1234.
44. Chaugule S, Graham C. Cost-effectiveness of G5 Mobile continuous glucose monitoring device compared to self-monitoring of blood glucose alone for people with type 1 diabetes from the Canadian societal perspective. *J Med Econ.* 2017; 20: 1128–1135.
45. Health Quality Ontario. Continuous monitoring of glucose for type 1 diabetes: a health technology assessment. *Ont Health Technol Assess Ser.* 2018; 18: 1–160.
46. Huang ES, O’Grady M, Basu A, Winn A, John P, Lee J, et al. The cost-effectiveness of continuous glucose monitoring in type 1 diabetes.

- Diabetes Care. 2010; 33: 1269-1274.
47. Garcia-Lorenzo B, Rivero-Santana A, Vallejo-Torres L, Castilla-Rodríguez I, Gracia-Perez S, Perestelo-Perez, et al. Cost-effectiveness analysis of real-time continuous monitoring glucose compared to self-monitoring of blood glucose for diabetes mellitus in Spain. *J Eval Clin Pract.* 2018; 24: 772-781.
 48. Smith JP. Healthy Bodies and Thick Wallets: The Dual Relation Between Health and Economic Status. *J Econ Perspect.* 1999; 13: 114-66.
 49. Wayne N, Perez DF, Kaplan DM, Ritvo P. Health Coaching Reduces HbA1c in Type 2 Diabetic Patients From a Lower-Socioeconomic Status Community: A Randomized Controlled Trial. *J Med Internet Res.* 2015; 17: e224.
 50. Acerini C. The rise of technology in diabetes care. Not all that is new is necessarily better. *Pediatr Diabetes.* 2016; 17: 168-173.
 51. Katz SJ, Hofer TP, Manning WG. Hospital utilization in Ontario and the United States: the impact of socioeconomic status and health status. *Can J Public Health.* 1996; 87: 253-256.
 52. Katz SJ, Hofer TP. Socioeconomic disparities in preventive care persist despite universal coverage. breast and cervical screening in Ontario and the United States. *JAMA* 1994; 272: 530-534.
 53. Alter DA, Naylor CD, Austin P, Tu JV. Effects of socioeconomic status on access to invasive cardiac procedures and on mortality after acute myocardial infarction. *N Engl J Med.* 1999; 341: 1359-1367.
 54. Okoro CA, Strine TW, Young SL, Balluz LS, Mokdad AH. Access to healthcare among older adults and receipt of preventive services. Results from the behavioral risk factor surveillance system, 2002. *Prev Med.* 2005; 40: 337-343.
 55. The complexities of physician supply and demand: projections from 2018 to 2033. Association of American Medical Colleges. 2018-2023.
 56. Pihoker C, Badaru A, Anderson A, Morgan T, Dolan L, Dabelea D, et al. Insulin regimens and clinical outcomes in a type 1 diabetes cohort: the SEARCH for Diabetes in Youth study. *Diabetes Care.* 2013; 36: 27-33.
 57. Canedo JR, Miller ST, Schlundt D, Fadden MK, Sanderson M. Racial/ethnic disparities in diabetes quality of care: the role of healthcare access and socioeconomic status. *J Racial Ethn Health Disparities.* 2018; 5: 7-14.
 58. Miller EM. Using Continuous Glucose Monitoring in Clinical Practice. *Clin Diabetes.* 2020; 38: 429-438.
 59. Agency for Healthcare Research and Quality. National Healthcare Quality Report (NHQR) 2010.
 60. Mathias P, Mahali LP, Agarwal S. Targeting Technology in Underserved Adults With type 1 diabetes: Effect of Diabetes Practice Transformations on Improving Equity in CGM Prescribing Behaviors. *Diabetes Care.* 2022; 45: 2231-2237.
 61. Garber AJ, Handelsman Y, Grunberger G, Einhorn D, Abrahamson MJ, Barzilay JI, et al. CONSENSUS STATEMENT BY THE AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS AND AMERICAN COLLEGE OF ENDOCRINOLOGY ON THE COMPREHENSIVE TYPE 2 DIABETES MANAGEMENT ALGORITHM-2020 EXECUTIVE SUMMARY. *Endocr Pract.* 2020; 26: 107-139.
 62. ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. American Diabetes Association: Diabetes Technology: Standards of Medical Care in Diabetes-2023. *Diabetes Care.* 2023; 46: S111-S127.
 63. Osler TK, Hall TL, Dickinson LM, Callen E, Carroll JK, Nease Jr DE, et al. Continuous Glucose Monitoring in Primary Care: Understanding and Supporting Clinicians' Use to Enhance Diabetes Care. *Ann Fam Med.* 2022; 20: 541-547.
 64. Saboo B, Kesavadev J, Shankar A, Krishna MB, Sheth S, Patel V, et al. Time-in-range as a target in T2D: An urgent need. *Heliyon.* 2021; 7: e05967.
 65. Continuous glucose monitoring (CGM): enhancing diabetes care, workflows, education, and payment. *AAFP TIPS.* 2022.
 66. FitzGerald C, Hurst S. Implicit bias in healthcare professionals: a systematic review. *BMC Med Ethics.* 2017; 18: 19.
 67. Liu NF, Brown AS, Younge MF, Guzman SJ, Close KL, Wood R, et al. Stigma in people with type 1 or type 2 diabetes. *Clin Diabetes.* 2017; 35: 27-34.
 68. Beverly EA, Guseman EH, Jensen LL, Fredricks TR. Reducing the Stigma of Diabetes in Medical Education: A Contact-Based Educational Approach. *Clin Diabetes.* 2019; 37: 108-115.
 69. Chapman EN, Kaatz A, Carnes M. Physicians and implicit bias: how doctors may unwittingly perpetuate healthcare disparities. *J Gen Intern Med.* 2013; 28: 1504-10.
 70. Zestcott CA, Blair IV, Stone J. Examining the Presence, Consequences, and Reduction of Implicit Bias in Health Care: A Narrative Review. *Group Process Intergroup Relat.* 2016; 19: 528-542.
 71. Agarwal S, Crespo-Ramos G, Leung SL, Finnan M, Park T, McCurdy K, et al. Solutions to Address Inequity in Diabetes Technology Use in Type 1 Diabetes: Results from Multidisciplinary Stakeholder Co-creation Workshops. *Diabetes Technol Ther.* 2022; 24: 381-389.
 72. Butkus R, Rapp K, Cooney TG, Engle LS. Health and Public Policy Committee of the American College of Physicians. Envisioning a better U.S. Healthcare System for All: Reducing Barriers to Care and Addressing Social Determinants of Health. *Ann Intern Med.* 2020; 172: S50-S59.
 73. Collins SR, Gunja MZ, Doty MM. How well does insurance coverage protect consumers from healthcare costs? Findings from the Commonwealth Fund Biennial Health Insurance Survey, 2016. *The Commonwealth Fund.* 2017.
 74. February 2022 Medicaid & CHIP Enrollment Data Highlights. *Medicaid.gov.* 2022.
 75. Medicaid Coverage Rates for the Nonelderly by Race/Ethnicity. *Kaiser Family Foundation.* 2021.
 76. Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Poor Control (>9.0%): Ages 18 to 75. *Centers for Medicare and Medicaid Services. Medicaid.gov.* 2020.

77. Garfield SS, Xenakis JJ, Bastian A, McBride M. Experiences of People with Diabetes by Payer Type: An Analysis of the Roper Diabetes Data Set. *Diabetes Ther*. 2015; 6: 113-125.
78. 2020 Medicaid and CHIP Beneficiary Profile: Characteristics, Health Status, Access, Utilization, Expenditures, and Experience. Centers for Medicare & Medicaid Services. 2021.
79. Galindo RJ, Grazia A, Parkin CG, Baidal DA, Carlson AL, Cengiz E, et al. Increase Access, Reduce Disparities: Recommendations for Modifying Medicaid CGM Coverage Eligibility Criteria. *SAGE Journals*. 2022.
80. 2017 AMA Prior Authorization Physician Survey. American Medical Association. 2021.
81. The management of Type 2 Diabetes in adults: management. National Institute for Health and Care Excellence: guideline. 2015.
82. Grunberger G, Sherr J, Allende M, Blevins T, Bode B, Handelsman Y, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons with Diabetes Mellitus. *Endocr Pract*. 2021; 27: 505-537.
83. World Health Organization. social determinants of health. 2018.
84. Walker RJ, Smalls BL, Campbell JA, Strom Williams JL, Egede LE. Impact of social determinants of health on outcomes for Type 2 Diabetes: a systematic review. *Endocrine*. 2014; 47: 29-48.
85. Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE. Independent effects of socioeconomic and psychological social determinants of health on self-care and outcomes in Type 2 Diabetes. *Gen Hosp Psychiatry* 2014; 36: 662-668.
86. Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE. Quantifying direct effects of social determinants of health on glycemic control in adults with Type 2 Diabetes. *Diabetes Technol Ther*. 2015; 17: 80-87.
87. Walker AF, Schatz DA, Johnson C, Silverstein JH, Rohrs H. Disparities in social support systems for youths with type 1 diabetes. *Clin Diabetes*. 2015; 33: 62-69.
88. Karb RA, Elliott MR, Dowd JB, Morenoff JD. Neighborhood-level stressors, social support, and diurnal patterns of cortisol: the Chicago Community Adult Health Study. *Soc Sci Med*. 2012; 75: 1038-1047.
89. Mani N, Caiola E, Fortuna RJ. The influence of social networks on patients' attitudes toward type II diabetes. *J Community Health*. 2011; 36: 728-732.
90. Hall WJ, Chapman MV, Lee KM, Merino YM, Thomas TW, Payne BK, et al. Implicit racial/ethnic bias among healthcare professionals and its influence on healthcare outcomes: a systematic review. *Am J Public Health*. 2015; 105: e60-e76.
91. Hagiwara N, Elston Lafata J, Mezuk B, Vrana SR, Fetters MD. Detecting implicit racial bias in provider communication behaviors to reduce disparities in healthcare: challenges, solutions, and future directions for provider communication training. *Patient Educ Couns*. 2019; 102: 1738-1743.
92. Pugh Jr M, Perrin PB, Rybarczyk B, Tan J. Racism, mental health, healthcare provider trust, and medication adherence among black patients in safety-net primary care. *J Clin Psychol Med Settings*. 2021; 28: 181-190.
93. Addala A, Auzanneau M, Miller K, Maier W, Foster N, Kapellen T, et al. A Decade of Disparities in Diabetes Technology Use and HbA_{1c} in Pediatric Type 1 Diabetes: A Transatlantic Comparison. *Diabetes Care*. 2021; 44: 133-140.
94. Addala A, Hanes S, Naranjo D, Maahs DM, Hood KK. Provider Implicit Bias Impacts Pediatric Type 1 Diabetes Technology Recommendations In The United States: Findings From The Gatekeeper Study. *J Diabetes Sci Technol*. 2021; 15: 1027-1033.
95. Baig AA, Benitez A, Quinn MT, Burnet DL. Family interventions to improve diabetes outcomes for adults. *Ann N Y Acad Sci*. 2015; 1353: 89-112.
96. Hilliard ME, Powell PW, Anderson BJ. Evidence-based behavioral interventions to promote diabetes management in children, adolescents, and families. *Am Psychol*. 2016; 71: 590-601.
97. Hirsch IB, Kerr MSD, Roberts GJ, Souto D, Nabutovsky Y, Richard BM. Utilization of Continuous Glucose Monitors is Associated with Reduction in Inpatient and Outpatient Emergency Acute Diabetes Events Regardless of Prior Blood Test Strip Usage. *Diabetes*. 2020; 69: 875-P.
98. Beck RW, Riddlesworth TD, Ruedy K, Ahamn A, Haller S, Kruger D, et al. Continuous Glucose Monitoring Versus Usual Care in Patients with Type 2 Diabetes Receiving Multiple Daily Insulin Injections: A Randomized Trial. *Ann Intern Med* 2017; 167: 365-374.
99. Wright E, Kerr MSD, Reyes IJ, Nabutovsky Y, Miller E. HbA_{1c} Reduction Associated with a FreeStyle Libre System in People with Type 2 Diabetes Not on Bolus Insulin Therapy. *Diabetes*. 2020; 69: 78-LB-P.
100. Vigersky RA, Fonda SJ, Chellappa M, Walker MS, Ehrhardt NM. Short- and long-term effects of real-time continuous glucose monitoring in patients with type 2 diabetes. *Diabetes Care*. 2012; 35: 32-38.
101. Majithia AR, Kusiak CM, Lee AA, Colangelo FR, Romanelli RJ, Robertson S, et al. Glycemic Outcomes in Adults With Type 2 Diabetes Participating in a Continuous Glucose Monitor-Driven Virtual Diabetes Clinic: Prospective Trial. *J Med Internet Res*. 2020; 22: e21778.
102. Bergenstal RM, Layne JE, Zisser H, Gabbay RA, Barleen NA, Lee AA, et al. Remote Application and Use of Real-Time Continuous Glucose Monitoring by Adults with Type 2 Diabetes in a Virtual Diabetes Clinic. *Diabetes Technol Ther*. 2021; 23: 128-132.