Development of a Continuous Glucose Monitoring Service by Clinical Pharmacists in a Medically Underserved Population

Sara Lingow, Pharm.D. [1,2]; Kacie Kinnikin B.S.[1]; Justinne Guyton, Pharm.D. [1,2]
[1] St. Louis College of Pharmacy at the University of Health Sciences and Pharmacy, St. Louis, Missouri, USA
[2] St. Louis County Department of Public Health, St. Louis, Missouri, USA

Abstract:
Background: Continuous glucose monitoring (CGM) is an evolving technology that provides a wealth of information to aid in managing diabetes. Professional CGM (ProCGM) is recommended when personal CGM is not desired or available. Patients in medically underserved areas may have limited access to personal CGM devices, thus ProCGM devices can be used for short-term monitoring and medication adjustment. Clinical pharmacists are well-positioned to help set up and establish personal and professional CGM management services. *Objectives:* To determine the effect of ProCGM in patients with persistently uncontrolled type 2 diabetes in a medically underserved population (MUP). *Methods:* Pre-post intervention analysis of a single cohort of patients in a public health center. Patients with persistently uncontrolled (A1c $\geq$ 9%) and taking at least one daily dose of insulin were included. Included participants wore a ProCGM sensor and met with the clinical pharmacist at least once for ProCGM data interpretation and education. The primary analysis evaluated patients who achieved an A1c <9% 1-6 months after intervention. The change in A1c was also evaluated. Participants completed a pre- and post-survey about their experience. *Results:* Twenty-two patients were included in the final analysis. Ten patients achieved an A1c <9% (45%). The mean A1c pre- and post-ProCGM was 11.0% and 9.8% respectively, with a decrease of -1.2% (p=0.055) overall and a decrease of -1.7% for patients who wore the sensor for at least 10 days (p=0.012; n=15). Using the CGM data 91% of participants had a change to their medication regimen and 45% achieved an A1c <9%. Six participants experienced hypoglycemia per the CGM report, but only two were aware of it. After reviewing their glucose report with the pharmacist, 95% of the respondents agreed or strongly agreed to feeling more knowledgeable about blood sugar patterns after reviewing the report with a pharmacist. *Conclusion:* Almost half of the patients in the study achieved an A1c <9%. This study demonstrated glycemic benefit in patients in a MUP who wore a ProCGM for at least 10 days and met with a clinical pharmacist. Data from ProCGM enabled patients to better understand glucose patterns in those with persistently uncontrolled type 2 diabetes.

Keywords: continuous glucose monitor, diabetes mellitus, pharmacist, patient safety, medically underserved area

INTRODUCTION

Continuous glucose monitors (CGM) are an evolving technology that offer an alternative to monitoring and managing diabetes with self-monitored blood glucose (SMBG) levels. CGMs are placed on the surface of the skin with a filament that penetrates the subcutaneous tissue, measuring interstitial blood glucose, and reporting glucose levels continuously over time through a receiver or smart device. Glucose data from a CGM is abundant as it is captured for the life of the sensor, typically 10-14 days, compared to single point-in-time readings with SMBG. CGM data can be uploaded to an online portal so providers can review glucose patterns and statistics. There are two categories of CGMs summarized in Table 1. The first is personal CGMs which are owned by the patient and intended for routine, daily use, largely to replace the need for frequent SMBGs. The sensors provide data to the receiver either in real-time (rt-CGM) or the sensor is intermittently scanned (is-CGM) to download data to the receiver. The second category is professional CGMs (ProCGM), which are owned by the clinic and provide glucose data over a short period of time.

Corresponding Author: Sara Lingow, Pharm.D.
St. Louis College of Pharmacy
University of Health Sciences and Pharmacy
Email: sara.lingow@uhsp.edu

Personal CGMs are recommended by the American Diabetes Association (ADA) for patients with type 1 or type 2 diabetes on insulin (either multiple daily insulin injections, continuous subcutaneous insulin infusions, or adults on basal insulin alone) who can use the device safely. The ADA evaluated rtCGMs as having a higher level of evidence than isCGMs. Furthermore, the ADA recommends professional CGMs when personal CGM use is not available, appropriate, or desired.[1] This is especially applicable when CGMs are not covered by insurance, or a patient is uninsured or underinsured.

In addition to monitoring glucose levels in real-time without a routine finger prick, one of the greatest advantages to utilizing CGMs is the accompanying ambulatory glucose report (AGP). The AGP translates measured data from the sensor into clinically relevant and actionable information. Components of an AGP typically include a summary of the data in addition to statistical reports described in Table 2.[3]

This paper briefly reviews the efficacy and safety benefits of CGM use, describes a pilot study evaluating ProCGM in medically underserved patients with persistently uncontrolled type 2 diabetes, and discusses benefits and limitations of implementing CGM services, particularly in a medically underserved patient population.

DOI: https://doi.org/10.24926/iip.v15i1.5906

Benefits of CGMs

Randomized, controlled trials of rtCGM have demonstrated a reduction in A1c and hypoglycemia in patients with type 1 diabetes and a reduction in A1c in patients with type 2 diabetes when the rtCGM was used regularly. Observational and real-world studies have demonstrated a reduction in A1c, rates of diabetic ketoacidosis, and episodes of severe hypoglycemia along with an increase in patient satisfaction. Glycemic improvements have been seen even without adjustment to pharmacotherapy, indicating the benefit of CGMs as a stand-alone intervention.[1] Additionally observational data demonstrated that CGMs had a higher rate of detecting nocturnal hypoglycemia in stable patients treated with insulin.[4] ProCGMs have also demonstrated clinical benefits in randomized, controlled trials such as lowering A1c in patients with type 2 diabetes not taking intensive insulin therapy.[1] Observational studies of ProCGMs have also demonstrated a reduction in A1c[5,6], increasing time in therapeutic range[5], and reducing hypoglycemia[5] even when used for 14 days or less. It is important to note that the clinical evidence indicates that combining ProCGM data analysis and interpretation with education, medication, and lifestyle adjustments is best practice.[1]

Pharmacists Role

Pharmacists are poised to aid in initial device selection because there are a wide variety of products and features amongst the personal and professional CGMs. There are several resources available that compare device features in detail.[7] After obtaining the device, many patients then need assistance with device setup and application, despite printed and electronic resources provided by the manufacturer with the product, in the device application, and online. Additionally, patients need to be educated on the functions, limitations, and drug interactions when using CGMs, all of which pharmacists can help with. Finally, through collaborative practice agreements, pharmacists can review and interpret the AGP report to adjust pharmacotherapy and make lifestyle recommendations to patients.

Several authors have studied the impact of clinical pharmacists' implementation of ProCGM into clinical practice. In these studies, clinical pharmacists made changes to therapy, recommended lifestyle changes, and identified and educated on hypoglycemia based on CGM results. Results from these studies demonstrated improvements in A1c along with improved diabetes self-efficacy.[8-11]

Pharmacists can engage in billing and reimbursement for CGM services. The billing codes used for CGM services include 95249 for personal CGM startup and training, 95250 for professional CGM placement for a minimum of 72 hours, and 95251 for CGM data analysis, interpretation, and report.[12] Of note, in the state of Missouri where this pilot study occurred, Medicaid only reimburses 95251.

Health Disparities and CGM Use

Patients in medically underserved areas face additional hurdles to achieving optimal health outcomes using diabetes technology. These hurdles can include the impact of social determinants of health, lack of support systems, structural racism, and inequity in the provision of health care.[13] These factors may affect the ability to implement CGM technology into practice and may limit the ability to measure its impact. According to Centers for Medicare and Medicaid Services, fewer Black and Hispanic beneficiaries reported knowing about Medicare coverage policies for diabetic testing supplies and self-management education, compared to white beneficiaries.[14] Patients with lower income who may not have access to personal CGMs are ideal candidates to trial a ProCGM coupled with education to foster better understanding of how diet and medications impact blood glucose in order to achieve long-term glycemic control. To date, few studies have looked at the use of ProCGM specifically in low-income patient populations with type 2 diabetes.

One study identified that the intervention of personal CGM use and carbohydrate counting education with monthly follow-up by a medical provider in low-income patients with type 1 diabetes was not associated with A1c reduction, however, 80% of patients in the study wanted to continue to use a CGM.[15] Limitations to the trial included low retention, difficulty performing self-adjustments, and low activation (no patients downloaded their results or analyzed their own glucose trends).

This pilot study was conducted at three primary care clinics within the St. Louis County Department of Public Health. As the clinics are located within medically underserved areas, many of the patients have characteristics that represent marginalized populations; 70% are black, 60% have Medicaid insurance, 9% have no insurance and in 4% of patients, English is not their primary language. At the time of the study, the patients with Medicaid or without any insurance did not have access to coverage of CGMs due to strict prior authorization requirements for multiple daily injections or a history of documented hypoglycemia, however, in June 2023, Missouri Medicaid expanded personal CGM coverage to participants requiring any insulin administration. Grant funding was obtained through the American College of Clinical Pharmacy Ambulatory Care PRN Seed Grant for junior investigators, and was used to purchase the CGMs. Maximum enrollment in the pilot was determined by the number of CGM sensors able to be purchased with grant funding. At the time of the pilot, it was advantageous to use the FreeStyle Libre Pro®, a professional CGM blinded to patients, due to cost. Previous research has shown that providers felt confident that ProCGM data collected over just 14 days was by itself enough information to make therapy changes.[16] There is limited literature evaluating the use of ProCGM in an underserved population, underlining the importance and innovation of this pilot study.

DOI: https://doi.org/10.24926/iip.v15i1.5906

Objectives

The objective of this pilot study was to evaluate the impact of ProCGM in patients with poorly and persistently uncontrolled diabetes taking insulin. The primary outcome for the pilot study evaluated the number of patients who achieved an A1c < 9% at follow-up. This is an institution-specific goal, and consistent with the National Committee for Quality Assurance (NCQA) definition of poor control.[17] The follow-up A1c was identified as the next A1c within 1-6 months of wearing the ProCGM to provide time for implementation of medication and lifestyle changes from wearing the ProCGM in addition to accounting for the wide variability in patients' ability to attend follow-up visits in this population. Secondary outcomes included change in A1c from baseline and change in A1c from baseline with consistent use of ProCGM (minimum of 10 days). Other exploratory data reported included changes in medications, episodes of hypoglycemia, hypoglycemia unawareness, time in therapeutic range while wearing the ProCGM, and patient perceptions as measured by a pre-post survey.

METHODS

Study Design

The pilot study enrolled adults with type 2 diabetes taking insulin therapy who were poorly controlled, defined by an A1c $\geq$ 9% for two consecutive readings or $\geq$ 9% with a $\geq$ 1% increase from the previous A1c from January 2022 to January 2023. Patients were identified from the Internal Clinical Quality Improvement Council which defined high-risk patients as those with an A1c > 9%. Patients were excluded from the final analysis if their diabetes was managed by an outside provider, if they were using a personal CGM, if they wore the ProCGM for less than 5 days, did not have any follow-up visits with the clinical pharmacists, or did not have a documented follow-up A1c within 1-6 months of the intervention. The visit structure was designed to maximize direct contact with the patient to provide meaningful education related to the AGP report during the intervention period of 14 days. All clinical recommendations were made by the pharmacist through a collaborative practice agreement which allowed for medication adjustments. After completion of the intervention period, patients returned to usual care with their primary care provider with or without continued clinical pharmacist involvement. A1c was then collected 1-6 months after the intervention.

Visit Structure

Visit 1: Initial Visit with Pharmacist

- Informed consent obtained
- Patient data reviewed: medications and lifestyle factors
- Patient educated about ProCGM
- ProCGM sensor placed
- Patient provided glucose log and food diary
- Patient completed pre-survey

Visit 2: Follow-up with Pharmacist (scheduled day 5-7)

- Patient data reviewed: medications, lifestyle factors, glucose log and food diary
- ProCGM data scanned, uploaded, and interpreted
- Reviewed AGP report with patient
- Medications adjusted (if needed) and goal for lifestyle modifications set

Visit 3: Follow-up with Pharmacist (scheduled day 14)

- Patient data reviewed: medications, lifestyle factors, glucose log and food diary
- ProCGM data scanned, uploaded, and interpreted
- Reviewed AGP report with patient
- Medications adjusted (if needed) and goal for lifestyle modifications set
- ProCGM sensor removed
- Patient completed post-survey

Data Collection

Data collected during this trial includes age, race, biological sex, insurance type, usual care provider, clinic location, baseline A1c baseline medication insulin regimen (basal only or basal/bolus), number of study visits attended, episodes of hypoglycemia and hypoglycemia awareness, TIR at visit 2 and/or 3, changes to insulin or noninsulin therapy at visit 2 or 3, number of days the sensor was worn, follow-up A1c 1-6 months after intervention, and number of contacts from the clinical pharmacist or other provider 6 months before and 6 months after the intervention.

Patients completed a four-item pre-intervention survey and a six-item post-intervention survey about their habits, experiences, and preferences for monitoring their blood sugar and using a CGM (Table 4). Questions 1-4 were repeated in both surveys, and questions 5 and 6 were only administered at the last visit on the post-survey as they focused on the patient's experience with the CGM. The survey questions were administered on paper and responses were in a Likert-scale format [strongly disagree, disagree, neutral, agree, strongly agree].

This research project involving human subjects was approved by the UHSP Institutional Review Board, as well as the St. Louis County Department of Public Health Internal Research Review Committee. Patient data collected was deidentified before analysis. All spreadsheets used were password-protected. All data was stored on a locked computer. Signed informed consent documents were stored in a locked file cabinet in a private office at the respective St. Louis County Department of Public Health clinics.

Statistical Analysis

Descriptive statistics was used for baseline characteristics. Data for this study were imported into IBM SPSS Statistics Version 28.0.1.1. Numeric data were tested with a paired t-test for pre-post change in A1c.

DOI: https://doi.org/10.24926/iip.v15i1.5906

RESULTS

A total of 43 patients met the study inclusion criteria to have a ProCGM placed. Patients were excluded for sensor falling off within the first 5 days (n=10), not attending any follow-up visits with the pharmacist (n=4), no follow-up A1c (n=7), leaving 22 patients in the final analysis. Baseline characteristics are described in Table 3. Within the six months prior to enrollment, these patients with uncontrolled diabetes had been seen by a medical provider (physician, nurse practitioner, or clinical pharmacist) an average of 3.6 times in the previous 6 months and the majority (54%) had met with a clinical pharmacist in the past 3 months.

Of the 22 patients included in the final analysis, 10 patients (45%) achieved an A1c < 9% at follow-up. Use of a ProCGM showed a decrease in A1c from a baseline of 11.0% to a follow-up of 9.8% (range 6.6% to > 14%), for a change of -1.2% ± 2.3 (p=0.055). Amongst the patients who wore the ProCGM consistently (n=15), there was a decrease in A1c from a baseline of 10.8% to a follow-up of 9.1%, for a change of -1.7% ± 2.0 (p=0.012).

Although only 14 of the 22 patients attended both scheduled follow-up visits with the pharmacist, 17 patients had a change in insulin dose (77%) and 13 had a change in a non-insulin medication (59%). The time-in-range (TIR) while wearing the ProCGM for patients at the first follow-up was 24.6%. For those patients who had a second follow-up (n=14), the TIR increased to 30.1%. Six of the 22 participants experienced episodes of hypoglycemia per the AGP report, but only two patients were aware they had a hypoglycemic event while wearing the CGM.

Survey Results

Twenty of the 22 patients included in the final analysis filled out both the pre- and post-survey (91% response rate). The results are presented in Table 4, and overall showed most patients would prefer wearing a CGM device to checking SMBG. Almost all patients felt more knowledgeable about blood sugar patterns after reviewing the AGP report with a clinical pharmacist.

DISCUSSION

Patients with poorly and persistently uncontrolled diabetes in a medically underserved setting were purposely selected as this could represent a subset of patients who would benefit from a ProCGM, and who may not have access to personal CGM at the time of the study. The authors hypothesized that these inclusion criteria would include difficult situations such as: patients whose medications have not been adjusted due to lack of SMBGs, patients who have a poor understanding of how food and exercise impact blood sugar, patients who do not perceive their diabetes as being uncontrolled, and patients who do not fully understand the impact of poor medication adherence. This allowed us to use the AGP report as a teaching tool during the 14-day intervention.

In this study, 10 of 22 (45%) participants achieved an A1c <9%. Although not statistically significant, a clinically relevant reduction in A1c of -1.2% was seen in included participants. Although the authors had a strict definition of consistent use defined as wearing the ProCGM for 10 days, this allowed for a to better evaluation of the effect of the ProCGM, which had a very short window of 14 days, compared to trials that have used personal CGMs for longer periods. In the pilot study, a statistically significant change in A1c was observed in patients who wore a ProCGM sensor consistently with a reduction of -1.7%. This is especially meaningful as these patients previously had poorly controlled diabetes despite staying in contact with medical providers and insulin use. The baseline A1c was very high in this study compared to most observational or randomized trials investigating CGMs. This may be attributed to health disparities in this population and likely explains why the magnitude of A1c reduction is much larger than what has been seen in other clinical trials.[1] The magnitude of the A1c change was variable among patients with seven patients having no change or an increase while seven patients had a >3% decrease in their A1c. This could be due, in part, to the level of patient activation, although each had to put additional effort and time into participating in the pilot. This may also highlight the difficult nature of obtaining glycemic control in patients with health disparities.

It was also notable that hypoglycemia was identified in 27% of patients, and over half were not aware of it. This highlights the safety aspect of having a CGM when using insulin, even during times of poor control. Additionally, patients reported gaining knowledge from their participation in the study and meeting with the clinical pharmacist. There was a high rate of sensors falling off early at 20%, likely indicating an area for more patient education. Clinics should consider use of additional tacky adhesives to place between the skin and sensor in addition to an over-the-sensor patch while patients are getting used to wearing the device.

As demonstrated by this pilot study, benefits of using ProCGM exist when personal CGM is not available. The AGP report provides actionable data allowing the opportunity to adjust medications or lifestyle with short-term data, which can be especially useful in patients who do not regularly check SMBG. ProCGM also presents a learning opportunity for patients to observe how lifestyle habits may impact blood sugar. Finally, ProCGMs provide an opportunity for individualized counseling and goal setting for patients, aiding in prevention of patient safety issues related to hypo- and hyperglycemia. In the auhtors' experience, use of ProCGM in this patient population was very helpful as these patients were previously identified as being high risk by our internal clinical quality improvement council and had contact with providers, but weren't reaching

DOI: https://doi.org/10.24926/iip.v15i1.5906

quality measures of A1c <9%. However, there are other clinical situations that may also benefit from further investigation, particularly in identifying patterns of hypoglycemia or glucose excursions that inhibit patients from reaching personalized A1c goals.

Study Limitations

The authors acknowledge that the pre-post survey questions have limited applicability due to using blinded ProCGMs. Since the patients only had experience with ProCGM, they did not have experience to assess the use of personal CGM which may affect their responses to question 1 of the survey. Additionally, using a ProCGM may not have impacted the patient's day-to-day life during this trial which may explain why there was a decrease in the responses to questions 2 and 4. Therefore, the authors believe it is understandable that there was not an improvement in questions 1, 2, and 4. Based on our visits with the patients during the study, we believe that question 3 may have had a higher pre-survey response due to patients not feeling comfortable stating that they have knowledge gaps related to how foods affect their blood sugar. This may be better evaluated with a knowledge-based assessment instead of a perception-based assessment.

Additionally, the pilot study was limited by the small sample size and lack of follow-up including patients returning for sensor download, labs, or issues with the CGM falling off and not being able to replace it. The follow-up A1c range of 1-6 months allowed for more patients to be included in the final analysis, however, introduces some variability in the results and therefore decreases generalizability. Although participants were asked to keep a medication, food, and glucose diary during the study provided to them during visit 1, few patients brought back this information, which limited the ability to provide education on how or which foods may impact blood glucose. This also limited the authors' ability to assess medication adherence. The lack of a control group limits the ability to determine the true impact of the ProCGM. The study period was limited to a 14-day intervention with only one A1c follow-up.

Finally, Freestyle LibrePro® may inaccurately indicate hypoglycemia, and the manufacturer recommends that hypoglycemia should only be assessed through patterns reviewed over time.[18] This information may decrease the validity of the hypoglycemia episodes observed in this pilot study.

CONCLUSION

Although there is literature to support the use of personal CGMs in patients both type 1 and type 2 diabetes, there appearau to be disparities in implementation based on race and income. At the current time, the use of ProCGMs may help fill the gap in care. Clinics should consider the previous literature with clinical pharmacist involvement in diabetes technology, particularly for CGM education.[7] This pilot study provides an example of the development of a ProCGM service when use of personal CGM was not available. The pilot identified benefits of the use of ProCGM by a clinical pharmacist in a medically underserved population in lowering A1c and identifying hypoglycemia. The AGP report provides actionable data allowing the opportunity to adjust medications or lifestyle with short-term data, which can be especially useful in patients who do not regularly check SMBG. ProCGM may also present a learning opportunity for patients to observe how lifestyle habits may impact blood sugar. Just under half of the participants achieved an A1c <9% after wearing the ProCGM sensor, and the average decrease in A1c was -1.2%; -1.7% for patients who wore the ProCGM for at least 10 days. At the end of the pilot, 95% of the respondents agreed or strongly agreed to feeling more knowledgeable about blood sugar patterns after reviewing the glucose report with a pharmacist. The pilot adds to the literature underscoring the importance and benefit of pharmacists working with patients with diabetes and health care disparities. It also highlights the disparity that the data in medically underserved populations is limited to small populations with a reliance on grant funding to achieve patient care goals.

Funding: This project was supported by the 2021 American College of Clinical Pharmacy Ambulatory Care PRN Seed Grant which allowed for the purchase of professional continuous glucose monitors. The funder did not have a role in study design, data collection, analysis, interpretation, writing of the report, or the decision to submit the article for publication.

Conflict of Interest Statement: The authors declare no conflicts of interest.

Treatment of Human Subjects: This research project involving human subjects was approved by the UHSP Institutional Review Board, as well as the St. Louis County Department of Public Health Internal Research Review Committee.

Disclaimer: The statements, opinions, and data contained in all publications are those of the authors.

References:

1. American Diabetes Association. Standards of medical care in diabetes—2024. Diabetes Care. 2024 Jan 1;47(Suppl 1):S1-S321.
2. Cgm device comparison. American Association of Clinical Endocrinology. https://pro.aace.com/cgm/toolkit/cgm-device-comparison.
3. Czupryniak L, Dzida G, Fichna P, et al. Ambulatory Glucose Profile (AGP) Report in Daily Care of Patients

with Diabetes: Practical Tips and Recommendations. Diabetes Ther. 2022;13(4):811-821.
4. Pazos-Couselo M, García-López JM, González-Rodríguez M, et al. High incidence of hypoglycemia in stable insulin-treated type 2 diabetes mellitus: continuous glucose monitoring vs. self-monitored blood glucose. Observational prospective study. Can J Diabetes. 2015;39(5):428-433.
5. Simonson GD, Bergenstal RM, Johnson ML, Davidson JL, Martens TW. Effect of professional cgm (Pcgm) on glucose management in type 2 diabetes patients in primary care. J Diabetes Sci Technol. 2021;15(3):539-545.
6. Rivera-Ávila DA, Esquivel-Lu AI, Salazar-Lozano CR, Jones K, Doubova SV. The effects of professional continuous glucose monitoring as an adjuvant educational tool for improving glycemic control in patients with type 2 diabetes. BMC Endocr Disord. 2021;21(1):79.
7. Hess R, Schumacher C, Whitley HP, et al. Diabetes technology: A primer highlighting the role of the pharmacist. J Am Coll Clin Pharm. 2022;5(12):1307-1323.
8. Van Dril E, Schumacher C. Impact of professional continuous glucose monitoring by clinical pharmacists in an ambulatory care setting. J Am Coll Clin Pharm. 2019;2(6):638-644
9. Sherrill CH, Houpt Ct, Dixon EM, Richter SJ. Effect of pharmacist-driven professional continuous glucose monitoring in adults with uncontrolled diabetes. J Manag Care Spec Pharm. 2020;26(5):600-09.
10. Simonyan AR, Isaacs D, Lekic S, Blanchette JE, Noe D, Galloway NR. Continuous glucose monitoring shared medical appointments improve diabetes self-efficacy and hemoglobin A1c. J Am Coll Clin Pharm. 2021;4:465-472.
11. Ulrich H, Bowen M. The clinical utility of professional continuous glucose monitoring by pharmacists for patients with type 2 diabetes. *J Am Pharm Assoc (2003)*. 2021;61(6):e76-e82. doi:10.1016/j.japh.2021.05.013
12. Dexcom cpt codes for continuous glucose monitors | dexcom provider. https://provider.dexcom.com/coding.
13. Agarwal S, Crespo-Ramos G, Leung SL, 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(6):381-389.
14. Centers for Medicare & Medicaid Services: Racial and ethnic disparities in diabetes prevalence, self-management, and health outcomes among Medicare beneficiaries. Volume 6, 2017. https://www.cms.gov/About-CMS/Agency-Information/OMH/research-and-data/information-products/data-highlights/disparities-in-diabetes-prevalence. Accessed September 24, 2023.
15. Sequeira PA, Montoya L, Ruelas V, et al. Continuous glucose monitoring pilot in low-income type 1 diabetes patients. Diabetes Technology & Therapeutics. 2013;15(10):855-858.
16. Midyett K, Unger JR, Wright EE, et al. A pilot study to assess clinical utility and user experience of professional continuous glucose monitoring among people with type 2 diabetes. Clin Diabetes. 2019;37(1):57-64.
17. Comprehensive diabetes care. NCQA. https://www.ncqa.org/hedis/measures/comprehensive-diabetes-care/
18. Important safety information | freestyle libre providers. https://www.freestyleprovider.abbott/us-en/safety-information.html

DOI: https://doi.org/10.24926/iip.v15i1.5906

Table 1: Types of CGM[1,2]

Type of CGM		Description	Available CGMs
Personal CGM	Real-time CGM (rtCGM)	Measures and displays glucose levels continuously on a receiver (a specific device or a compatible smartphone).	• Dexcom G6© • Dexcom G7© • Freestyle Libre 3® • Medtronic Guardian™ • Sensionic Eversense®
	Intermittently scanned CGM (isCGM)	Measures glucose levels continuously, but only displays glucose values when scanned by a receiver (a specific device or a compatible smartphone). The sensor must be scanned with receiver every 8 hours to prevent loss of data older than 8 hours.	• Freestle Libre 2® • Freestyle Libre 14-day®
Professional CGM		Measures glucose levels continuously, but glucose levels are often blinded to the patient (some devices allow for unblinding). The receiver is owned and kept by the provider as it does not display glucose data. Typically used short-term for the life of one sensor (usually 10-14 days).	• Dexcom G6 Pro© • Freestyle Libre Pro®

Table 2: Key Features of Ambulatory Glucose Report[1,3]

Component	Description
Mean glucose concentration	Mean value of glucose per time period analyzed
Glucose management indicator	A measure of average glucose control
Time in Range	Percentage of time in a specified range per time period analyzed: • Time above range (TAR): >250 mg/dL (goal <5%) • TAR: > 180 to 250 mg/dL (goal <25%) • Time in range (TIR): 70-180 mg/dL (goal >70%) • Time below range (TBR): <70 mg/dL (goal <4%) • TBR: < 54 mg/dL (goal <1%)
Glucose variability	Percent coefficient of variation of glucose measurements

DOI: https://doi.org/10.24926/iip.v15i1.5906

Table 3: Baseline Characteristics

Baseline Characteristics	(N = 22)
Age – (year, SD)	51.6 ± 11.4
Male – no (%)	10 (45.5)
Race – no (%)	
Black	14 (63.6)
White	6 (27.3)
Asian	1 (4.5)
Not reported	1 (4.5)
Insurance – no (%)	
Commercial	2 (9.1)
Medicaid	15 (68.2)
Medicare	1 (4.5)
None	4 (18.2)
A1c, baseline – (%, SD)	11.0 ± 1.6
Insulin regimen – no (%)	
Basal only	13 (59.1)
Basal and bolus	9 (40.9)
Average visits in past 6 months – (%, SD)	3.6 ± 3.4
PharmD visit in past 3 months – no (%)	12 (54)

Table 4: A1c Outcomes

Outcome	Result	P-value
Primary Outcome Number of patients to achieve an A1c <9% (n, %)	10 (45)	
Secondary Outcomes Change in A1c from baseline (n=22) – (%, SD)	-1.2 ± 2.3	p=0.055
Baseline A1c	11.0 ± 1.6	
Post A1c	9.8 ± 2.3	
Change in A1c with sensor worn ≥ 10 days (n=15) – (%, SD)	-1.7 ± 2.3	p=0.012
Baseline A1c	10.8 ± 1.5	
Post A1c	9.1 ± 2.0	

DOI: https://doi.org/10.24926/iip.v15i1.5906

Table 5: Survey Results

Question Text	Participants who agree or strongly agree (N=20)	
	Pre-Survey	Post-Survey
Q1: I check my blood sugar regularly (at least once daily) (n, %)	10 (50)	10 (50)
Q2: I check my blood sugar when I feel like my blood sugar might be low (dizzy, sweaty, shaky etc) (n, %)	12 (60)	11 (55)
Q3: I feel knowledgeable about how certain foods affect my blood sugar (n, %)	14 (70)	16 (80)
Q4: I would prefer wearing a continuous glucose monitor to checking my blood sugar (n, %)	15 (75)	14 (70)
Q5: I feel more knowledgeable about my blood sugar patterns after reviewing my continuous glucose report with the pharmacist (n, %)	--	19 (95)
Q6: Overall, I am satisfied with wearing a Professional Continuous Glucose Monitor (n, %)	--	16 (80)

DOI: https://doi.org/10.24926/iip.v15i1.5906