Increasing Utilization of Continuous Glucose Monitors for Veterans Association Primary Care Providers for Patients with Type 2 Diabetes: A Quality Improvement Project

Dylan N. LeGrady

School of Nursing, Oregon Health & Science University

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Dr. Huey

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Abstract

Background

Type 2 Diabetes Mellitus (T2DM) is a prevalent chronic condition characterized by elevated blood glucose levels due to impaired insulin secretion and insulin resistance. These dysfunctions lead to hyperglycemia, increasing the risk of microvascular and macrovascular complications.

Management focuses on glycemic control through blood glucose monitoring and pharmacologic oral and injectable therapies. Traditionally, monitoring relies on glucometers and Hemoglobin A1c testing. However, Continuous Glucose Monitors (CGMs) now offer real-time glucose tracking, improving glycemic management and reducing hypoglycemic events.

CGM use is expanding exponentially considering both the availability of an over-the-counter option and benefits associated with CGM's. While the Veterans Health Administration anticipates broader adoption, primary care workflows for prescribing and managing these devices remain underdeveloped.

Methods

Pre- and post-surveys assessed provider comfort, experience, and knowledge of CGMs using a one-to-four scale for some questions. A 25-question pre-survey, distributed via Qualtrics to VA primary care providers, informed the development of a CGM toolkit. After four weeks of implementation, a post-survey evaluated the toolkit's effectiveness, adding six questions on its utility. Demographic data were collected to explore associations with CGM-related outcomes and for anonymous pre- to post-survey continuity. Results were compared, and an independent t-test examined whether the toolkit significantly improved provider scores. Feedback from the post-survey will guide future toolkit improvements beyond this project.

Results

Seven responses were collected in the pre-survey and six in the post-survey. Due to the difficulty being able to adequately compare experience pre- and post-survey, only knowledge and comfort responses were analyzed. The experience domain included questions that did not translate to a Likert scale format and could not be compared pre and post. Instead, these questions were used to track anonymous participants between the surveys looking for continuity of survey participation. Seven questions from the survey assessed comfort, and three assessed knowledge. The mean knowledge score increased from 2.86 to 3.05, and comfort from 2.63 to 2.67. Standard deviations were calculated for both categories. A two-sample equal variance T-test (two-tailed) yielded p-values of 0.58 for knowledge and 0.55 for comfort. Additionally, three post-survey questions evaluated toolkit utility, with mean scores of 3 (knowledge), 2.75 (comfort), and 3 (experience).

Conclusion

PNWVA providers identified barriers to CGM implementation, including education and workflow challenges. A CGM toolkit was developed, but pre- and post-surveys showed no significant improvements in scores. Despite this, the toolkit's relevance remains as CGM use grows. Future improvements should address feedback to enhance effectiveness and support primary care demands.

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Problem Description

Diabetes is a medical diagnosis characterized by abnormally elevated blood glucose levels. Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder that manifests with elevated serum glucose levels, often caused by impaired insulin secretion, resistance to insulin uptake, or a combination of the two (Li et al., 2022). Numerous risk factors exist for the development of T2DM including socioeconomic status, gender, ethnicity, advanced age, family history of diabetes, drug use, and medical history; physical inactivity and obesity are strongly linked to T2DM (Center for Disease Control [CDC], 2021; Ismail et al. 2021; Yan et al., 2023). Patients with diabetes have an increased risk of myocardial infarction or strokes, cognitive decline, kidney failure, liver disease and infection (Tomic et al., 2022; World Health Organization, 2023). The cost of diabetic care has been increasing over time with $412.9 billion spent on direct and indirect costs for patients with T2DM in the United States in 2022 (Parker et al., 2024).

Blood glucose (BG) monitoring is a tool applicable for patients with poorly controlled diabetes, given the complications associated with hypoglycemia and hyperglycemia, which may precipitate life threatening conditions (Mathew et al., 2024). Patients with poorly controlled diabetes are those whose BG persist above or below therapeutic range. Some patients with diabetes take medications that put them at a higher risk for hypoglycemia, further emphasizing the importance of proper BG monitoring.

BG monitoring may be variable since it is influenced by many factors, including medications, kidney disease, diet and exercise (ADAPPC, 2024). A hemoglobin A1c is a measured serum marker for BG that provides an average BG reading over a three-month period. Yet, it does not provide real time values. Additionally, A1c's can be inaccurate and heavily influenced by kidney failure, anemia, pregnancy, altitude, ethnicity and more (ADAPPC, 2024; Sacks et al., 2023).

Monitoring BG levels are further complicated by the other form of BG collection via point-of-care testing with fingertip prick and glucometer use. This method requires the patient to intentionally prick their finger and extract blood for a BG measurement. Patients with diabetes on insulin therapy are required to monitor their blood sugar numerous times throughout the day (Weinstock et al., 2020). Numerous studies have evaluated patients' thoughts on fingertip pricks for point-of-care testing BG monitoring and have found similar results of anxiety and pain surrounding fingertip pricks (Biwas et al., 2022; Heinemann 2008; Ong et al., 2014). Subsequently, this anxiety and pain reduces adherence rates for BG monitoring, which is directly related to worsening health outcomes and poorer quality of life (Aggarwal et al., 2022). The American Diabetic Association found that nearly 64% of T2DM were nonadherent to twice-daily point-of-care testing BG monitoring (Sachmechi et al., 2023).

Due to the low adherence rate of fingertip pricks for point-of-care testing BG measurement, it may be advantageous to consider other methods of BG collection for the diabetic population. One such method is continuous glucose monitor (CGM), which has allowed for continuous blood glucose monitoring, improvement in glycemic control, increased time spent in target BG range and decreased hypoglycemic events when compared to self-monitoring BG practices (Manov et al., 2023).

Currently, only endocrinology specialists prescribe CGMs for patients with diabetes at a community-based outpatient clinic in a Pacific Northwest VA (PNWVA). Yet, it is estimated that 90% of patients with diabetes receive their diabetic care from their primary care providers (PCP) (Oser et al., 2022). Veterans have numerous risk factors that increase their risk for T2DM including obesity, lower socioeconomic status, older age, and possible exposure to herbicides (Avramovic et al., 2020; Mendez et al., 2022). Crude estimation approximates 11.6% of the total United States (US) population have diabetes, while 20.5% of US veterans have diabetes (CDC, 2021; Liu et al., 2017). Additionally, veterans often delay seeking medical care more often than the US population, which is concerning when considering that diabetes is a condition that requires close monitoring by medical professionals (Lee &

Begley, 2017). As a result, veterans may have more T2DM complications when compared to non-veterans with an annual mortality rate of 5%, which is double of those veterans without diabetes (Avramovic et al., 2020).

The purpose of this quality improvement project is to assess the primary care providers' knowledge, comfort, and experience of prescribing CGMs. This will be accomplished through a pre and post survey to help support the development of a CGM toolkit for Veterans Association medical providers that will provide both CGM ordering and management information.

Search Strategy

An electronic search of PubMed was conducted using the keywords *continuous glucose monitor* AND/OR *CGM, primary care, training* AND/OR *education* AND/OR *flowsheet* AND/OR *workflow, diabetic toolkit, provider, knowledge,* AND *barriers* which yielded 545 results. Publication dates were narrowed to articles within the last six years, yielding 234 remaining studies. Fifty-four studies discussing CGM education for providers, barriers to CGM utilization, toolkits, and clinic workflow changes to increase CGM utilization were eligible for inclusion and 24 were incorporated into this review.

Available Knowledge

The CGM is a device that measures interstitial fluid glucose every 1-15 minutes (Bergenstral 2018; Kawakatsu et al., 2022). Interstitial fluid glucose readings may be slightly different from serum blood glucose readings because of the lag time for when glucose enters the blood stream and then gets absorbed by the interstitial fluid (Faerch et al., 2021). CGM's allow medical providers to track real-time glucose levels in patients and offer individualized therapy (Kawakatsu et al., 2022). CGMs promote patient safety by alarming hypo- and hyperglycemic events (Elsayed et al., 2023). CGM's are important to uncover BG trends to guide medication and dietary management (Kieu et al., 2023). Over the years, CGM use has increased from 0.4% to 4.1% between 2014 to 2020 (Sherill & Lee 2023). Currently, there

are three brands that represent a majority of CGMs on the market, which includes FreeStyle Libre, Medtronic, and Dexcom (Edward & Priefer 2023; Elsayed et al., 2023; Sherrill & Lee, 2023). CGM sensors can be placed on different sites on the patient's body; however, it is FDA-approved for the upper back of the arms (Libre, Dexcom) or abdominal area (Dexcom, Medtronics), since these sites provide improved accuracy (Hall et al., 2022; Kawakatsu et al., 2022). CGMs have been found to reduce the incidence of hypoglycemic events for patients with impaired hypoglycemia awareness, history of severe hypoglycemia or diabetes-related-hospitalization, and glycemic control in diabetic patients (Aggarwal et al., 2022; Kant et al., 2022; Reaven et al., 2023; Wang et al., 2022). The findings listed previously may be attributed to a higher adherence and satisfaction rate for CGMs compared to fingertip prick point-of-care testing BG monitoring (Cowart et al., 2020; Janapala et al., 2019; Lin et al., 2021). Reaven et al. (2023) investigated CGM use in diabetic patients and found improved glycemic control and fewer clinical events for US veterans. It is important to note that CGMs do not always resolve the issue of fingertip prick BG point-of-care testing; CGMs only decrease the number of times one must perform BG point-of-care testing. Although, in current Dexcom and Libre factory calibrated models, no fingertip prick BG point-of-care testing calibration is required (Forlenza et al., 2019).

Studies have identified several barriers preventing primary care providers (PCPs) from prescribing continuous glucose monitors (CGMs), including cost, insurance coverage, technological challenges, and patient discomfort (Anderson et al., 2020; Kompala et al., 2023; Lanning et al., 2020). Provider-specific issues like resistance to change and unfamiliarity with CGM technology also play a role (Edelman et al., 2021; Friedman et al., 2023). In a survey of 656 providers, 46.6% had seen patients using CGMs, but only 38.6% had prescribed one (Oser et al., 2022).

Specialists, along with PCP's, also show hesitation (Grunberger et al., 2020; Oser et al., 2022; Tanebaum et al., 2018). Lanning et al. (2020) reported that nearly 85 of 127 endocrinologists were reluctant to prescribe them. Yet, Mayberry et al. (2023) found that of 30,585 CGM patients, 78.6% were

prescribed by endocrinologist while 23.2% by primary care providers. Even diabetes specialists face barriers like cost, insurance, and prescription difficulties (Kompala et al., 2023). In primary care, time constraints, limited training, and inadequate resources exacerbate these issues (Warman et al., 2023). Furthermore, the scarcity of endocrinologist further exacerbates CGM prescribing rates given that endocrinologist tend to prescribe CGM's more the primary care providers (Hall et al., 2024)

Education is a modifiable barrier. In Oser et al.'s (2022) survey, 72.3% of providers were interested in CGM workshops. PCPs advocate for resources like online guides, conferences, and webinars to boost their confidence (Hall et al., 2022; Warman et al., 2022). Educational programs have shown success. Sherrill et al. (2022) found a two-week intervention improved pharmacists' and pharmacy students' CGM knowledge. Root et al. (2022) demonstrated that education increased PCP adoption of unfamiliar monitoring tools. Targeted education can help overcome barriers, enhancing CGM use and patient outcomes.

Rationale

The PNWVA community-based outpatient clinic anticipates more questions and requests surrounding CGMs given the first over-the-counter (OTC) CGM was approved by the Food and Drug Association in 2024 (U.S. Food and Drug Association, 2024). The increasing demand, marketing and prevalence of CGMs, along with the benefits associated with CGMs, has resulted in the Veterans Association investigating use of CGMs in their T2DM veteran patients (Lacy et al., 2024). Currently, VA policy requires veterans with diabetes be on insulin therapy prior to CGM prescription coverage. However, there are no standardized screening procedures or assessments available for PCPs to identify eligible patients who may be good candidates for CGMs. Furthermore, there are no existing programs for educating, setting up, and training patients to utilize CGMs in the outpatient primary care setting. Additionally, there currently no toolkits available for providers to guide CGM management at the PNWVA.

CGMs are often utilized by insulin-dependent diabetics given their utility to adjusting insulin regimens (Spanakis et al., 2022). Specifically, insulin-dependent patients are at greater risk of hypoglycemic events, and require close BG monitoring, which can be accomplished with a CGM (ADAPPC, 2024). Therefore, it is important to achieve and maintain a safe BG range in diabetic patients. De Block et al. (2023) found that CGM utilization improved providers' confidence in managing diabetes. However, it is unclear how comfortable the providers at the PNWVA are regarding CGM prescribing and management.

The experimental design will examine PNWVA providers' perceived barriers for CGM utilization with a survey measuring provider comfort, experience and knowledge. A toolkit will be implemented to improve provider experience, knowledge and comfort surrounding CGM's and subsequent prescribing for eligible patients. The Institute of Healthcare's Model of Improvement focuses on accelerating improvement based on three fundamental questions and subsequent application of a Plan-Do-Study-Act cycle to implement and evaluate the proposed change (Institute for Healthcare Improvement, n.d.). The three questions include: (1) what is trying to be accomplished, (2) how will it be known if the change is an improvement, and (3) what change can be made to make an improvement (Institute for Healthcare Improvement, n.d.; Valier 2020)? This process streamlines the improvement process by appraising the site for a theoretical change, as well as employing an organized mechanism to produce and modify sustainable change. This model is very applicable for this quality improvement project, since the CGM toolkit intervention will be evaluated using a Plan-Do-Study-Act cycle.

Specific Aims

This Quality Improvement project aims to assess PCP's knowledge, comfort, and experience with prescribing CGMs before and after the implementation of a CGM toolkit. This will be assessed through a pre-survey and post-survey to identify barriers and gaps in providers' knowledge, comfort and experience surrounding CGMs.

A CGM toolkit will be created for PCPs and Diabetic-Focused Nurse Practitioners (DFNP). The CGM toolkit will provide education and guidance for CGM management, identify eligible patients for CGM utilization, provide additional educational resources for providers to reference, and potentially introduce a new workflow for follow-up timeline. At this time, the workflow has yet to be approved for implementation.

Methods

Context

The location of this project is at a PNWVA community-based outpatient clinic, one of many located in Oregon located in a metropolitan city. The Veteran's Association is a department of the federal government tasked with providing care to eligible current and past veterans. The Veterans Association offers a wide range of health services ranging from primary care to specialty care. At the PNWVA, a review of 13 PCPs revealed a combined patient panel of 2,300 individuals with diabetes. Among these, 580 are on insulin therapy, yet only 61 are utilizing CGMs.

The PCPs at the PNWVA spend considerable time in diabetic patient care which includes direct patient care, chart review, referrals, lab interpretation, and preventative care. The volume of new CGM orders is anticipated to increase significantly as CGMs become a standard of PCP care. Given the large diabetic population at the PNWVA and the anticipated increasing demand for OTC CGM device, the PNWVA management wanted to develop an organized CGM toolkit resource for providers. Specifically, a clear process for ordering the appropriate CGM, education and training of the veteran, outlining interdisciplinary roles, and a clear process for data and care management are needed. The CGM toolkit will be piloted among PNWVA providers; if successful, this toolkit may be utilized in other Veterans Association primary care clinics throughout Oregon. Refer to the "Cause and Effect Diagram" for a summary of the current issue surrounding CGM underutilization in the PNWVA (Appendix A).

Interventions

A survey named Continuous Glucose Monitoring Survey for Veterans Association Providers (CGMSVAP) (Appendix B) was created and modeled after the *Continuous Glucose Monitoring Survey of Primary Care Clinicians* survey to assess providers' knowledge, comfort and experience surrounding CGM's (Oser et al., 2022). Oser et al., 2022 gave permission to have questions from their survey used when constructing the CGMSVAP survey. This survey evaluated PCPs' familiarity, baseline knowledge, experience, current prescribing practice for CGMs, interest in completing education on CGM interpretation, and provider's preference for monitoring CGM patients. To participate in the survey, PCPs must have a patient panel that includes T2DM patients on insulin therapy that are not managed by endocrinology and have prescribing authority.

The CGMSVAP survey asked providers to describe their professional role in the care team, number of years in clinical practice, baseline knowledge of CGMs, current CGM utilization, barriers to prescribing CGMs, and other questions relating to knowledge, comfort and experience surrounding CGM's, as seen in **appendix B**. The survey was created using the Qualtrics platform. Most questions had an assigned point value equivalent to the Likert scale rating or similar rating style. The pre-surveys were sent out electronically to 13 providers' emails in September of 2024 and were open for two weeks. After, two separate toolkits were developed, one prioritizing CGM overview and ordering while the other emphasized CGM evaluation and management. The CGM toolkits were sent out to the PNWVA community-based outpatient clinic in December for four weeks and the post survey was sent out in January for ten days. The CGM toolkit included CGM education, identifying eligible CGM patients, providing guidance on CGM report interpretation and management with medication titration, and provide additional resources that providers can refer to for further education surrounding CGMs (Appendix C). The post-survey contained the same pre-survey questions plus additional questions

evaluating their opinion on the utility of the CGM toolkit. Values between the pre- and post-survey will be compiled for analysis and interpretation.

Measures

The outcome measures of this project were to evaluate the change in PCPs' knowledge and comfort regarding CGMs after the implementation of the CGM toolkit. Providers' survey responses were assessed to identify potential barriers for prescribing and managing CGMs.

The Doctor of Nursing Practice (DNP) student is responsible for facilitation of the CGMSVAP survey and creation of the CGM toolkit. The site's Clinical Practice Manager is responsible for approving the CGMSVAP survey and CGM toolkit materials and encouraging PCPs to utilize the CGM toolkit.

Data management

Data collected from the study is solely be based on the anonymous survey responses. Pre- and post-surveys were created using the Qualtrics platform, which has accredited data centers that adhere to security and technical best practices. Links for survey completion was sent to each participant's private VA email. Data results were presented and categorized through Likert scales or a similar ranking system. There were point values attached to each element of the scale. Element value totals were analyzed to determine if there is statistical significance from the pre- and post-survey scores. Only Veterans Association providers were subject to the study; there were no patient identifiers included throughout the study. The CGMSVAP survey responses remained anonymous and confidential to encourage participants to answer honestly. Pre- and post-survey response data were collected by the DNP student.

Analysis

Pre- and post-survey questions were categorized in either knowledge or comfort as seen in **Table 1**. Quantitative and qualitative data was extracted from Qualtrics. Data was gathered from the pre and post CGMSVAP surveys and results were compared based on the numerical value of each question based on the Likert scale ranking. Meaning, the higher the Likert score ranking, the higher the point total, as seen in **Table 4**. For questions that did not have a Likert scale ranking, these questions were either not included or presented as qualitative data, as seen in **Table 1**. Questions in the survey were placed into three categories based on the projects aim of analyzing providers comfort, experience and knowledge. Numerical values were compared pre and post CGMSVAP surveys based on the categories of provider comfort, experience and knowledge. Quantitative data point totals for comfort and knowledge resulted in two different means/standard deviations for the CGMSVAP pre-survey and two different means/standard deviations for the CGMSVAP post-survey, as shown in **Table 2**. A graphical representation of knowledge vs comfort means pre- vs post- intervention can be seen in **Figure 4**. A T-test was run for comparing pre- vs post-survey comfort and knowledge to determine if there is statistical significance with a p value less then 0.05. The p value was greater than 0.05, indicating that there was no statistical significance in knowledge or comfort with implementation of the CGM toolkit.

Demographic data, including years of clinical experience, years of clinical experience at the Veterans Association, and tenure at the Veterans Association, were collected to examine participant characteristics and track anonymous participation from pre- to post survey. These results were displayed in **Figure 1**. Additionally, barriers to CGM utilization (**Figure 2**) and PNWVA provider patient panels (**Figure 3**) were included to understand current trends in CGM avoidance and CGM need.

For providers to be eligible in receiving the $20 gift card Amazon, they were encouraged to complete both CGMSVAP surveys and utilize the CGM toolkits in their clinical practice. At the end of the CGMSVAP post-survey, providers had the option to input their emails for a raffle. Given the anonymous nature of the CGMSVAP surveys, there was no way to ensure if providers completed both the CGMSVAP

pre-survey and CGMSVAP post-survey unless 13/13 responses were submitted. Hence, a gift card incentive was offered to encourage participation.

Ethical Considerations

Ethical considerations surrounding this project concerned maintaining anonymity among survey participants. Participants were not asked to provide any identifiers except an email to be entered to the raffle and the winner was selected for $20 gift card after survey completion. Anonymous surveys may reduce or eliminate social desirability bias and give the respondent confidence to be candid with the survey (Gair et al., 2020). Online surveys also have a lower cost of production and can reach more participants (Oliveri et al., 2021). Incentivizing survey completion also increases response rates (Sammut et al., 2021). Qualtrics has an anonymous option for survey responses. No patient identifiers were used in this quality-based improvement project.

Results

There were seven responses in the pre-survey and six responses in the post-survey. Of the three categories being measured, only the knowledge and comfort questions could be included in the analysis due to the lack of a Likert scale ranking system for the experience questions. Of the included questions, only seven pre- and post-survey items assessed comfort, and only three assessed knowledge, as shown in **Table 1**. The mean score for knowledge increased from 2.86 (pre-survey) to 3.05 (post-survey). Similarly, the mean score for comfort increased from 2.63 (pre-survey) to 2.67 (post-survey). Standard deviations for both knowledge and comfort questions were calculated pre- and post-survey, as displayed in **Table 2**. A two-sample equal variance T-test with a two-tailed distribution was conducted for both knowledge and comfort data sets, yielding p-values of 0.58 and 0.55, respectively. Additionally, three post-survey questions directly assessed the utility of the toolkit in knowledge, comfort, and experience

categories, as presented in **Table 3**. The mean scores for these were 3 for knowledge, 2.75 for comfort, and 3 for experience.

Discussion

Summary

This quality improvement project utilized a PDSA cycle that included a pre-survey, toolkit implementation, and a post-survey to evaluate the toolkit's utility. The project aimed to identify barriers and gaps in providers' knowledge, comfort, and experience with CGMs using the pre-survey. Of the 13 providers, seven responses identified weaknesses such as unclear benefits of CGMs in T2DM management, insufficient time to educate patients, unfamiliarity with VA CGM policies, challenges in identifying eligible patients, difficulty analyzing CGM reports, medication management strategies, and limited CGM educational resources. Based on this input, a CGM toolkit was developed to address these weaknesses and was approved by the VA for distribution. The toolkit was implemented for 25 days in December 2024 at the PNWVA clinic. A post-survey was conducted in January 2025, with six respondents. Efficacy was evaluated by comparing pre- and post-survey results, and a t-test was used to assess statistical significance in knowledge and comfort improvements from using the toolkit.

Interpretation

The two-sample equal variance T-test yielded p-values of 0.580 and 0.554 for knowledge and comfort, respectively, indicating no statistically significant improvement. These results suggest that the observed changes in knowledge and comfort could have occurred by chance. However, post-survey questions directly assessing the toolkit's utility showed four out of six respondents reported improvement in their confidence, knowledge, and experience with CGM prescribing and management after the toolkit became an available resource, as reflected in **Table 3**. Additionally, mean values for knowledge and comfort showed slight increases, as depicted in **Figure 4**. Despite these improvements,

the lack of statistical significance limits the conclusions about the toolkit's effectiveness. The subjective nature of the survey's responses and the absence of critical feedback further complicate the interpretation of these results.

Limitations

The additional workload for PCPs to complete CGMSVAP surveys likely affected response rates, as no designated time was allotted for survey completion. Of the 13 providers, only seven responded to the pre-survey and six responded to the post-survey, yielding response rates between 46% and 54% respectively. The small sample size limits the generalizability of findings to the broader VA system. Usage of CGM toolkit was optional, and only 66.67% of post-survey respondents reported using it. The sample size, representing roughly 30% of the PCP pool at PNWVA, was insufficient to draw definitive conclusions about the toolkit's utility.

Providers attended two in-service education seminars to learn about CGM models, report interpretation, and workflow processes. The variability in provider's background education, CGM educational experiences, patient panel size and population, made it difficult to independently analyze and confirm improvements in knowledge, comfort and experience based solely on the toolkit. Challenges in maintaining fidelity to the intervention protocol and subjective categorization of survey questions further limited data reliability.

The anonymous design of the survey questions prevented tracking of whether respondents completed both surveys or used the toolkit, enabling them to receive incentives regardless of participation level. Differences in survey participants between pre- and post-surveys, as shown in **Figure 1**, further complicated data interpretation. Specifically, some participants did the pre-survey without doing the post-survey, along with participants doing the post-survey without completing the pre-survey. A decrease in the number of respondents, from seven to six, prevented the ability to seamlessly translate the direct impact of knowledge, comfort, and experience of participants pre- and post-

implementation of the toolkit. Additionally, the project lacked a control group to assess the intervention's effectiveness, and the four-week implementation period may have been too short for meaningful adoption the toolkit.

The analysis also included its own set of difficulties. Not all questions translated well to statistical analysis, resulting in less questions included in the statistical analysis for knowledge and comfort, as seen in **Table 1**.

Without an objective method for categorization of question types, the assigned point values may lack reliability and should be interpreted with caution. Not all questions translated well to quantitative comparison, and only the questions that were framed in a Likert scale rating could be included in analysis, resulting in numerous questions not being included in the final analysis. The absence of a formal Likert scaling system for some questions prevented their inclusion in quantitative analyses, particularly in the experience category. Consequently, a qualitative summary was provided, though it did not serve as a robust metric for evaluating improvements.

Conclusions

PNWVA medical providers identified multiple barriers to CGM implementation, including education and workflow challenges, as outlined in **Figure 2**. The PNWVA held CGM educational meetings, which occurred July and October 2024, with the October meeting occurring after pre-survey completion. A CGM toolkit was developed to address these barriers. Pre- and post-surveys tracked improvements in knowledge and comfort categories; mean scores showing slight increases, as displayed in **Figure 4** and **Table 3**. However, the T-test results confirmed no statistically significant improvements, indicating the observed changes could have occurred by chance. Although the toolkit did not achieve the desired impact, its elements remain valuable as CGM usage is expected to increase in primary care. Future iterations should incorporate critical feedback to enhance the toolkit's effectiveness. Despite the

lack of significant findings, the project highlights the need for evidence-based CGM toolkits in primary care to meet growing demands.

Future Directions

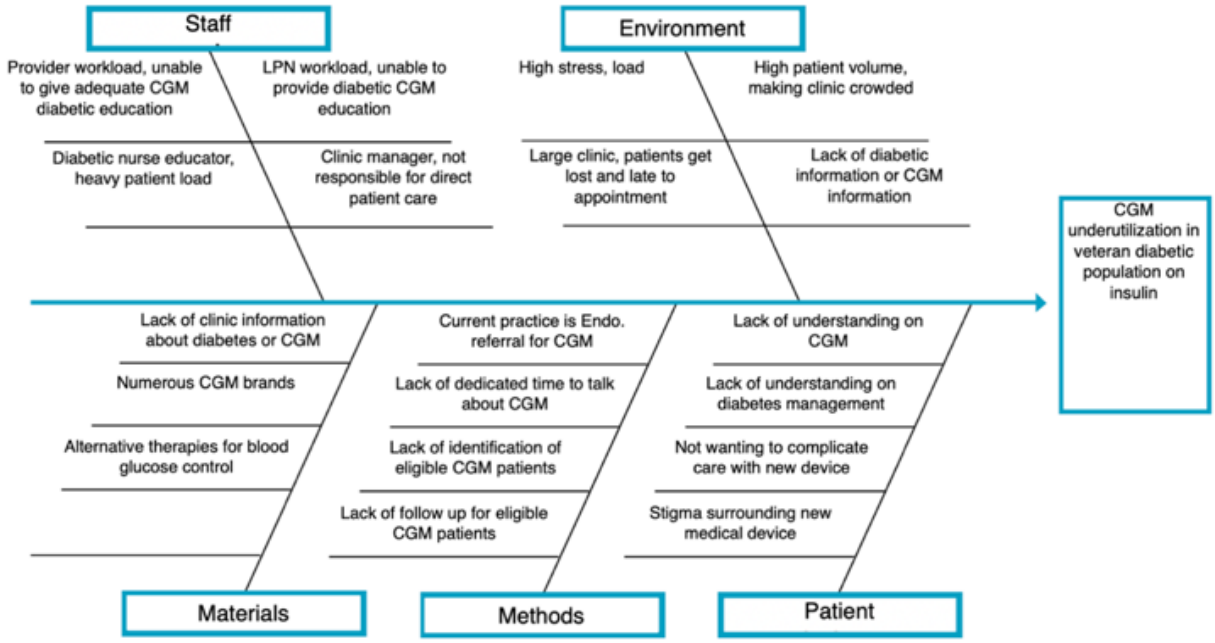
Future efforts should focus on improving and expanding the CGM toolkit's utility. Due to the lack of feedback from the post-survey, revisions will not include participant input. Once the desired CGM workflow is approved by upper management, it should be integrated into the toolkit, emphasizing patient education, training, and interdisciplinary roles. Expanding the toolkit to other primary care clinics within the Oregon VA system is essential to address the anticipated rise in CGM use. Further research is needed to optimize toolkit design and implementation, ensuring it effectively supports providers in managing CGMs in primary care settings.

Appendix

Appendix A: Cause and Effect Diagram

Team: Spring 2024 DNP projection **Project:** CGM utilization among VA PCP's

1) Input the effect you'd like to influence.
2) Input categories of causes for the effect (or keep the classic five).
3) Input causes within each category.



Appendix B: CGMSVAP survey

Continuous Glucose Monitor Survey for Veteran Association Providers (CGMSVAP) to assess Provider Knowledge, Comfort and Experience Surrounding Continuous Glucose Monitors.

Pre-Survey

1) I am a licensed medical provider in the United States (please select one)

a) MD or DO
b) NP
c) PA

2) **How many years have you been practicing upon graduation**?

a) 1-10 years
b) 11-20
c) 21-30
d) 31-40
e) 41-50

3) How many years have you been practicing at the Veterans Association (VA)? (regardless of location of the VA)

a) 1-10
b) 11-20
c) 21-30
d) 31-40
e) 41-50

4) How many years have you been practicing in primary care or internal medicine?

a) 1-10
b) 11-20
c) 21-30
d) 31-40
e) 41-50

5) Which statement best describes you experience with continuous glucose monitors (CGMs) such as Libre, Dexcom, or MedTronix?

a) I have never heard of CGMs
b) I have heard of CGMs, but I have never had patients using one
c) I have had patients on CGMs, but I have never prescribed one

d) I have prescribed a CGM before

6) What sources below do you receive you education about diabetes? (select all that apply)

a) American Academy of Family Physicians (AAFP)
b) American Diabetic Association (ADA)
c) American College of Endocrinology (ACE)
d) American Association of Clinical Endocrinologists (AACE)
e) DynaMed
f) UpToDate
g) American Association of Nurse Practitioners (AANP)
h) American College of Physicians (ACP)
i) American Association of Physician Assistants (AAPA)
j) Other

7) During your medical education, do you believe you has sufficient knowledge surrounding CGMs utilization and management? (Answer N/A if CGM's were not utilized during your schooling)

a) Yes
b) No
c) N/A

8) Please estimate the approximate number of patients you manage in each of the following categories.

	0	1-5	6-10	11-20	21+
Patients with Type 1 diabetes on insulin therapy					
Patients with Type 2 diabetes not on insulin therapy					
Patients with Type 2 diabetics on insulin therapy					
Patients with Type 1 or 2 diabetes utilizing a CGM					

9) How likely are you to recommend a CGM for a patient with diabetes?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

10) How useful do you believe CGMs are on producing optimal patient outcomes?

(1) Not useful
(2) Somewhat useful
(3) Moderately useful
(4) Very useful

11) How confident are you on the benefits of diabetic CGM utilization?

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

12) What barriers do you personally feel regarding outpatient CGM prescription and management?

a) Unaware of current VA CGM policy
b) Lack of education or experience surrounding CGMs
c) Lack of time to manage CGM patients given current patient load
d) Lack of patients' interest to start or continue CGM utilization
e) Lack of perceived benefits CGMs can offer the patient
f) Lack of perceived benefits CGMs can offer the provider
g) Other

13) How well do you understand the VA's criteria for patients who would be eligible for a CGM?

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

14) How likely will you prescribe, manage, and adjust insulin therapies based on CGM's currently?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

15) When providing diabetes related care, please rate how confident you are at prioritizing which patients may benefit from CGMs.

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

16) **When providing diabetes related care, please rate how confident you are counseling patients on the benefits of CGMs.**

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

17) **When providing diabetes related care, please rate how confident you are at educating patients on how to appropriately use their CGM.**

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

18) **When providing diabetes related care, please rate how confident you at analyzing and interpreting CGM data.**

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

19) **When providing diabetes related care, please rate how confident you at adjusting treatments based on CGM data.**

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

20) **Would you be more likely to prescribe CGMs if you had access to educational resources provided by the VA?**

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

21) **If educational resources were offered, how interested would you be to get access to these CGM educational resources?**

(1) Not interested
(2) Somewhat interested
(3) Moderately interested
(4) Very interested

22) What educational resources would you like regarding CGM's? (select all that apply)

a) 1-hour CGM educational class/workshop
b) CGM toolkit which will provide the following information:
    a. How to determine which patients will be eligible for a CGM
    b. Management of CGM
    c. Follow-up guidance
    d. Educational resources
c) Continuing education module
d) Other

23) If an educational CGM class/workshop was developed, how likely would you sign up for it?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

24) How likely will you refer patients on a CGM to a CGM education clinic led by a the diabetic Nurse Practitioner or Nursing Care Manager?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

25) Completing the pre and postsurvey enters you into a raffle to win a $20 gift card, please rank what the gift card should be for

(1) Amazon
(2) Dominos Pizza
(3) Starbucks
(4) Dutch Brothers
(5) Target
(6) Other

Continuous Glucose Monitor Survey for Veteran Association Providers (CGMSVAP) to assess Provider Knowledge, Comfort and Experience Surrounding Continuous Glucose Monitors.

Post-Survey

1) I am a licensed medical provider in the United States (please select one)

d) MD or DO
e) NP
f) PA

2) **How many years have you been practicing upon graduation**?

f) 1-10 years
g) 11-20
h) 21-30
i) 31-40
j) 41-50

3) How many years have you been practicing at the Veterans Association (VA)? (regardless of location of the VA)

f) 1-10
g) 11-20
h) 21-30
i) 31-40
j) 41-50

4) How many years have you been practicing in primary care or internal medicine?

f) 1-10
g) 11-20
h) 21-30
i) 31-40
j) 41-50

5) Which statement best describes you experience with continuous glucose monitors (CGMs) such as Libre, Dexcom, or MedTronix?

e) I have never heard of CGMs
f) I have heard of CGMs, but I have never had patients using one
g) I have had patients on CGMs, but I have never prescribed one
h) I have prescribed a CGM before

6) What sources below do you receive you education about diabetes? (select all that apply)

k) American Academy of Family Physicians (AAFP)
l) American Diabetic Association (ADA)
m) American College of Endocrinology (ACE)
n) American Association of Clinical Endocrinologists (AACE)
o) DynaMed
p) UpToDate
q) American Association of Nurse Practitioners (AANP)
r) American College of Physicians (ACP)
s) American Association of Physician Assistants (AAPA)
t) Other

7) During your medical education, do you believe you has sufficient knowledge surrounding CGMs utilization and management? (Answer N/A if CGM's were not utilized during your schooling)

a) Yes
b) No
c) N/A

8) Please estimate the approximate number of patients you manage in each of the following categories.

	0	1-5	6-10	11-20	21+
Patients with Type 1 diabetes on insulin therapy					
Patients with Type 2 diabetes <u>not</u> on insulin therapy					
Patients with Type 2 diabetics on insulin therapy					
Patients with Type 1 or 2 diabetes utilizing a CGM					

9) How likely are you to recommend a CGM for a patient with diabetes?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

10) How useful do you believe CGMs are on producing optimal patient outcomes?

(1) Not useful
(2) Somewhat useful

(3) Moderately useful
(4) Very useful

11) How confident are you on the benefits of diabetic CGM utilization?

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

12) What barriers do you personally feel regarding outpatient CGM prescription and management?

h) Unaware of current VA CGM policy
i) Lack of education or experience surrounding CGMs
j) Lack of time to manage CGM patients given current patient load
k) Lack of patients' interest to start or continue CGM utilization
l) Lack of perceived benefits CGMs can offer the patient
m) Lack of perceived benefits CGMs can offer the provider
n) Other

13) How well do you understand the VA's criteria for patients who would be eligible for a CGM?

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

14) How likely will you prescribe, manage, and adjust insulin therapies based on CGM's currently?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

15) When providing diabetes related care, please rate how confident you are at prioritizing which patients may benefit from CGMs.

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

16) When providing diabetes related care, please rate how confident you are counseling patients on the benefits of CGMs.

(1) Not confident

(2) Somewhat confident
(3) Moderately confident
(4) Very confident

17) When providing diabetes related care, please rate how confident you are at educating patients on how to appropriately use their CGM.

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

18) When providing diabetes related care, please rate how confident you at analyzing and interpreting CGM data.

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

19) When providing diabetes related care, please rate how confident you at adjusting treatments based on CGM data.

(1) Not confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident

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(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

21) If educational resources were offered, how interested would you be to get access to these CGM educational resources?

(1) Not interested
(2) Somewhat interested
(3) Moderately interested
(4) Very interested

22) What educational resources would you like regarding CGM's? (select all that apply)

e) 1-hour CGM educational class/workshop

f) CGM toolkit which will provide the following information:
    a. How to determine which patients will be eligible for a CGM
    b. Management of CGM
    c. Follow-up guidance
    d. Educational resources
g) Continuing education module
h) Other

23) If an educational CGM class/workshop was developed, how likely would you sign up for it?

(1) Not likely
(2) Somewhat likely
(3) Moderately likely
(4) Very likely

24) Did you have the opportunity to view or use the toolkits? If not, please select N/A for the next responses

(1) Yes
(2) No

25) Did implementation of the CGM toolkit make you more confident surrounding CGM prescribing and management

(1) Not at all confident
(2) Somewhat confident
(3) Moderately confident
(4) Very confident
(5) N/A

26) Did implementation of the CGM toolkit increase your knowledge surrounding CGM prescribing and management

(1) Not at all
(2) Somewhat
(3) Moderately
(4) Very
(5) N/A

27) Did implementation of the CGM toolkit improve your experience of CGM prescribing and management

(1) Not at all
(2) Somewhat
(3) Moderately
(4) Very
(5) N/A

28) Did the CGM toolkit influence your current practice surrounding CGMs?

(1) Not at all
(2) Somewhat
(3) Moderately
(4) Very
(5) N/A

29) What would you have like to see added or changed for the CGM toolkit?

Please fill in the blank

30) Please include an email to have the $20 Amazon gift card sent to

Appendix C: CGM Toolkit

CGM EVALUATION, INTERPRETATION AND MANAGEMENT

CGM Toolkit

Table of Contents

What is a continuous glucose monitor (CGM)

The CGM is a device that measures interstitial fluid (ISF) glucose every 1-15 minutes (Bergenstral 2018; Kawakatsu et al., 2022). CGM devices allow medical providers to track real-time glucose levels in patients and offer individualized therapy (Kawakatsu et al., 2022). ISF glucose readings may be slightly different from serum blood glucose readings due to a lag time from when glucose enters the bloodstream and is then absorbed by the ISF (Faerch et al., 2021).

Currently, there are three major brands that represent a majority of CGMs on the market: FreeStyle Libre, Medtronic, and Dexcom (Edward & Priefer 2023; Elsayed et al., 2023; Sherrill & Lee, 2023). The CGM sensors can be placed on different sites on the patient's body; however, they are FDA-approved for the upper back of the arms (Libre, Dexcom) or abdominal area (Dexcom, Medtronic), since these sites provide improved BG level accuracy (Hall et al., 2022; Kawakatsu et al., 2022).

Why are CGM's beneficial?

Routine use of CGMs has been found to promote safety outcomes in patients with diabetes. CGM use has been shown to (1) reduce the incidence of hypoglycemic events for those with impaired hypoglycemia awareness or history of severe hypoglycemia, (2) decrease diabetes related-hospitalization of roughly 17-18%, and (3) improve A1c levels and glycemic control in adherent diabetic patients (Aggarwal et al., 2022; Hannah et al., 2024; Kant et al., 2022; Manov et al., 2023; Reaven et al., 2023; Wang et al., 2022).

CGMs offer the opportunity for continuous blood glucose monitoring to provide more patient-specific data. Subsequently, this allows medical providers to assess their patient's comprehensive glucose trends for personalized adjustments to diabetic drug therapies (Manov et al., 2023).

CGMs have also been shown to have higher patient adherence rates and satisfaction compared to fingerstick testing (Cowart et al., 2020; Janapala et al., 2019; Kieu et al., 2023; Lin et al., 2021).

Traditional A1c's can be inaccurate and heavily influenced by kidney failure, anemia, pregnancy, altitude, ethnicity and more (Eyth & Naik, 2023).

Current trends in CGM use

The use of CGMs for patients with Type 2 Diabetes Mellitus is becoming more common, especially in the primary care setting (Mayberry et al., 2023). Over the years, CGM use has increased from 0.4% to 4.1% between 2014 to 2020 (Sherill & Lee 2023). In 2024, the Food and Drug Administration (FDA) announced that the first approved over-the-counter CGM for patients not on insulin therapy, the Dexcom Stelo Glucose Biosensor System, is available now via the subscription model but has not yet rolled out to retail locations (U.S. Food and Drug Association, 2024).

Current VA practice

The VA Clinical Practice Guidelines for the Management of Type 2 Diabetes Mellitus provides a list of therapeutic medications covered under formulary, which includes metformin IR, metformin XR, glipizide IR, glimepiride, sitagliptin, empagliflozin, acarbose, semaglutide, insulin glargine and insulin aspart.

Of these medications, glipizide IR, glimepiride, insulin glargine and insulin aspart are high-risk medications for hypoglycemia (AGS, 2023). Semaglutide may increase the risk for hypoglycemia when used concurrently with these other high-risk medications (Zhao et al., 2021). Medications that have minimal to no risk of hypoglycemia include metformin, empagliflozin, acarbose, and sitagliptin when taken as monotherapy (Feingold, 2024). Providers should be aware that combinations of these medications may increase the risk of hypoglycemia.

Who may benefit from CGM?

Patients with Type 2 Diabetes Mellitus on insulin therapy who may benefit from CGM

- History of recurrent and/or severe hypoglycemia
- Poorly controlled diabetes despite adherence to checking capillary blood glucose
- Significant cardiovascular disease
- Severe renal or hepatic disease
- Multiple insulin injections or finger pricks needed per day
- Requiring improvement of A1c in preparation for a surgery/procedure
- Problems with dexterity or difficulty completing finger sticks
- High fall risk (e.g. elderly)
- Athletes
- Those who operate heavy equipment or drive for a living

Criteria to take into consideration before prescribing a CGM

- Technological knowledge
- Compliance to medical care
- Patient preferences
- A1c goal
- Adhesive allergies

Who qualifies for CGM at the VA?

All must be selected for patient to be eligible for ongoing, personal use CGM:

- Diagnosis of diabetes mellitus (type I, type II, or uncommon conditions that may warrant CGM therapy)
- Daily insulin or insulin pump therapy
- Requesting provider/clinic has documented that patient has followed provider recommendations for blood glucose monitoring and therapy changes
- Requesting provider/clinic must have the resources, experience, and/or training to appropriately monitor and utilize CGM data
- Assessment of patient and/or caregiver to be competent to use CGM devices and able to reliably self-manage their diabetes
- Patient is able/willing to attend visits for training on use of the device and plan for training has been arranged and documented
- Patient is able/willing to attend follow up visits with prescriber at 3 and 6 months of therapy (every 6 months over the long-term) while using the device; remote visits may be conducted if patient is able to upload CGM data electronically
- Patient is able/willing to continue to test capillary blood glucose as needed for safe diabetes management and/or for device operation
- Patient is able/willing to submit documentation of glucose readings, insulin use, meals consumed, physical activity or other information as requested for diabetes management
- Patient consents to remote sharing of glucose data

And one of the following must be selected for patient to be eligible:

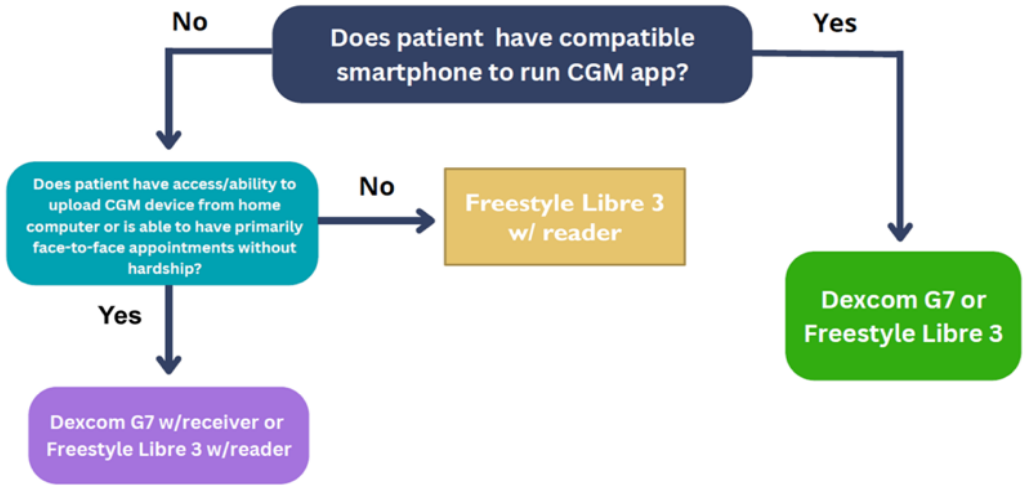
- Documented frequent, recurrent, and/or severe hypoglycemic events in the past year, despite documented attempt(s) to manage hypoglycemia via traditional therapy with saeter and 4 x daily test strips (or other extenuating circumstances)
- Special circumstances where the risk of severe hypoglycemia and potential sequelae are considerable (e.g. high-risk elderly, athlete, pregnancy or pregnancy planning, high risk employment activities, severe hepatic or renal disease)
- Inability to meet desired glycemic control despite adherence to the prescribed pharmacologic and non-pharmacologic treatment regimen
- Documented limitation to perform minimum frequency of blood glucose testing despite alternate site testing (e.g. severe dexterity issues)

Exclusion Criteria for a CGM

- Systemic allergy to medical adhesives (for localized allergy, suggest Flonase at site of application prior to CGM placement)
- Refusal to conduct conventional glucose measures (e.g. capillary blood glucose)

How to select which CGM to prescribe

Step 1: Check for CGM compatibility to pair with a patient's smartphone before choosing a device. If neither CGM is compatible, the patient must use a receiver device instead.



Step 2: Compare CGM options to select a CGM that fits the patient's preferences. A comparison of these CGM models are shown in the table below.

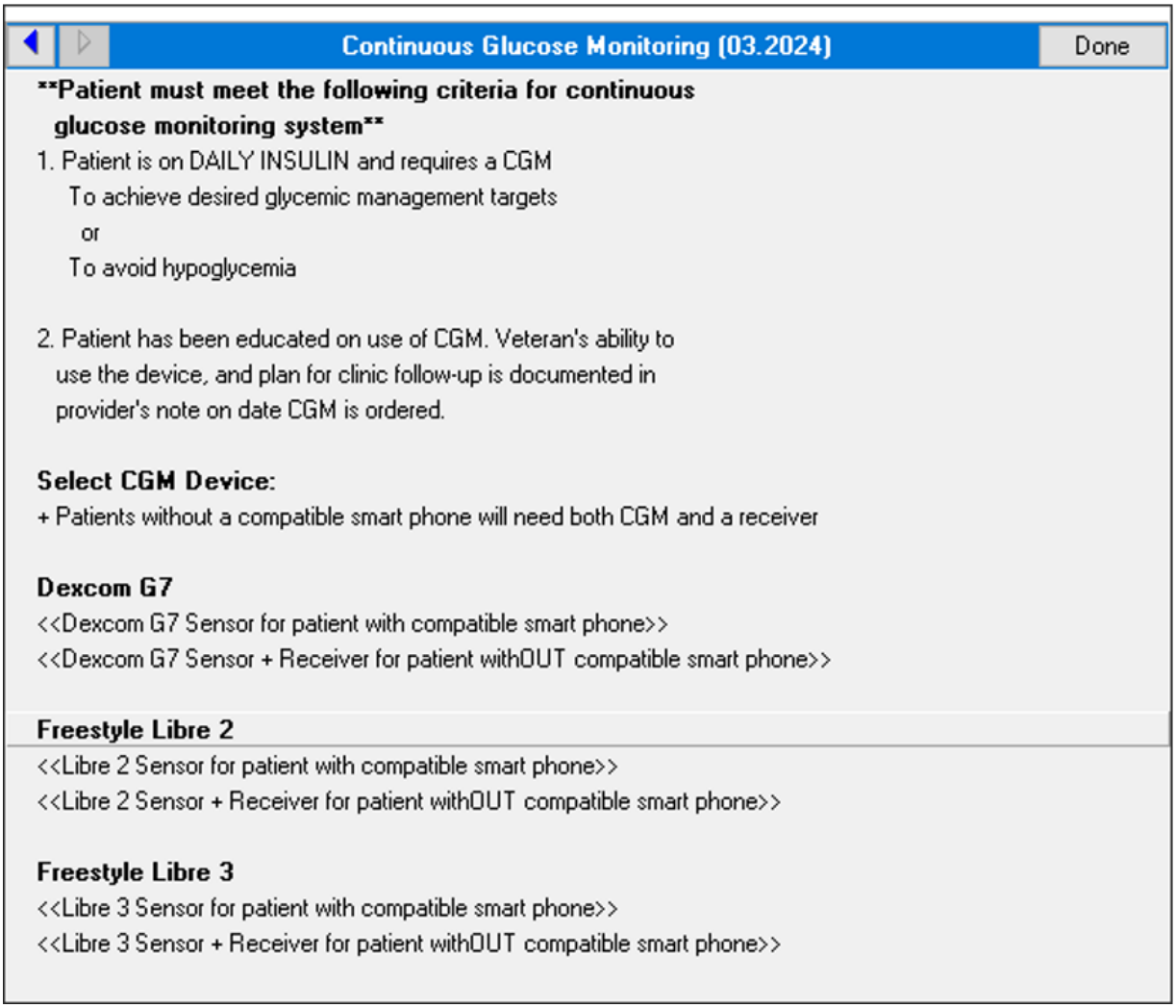
	Freestyle Libre 2	**Freestyle Libre 3**	**Dexcom G7**
Frequency of readings	5 min	1 min	5 min
Duration of sensor	14 days	14 days	10 days
Warm-up	1 hour	1 hour	30 min
CGM type	Flash-scanning required every 8 hours	Real time	Real time
Bluetooth distance	20 feet	33 feet	20 feet
Drug interference	Ascorbic acid >500 mg/d	Ascorbic acid >500 mg/d	Acetaminophen >4000 mg/d
Data sharing	Smartphone app, receiver device, family-sharing app available		
Phone compatibility	Libre Phone Compatibility		Dexcom Phone Compatibility

How to order a CGM in CPRS

Orders → Outpatient Medications → Endocrine → CGM

Choosing a CGM sensor and CGM receiver will open two order sets:

1. Sensor order for pharmacy
2. Receiver order for prosthetics



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CGM EVALUATION, INTERPRETATION AND MANAGEMENT

CGM Toolkit

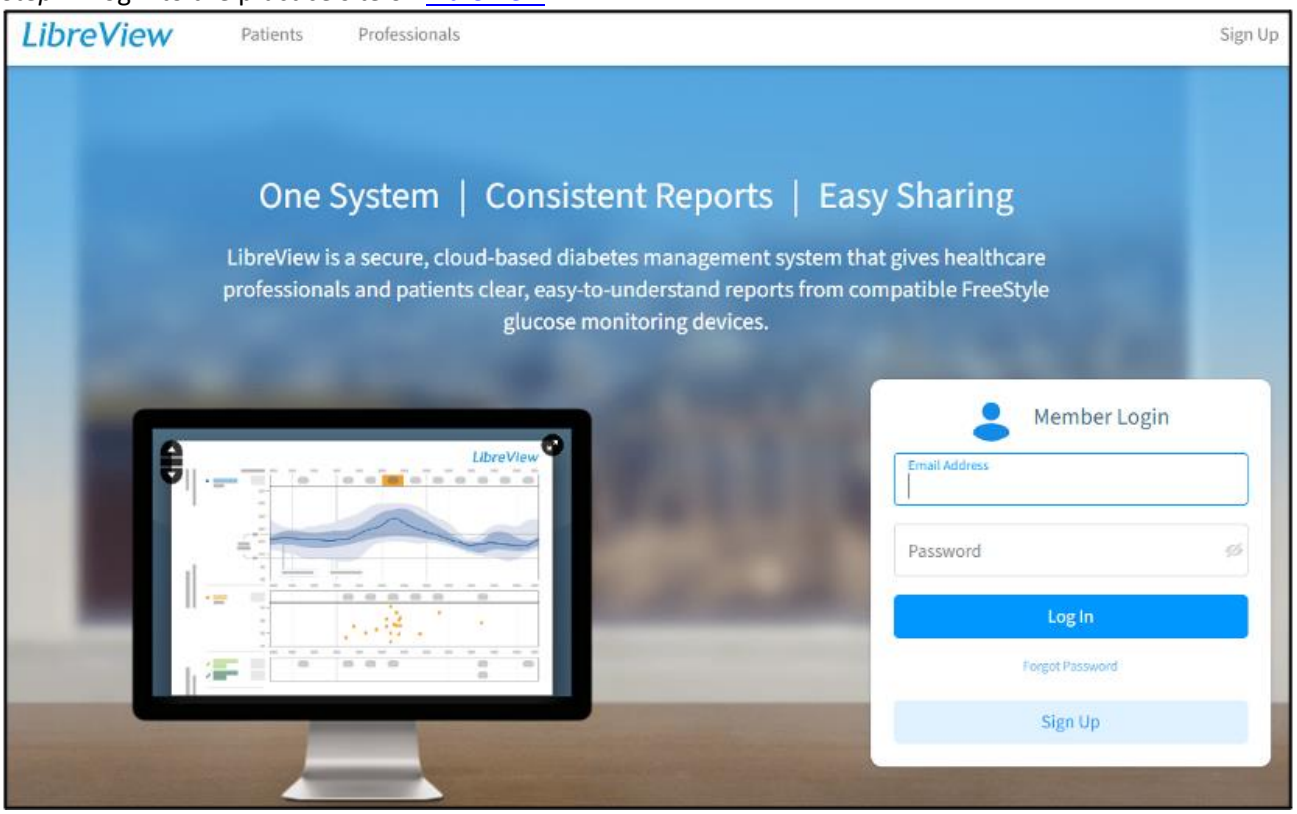
Table of Contents

Accessing patient Libre CGM data

Patients should have already completed setting up sharing their CGM data to the clinic during their visits with the CGM NP or NCM. CGM providers will have access to the CGM data by logging into the shared account online.

Instructions to download LibreView data for patients using a Libre receiver device

Step 1: Log into the practice site on LibreView



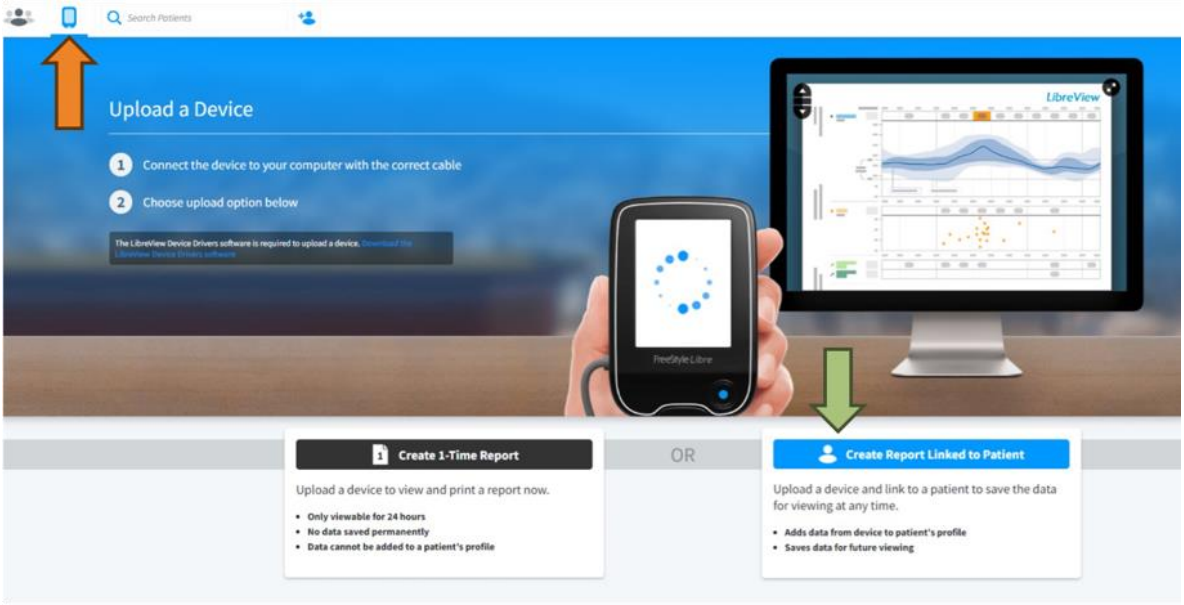
Step 2: To download a Libre reader in-clinic, must ensure that the device driver is installed on the laptop.

- Laptops that will be used to upload data from a reader MUST have the associated software drivers installed first.
- Open the Software Center → type into search bar on bottom of windows taskbar.
- Search for the required software:

- Install and restart the laptop.

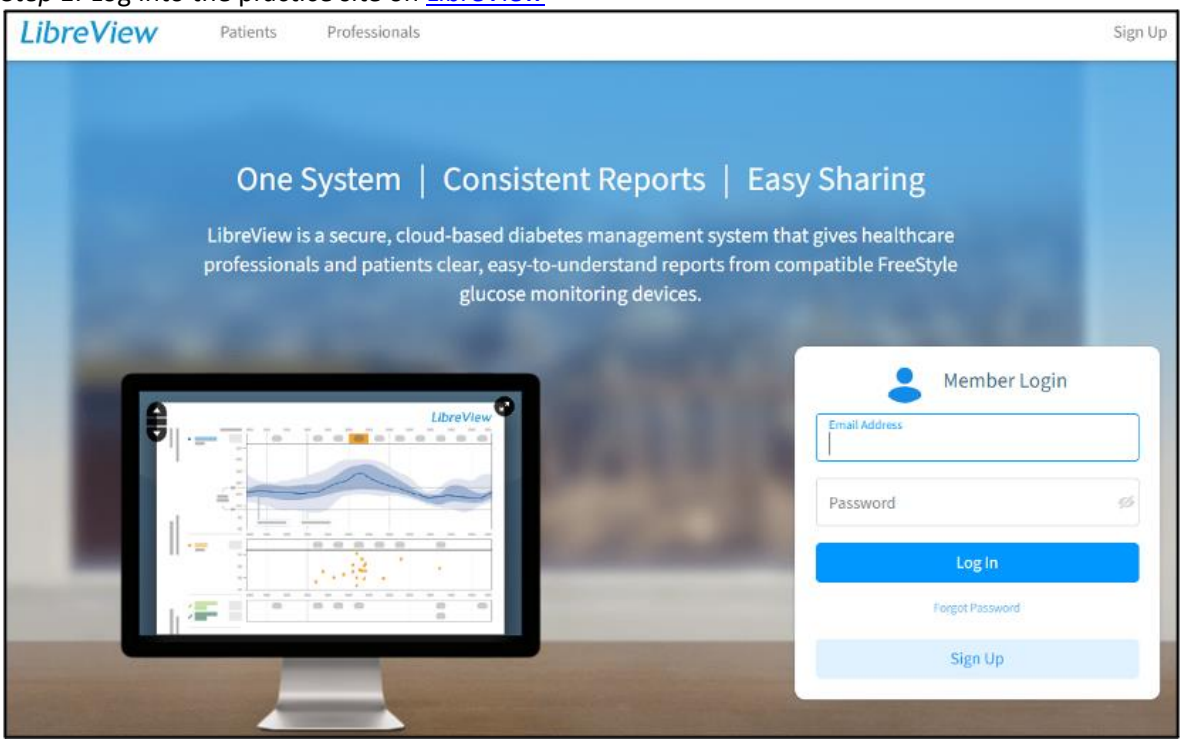
Step 3:

- Click on the reader icon at top (orange arrow).
- Plug in Libre reader device to laptop.
- Click on Create Report Linked to Patient (green arrow).

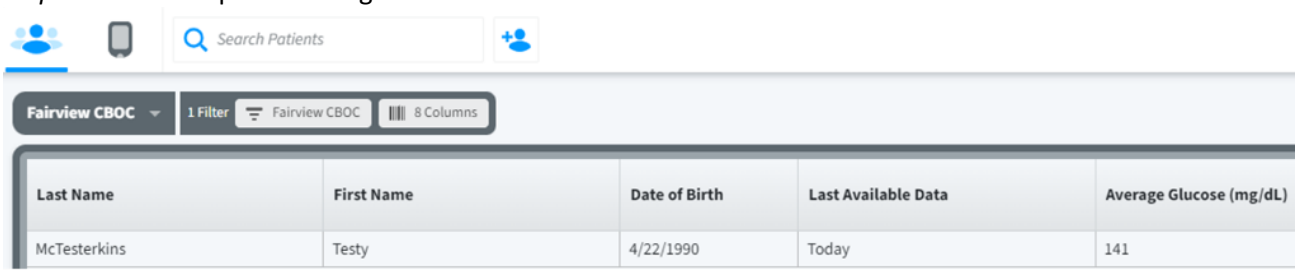


Instructions for accessing LibreView data for patients using a smartphone

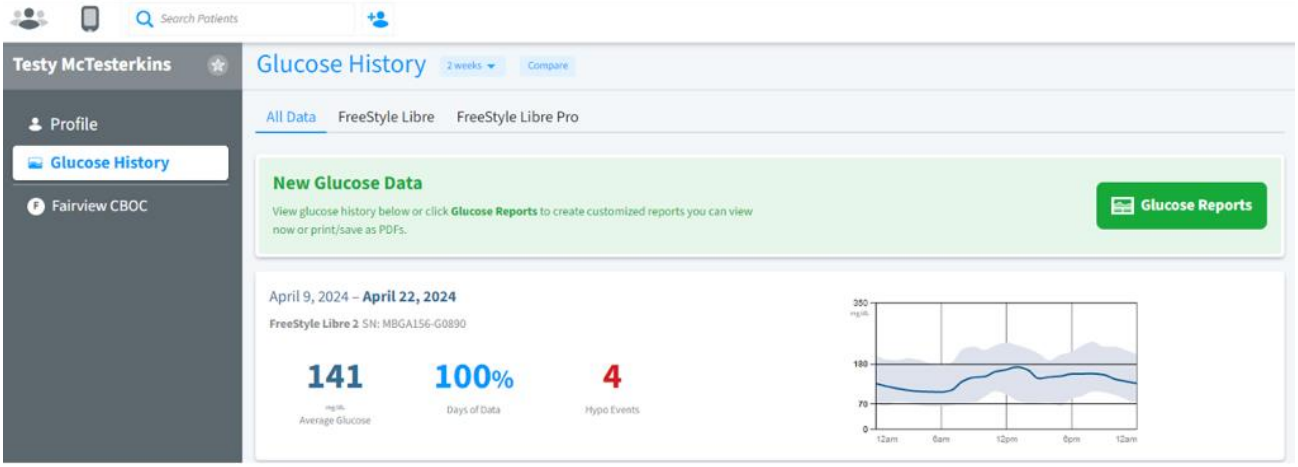
Step 1: Log into the practice site on LibreView



Step 2: Search for patient using their first or last name

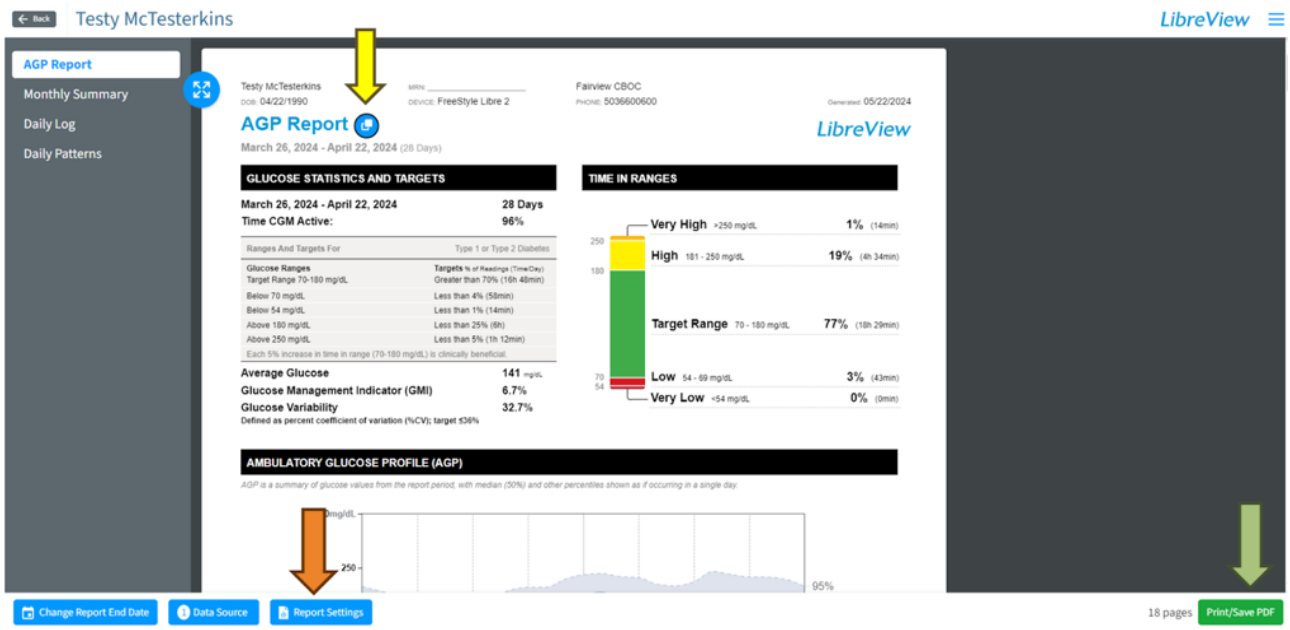


Step 3: Click on "Glucose Reports"



Step 4:

- Report Settings (orange arrow) – can edit date range and filter data.
- Print/Save PDF (green arrow) to download PDF.
- Copy as Text AGP Summary (yellow arrow) to copy AGP data into CRPS note.



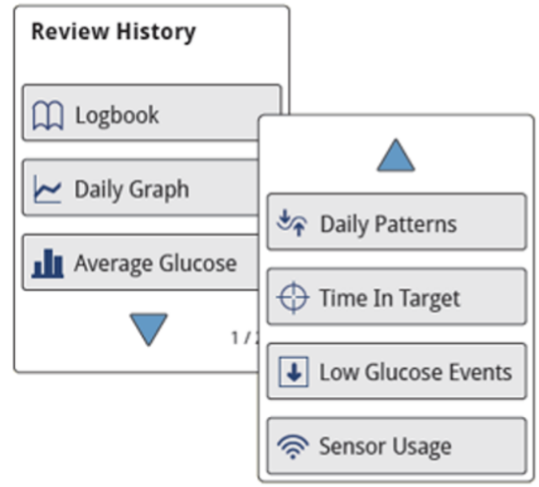
Instructions for veterans to report LibreView data from their Libre reader device

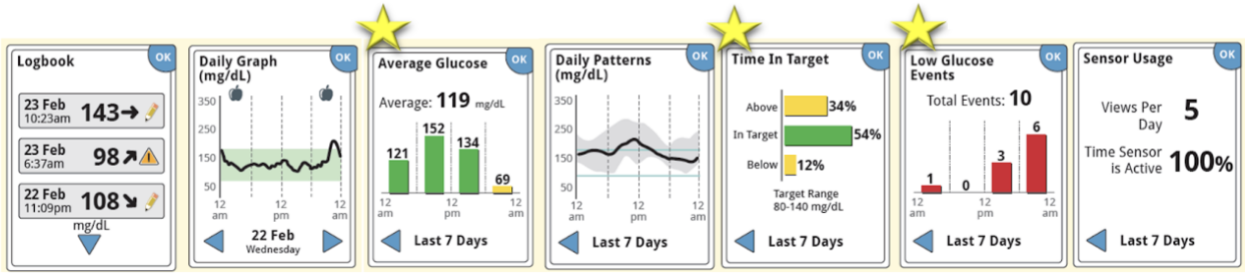
If a veteran cannot download the data into their own computer/LibreView account, they must follow these steps to report the data from the reader (or bring the reader into the clinic to be downloaded).

Step 1: Tell patient to select “Review history"

Step 2:

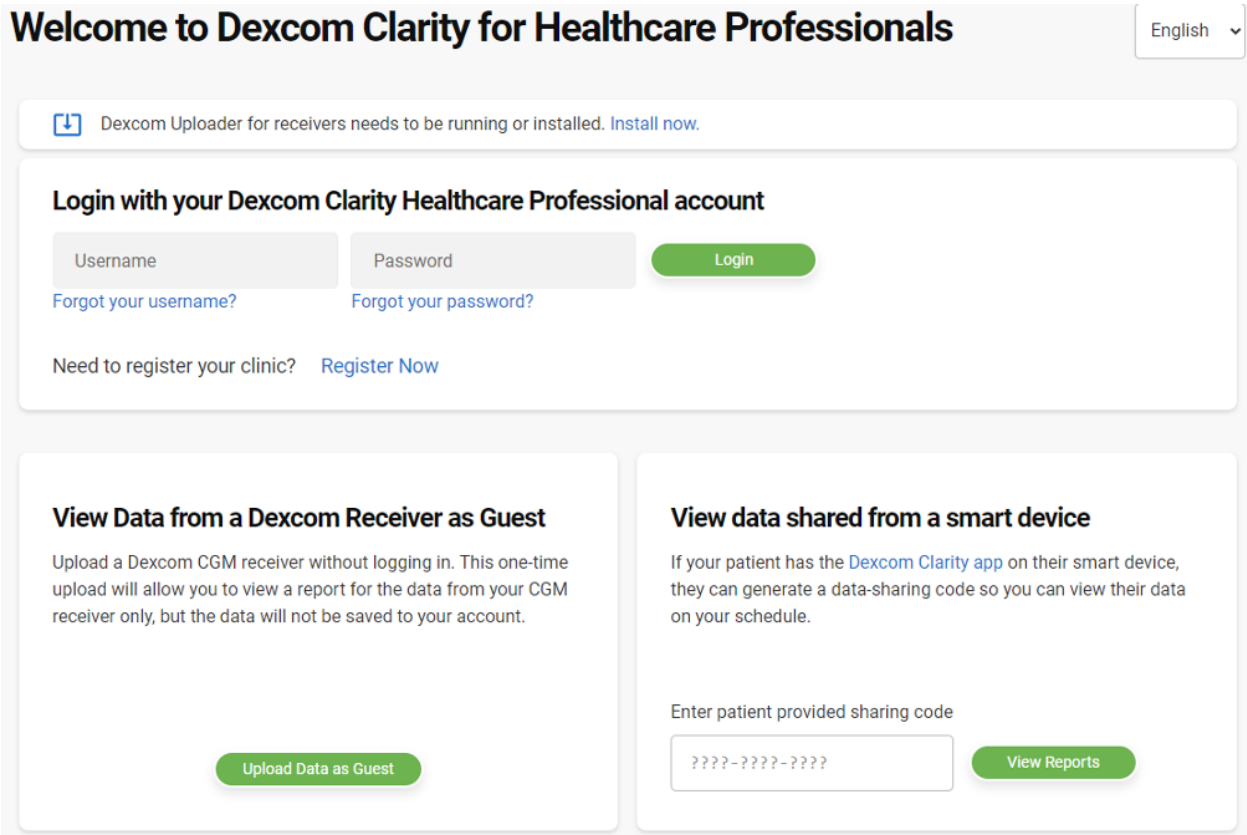
- Tell patient to select “Average glucose”
  - Instruct patient to report average glucose readings from the past 7-days, 14-days, and 30-days
- Then tell patient to select “Time in Target”
  - Instruct patient to report the percentage of time “in target, “above” and “below”
- Lastly, tell patient to select “Low Glucose Events”
  - Instruct patient to report the number of “total events” from the past 7-days, 14-days, and 30-days





Accessing patient Dexcom CGM data

Step 1: Log into the [Dexcom Clarity portal]



Step 2: To download a Dexcom reader in-clinic, must ensure that the device driver is installed on the laptop.

- Laptops that will be used to upload data from a reader MUST have the associated software drivers installed first.
- Open the Software Center → type into search bar on bottom of windows taskbar.
- Search for the required software:

- Install and restart the laptop.

Step 3: Select the desired patient or add a new patient.

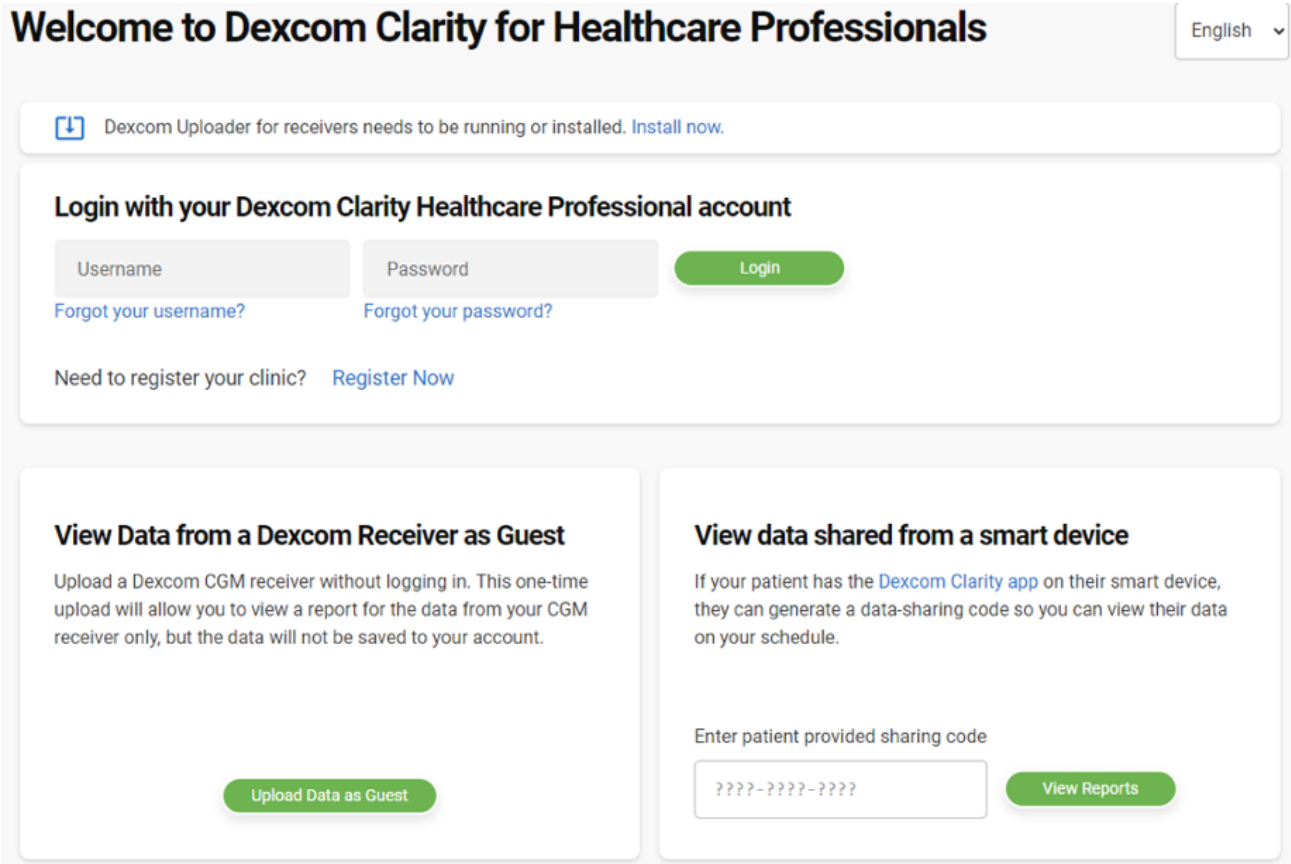
Step 4: Plug in Dexcom reader device to laptop.

Step 5: Click on Upload Data

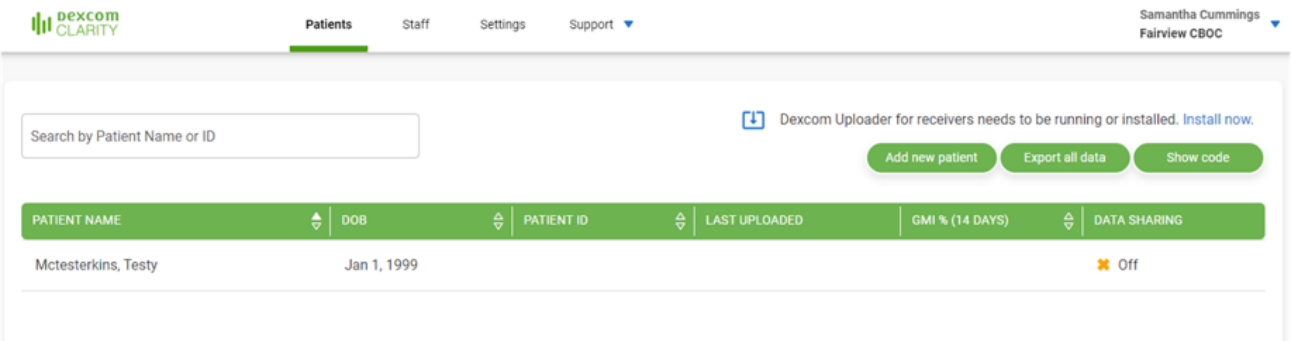
Accessing patient Dexcom CGM data

Step 1: Log into the Dexcom Clarity portal
Note: there are 2 ways to get data

- Option 1: Preferred: Log into account, add new patient or select patient
- Option 2: Without logging in, from home page, upload receiver OR enter the patient-provided share code (generated on their end).

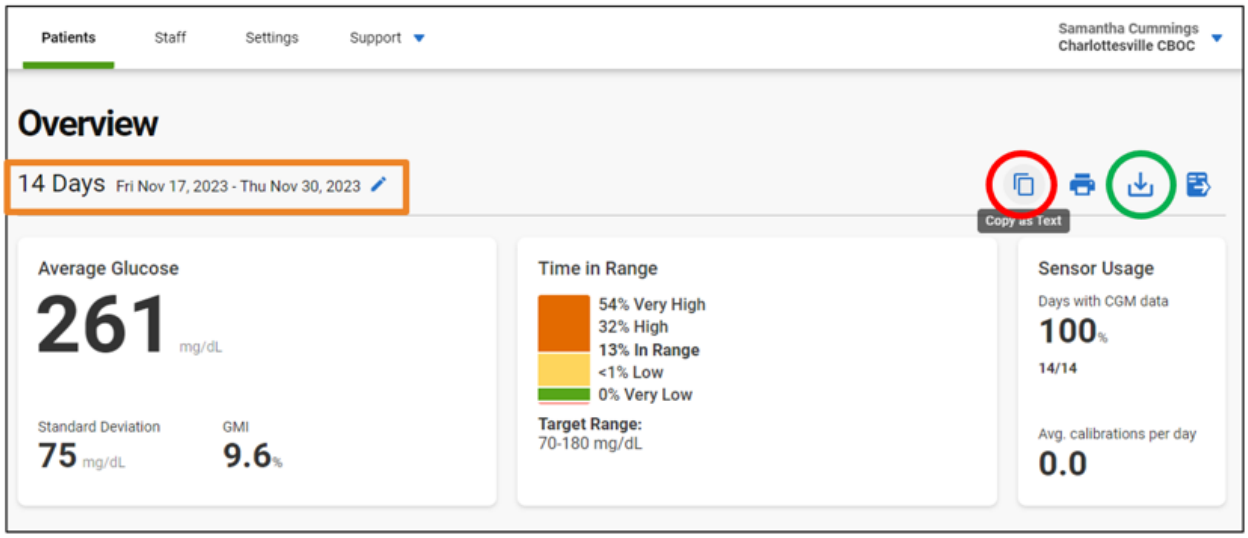


Step 2: Search for patient using their first or last name



Step 3:

- Generated from “Interactive Reports”
- Edit date range underneath Overview (orange box).
- Can copy data as text into CPRS note – click paper icon “Copy as text” (red circle), then ctrl+V into CPRS note.
- Can download pdf report with download icon (green circle).



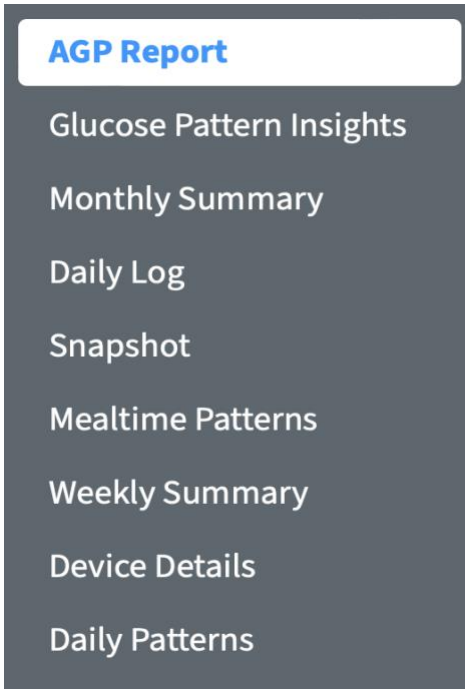
Evaluating CGM reports

When going over reports, it may be beneficial to have a printout of the Ambulatory Glucose Profile and go over the trends with the patient.

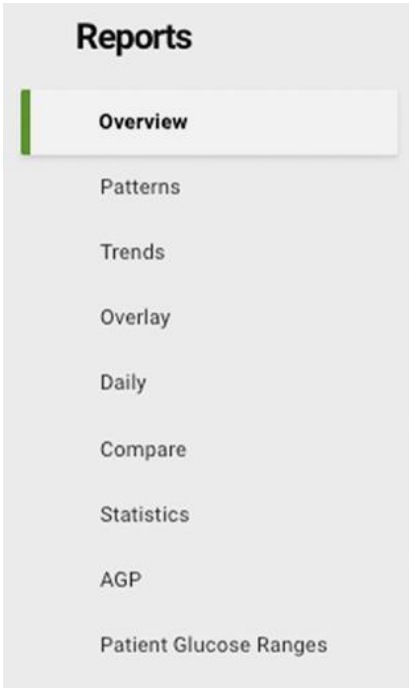
CGM report options

LibreView and Dexcom Clarity will generate a data report with the following menu options:

LibreView



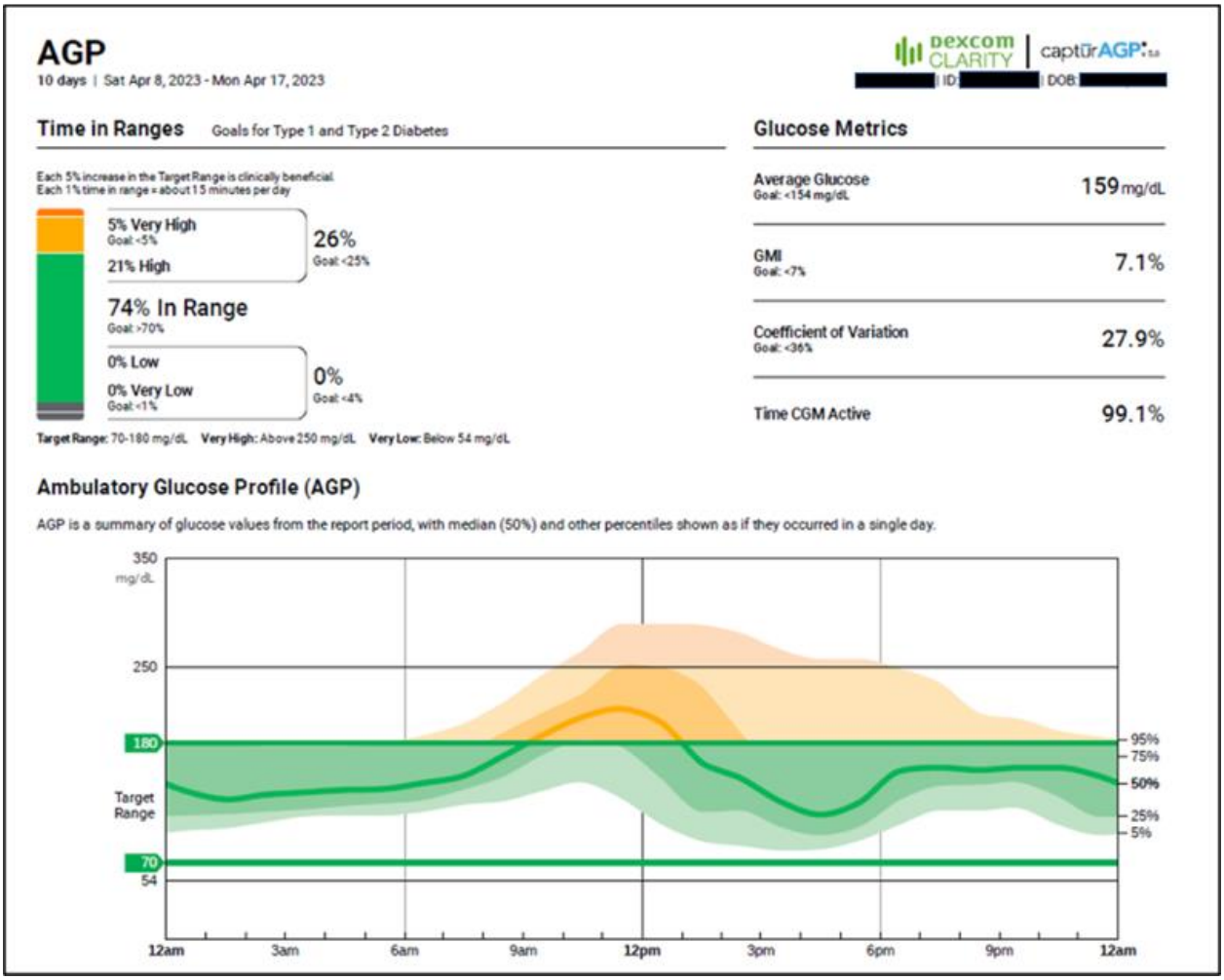
Dexcom Clarity



The most comprehensive summary of the patient's CGM data may be viewed under the "AGP" report/ See more information below.

Ambulatory Glucose Profile (AGP)

Standardized clinical data is reported on a patient's ambulatory glucose profile (AGP), which reports the following important information:



AGP data components	Recommendations
Date	Double check the date range that is used to generate the CGM report to ensure that the intended date range is selected.
% of time CGM active	The recommended percentage of time CGM is active is ≥70%. Having at least 70% CGM wear time adds confidence that the data is a reliable indicator of usual patterns.
Average glucose	The average glucose level is based on all glucose levels measured throughout a time period.

Glucose management Indicator (GMI)	GMI approximates the laboratory A1C level expected based on average glucose measured using continuous glucose monitoring (CGM) values. GMI may not directly correlate to lab A1c due to the following scenarios: • Short periods of acute hyperglycemia (illness, steroid burst, DKA) or hypoglycemia (new medication, lifestyle change, illness) can cause variations. • Slower/faster RBC turnover rate can also cause discrepancies. • May show the impact of medication changes sooner than A1c.

Glycemic variability (%CV-coefficient of variation)	• Glucose variability is associated with increased risk of hypoglycemia.
	• A lower %CV reflects more stable glucose trends
	  ○ Recommended to aim for ≤36% CV threshold, which was derived from a single 2017 study.
	  ○ Other data suggests a lower %CV threshold may be more appropriate to prevent hypoglycemia, especially in non-insulin treated patients with type 2 DM.

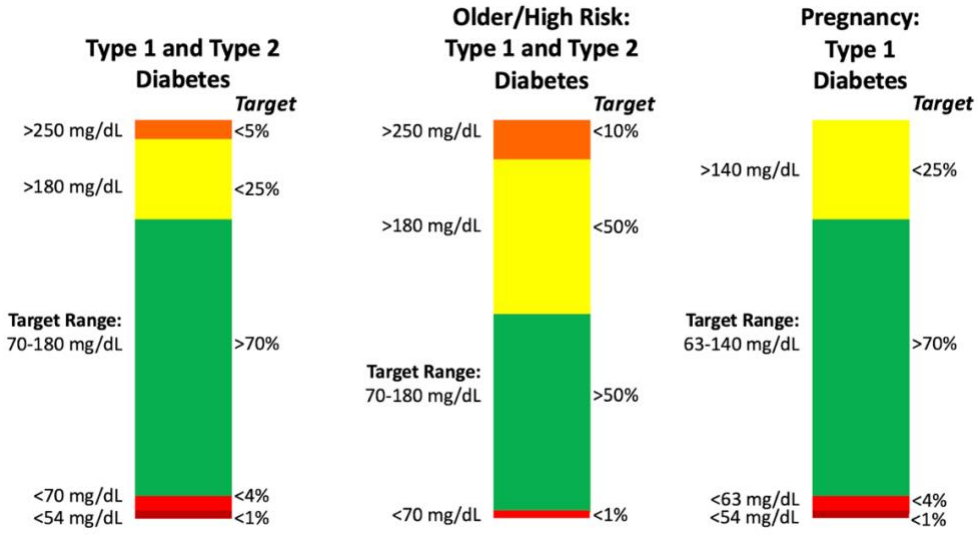
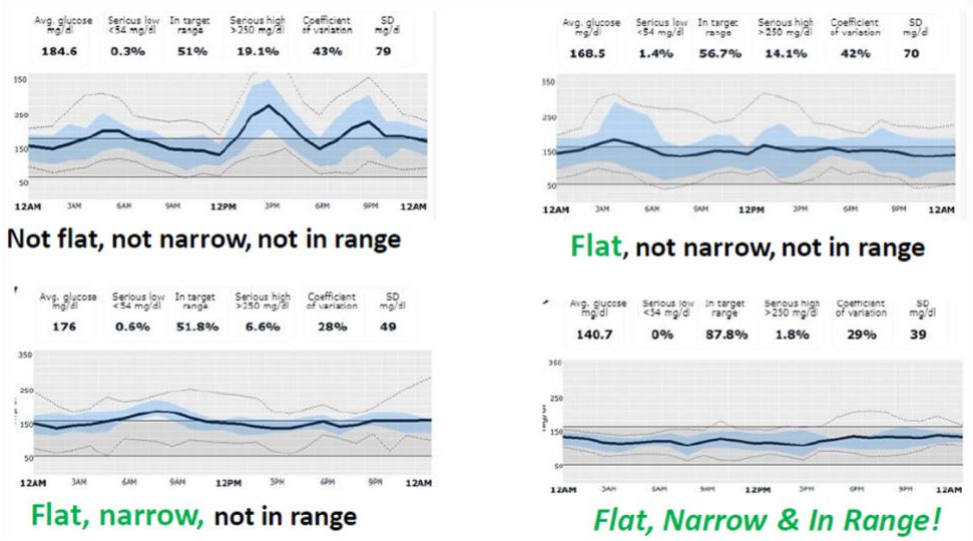
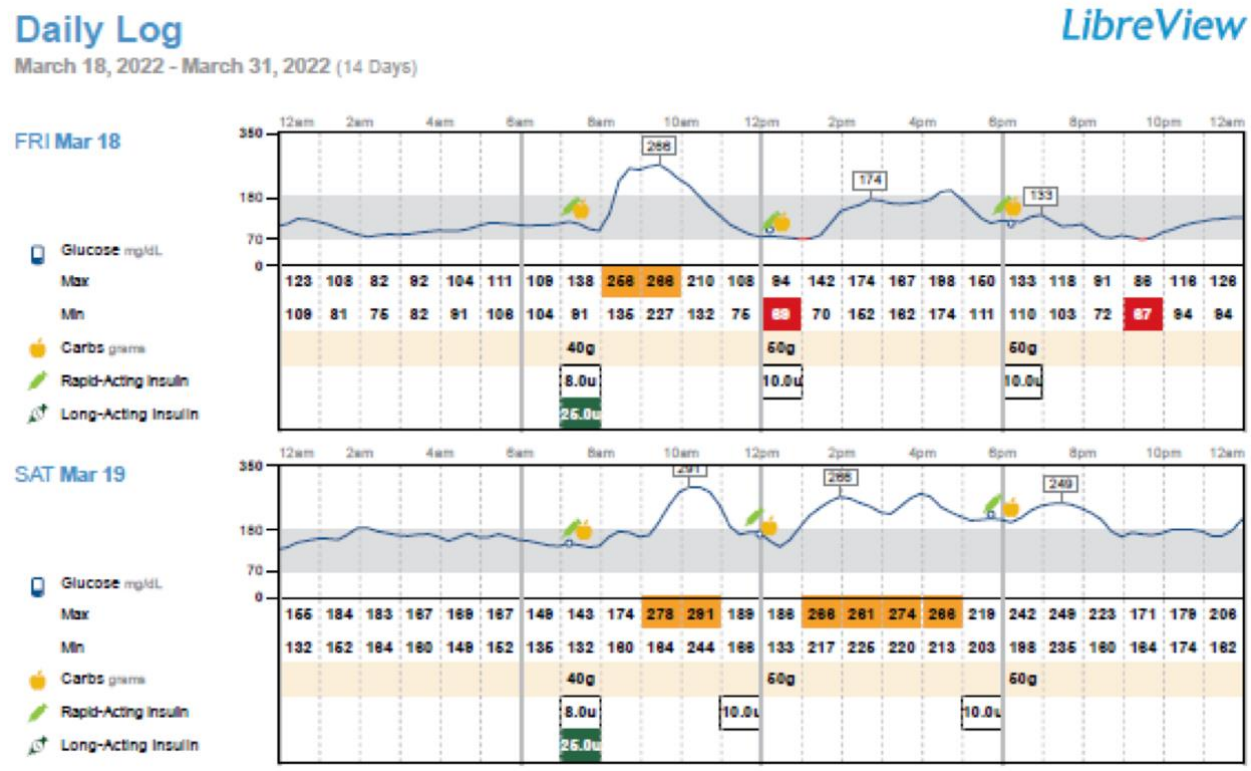
Time in ranges (TIR)	Time in range is the amount of time spent in the target blood glucose range. Recommendations for standard TIR targets are as follows:  Battelino et al. (2019). The percent TIR may help estimate the patient's A1c value. For example, a TIR of 70% = 6.7% while a TIR of 50% = 8.3% A1c.

	Table 5—Estimate of A1C for a given TIR level based on type 1 diabetes and type 2 diabetes studies Beck et al. (26) (n = 545 participants with type 1 diabetes) / Vigersky and McMahon (27) (n = 1,137 participants with type 1 or type 2 diabetes) TIR 70–180 mg/dL (3.9–10.0 mmol/L) | A1C, % (mmol/mol) | 95% CI for predicted A1C values, % | TIR 70–180 mg/dL (3.9–10.0 mmol/L) | A1C, % (mmol/mol) 20% | 9.4 (79) | (8.0, 10.7) | 20% | 10.6 (92) 30% | 8.9 (74) | (7.6, 10.2) | 30% | 9.8 (84) 40% | 8.4 (68) | (7.1, 9.7) | 40% | 9.0 (75) 50% | 7.9 (63) | (6.6, 9.2) | 50% | 8.3 (67) 60% | 7.4 (57) | (6.1, 8.8) | 60% | 7.5 (59) 70% | 7.0 (53) | (5.6, 8.3) | 70% | 6.7 (50) 80% | 6.5 (48) | (5.2, 7.8) | 80% | 5.9 (42) 90% | 6.0 (42) | (4.7, 7.3) | 90% | 5.1 (32) Every 10% increase in TIR = ~0.5% (5.5 mmol/mol) A1C reduction | Every 10% increase in TIR = ~0.8% (8.7 mmol/mol) A1C reduction The difference between findings from the two studies likely stems from differences in number of studies analyzed and subjects included (RCTs with subjects with type 1 diabetes vs. RCTs with subjects with type 1 or type 2 diabetes with CGM and SMBG). Battelino et al. (2019).
Trend line	The goal for trend line patterns is to maintain in flat, narrow, and within range (as shown in the bottom right graph)  Using Continuous Glucose Monitoring and the Ambulatory Glucose Profile. (2023). To see specific day-to-day trends, view the “daily log” report for more detailed data.

Daily log

The daily log report shows detailed glucose, carbohydrate, insulin, and other data that a patient has logged each day in the 14-day time period.

This may be useful to determine the cause and effect of insulin dosing on blood sugar trends, especially for hypoglycemic events.

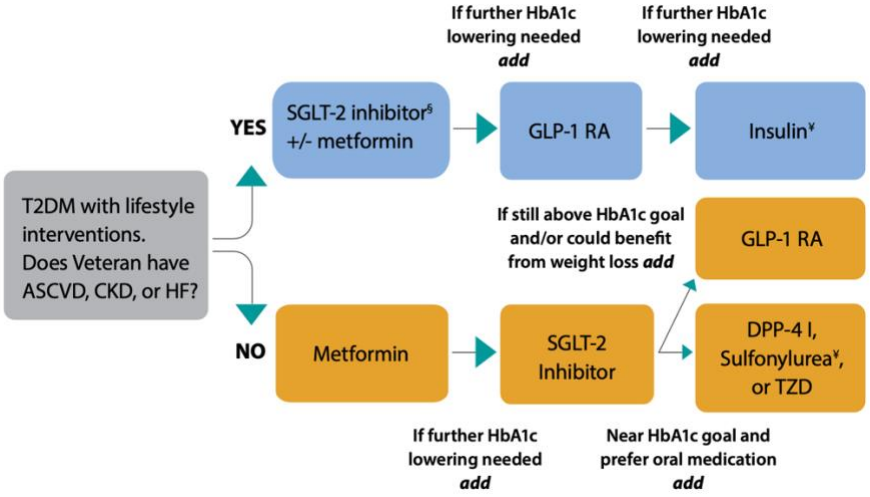


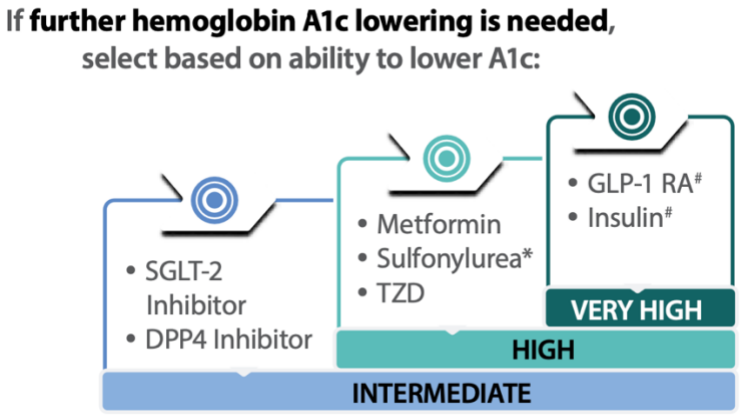
Interpreting CGM reports and adjusting medications

General guidance for interpreting CGM reports:

- Review % time active, BG average/GMI, % variability, and TIR.
  - Is the patient utilizing CGM enough (>70%?)
  - Is the patient meeting their specific goals?
- Evaluate for concerning trends/patterns:
  - High variability times
  - Hypo/hyperglycemic episodes
- Consider medication adjustment to achieve glycemic goals
  - Patients should be involved in this process

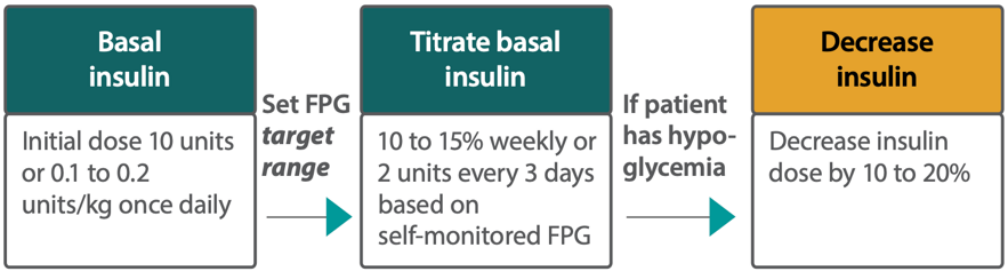
General stepwise pharmacotherapy recommendations for type 2 diabetic therapy





Guidance for adjusting insulin therapy based on CGM trends:

Basal insulin

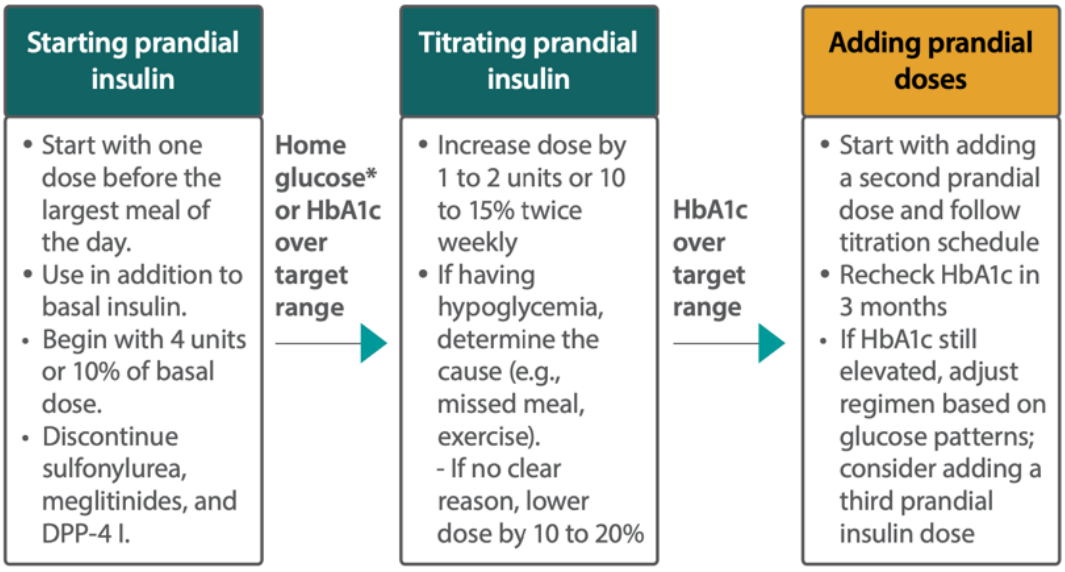


General rule: Decrease basal insulin by 10% at a time minimum

Basal insulin dose adjustment based on morning blood glucose pattern from previous week

Glucose Results Before Morning Meal or Upon Waking	Bedtime Basal Insulin Dose Adjustment
Two or more morning glucose values <70 mg/dL	Subtract 4 units
One morning glucose value <70 mg/dL	No change
No morning glucose values <70 mg/dL AND Three or more morning glucose values >130 mg/dL OR No morning glucose values <70 mg/dL AND Three or more morning glucose values >180 mg/dL	Add 2 units OR Add 4 units
If none of the above apply	No change

Prandial insulin



Weekly starting mealtime dose adjustments for prandial insulin

Glucose Test Results Before Midday Meal	**Morning Mealtime Dose Adjustment**
Two or more midday glucose values <70 mg/dL	Subtract 2 units
One midday glucose value <70 mg/dL	No change
No midday glucose values <70 mg/dL AND Three or more midday glucose values >130 mg/dL	Add 2 units
If none of the above apply	No change
Glucose Test Results Before Evening Meal	**Midday Mealtime Dose Adjustment**
Two or more evening glucose values <70 mg/dL	Subtract 2 units
One evening glucose value <70 mg/dL	No change
No evening glucose values <70 mg/dL AND Three or more evening glucose values >130 mg/dL	Add 2 units
If none of the above apply	No change
Glucose Test Results at Bedtime	**Evening Mealtime Dose Adjustment**
Two or more bedtime glucose values <70 mg/dL	Subtract 2 units
One bedtime glucose value <70 mg/dL	No change
No bedtime glucose values <70 mg/dL AND Three or more bedtime glucose values >130 mg/dL	Add 2 units
If none of the above apply	No change

Where providers can get more education on CGM management

Libre:

- FreeStyle Foundations | FreeStyle Libre Providers (freestyleprovider.abbott)
    - Getting Started guides and educational videos.
- FreeStyle Libre Portfolio Report Set Overview
    - Detailed information about the LibreView report

Dexcom:

- Diabetes Education Patient Handouts & CGM Brochures | Dexcom Provider
    - Product information and clinic resources.

American Diabetes Association (ADA):

- Glycemic Targets: Standards of Medical Care in Diabetes
- A Safe and Simple Algorithm for Adding and Adjusting Mealtime Insulin to Basal-Only Therapy

Appendix D: Data (tables &figures) from survey results

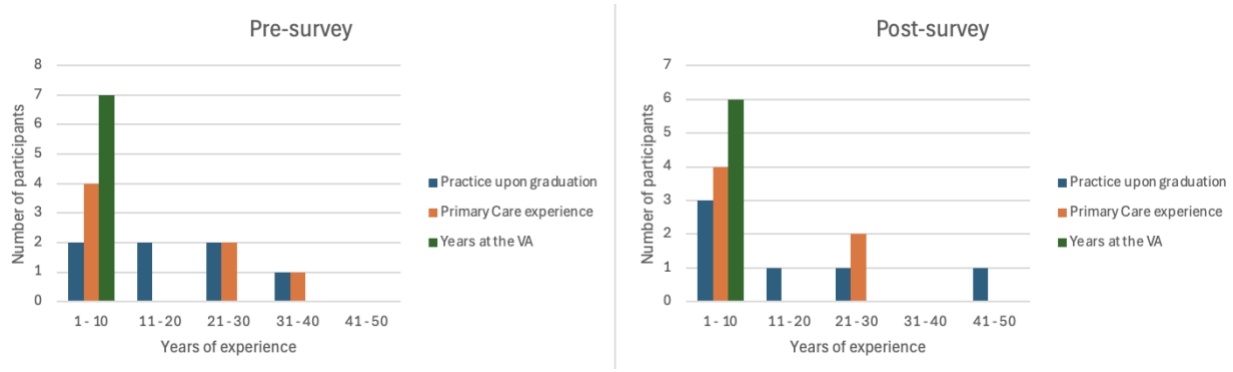


Figure 1: Demonstrates a comparison of the pre-survey and post-survey of total practice year, primary care experience, and years of practice at the VA.

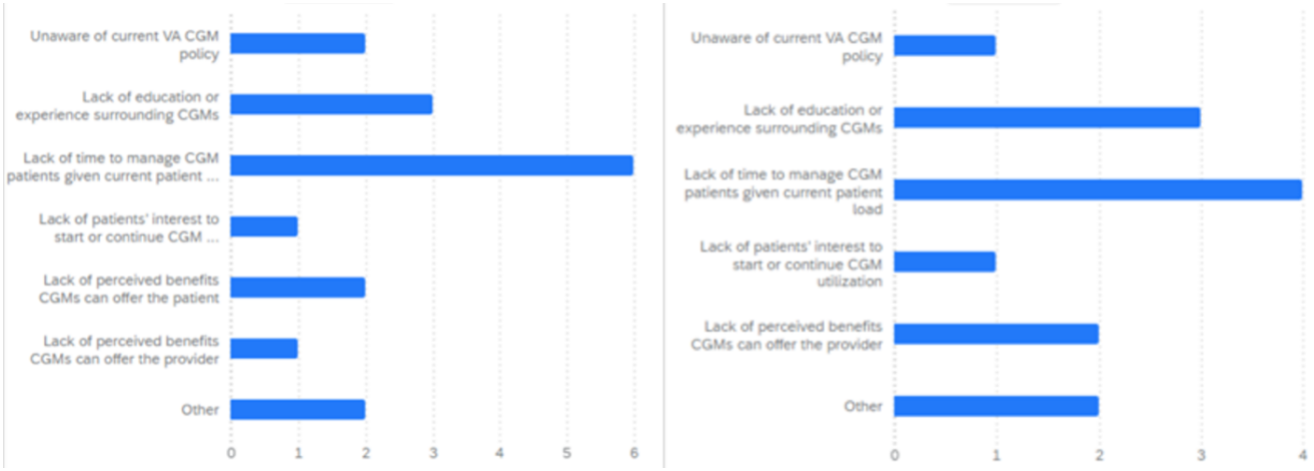


Figure 2: Demonstrates general barriers for CGM utilization comparing pre-survey (left) and post survey (right) results. Responses in the "other" category included cost.

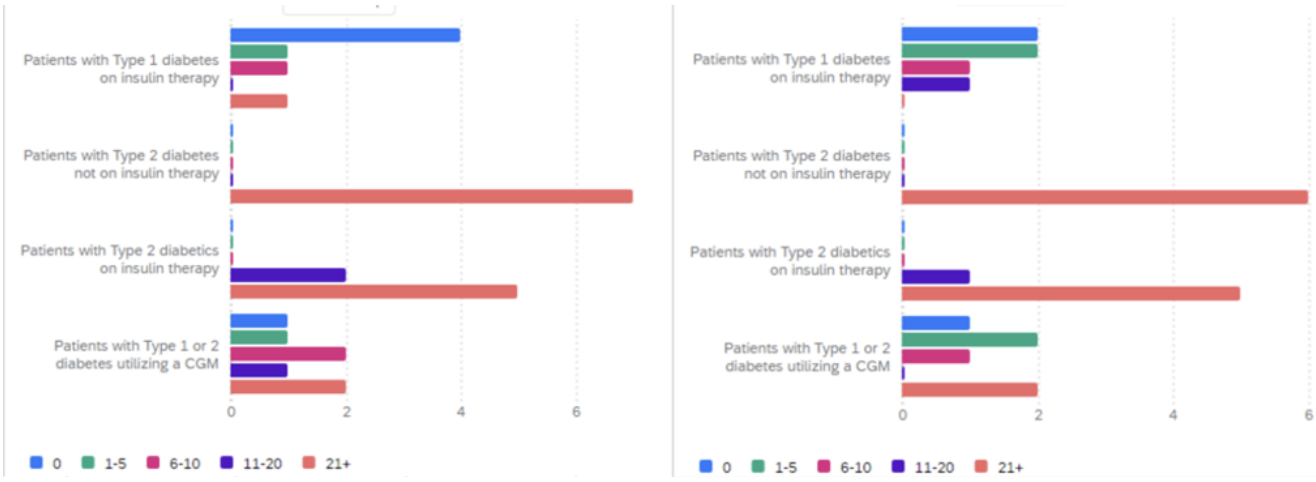


Figure 3: Demonstrates a comparison of the pre-survey (left) and post-survey (right) for number of diabetic patients in each provider's panel and if they are type one or type two, on insulin, or use a CGM.

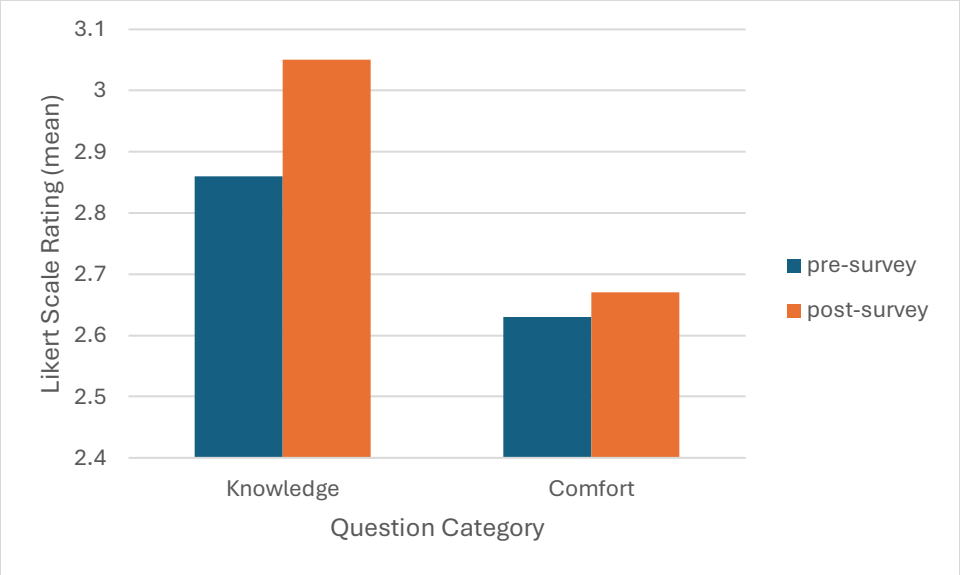


Figure 4: Demonstrates a comparison of mean values for knowledge and comfort pre- and post-survey.

Question type	Question number	Questions included in data analysis
Knowledge questions	5, 6, 7, 10, 13, 14	10, 13, 14
Comfort questions	9, 11, 15, 16, 17, 18, 19	9, 11, 15, 16, 17, 18, 19
Experience questions	2, 3, 4, 5, 8	N/A

Table 1: Demonstrates survey questions and how they were categorized into the three categories along with what questions were included in data analysis. N/A was applicable if no questions were used for data analysis

Question type	Likert Scale Rating (mean)		Standard deviation		P value
	Pre-survey	Post-survey	Pre-survey	Post-survey	
Knowledge questions	2.860	3.050	0.494	0.253	0.580
Comfort questions	2.630	2.670	0.588	0.599	0.554
Experience questions	N/A		N/A		N/A

Table 2: Demonstrates the mean, standard deviation, and p-value comparison of the knowledge, comfort and experience questions pre- and post-survey. N/A was applicable if no mean or p-value were used for data analysis

Question type (post survey)	Question number	Likert Scale Rating (mean)
Knowledge questions	26	3
Comfort questions	25	2.75
Experience questions	27	3

Table 3: Demonstrates post-survey reflection of the toolkits utility in the three categories with a scale of (1) Not at all (2) Somewhat (3) Moderately (4) Very. N/A was applicable if the toolkit was not used by the participant

Likert scale ranking	Point total
(1) Not at all/not likely/not confident	1
(2) Somewhat/somewhat likely/ somewhat confident	2
(3) Moderately/moderately likely/moderately confident	3
(3) Very/very likely/very confident	4

Table 4: Demonstrates how the Likert scale ranking translates to a direct point total

Appendix E: IRB application approval

VA Portland Health Care System (VAPORHCS)
Institutional Review Board (IRB)
CHECKLIST: QUALITY ASSURANCE OR IMPROVEMENT (QA/QI) OR RESEARCH?

Signature of Responsible Project Lead[4]: Dylan LeGrady Date: 7/24/2024

Print Name of Responsible Project Lead: Dylan LeGrady

For projects that involve using/collecting data from sites other than those covered by the VAPORHCS

1. *If the project is being **conducted/coordinated** at a site other than the VAPORHCS:*
   Signature of Medical Center Director: Kerri Woelfle NP Date: 7/24/2024
2. If your project includes obtaining data or participation from VA sites other than those covered by the VAPORHCS you must request approval from the facility director(s) prior to initiating the project at those facilities.

FOR VAPORHCS IRB OFFICE USE ONLY BELOW THIS LINE

VAPORHCS ACOS/R&D Determination:
Note: The VAPORHCS ACOS/R&D has been designated by the VA Portland Health Care System Director and the VISN20 Network Director to serve as the individual who will evaluate and document the determination for projects conducted at the following VISN20 facilities: Alaska, Spokane, Walla Walla, Roseburg, and White City.

☑ **Not Research**. The ACOS/R&D has determined that based on the responses above and the proposed project description approval by an IRB or other review committee is not needed. The project is considered to be non-research VHA operations activity. If the results of this project are presented or published they cannot be presented as research, nor does it have research approval.

☐ **Research Project**. As designed this project requires review by an IRB or other appropriate review committee *prior* to initiation. Please refer to the VAPORHCS R&D website for guidance.

☐ Additional information is needed to make a determination. See comments below.

ACOS/R&D or IRB Analyst Comments:

VAPORHCS ACOS/R&D Signature and Date: DAVID COHEN Digitally signed by DAVID COHEN Date: 2024.07.30 13:03:28 -07'00'

OREGON HEALTH & SCIENCE UNIVERSITY

IRB MEMO

Research Integrity Office
3181 SW Sam Jackson Park Road - L106RI
Portland, OR 97239-3098
(503)494-7887 irb@ohsu.edu

NOT HUMAN RESEARCH

August 14, 2024

Dear Investigator:

On 8/14/2024, the IRB reviewed the following submission:

Title of Study:	Increasing Utilization and Management of Continuous Glucose Monitors for Primary Care Providers at a VA for Patients with Type 2 Diabetes: A Quality Improvement
Investigator:	Sally Huey
IRB ID:	STUDY00027582
Funding:	None

The IRB determined that the proposed activity is not research involving human subjects. IRB review and approval is not required.

Certain changes to the research plan may affect this determination. Contact the IRB Office if your project changes and you have questions regarding the need for IRB oversight.

If this project involves the collection, use, or disclosure of Protected Health Information (PHI), you must comply with all applicable requirements under HIPAA. See the HIPAA and Research website and the Information Privacy and Security website for more information.

Sincerely,

The OHSU IRB Office

Appendix F: Letter of Support from Site

Letter of Support from Clinical Agency

Date: *[06/13/2024]*

Dear *Dylan LeGrady*,

This letter confirms that I, *Kerri Woelfle*, allow *Dylan LeGrady* (OHSU Doctor of Nursing Practice Student) access to complete his/her DNP Final Project at our clinical site. The project will take place from approximately *June 2024* to *March 2024*

This letter summarizes the core elements of the project proposal, already reviewed by the DNP Project Preceptor and clinical liaison (if applicable):

Project Site(s): Salem VA clinic (1750 McGilchrist Street Southeast, Suite 130, Salem, Oregon, 97302-1691

Project Plan

Identified Clinical Problem: Currently, only endocrinology specialists prescribe Continuous Glucose Monitor's (CGM) for patients with diabetes at the Salem Veterans Association outpatient clinic. Yet, it is estimated that 90% of diabetics receive their diabetic care from their primary care provider (PCP). The Veterans Association (VA) anticipates more questions and requests surrounding CGMs, given the first over-the-counter (OTC) CGM was approved by the Food and Drug Association in 2024. However, there are no workflows available for primary care providers (PCP) to identify eligible patients who may be good candidates for CGMs. Furthermore, there are no workflows for educating, setting up, and training patients to utilize CGMs in the outpatient primary care setting. Additionally, there currently no toolkits available for providers to guide CGM management at the Salem Veterans Association.

Rationale: This Quality Improvement Project will be guided by the Institute of Healthcare Model of Improvement based on three fundamental questions and subsequent application of a Plan-Do-Study-Act (PDSA) cycle to implement and evaluate the proposed change.

Specific Aims: This workflow quality improvement project aims to identify barriers and gaps in provider's knowledge surrounding CGMs, produce a CGM toolkit capable of providing education and guidance for CGM management, identify eligible patients for CGM utilization, provide a workflow guidance for PCP or DFNP follow-up, and provide additional resource for providers to get more education surrounding CGM's. After the creation and implementation of the CGM toolkit at the Pacific Northwest Veterans Association (PNWVA) clinic, efficacy of the toolkit's impact will be measured with a post survey.

Methods/Interventions/Measures:

- An anonymous pre-survey named Continuous Glucose Monitoring Survey for VA Providers (CGMSVAP) was created, which will be given out to all 11 VA PCP's through the Qualtrics platform.
- After the creation and implementation of the CGM toolkit at the PNWVA clinic for 6 weeks, efficacy of the toolkit's impact will be measured with an anonymous post CGMSVAP survey.

- Outcomes of this project are to Identify pre toolkit knowledge/comfort/experience of PCPs and if toolkit effected PCP CGM knowledge. Other outcomes include identifying current PCP thoughts surrounding CGM education sessions.

Data collected from the study will solely be based on the anonymous CGMSVAP pre and post survey responses. Pre and post surveys will be created using the Qualtrics platform, which has accredited data centers that adhere to security and technical best practices. Only VA providers are subject to the study, meaning no patient information will be taken into consideration throughout the study.

Site(s) Support: Support for the site is through two different VA providers. The site clinic manager was responsible for approving the survey material and encouraging Salem VA PCPs to implement CGM workflow. The site clinic manager also authorized the disbursement of eligible VA providers emails to complete the surveys. The site clinic manager offered nurse scientist surveys and may be utilized in the future when determining significance of the CGM toolkit post implementation.

Other: *Non applicable*

During the project implementation and evaluation, *Dylan LeGrady* will provide regular updates and communicate any necessary changes to the DNP Project Preceptor.

Our organization looks forward to working with this student to complete their DNP project. If we have any concerns related to this project, we will contact *Dylan LeGrady* and *Sally Huey* (student's DNP Project Chairperson).

Regards,

Dylan LeGrady

Kerri Woelfle DNP Clinical Practice Manager-Salem VA Outpatient Clinic

DNP Project Preceptor (Name, Job title)

Kerri.Woelfle@va.gov 971 304-2255

Email and Phone number

Kerri Woelfle DNP Clinical Practice Manager 6/17/2024

Signature and date signed

References

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