Title

Improving Continuous Glucose Monitor Adherence and Diabetes Empowerment in Latinx Adults

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Publication Date

2024

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

Improving Continuous Glucose Monitor Adherence and Diabetes Empowerment in Latinx Adults

A dissertation submitted in partial satisfaction of the

requirements for the degree

Doctor of Nursing Practice

by

Marielle Tavares

2024

ABSTRACT OF THE DISSERTATION

Improving Continuous Glucose Monitor Adherence and

Diabetes Empowerment in Latinx Adults

by

Marielle Tavares

Doctor of Nursing Practice

University of California, Los Angeles, 2024

Professor Carol Pavlish

Background: Continuous glucose monitors (CGMs) are associated with improved HgA1C and quality of life but have historically been less accessible to underserved populations. The 2022 changes to California Medicaid switched CGM coverage from Durable Medical Equipment to expanded pharmacy benefits which increased CGM access for Medi-Cal beneficiaries with Type 2 Diabetes (T2DM). These reimbursement changes necessitate opportunities to support CGM use among the Latinx population, which is significantly impacted by T2DM and remains disproportionately underserved and understudied.

Objectives: To evaluate the effectiveness of a CGM educational intervention on diabetes empowerment, CGM adherence, diabetes distress, glucose monitoring satisfaction, and blood glucose regulation for Latinx adults with T2DM who have been prescribed a CGM.

Methods: Participants for this pilot study were recruited at a Federally Qualified Health Center in Southern California from a primary interprofessional research study focused on patient outcomes of CGM use within underserved populations. Inclusion criteria included Spanish-speaking Latinx adults (18 years and older) diagnosed with T2DM who were prescribed a CGM. Ten participants agreed to attend a Spanish-speaking, in-person educational intervention with enhanced telephonic follow-up. The Diabetes Empowerment Scale Short Form (DES-SF) measured diabetes empowerment and was administered pre-intervention, immediately post-intervention, and six weeks post-intervention. CGM adherence and blood glucose regulation were measured by the CGM device and collected pre-intervention and six weeks post-intervention. Glucose-monitoring satisfaction scores and diabetes distress scores were administered pre-intervention and six weeks post-intervention.

Results: Statistical significance was observed post-intervention in glucose monitoring satisfaction and CGM adherence. CGM adherence increased by 80%, and blood glucose control results varied one month after the intervention. Improvements were also demonstrated in diabetes distress and diabetes empowerment, although not statistically significant. The need for language-concordant health education and interventions focused on supporting Latinx adults with T2DM should continue to be explored.

Conclusion: An educational intervention on CGMs, problem-solving barriers to CGM use, and diabetes empowerment in Latinx adults with T2DM provides preliminary data on the potential for improving CGM adherence, diabetes empowerment, and glucose monitoring satisfaction while decreasing diabetes distress. Further research on a larger sample is necessary.

The dissertation of Marielle Tavares is approved.

Nancy Jo Bush

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Carol Pavlish, Committee Chair

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2024

This dissertation is dedicated to the nurses and healthcare providers who care for the underserved and the many lives they impact every day. Thank you for your relentless pursuit of justice and your unwavering belief in the power of care and compassion. May we continue to lead through the complexities of healthcare with grace and fortitude as we strive to ensure that every patient receives the dignity, respect, and quality of care they deserve.

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ACKNOWLEDGEMENTS

This project would not have been possible without the expertise and support of the DNP Scholarly Project committee members: Dr. Carol Pavlish, Dr. Estelle Everett, and Dr. Bush. I am eternally grateful for their wisdom, time, guidance, and mentorship. Thank you, Dr. Pavlish for your exceptional compassion and for always making yourself available. Thank you, Dr. Bush, I am deeply grateful for your care and constant encouragement. Dr. Everett, I truly appreciate your efforts in establishing a collaboration between the UCLA School of Nursing and the UCLA Geffen School of Medicine, as well as your unwavering support.

I would like to acknowledge the Federally Qualified Health Clinic (FQHC) where this project was implemented, its patients, its Staff, Diabetes Educators, and especially Nurse Practitioner Ligaya Scarlett who was instrumental in the implementation of this project. I would like to acknowledge the research team at the UCLA Geffen School of Medicine for welcoming me to their team and for supporting this project. Additionally, I would like to acknowledge Dr. Nancy Bush and Dr. Theresa Brown for their leadership and dedication to their students at the UCLA School of Nursing; and Soo Kwon for her remarkable support of the cohort.

Thank you to my friends and family who have supported me on this journey. Thank you Yerania, Rebekah, Viken, Myrna, Veronica, and Princess. Thank you, Grandmother Reyna, for encouraging me to choose nursing. A special thank you to all of my grandparents whom I hold dear to my heart. Thank you to my parents. Thank you to my fur baby, Frankie, for your loyal companionship and for keeping me company through all the late nights, early mornings, and countless hours while I worked at my desk even when you would rather be playing. Last but certainly not least, thank you to my partner, Jesse, for your patience, love, support, and encouragement; this project would not have been possible without you.

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2023	*Continuous Glucose Monitoring: Better Control of Your Diabetes* [Patient Education Brochure]

CHAPTER ONE: INTRODUCTION

Over 37 million individuals in the United States (U.S.) have diabetes, with nearly 90-95% accounting for Type 2 Diabetes Mellitus (T2DM) (Centers for Disease Control and Prevention [CDC], 2023). African Americans, Latinx Americans, and Native Americans have higher prevalence rates and increased risks of developing T2DM compared to White Americans (CDC, 2023). Strategies to address these disparities must be developed. This Doctor of Nursing Practice (DNP) Scholarly Project investigated one such strategy for Latinx populations in the U.S.

According to the U.S. Census Bureau (2023), the U.S. Hispanic population numbered 63.7 million, making this population the second largest racial or ethnic group behind White Americans in the U.S. Latin Americans account for 19.1% of all Americans and are estimated to account for approximately 28% of the U.S. population by 2060 (Titus & Quiles-Polard, 2022). The prevalence of T2DM among adults of Latinx descent is 11.7%, which is far ahead of non-Hispanic White adults (8%) (CDC, 2024) and is projected to increase by 481% from 2005 to 2050 (Gaston et al., 2021). Currently, diabetes is the fifth leading cause of death among Latino Americans (Titus & Quiles-Polard, 2022).

Latinx Americans experience unique barriers in managing T2DM, including sociocultural factors. The risk factors for Latinx Americans are multifactorial, and the literature suggests that traditional approaches to diabetes management may not be effective among underserved populations such as Latinx Americans (Fortmann et al., 2019). For example, Latinx groups struggle more frequently to control their blood glucose compared to adults of other ethnic groups and are 1.5 times more likely to die from diabetes and diabetes-related complications than their non-Latin White counterparts in the U.S. (Soderlund et al., 2019; Titus & Quiles-Pollard, 2022).

Diabetes care and management are costly in the U.S. Approximately 25% of all healthcare dollars are spent on individuals with T2DM (Gaston et al., 2021). Most costs associated with diabetes care are covered by tax-dollar-supported government insurance, including Medicare, Medicaid, and the military, with California having the highest costs, estimated at $39.47 billion annually (American Diabetes Association [ADA] n.d.).

Although Latinx Americans living with T2DM suffer some of the worst outcomes from the disease, limited data on effective strategies to improve diabetes management among this population are presently available. Latinx Americans experience unique circumstances, such as socioeconomic and cultural considerations that impact modifiable risk factors for T2DM, including diet and physical activity (Titus & Quiles-Polard, 2022). Latinx Americans also face various social determinants of health, such as barriers to healthcare for T2DM and the degree of acculturation, which influence their attitudes toward the healthcare system and preventive care (Vidal et al., 2022). A gap in the literature exists regarding adapting known diabetes management strategies, such as continuous glucose monitoring (CGM), to address perceptions and barriers that Latinx Americans and other underserved populations with T2DM experience as they manage diabetes.

CGMs have proven to be valuable tools in the early detection of glucose dysregulation and in managing T2DM, as they provide personalized insight into an individual's metabolic health by detecting blood glucose fluctuations in real time (Oser et al., 2022). CGMs are associated with improved A1C levels, decreased glucose variability, reduced adverse hyperglycemic and hypoglycemic events, and improved quality of life, although these outcomes are not specific to Latinx Americans (Mian et al., 2019). CGMs are also associated with

significant cost savings as they decrease healthcare utilization caused by uncontrolled diabetes and diabetes-related complications (Frank et al., 2021).

Despite the known benefits of CGMs, they have historically been out of reach for many in underserved populations. This lack of access has primarily been due to the CGM cost which poses a barrier for lower socioeconomic groups and individuals with limited or no health insurance (Everett & Wisk, 2022; Hougas et al., 2022). Other barriers included provider bias (Odugbeson et al., 2022) and patient-related barriers such as language discordance (Hougas et al., 2022). In 2022, a change in policy resulting in less restrictive requirements for CGM coverage has increased access. For example, the changes to Medi-Cal implemented switched CGM coverage from the Durable Medical Equipment (DME) benefit to expanded pharmacy benefits, Medi-Cal Rx, which increased CGM access for Medi-Cal beneficiaries with T2DM (California Department of Health Care Services, 2022). These changes in coverage provide an opportune time to introduce and support CGM use among the Latinx population, which is significantly impacted by T2DM and remains disproportionately underserved and understudied.

The term "Latinx" is meant to include persons who may also identify as "Hispanic," "Latino/Latina," or "Latino/Latina American" in the United States. It should also be noted that individuals who identify as Latina/Latino, Hispanic, and Latinx are not a monolith but represent diverse groups of people from different cultures. Latinx individuals may identify as multiracial or of any racial demographic (Pew Research Center, 2022). This paper will not explore racial and cultural differences among Latinx people.

Background

The literature on the effectiveness of CGMs in managing T2DM is limited as CGMs have primarily been studied in individuals with Type 1 diabetes (T1D) (Frank et al., 2018). The

American Diabetes Association (ADA) (2022) recommends using CGMs and maintaining blood glucose time in range (TIR) between 70-180 mg/dL 70% of the time, approximately 17 hours a day, for those diagnosed with T2DM. CGMs allow individuals to monitor their blood glucose throughout the day without finger sticks and have been found to contribute to improved blood glucose regulation even after discontinuing using the device (Hougas et al., 2022). In one small study, Zahedani et al. (2021) found that using CGMs when wearing a smartwatch improved TIR after ten days for over 50% of participants. Some experts opine that diabetes cannot be appropriately treated without understanding individual glucose trends throughout the day (Mian et al., 2019). Other studies suggest that the self-awareness gained through CGMs increases personal accountability in managing diabetes and that barriers to utilizing CGMs include the initial cost, access, and patient-related barriers to implementation such as issues with technology, discomfort while wearing a CGM, and English fluency. (Ellahham, 2020; Litchman et al., 2022; Rivera-Avila et al., 2021). CGMs can also decrease costs by reducing healthcare utilization and expenditures associated with treating co-morbidities and diabetes-related complications (Ellahham, 2020).

Problem Statement

The burden of diabetes is significant not only economically but also as a contributor to human suffering, morbidity, and mortality. Diabetes is a leading cause of chronic kidney disease, lower-limb amputations, and adult-onset blindness, and doubles the risk of heart disease and stroke (Janapala et al., 2019). Reducing the number of diabetes complications and deaths are objectives of Healthy People 2030 (Office of Disease Prevention and Health Promotion [ODPHP], 2020). Diabetes management and its serious complications are major global public health challenges, and interventions that empower patients to improve their glycemic control

effectively are needed. Although CGMs may be more accessible to the underserved in California due to recent changes in Medi-Cal, barriers to personal CGM adherence that may hinder their optimal use persist. As previously noted, the trajectory for Latinx Americans and T2DM is poor, and innovative interventions focused on empowering this population are needed.

PICOT

The following population, intervention, comparison, outcome, and time (PICOT) question seeks to highlight the best evidence-based practice research to address the problem statement: In Latinx adults with T2DM who have been prescribed a CGM, how does a CGM-focused educational program, in the participant's preferred language, that addresses problem-solving barriers to CGM use and diabetes empowerment, as compared to no educational intervention, impact CGM adherence, glucose monitoring satisfaction, diabetes empowerment, blood glucose regulation and diabetes distress over the course of six weeks?

CHAPTER TWO: THEORETICAL FRAMEWORK

Frameworks contribute to the method of scientific inquiry and are measurable; therefore, they offer the ability to demonstrate efficacy and outcomes (Nelson et al., 2017). This scholarly project explored Nola J. Pender's Health Promotion Model (HPM) (Appendix A), a middle-range theory, as a valuable theoretical framework that can guide interventions to promote patient empowerment. Nola J. Pender, a baccalaureate-prepared nurse with a Ph.D. in Psychology, developed the HPM. HPM is described as integrative and holistic as it considers the individuals' interpersonal interaction within their physical environment in their pursuit of health or the enhancement of health. Given Pender's academic background, HPM was greatly influenced by Albert Bandura's social learning theory and Fishbein's behavioral intentions theory, both of which explore factors that influence personal behavior change, including self-direction, the ability to regulate oneself and perceptions of self-efficacy (Chism & McLain, 2022; George 2014). HPM has three major categories: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcomes.

Individual characteristics and experiences are distinctive to each person and are divided into two subcategories: prior related behavior and personal factors that include biological, psychological, and socio-cultural dynamics (George, 2014). Pender noted that prior behaviors and experiences greatly influence future health-promoting behaviors and habits (Chism & McLain, 2022). Personal factors pertain to an individual's biological, psychological, and socio-cultural aspects. Biological elements include age, physical status, and abilities. Psychological features pertain to perceived health status, self-regard, and motivation. Socio-cultural factors include ethnicity, race, socio-economic status, education, and acculturation. It is important to note that some of the aforementioned personal factors, including but not limited to BMI, self-

regard, and motivation, are modifiable. Non-modifiable personal factors such as age and race are not targeted when addressing behavioral changes (George, 2014)

The second major category addresses behavior-specific cognitions and affects, considered the most responsive to change, and according to Pender, are the areas where nursing interventions may offer the most impact. Subcategories include perceived self-efficacy, perceived barriers to action, perceived benefits to action, and affect or emotions related to the activity. Interpersonal and situational influences are also included in the subcategories that influence cognitions and affect, areas where Pender noted nursing interventions may have a lesser impact or opportunities for intervention. The aforementioned subcategories affect one's commitment to an action plan for change while also considering other potential competing demands and lifestyle preferences. Additionally, believing that one stands to benefit from a behavioral change or has had prior positive personal experiences or observations of a particular change contributes to the individual's expectation of whether the outcome will be positive or negative.

The third category in the HPM addresses behavioral outcomes driven by a commitment to a plan of action that ultimately leads to health-promoting behaviors (Chism & McLain, 2022). Health-promoting behavior aims for the individual to achieve a personal understanding and experience beneficial health outcomes. This may include increasing existing health-contributing behaviors and or risk reduction of unhealthy behaviors (Nelson et al., 2017). The HPM guided the development and implementation of this DNP Scholarly Project. The educational intervention and follow-up encounters sought to influence perceptions of self-efficacy, perceived barriers to action, and perceived benefits to action in managing T2DM for Latinx adults who use

a CGM. According to the HPM, increasing self-efficacy results in a commitment to personal behavior changes and health-promoting behaviors.

CHAPTER THREE: REVIEW OF LITERATURE

Databases and tools utilized to search literature included PubMed, Cochrane, Google Scholar, and Cumulated Index to Nursing and Allied Health Literature (CINAHL). Keywords used to address the population of the PICO question included “adults,” “type 2 diabetes,” “Latinx,” “Latino,” and “Hispanic.” Keywords addressing the topic of interest or intervention included “continuous glucose monitor,” “blood glucose self-monitoring, “CGM problem-solving,” and “language concordance healthcare.” Keywords used to identify outcomes and comparisons included “blood glucose,” “A1C”, “Hemoglobin A1C”, “glycemic control,” “management of diabetes,” “economic impact,“ and “diabetes empowerment.” Filters and utilization of Medical Subject Headings (MeSh) terms were not included to capture as much relevant literature as possible. Boolean operators were not used. Initial results produced fewer than 2,000 articles. Articles primarily focused on CGM use within the pediatric population, and those published before 2018 were excluded.

Over 100 article titles and abstracts were initially reviewed for relevancy (Appendix B). CGM use within the Latinx population with T2DM has yet to be widely studied, limiting studies directly correlating to the PICOT question. The literature selected focused on the relevance and benefits of CGM use in T2DM, current barriers to CMG use, interventions that may improve CGM adherence, and the effects of language concordance in healthcare. Six articles that were most pertinent to this scholarly project were selected for review and analyzed by common themes, including CGM use and improved blood glucose control, patient satisfaction and adherence, barriers to CGM use, interventions that may improve CGM use, and implications of language concordance on patient health outcomes. One additional article that was not found

during the initial literature search was included after a suggestion by one of the co-authors, given its relevance to the PICOT question.

Improved Blood Glucose Control

Zahedani et al. (2021) conducted a prospective unblinded observational study that included 665 participants from 47 states plus the District of Columbia. In addition to participants with T2DM (N=192), this study also included non-diabetic (N=448) and pre-diabetic participants (N=25) and found the insights gained through the use of a CGM in addition to an app and smartwatch improved blood glucose time in range (TIR) after just ten days of use. TIR improved by an average of 6.4% for 51.4% of the participants, including those with T2DM and the non-diabetic and pre-diabetic participants. Interestingly, 5.8% of the non-diabetic patients also experienced glucose dysregulation consistent with pre-diabetes, and 1.2% of the pre-diabetics experienced glucose dysregulation consistent with T2DM, which suggests the practice of measuring A1C to screen for glucose dysregulation may not be as reliable as CGMs. Limitations to this study include the median age of participants being 36 years of age, and it is unclear if any participants were of Latinx descent. Despite the limitations, this study included a sizeable number of participants, including those with T2DM, and applied to the PICOT question, demonstrating that CGMs contribute to improved glucose control.

Ni et al., 2023, conducted a retrospective cohort study that included 3,036 participants enrolled in a Medicaid program that fully subsided CGMs. In addition to pre- and post-CGM use of Hemoglobin A1C, CGM adherence and uptake were assessed by measuring medication possession ratio (MPR), an indicator of CGM prescription, dispense, and more than one fill data. A multivariate logistic regression analysis evaluated CGM uptake predictors. The findings suggested both individuals with T1D and T2DM had high adherence levels. Participants with

T2DM who used CGMs improved their A1C by an average of 1.2%. Those with higher adherence improved A1C by 1.4%, and those with lower adherence improved A1C by 1.0%. CGM use was associated with improved A1C among all racial/ethnic groups. Reported limitations to this article include the participants' support system were not fully examined, the study duration was one year and potential barriers to diabetes management were not eliminated. This article was not found during the initial literature search but has been included after a suggestion by one of the co-authors, given its relevance to the PICOT question.

Clinician Perspectives on Barriers to CGM Use

Oser et al. (2022) conducted a cross-sectional quantitative study that included 656 primary care providers (PCPs) consisting of nurse practitioners, physician assistants, medical doctors, and doctors of osteopathy representing all 50 States. Oser et al. note that most patients with diabetes are managed in primary care, and primary care clinicians need the appropriate resources and training to prescribe and manage CGMs. Barriers to prescribing CGMs must be addressed as the evidence strongly supports CGM effectiveness in managing blood glucose. Participants were invited to complete a web-based survey to explore CGM prescribing behaviors and the resource needs of primary care clinicians.

The survey results indicated that PCPs are open to using CGMs to help patients manage their diabetes but require additional resources and support. Approximately 72.3% of participants indicated that they would prescribe a CGM with additional training or consultation on issues related to insurance coverage. Additional findings suggest that having 16 or more years of clinical experience, full-time employment, spending a more significant percentage of time delivering primary care, caring for patients with Medicare coverage, and being located at a greater distance from endocrinologists were significantly associated with having prescribed a

CGM. Participants who previously prescribed a CGM were more confident in prescribing one and seven times more likely to prescribe one in the future. The findings suggest that once clinicians have the experience and become more comfortable with working with CGMs, they are more likely to prescribe them in the future.

Oser et al. (2022) also suggest that continued expansion of Medicaid coverage for CGMs could increase CGM access, support more widespread primary care prescriptions, and reduce disparities for patients with scarcer resources. Limitations to this study include the possibility of nonresponse bias and an overestimation of CGM interest, as the invitation to participate described the purpose of the survey as better understanding factors related to CGM. Although this study does not directly address the PICOT question, it highlights that CGMs have been generally under-prescribed by PCPs partially due to a lack of insurance coverage and PCPs potentially not always having sufficient experience to support or manage patients who use a CGM. This reinforces the need for educational interventions that support patients who use a CGM.

Interventions that May Improve CGM Use

Studies focusing on interventions that may improve CGM use in patients with T2DM are limited. Litchman et al. (2022) conducted a mixed methods feasibility study that found that providing online peer support and diabetes self-management education and support (DSMES) tailored to the Hispanic population in Spanish-speaking adults with T2DM who use CGMs improved participant self-efficacy scores. The educational intervention and support were found to be feasible, acceptable, and satisfactory by the participants. The study included 26 Spanish-speaking adults who were provided with a CGM and were equipped with a Spanish reader that they wore for 12 weeks. The online support group was moderated by bilingual, trained peer

facilitators who encouraged self-care behaviors in diabetes management. Secondary outcome data included A1C and TIR. A statistically significant improvement in A1C was noted in nine participants, but interestingly, no significant changes in TIR were noted. A statistically significant improvement was noted in self-efficacy scores for the participant group as a whole. Participants unanimously reported preferring CGMs to traditional finger stick blood glucose monitoring.

Barriers encountered by the participants included the devices falling off and technology issues. Participants requested more information on ways to keep CGMs from falling off. Litchman et al. opined that the benefits gained from CGM use and improved patient outcomes in the Latino population may contribute to decreasing disparities in diabetes and diabetes technology use. The small sample size is a limitation of this study, which likely contributed to the lack of a statistically significant change in A1C for the participant group as a whole. This study directly applies to the PICOT question.

Gomez-Velasco et al. (2019) conducted a literature review, including 51 articles, on the empowerment of patients with T2DM and concluded that patient empowerment is possible when patients have sufficient knowledge to make decisions about their health, have the resources necessary to implement their decisions and the experience to be able to evaluate if their decisions are effective. Gomez-Velasco et al. state that patients must also feel that they are in a psychologically safe environment where they can collaborate with their healthcare providers while also feeling respected. Possessing knowledge of diabetes care alone does not empower patients if psychosocial aspects and level of skill that impact daily life activities and one's ability to implement self-care behaviors are not considered. A core intervention to raise patient empowerment must be supplemented with reinforcement tools such as booklets or manuals that

patients can continue to reference. Phone calls, mobile apps, websites, and software are additional resources to support empowerment. Gomez-Velaso et al. found that empowerment programs for patients with T2DM require ongoing reinforcement, including self-management education, problem-solving, and shared decision-making skills. This literature review directly applies to the PICOT question and was considered in the development of the DNP Scholarly Project's intervention. The authors did not address their literature review's limitations or the studies' evidence level.

Language Concordant Care

Hougas et al. (2022) completed a prospective cohort study conducted in a family practice clinic serving patients with diverse backgrounds in Minneapolis, Minnesota. The study found that 12 patients who were provided a CGM expressed that the device improved their ability to check blood glucose throughout the day and their overall diabetes management even after they were no longer wearing the device. Disadvantages to using CGMs identified in this study included the initial task of learning how to use the device for those who are not technologically savvy and those who cannot read or speak English. Limitations of this study included a small sample size and the brief duration of CGM use (seven days). In addition, the blood glucose results were blinded for part of the study, preventing participants from responding to their glucose levels in real-time. Along with improved diabetes management with CGM use, the findings of this study underscore the potential for language fluency to be a potential barrier to CGM use and is applicable to the PICOT in offering an educational intervention in the participant's preferred language.

Lor & Martinez (2020) conducted a scoping literature review that included 50 studies examining the impact of language-concordant care on patient outcomes. Findings revealed that

67% of the reviewed studies associated improved outcomes with language-concordant care, including interpersonal relationships, access to care, and patient satisfaction. Lor & Martinez suggest that language concordance can be useful in providing culturally and linguistically appropriate care. This study was selected for the literature review as it provides a broad analysis of the impact of language concordance on health care and impacted the decision to provide the educational intervention in the participant's preferred language for the current DNP project.

Synthesis of Literature Review

This literature review included an observational study, retrospective cohort study, mixed methods interventional study, cross-sectional quantitative study and two literature reviews. Themes in the literature included improved blood glucose control using CGMs (Litchman, 2022; Ni et al., 2023; Zahedani et al., 2021), improved patient satisfaction (Hougas et al. 2022; Zahedani et al., 2021) and multifactorial barriers to CGM use (Lor & Martinez, 2020; Oser et al., 2022;). Multiple studies, including Hougas et al. (2022) and Zahedani et al. (2021), note that CGMs are associated with improved patient satisfaction, treatment adherence, and enhanced quality of life. Barriers to CGM use include PCP prescribing hesitancy and insurance coverage issues impacting access to CGMs (Oser et al., 2022). Individual patient barriers include and are not limited to language discordance, difficulty with CGM technology use, and multiple issues, including discomfort caused by utilizing the device (Lor & Martinez, 2020; Oser et al., 2022). Optimizing CGM implementation, including robust education, training, and support, could improve diabetes management self-efficacy, influence positive behavioral changes, and decrease disparities in diabetes technology use (Gomez-Velasco et al., 2019; Litchman et al., 2022; Ni et al., 2023; Oser et al., 2022). Addressing barriers to CGM use, such as teaching patients ways to prevent them from falling off, may improve the patient experience with CGM use and support

adherence, and increasing patient empowerment may increase self-efficacy in diabetes care (Gomez-Velasco et al., 2019; Litchman et al., 2022). Few studies have focused on the perspectives of CGM use by the T2DM Latinx population, the effectiveness of language-concordant CGM teaching methods for diabetes self-management, and interventions that empower and increase treatment adherence among this population.

CHAPTER FOUR: METHODS

Participants for this pilot study were recruited at a Federally Qualified Health Center in Southern California, which is affiliated with a large academic center. Eligible participants were identified through a larger ongoing research study focused on CGM use in underserved populations. Inclusion criteria for the DNP project included Spanish-speaking Latinx adults (18 years and older) diagnosed with T2DM who were prescribed a CGM. Participants were not excluded if they lacked adherence to CGM use. Eligible participants were asked if they were interested in participating in the educational program and were contacted telephonically to confirm their eligibility and interest.

Intervention

Our intervention was a nurse practitioner (NP)-led 60-minute in-person CGM educational program combined with three follow-up support phone calls. The content was designed by the Project Lead in collaboration with an advanced practice nurse diabetes educator at the FQHC and one of the co-authors, who is also an Endocrinologist. Topics in the educational program included: (a) an overview of CGMs, (b) benefits of CGM use, (c) interpreting data from the CGM, (d) how to get the most out of CGM use, including wearing the device at all times, (e) potential barriers encountered while using a CGM, (f) problem-solving techniques in using a CGM, and (g) an overview of diabetes empowerment. Participants were also advised of recommendations from the ADA (2023), including guidance on maximizing TIR. Participants were contacted via telephone every two weeks to offer support and address any questions regarding CGM use or any information covered during the educational program for six weeks after the intervention. Three attempts were made to contact each participant, either by phone call or text message, before a participant was considered “unreachable.” Quantitative data was

collected pre-intervention and post-intervention and CGM report reviews to assess CGM adherence and blood glucose

Data Collection

The Diabetes Empowerment Scale Short Form (DES-SF) in Spanish (Appendix C), developed by the University of Michigan's Diabetes Research and Training Center, was utilized. The DES-SF in Spanish is a Likert-type questionnaire used to measure psychosocial self-efficacy as an outcome of successful clinical and/or educational intervention and is free to use as long as it is cited per the University of Michigan's Diabetes Research and Training Center instructions (Anderson et al., 2020). The DES-SF in Spanish was administered pre-intervention, immediately post-intervention, and at six weeks post-intervention to assess if the educational intervention impacted the participant's perceived self-efficacy in managing the psychosocial aspects of diabetes, assessing dissatisfaction and readiness for change and setting and achieving goals (University of Michigan, 2023). The scoring instructions (Appendix D) and the English version of the DES-SF have been included in this manuscript for reference (Appendix E).

The GMSS is a Likert-type questionnaire developed by Polonsky et al. (2015) to assess glucose monitoring device-related treatment satisfaction. The GMSS's reliability and validity have been supported (Polonsky et al., 2015). The DDS is also a Likert-type questionnaire developed by Polonsky et al. (2005) to measure the emotional and cognitive stress caused by daily diabetes management. The DDS has high reliability, Cronbach's alpha=0.94, and its validity has been supported (Fukuda et al., 2019). High levels of diabetes distress have been significantly associated with poor glycemic control, poor self-care, low diabetes self-efficacy, and poor quality of life (Fisher et al., 2012; Fukuda et al., 2019). Demographic information,

including gender, age, and highest level of education completed, was collected for descriptive analysis.

Since increased CGM percent time-worn correlates with increased benefits from CGM use (Ni et al., 2023), most patients prescribed CGM for diabetes management are recommended to wear the device at all times. This is measured by "percent time CGM active," data collected from CGM reports. Participants are considered adherent to CGM use if they have worn their CGM for at least 70% of the time since this level of adherence offers sufficient data for meaningful analysis and effective management of blood glucose levels (ADA, 2024). "Percent time CGM active" was collected pre-intervention and post-intervention to assess if the educational intervention impacted CGM adherence. Hemoglobin A1C is generally evaluated every three months, exceeding the time to implement this DNP scholarly project. Thus, the average monthly glucose levels were utilized for the respective one-month periods before and after the intervention.

Analysis

Redcap software was utilized to store results. IBM SPSS version 29 and Excel were used to conduct the statistical analysis to determine the intervention's impact. The analysis covered the computation of descriptive statistics and the application of inferential statistical tests to determine significant differences between pre-and post-intervention. For Likert Scale Responses, the frequency and percentage of responses for each category (e.g., strongly agree, agree, neutral, disagree, and strongly disagree) were presented. The mean for CGM percent time active was calculated in Excel. Repeated measures ANOVA was used to evaluate the DES-SF results. T-test was used to evaluate GMSS results, and the Mann-Whitney U Test was used to compare DDS pre-intervention and post-intervention results. All tests were conducted at a 5% level of

significance ($\alpha = 0.05$). Results with p-values less than 0.05 will be considered statistically significant. The data was reviewed to check for outliers and missing data and coding was done to ensure categorical variables were coded correctly, and Likert scale responses were appropriately quantified.

Ethical Considerations

Participation was voluntary, and participants could withdraw at any time without penalty. The electronic medical record (EMR) utilized to perform a chart review of the patient's CGM adherence and A1C was password-protected and only accessible to authorized individuals associated with the FQHC. Patient confidentiality was assured by securing a list of eligible participants and assigning each participant a code number accessible only to the DNP Scholarly Project Lead and individuals associated with the primary interprofessional research study. Participants' names were only accessible to the DNP Scholarly Project Lead and individuals associated with the primary research study. Only code numbers, including demographics and record-keeping, were used during data collection. All other protected health information was removed. Approval from the University of California, Los Angeles Office of the Human Research Protection Program was obtained before initiating the scholarly project (IRB # 22-001851-AM-00002). The Project Lead obtained Individual verbal consent from participants before enrolling them in the scholarly project.

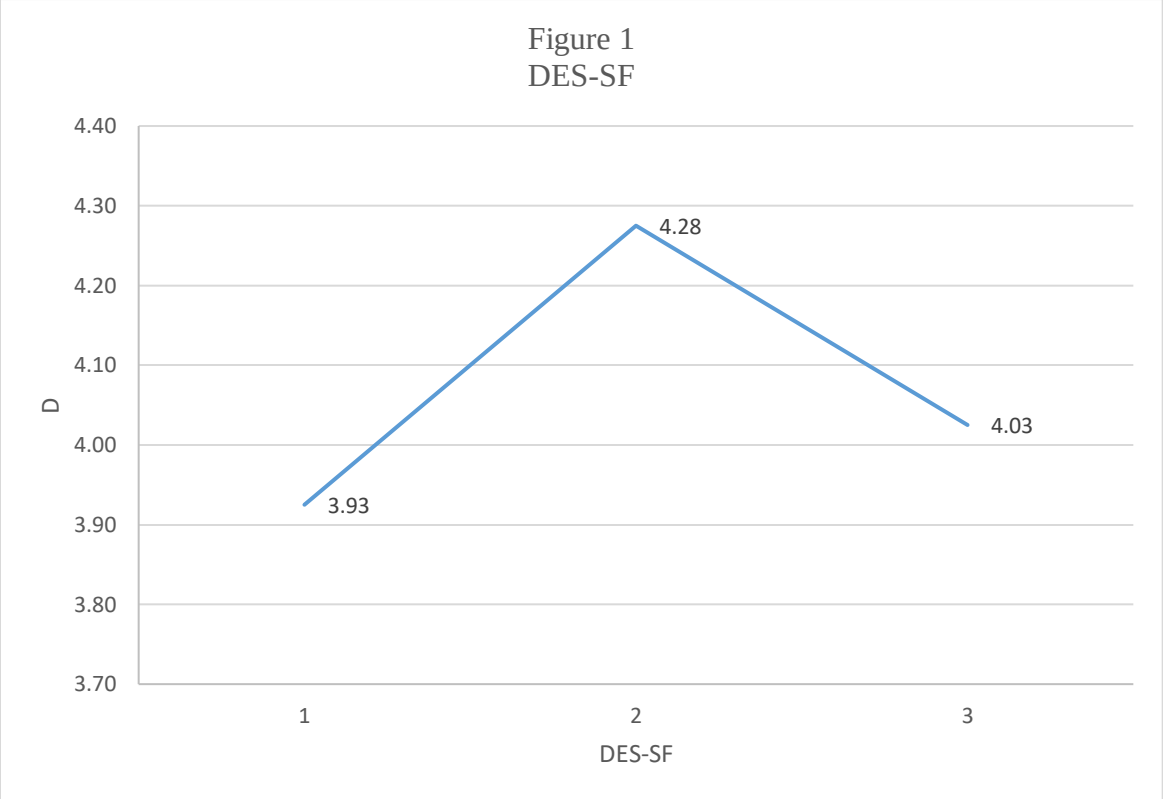
CHAPTER FIVE: RESULTS

Seventeen patients reported they were interested in participating in the educational intervention with enhanced follow-up, 12 agreed to participate and 10 completed the intervention. Two cohorts attended the in-person educational program. The participant sample comprised of adults ages 46-69, with a mean age of 58.6. Nine participants were female (90%), and one was male (10%). (Appendix H). The mean age when the participants were initially diagnosed with T2DM was 37.1 years old. Most of the participants did not attend high school (60%), one attended some high school (10%), one completed high school (10%) and one completed some college (10%). There was a 100% retention rate. IBM SPSS version 29 was used to conduct the statistical analysis to determine the impact of the intervention.

We found that there was an improvement in patient empowerment after our intervention, although this was only significant at a level of p=0.201, and this improvement was the largest immediately post-intervention (Figure 1). Significant statistical differences were noted in the question related to being able to feel the ability to turn diabetes goals into a workable plan (p=0.036), trying out different ways of overcoming barriers to diabetes goals (0.024), knowing what helps to stay motivated to care for diabetes (0.021), and knowing enough about oneself as a person to make diabetes care choices that are right (0.036) (Appendix G). DES-SF scores were noted to be high at baseline, which limited variability. At baseline, 80% of participants agreed or strongly agreed they know what helps them stay motivated to care for their diabetes, can find ways to feel better about having diabetes, and know positive ways to cope with diabetes-related stress, and 100% agreed or strongly agreed post-intervention. Pre-intervention, 70% of participants agreed or strongly agreed that they knew what parts of taking care of their diabetes they were dissatisfied with, and 100% agreed or strongly agreed post-intervention. At baseline

and post-intervention, 100% of participants either agreed or strongly agreed they were able to turn their diabetes goals into a workable plan, could try out different ways of overcoming barriers to their diabetes goals, and could ask for support for caring for their diabetes. Finally, 90% of participants agreed or strongly agreed they know enough to make diabetes care choices that are right for them at baseline, and 100% agreed or strongly agreed post-intervention.

Figure 1: *DES-SF Means at Baseline, Immediate Post-Intervention, and 6-Weeks Post-Intervention*



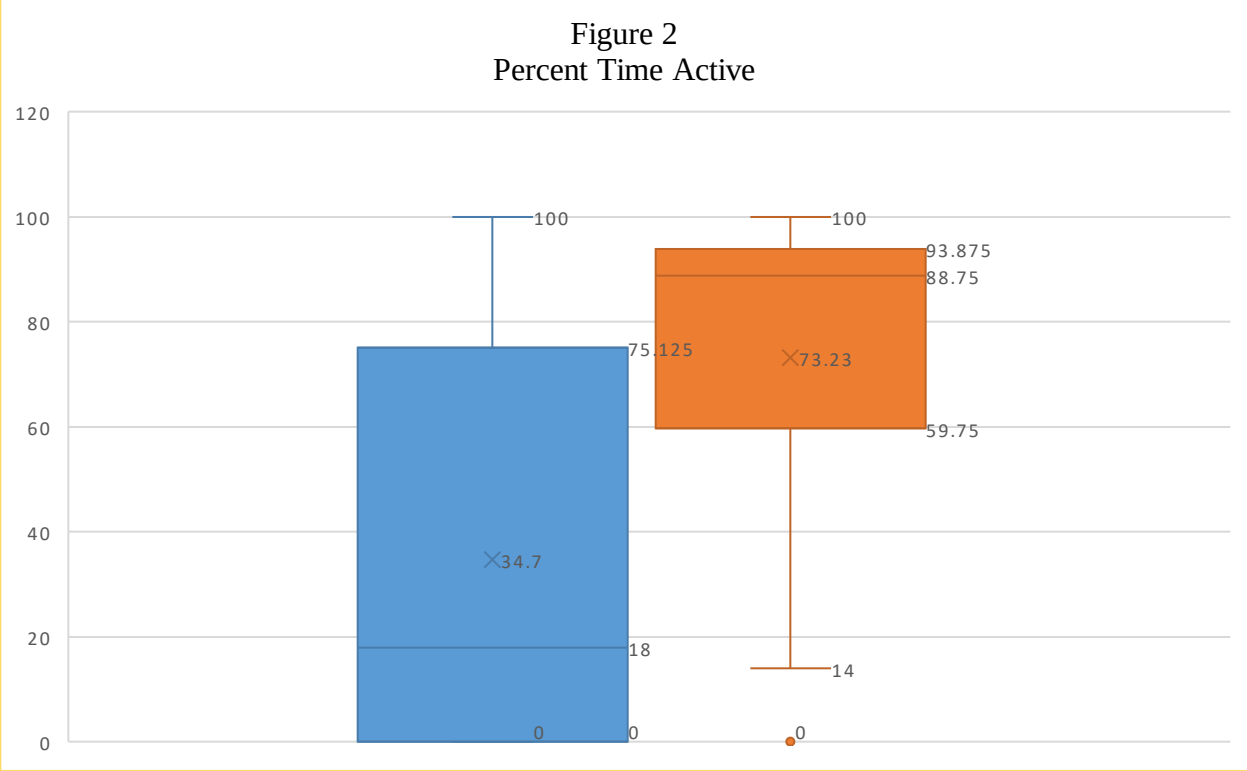
An improvement in CGM "percent time active" was observed in 80% of the participants (Table 1; Figure 2). The mean percent time active was 34.7 at baseline and 73.23 post-intervention. Forty percent of participants who were not adherent to CGM use at least one-month pre-

intervention became adherent to CGM use post-intervention. One participant (10%) did not adhere to CGM use pre- or post-intervention.

Table 1: *Percent Time Active with CGM*

Table 1 Percent Time Active	
Pre-Intervention	Post-Intervention
53.5	75
0	0
0	14
0	83.3
71.5	88
0	89.5
0	93
36	93
100	100
86	96.5

Figure 2: *Percent Time Active Box Plot*

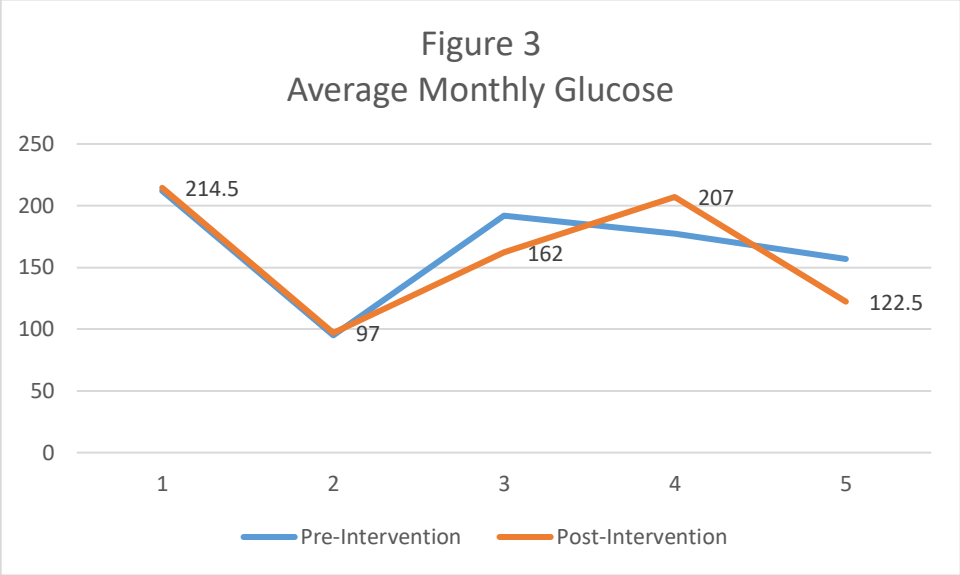


Only five participants' average monthly glucose was captured, given that half did not adhere to CGM regularly before the intervention. Only two of the five participants demonstrated an improvement in average monthly glucose, two remained about the same, and one demonstrated decreased blood glucose control (Table 2 & Figure 3). Ideally, Hemoglobin A1C would have been measured pre-intervention and 12 weeks post-intervention However, measuring Hemoglobin A1C 12 weeks post-intervention was not possible due to time restraints for this project, and the average monthly glucose measured by the CGM device was used instead.

Table 2: *Average Monthly Glucose Levels*

Table 2 Average Monthly Glucose	
Pre-Intervention	Post-Intervention
212	214.5
95	97
192	162
177.5	207
157	122.5

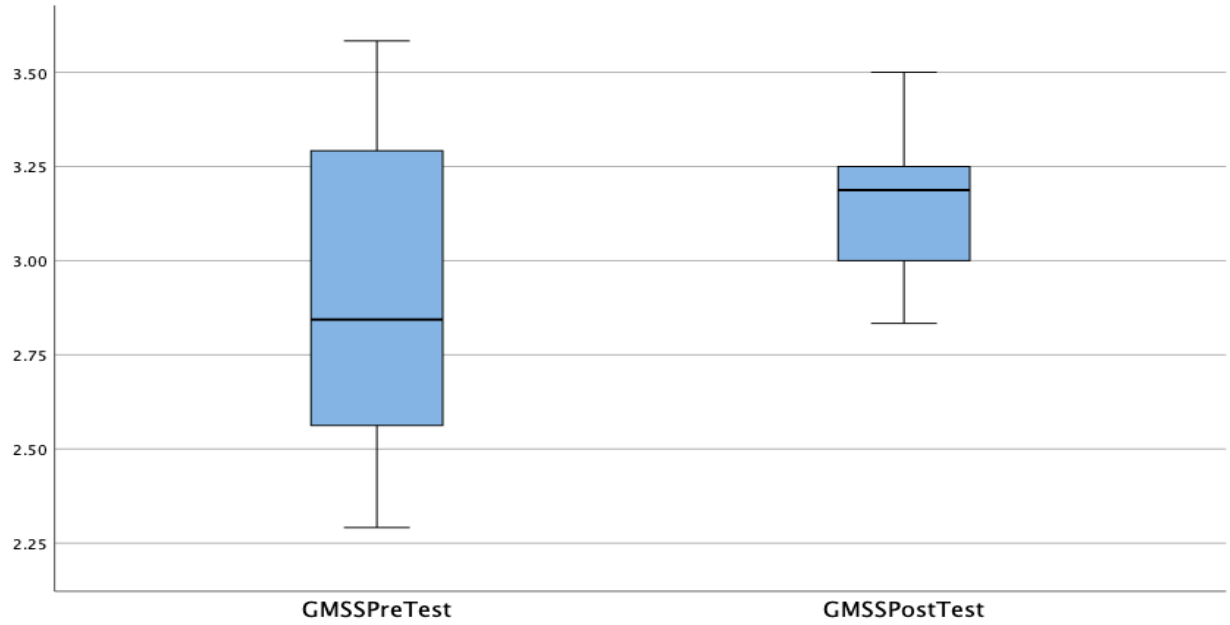
Figure 3: *Average Monthly Glucose Levels*



A statistical difference was noted in Total GMSS (p=0.016) and the GMSS subscale of Behavioral Burden (p=0.040) (Figure 4 & Table 3). Although no significant differences were noted in the GMSS subscales of Openness, Worthwhileness/Trust, or Emotional Burden, a Mann-Whitney U Test revealed improvements in the mean scores for Openness (Appendix J) and Emotional Burden (Appendix K). The mean score for Openness increased from 9.10 to 11.90, and the mean score for Emotional Burden decreased from 12.90 to 8.10. Interestingly, the

mean score for Worthwhileness/Trust increased from 9.25 to 11.75, suggesting a decrease in Worthwhileness/Trust (Appendix L).

Figure 4: *GMSS Pre and 6-Weeks Post-Intervention*



GMSS Pre-test:	GMSS Post-test:
Maximum – 3.583	Maximum – 3.5
Q-3 – 3.2917	Q-3 – 3.266
Median – 2.844	Median – 3.188
Q-2 – 2.542	Q-2 – 2.969
Minimum – 2.292	Minimum – 2.833

Table 3: *GMSS Statistical Results*

GMSS Statistical Results				
	Mean	**Standard Deviation**	**One-sided p**	**Two-sided p**
GMSS Openness	.17500	.68769	.221	.442
GMSS Emotional	-.50000	1.00000	.074	.148
GMSS Behavioral	-.65000	.85959	.020	.040
GMSS Worthwhileness/Trust	-.03333	.82327	.450	.901
GMSS Total	.44000	.47057	.008	.016

No statistically significant difference was noted in the DDS (p= 0.579), although comparing the pre-intervention and post-intervention sample means revealed a modest reduction in the Emotional Burden, Regimen, and Total distress scores post-intervention. No changes were noted to the Physician Distress Category (Table 4).

Table 4: *Diabetes Distress Sub-Categories Results*

DDS Sub-Categories Statistical Results			
	Mean (Standard deviation)		**Paired-Exact t-test (p-value)**
	Pre-intervention	**Post-intervention**	
Emotional Burden	9.4(4.9)	8.1(2.6)	0.739
Interpersonal Distress	3.8(1.6)	4.4(2.6)	0.853
Regimen Distress	8.5(4.1)	6.3(1.3)	0.481
Physician Distress	4(0)	4(0)	-
DSS Total	25.7(7.9)	22.8(5.1)	0.579

CHAPTER SIX: DISCUSSION

The educational intervention and follow-up seemed to be well received by the participants and improvements were noted in some areas of diabetes empowerment, diabetes distress, GMSS, and an increase in CGM percent time active. The overall improvement in the DES-SF was not statistically significant. As previously noted, diabetes empowerment scores among participants trended high at baseline, and mean scores only improved slightly after the intervention – more immediately after the intervention than six weeks later. During the educational intervention, the Project Lead noted that many participants responded positively when the empowerment topic was reviewed. This suggests that this patient population may be particularly interested in and could benefit from further discussion about ways to increase diabetes empowerment in future educational sessions.

Statistical significance was noted in GMSS Total and GMSS Behavioral Burden. The questions pertaining to behavioral burden related to participants' experience of fewer skin irritations and less pain after the intervention. Additionally, participants found the instruction on CGM led to less hassle for monitoring blood glucose and tended to take less time than before the intervention. Smaller improvements in the mean score for Emotional Burden and Openness subscales were observed; these improvements appeared to contribute to a significant increase in overall satisfaction with glucose monitoring. There was also a marked improvement in CGM percent time active, which could be related to an increase in glucose monitoring satisfaction – particularly as it relates to ease of use and more physical comfort when using the device after the intervention. The results suggest that the educational intervention positively impacted glucose monitoring satisfaction and CGM adherence.

Although not statistically significant, multiple DDS subscales, including Openness and Emotional Burden, noted a trend toward improvements. However, the intervention did not significantly impact the level of diabetes distress that participants experienced. Several extraneous variables could impact the perception of diabetes distress. More data is needed to explore factors that contribute to ongoing distress experienced by Latinx patients with diabetes.

All participants answered the pre- and post-intervention DDS questions related to physician distress similarly. According to these results, none of the participants experienced physician distress. All participants received diabetes care from the same group of advanced practice nurse (APRN) providers at the FQHC where the intervention occurred, which may have influenced responses related to distress with provider encounters. Of note, the DDS physician distress category should be updated to "provider distress" to more accurately describe who patients receive diabetes care from, including APRNs, physicians, and physician assistants.

The average monthly glucose results varied, and only data from five participants were included, which limits data analysis. Any future interventions should consider measuring Hemoglobin A1C pre- and post-intervention, as it is currently considered the gold standard for assessing glycemic control in diabetes.

The results were likely impacted by the small sample size, limiting generalizability. Literacy and health literacy may have also impacted the results. Sixty percent of the participants did not attend high school, which may have contributed to lower health literacy. The DES-SF was administered on paper pre-intervention and immediately after the intervention. Several participants required assistance completing the form, and one participant required the questions to be read to her due to her limited ability to read. Most participants required assistance

understanding the survey questions and the Likert scale even when verbally administered, which may have contributed to the decreased variability in the results, most notably the DES-SF results.

In light of project results, the educational intervention curriculum should be revised to allow for further discussion on concepts related to diabetes empowerment. The curriculum may also be improved to reinforce concepts where no improvements were observed or where scores demonstrated an increase in distress, such as in the GMSS Worthwhileness/Trust category. Cohort class sizes for future educational interventions should remain small enough to allow participants to engage and share their personal experiences using continuous glucose monitors (CGMs), including challenges experienced while using a CGM and how they overcame them.

Implications for Practice and Research

An educational intervention on CGMs, problem-solving barriers to CGM use, and diabetes empowerment in Latinx adults with T2DM provides preliminary data on the potential for improving CGM adherence, diabetes empowerment, and glucose monitoring satisfaction while decreasing diabetes distress. However, a larger participant pool is necessary to fully ascertain the clinical significance of this educational intervention. As the number of Latinx patients with T2DM using CGMs continues to rise, the need for language-concordant educational programs to support their use among this vulnerable population becomes increasingly evident. A general assessment of Latinx patients' educational level and general health literacy could also assist educators to tailor educational programs to accommodate Latinx patient needs. The consideration of virtual educational programs could further enhance accessibility and should be a part of future interventions.

Limitations

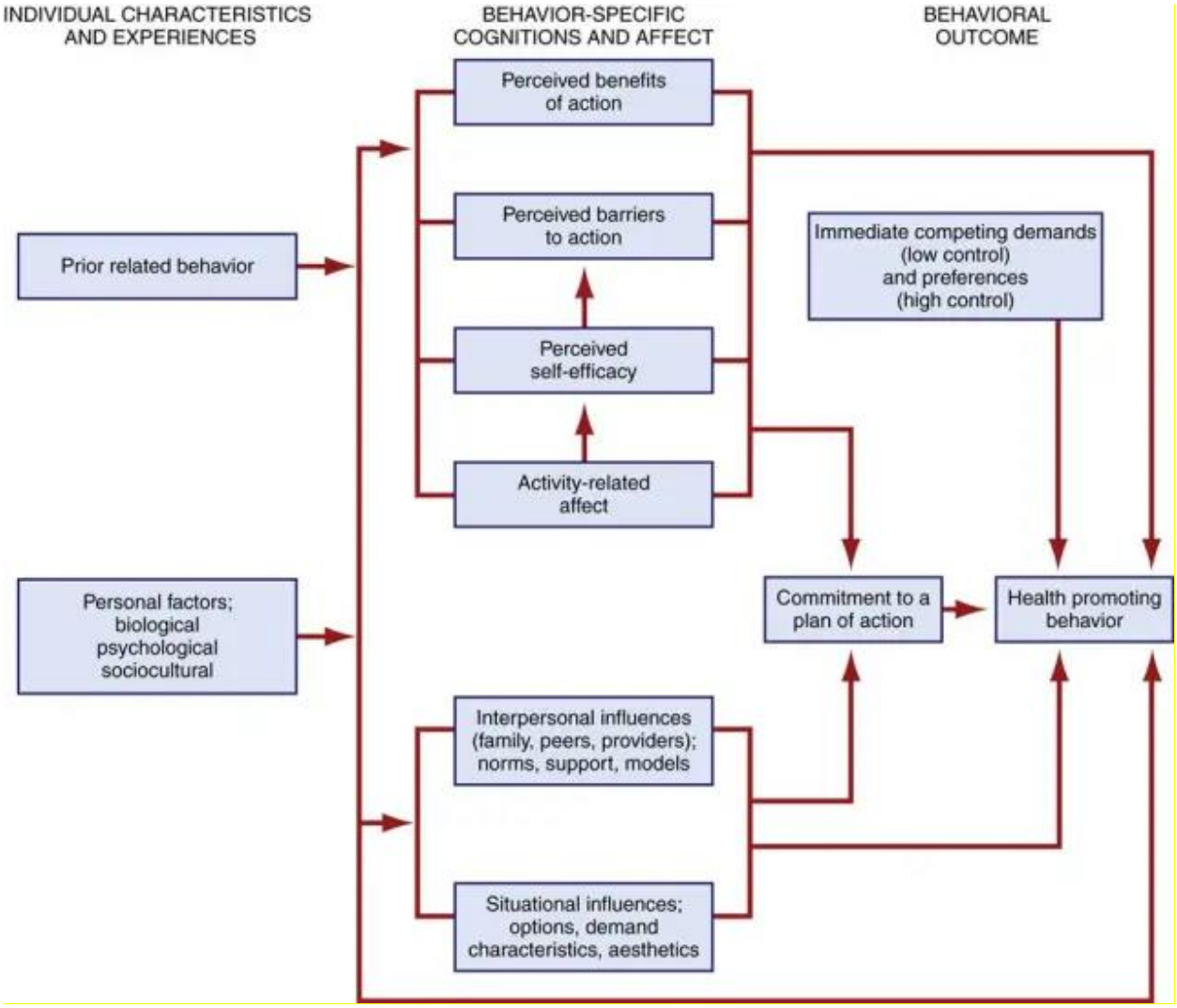
While providing some valuable insights on an education-focused intervention supporting Latinx adults with T2DM who use a CGM, this scholarly project had several limitations. The small sample size increased the possibility of Type 2 errors and decreased generalizability and external validity. There was also a delay in obtaining IRB approval, which limited the time for recruiting. The time restraints also did not allow for collecting Hemoglobin A1C pre-and post-intervention. The educational intervention was also conducted at one FQHC clinic site during regular business hours, which may have contributed to the low sample size. Future interventions may benefit from holding the educational programs during the weekend, as several individuals expressed interest in participating but could not attend due to work, transportation barriers, and other obligations.

CONCLUSION

An educational intervention on CGMs, problem-solving barriers to CGM use, and diabetes empowerment in Latinx adults with T2DM provides preliminary data on the potential for improving CGM adherence, diabetes empowerment, and glucose monitoring satisfaction while decreasing diabetes distress. Further research on a larger sample and over a longer time period is necessary. The need for language-concordant health education and interventions focused on supporting Latinx adults with T2DM should continue to be explored.

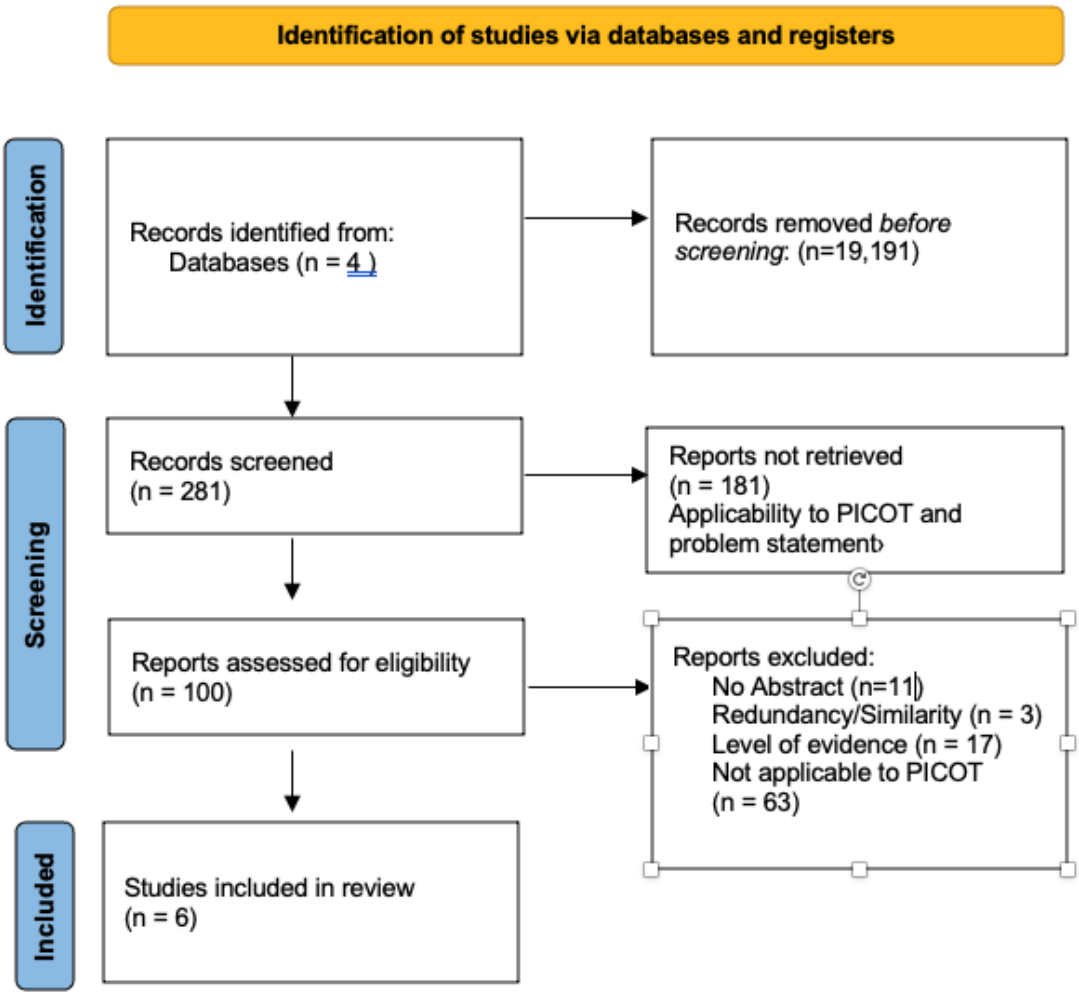
APPENDICES

Appendix A



Adopted from: https://pmhealthnp.com/nola-pender-health-promotion-model/

Appendix B


Identification of studies via databases and registers
Identification
Records identified from:
Databases (n = 4)
Records removed *before screening*: (n=19,191)
Screening
Records screened
(n = 281)
Reports not retrieved
(n = 181)
Applicability to PICOT and problem statement›
Reports assessed for eligibility
(n = 100)
Reports excluded:
No Abstract (n=11)
Redundancy/Similarity (n = 3)
Level of evidence (n = 17)
Not applicable to PICOT
(n = 63)
Included
Studies included in review
(n = 6)

Appendix C

Diabetes Empowerment Scale – Short Form (DES-SF) in Spanish

Attitudes Toward Diabetes – DES

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
In general, I believe that I:					
1. ...know what part(s) of taking care of my diabetes that I am **dissatisfied** with.	( )	( )	( )	( )	( )
2. ...am able to turn my diabetes goals into a workable plan.	( )	( )	( )	( )	( )
3. ...can try out different ways of overcoming barriers to my diabetes goals.	( )	( )	( )	( )	( )
4. ...can find ways to feel better about **having** diabetes.	( )	( )	( )	( )	( )
5. ...know the **positive** ways I cope with diabetes-related stress.	( )	( )	( )	( )	( )
6. ...can ask for support for having and caring for my diabetes when I need it.	( )	( )	( )	( )	( )
7. ...know what helps me stay motivated to care for my diabetes.	( )	( )	( )	( )	( )
8. ...know enough about myself as a person to make diabetes care choices that are right for me.	( )	( )	( )	( )	( )

Adopted from: https://medicine.umich.edu/sites/default/files/downloads/DES-SF_Spanish.pdf

Appendix D

DES-SF Scoring Key

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Diabetes Empowerment Scale (DES)

Scoring Key

The DES measures the patient's self efficacy related to:		Subscales & Items
I.	Managing the psychosocial aspects of diabetes (9 items)	(18,20–27)
II.	Assessing dissatisfaction and readiness to change (9 items)	(1-4,15-17, 19, and 28)
III.	Setting and achieving diabetes goals (10 items)	(5–14)

The scoring of the DES is straightforward and is based on completed items. An item checked "strongly agree" receives 5 points; "agree" – 4 points; "neutral" – 3 points; "disagree" – 2 points; and "strongly disagree" receives 1 point. The numerical values for a set of items in a particular subscale (for example: items 5-14 in the "Goal Setting" subscale) are added and the total is divided by the number of items (in this case 10) in the subscale. The resulting value is the score for that subscale. An overall score for the DES can be calculated by adding all of the item scores and dividing by 28.

Rev. 10/19/99
University of Michigan
Diabetes Research & Training Center

Adopted from: https://medicine.umich.edu/sites/default/files/downloads/des5_scoring-2.pdf

Appendix E

Diabetes Empowerment Scale – Short Form (DES-SF) in English

I am going to read you some statements about diabetes. Each statement finishes the sentence "In general, I believe that…" The response categories are: **Strongly Disagree, Somewhat Disagree, Neutral, Somewhat Agree, and Strongly Agree.**
It is important that you answer every statement.

Attitudes Toward Diabetes – DES

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
In general, I believe that I:					
1. ...know what part(s) of taking care of my diabetes that I am **dissatisfied** with.	( )	( )	( )	( )	( )
2. ...am able to turn my diabetes goals into a workable plan.	( )	( )	( )	( )	( )
3. ...can try out different ways of overcoming barriers to my diabetes goals.	( )	( )	( )	( )	( )
4. ...can find ways to feel better about **having** diabetes.	( )	( )	( )	( )	( )
5. ...know the **positive** ways I cope with diabetes-related stress.	( )	( )	( )	( )	( )
6. ...can ask for support for having and caring for my diabetes when I need it.	( )	( )	( )	( )	( )
7. ...know what helps me stay motivated to care for my diabetes.	( )	( )	( )	( )	( )
8. ...know enough about myself as a person to make diabetes care choices that are right for me.	( )	( )	( )	( )	( )

Adopted from: https://medicine.umich.edu/sites/default/files/downloads/DES-SF_english.pdf

Appendix F

The Glucose Monitoring Satisfaction Survey (GMSS)

Version: Type 2 Diabetes

We are interested in your thoughts and feelings regarding your current glucose monitor.

For each item below, circle the number that best indicates how much you agree or disagree with each statement as it pertains to your current monitor. Some patients use more than one monitor. Please consider the monitor you use the most or consider to be your primary monitor when answering these questions.

	My current monitor:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Helps me feel more satisfied with how things are going with my diabetes.	1	2	3	4	5
2	Makes me think about diabetes more than I want to.	1	2	3	4	5
3	Takes too much time to use.	1	2	3	4	5
4	Helps me and my doctor to know how much of my diabetes medications to take.	1	2	3	4	5
5	Makes me worry a lot.	1	2	3	4	5
6	Is too much of a hassle to use.	1	2	3	4	5
7	Gives me information that I don't find very useful.	1	2	3	4	5
8	Helps me feel less restricted by diabetes.	1	2	3	4	5
9	Makes me feel more frustrated with my diabetes.	1	2	3	4	5

https://behavioraldiabetes.org/xwp/wp-content/uploads/2015/11/GMSS-T2D-English.pdf

Appendix G

DDS

DIRECTIONS: Living with diabetes can sometimes be tough. There may be many problems and hassles concerning diabetes and they can vary greatly in severity. Problems may range from minor hassles to major life difficulties. Listed below are 17 potential problem areas that people with diabetes may experience. Consider the degree to which each of the 17 items may have distressed or bothered you DURING THE PAST MONTH and circle the appropriate number.

Please note that we are asking you to indicate the degree to which each item may be bothering you in your life, NOT whether the item is merely true for you. If you feel that a particular item is not a bother or a problem for you, you would circle "1". If it is very bothersome to you, you might circle "6".

	Not a Problem	A Slight Problem	A Moderate Problem	Somewhat Serious Problem	A Serious Problem	A Very Serious Problem
1. Feeling that diabetes is taking up too much of my mental and physical energy every day.	1	2	3	4	5	6
2. Feeling that my doctor doesn't know enough about diabetes and diabetes care.	1	2	3	4	5	6
3. Not feeling confident in my day-to-day ability to manage diabetes.	1	2	3	4	5	6
4. Feeling angry, scared and/or depressed when I think about living with diabetes.	1	2	3	4	5	6
5. Feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes.	1	2	3	4	5	6
6. Feeling that I am not testing my blood sugars frequently enough.	1	2	3	4	5	6
7. Feeling that I will end up with serious long-term complications, no matter what I do.	1	2	3	4	5	6
8. Feeling that I am often failing with my diabetes routine.	1	2	3	4	5	6

https://professional.diabetes.org/sites/default/files/media/ada_mental_health_workbook_chapter_3.pdf

Appendix H

Demographic Information on Participants

Age	Gender	Age When Diagnosed with T2DM	Highest Level of Education
48	Female	33	High school or GED
67	Female	39	Some high school
69	Female	35	Did not attend high school
62	Female	26	Did not attend high school
56	Female	48	Did not attend high school
56	Female	38	High school or GED
50	Female	35	Some college
63	Female	21	Did not attend high school
69	Male	50	Did not attend high school
46	Female	46	Did not attend high school

Appendix I

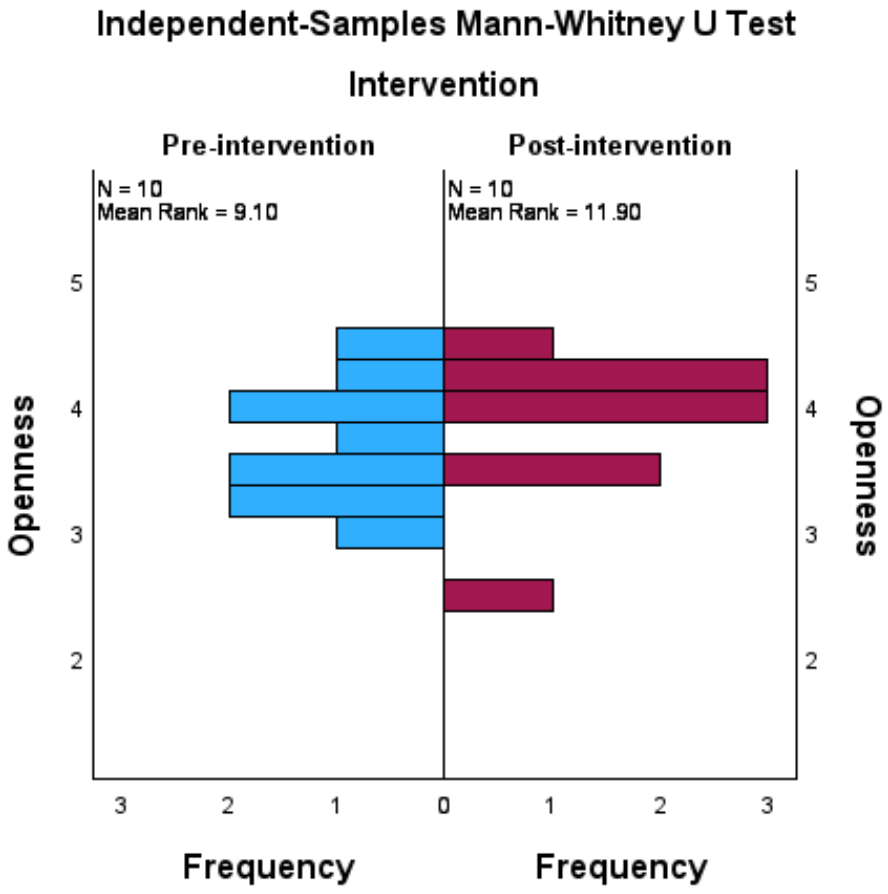
DES-SF Responses by Question

		Intervention			Total	p-value
		Pre-intervention	Immediate post intervention	6 months post intervention		
I believe that I know what parts of taking care of my diabetes that I am dissatisfied with	Agree	5(50)	4(40)	9(90)	18(60)	0.059
	Neutral	3(30)	1(10)	0(0)	4(13.3)	
	Strongly agree	2(20)	5(50)	1(10)	8(26.7)	
Total		10(100)	10(100)	10(100)	30(100)	
I am able to turn my diabetes goals into a workable plan	Agree	6(60)	5(50)	10(100)	21(70)	0.036
	Strongly agree	4(40)	5(50)	0(0)	9(30)	
Total		10(100)	10(100)	10(100)	30(100)	
I can try out different ways of overcoming barriers to my diabetes goals.	Agree	6(60)	1(10)	7(70)	14(46.7)	0.024
	Neutral	1(10)	0(0)	0(0)	1(3.3)	
	Strongly agree	3(30)	9(90)	3(30)	15(50)	
Total		10(100)	10(100)	10(100)	30(100)	
I can find ways to feel better about having diabetes	Agree	5(50)	4(40)	6(60)	15(50)	0.484
	Neutral	1(10)	0(0)	0(0)	1(3.3)	
	Disagree	1(10)	0(0)	0(0)	1(3.3)	
	Strongly agree	3(30)	6(60)	4(40)	13(43.3)	
Total		10(100)	10(100)	10(100)	30(100)	
I know the positive ways I cope with diabetes-related stress	Agree	6(60)	3(30)	8(80)	17(56.7)	0.115
	Neutral	2(20)	1(10)	0(0)	3(10)	
	Strongly agree	2(20)	6(60)	2(20)	10(33.3)	
Total		10(100)	10(100)	10(100)	30(100)	
I can ask for support for having and caring for my diabetes when I need it	Agree	5(50)	1(10)	6(60)	12(40)	0.134
	Neutral	0(0)	1(10)	0(0)	1(3.3)	
	Strongly agree	5(50)	8(80)	4(40)	17(56.7)	

Total		10(100)	10(100)	10(100)	30(100)	
I know what helps me stay motivated to care for my diabetes	Agree	4(40)	1(10)	8(80)	13(43.3)	0.021
	Neutral	1(10)	0(0)	0(0)	1(3.3)	
	Strongly agree	4(40)	9(90)	2(20)	15(50)	
	Strongly disagree	1(10)	0(0)	0(0)	1(3.3)	
Total		10(100)	10(100)	10(100)	30(100)	
I know enough myself as a person to make diabetes care choices that are right for me	Agree	4(40)	1(10)	8(80)	13(43.3)	0.036
	Neutral	1(10)	1(10)	0(0)	2(6.7)	
	Strongly agree	5(50)	8(80)	2(20)	15(50)	
Total		10(100)	10(100)	10(100)	30(100)	

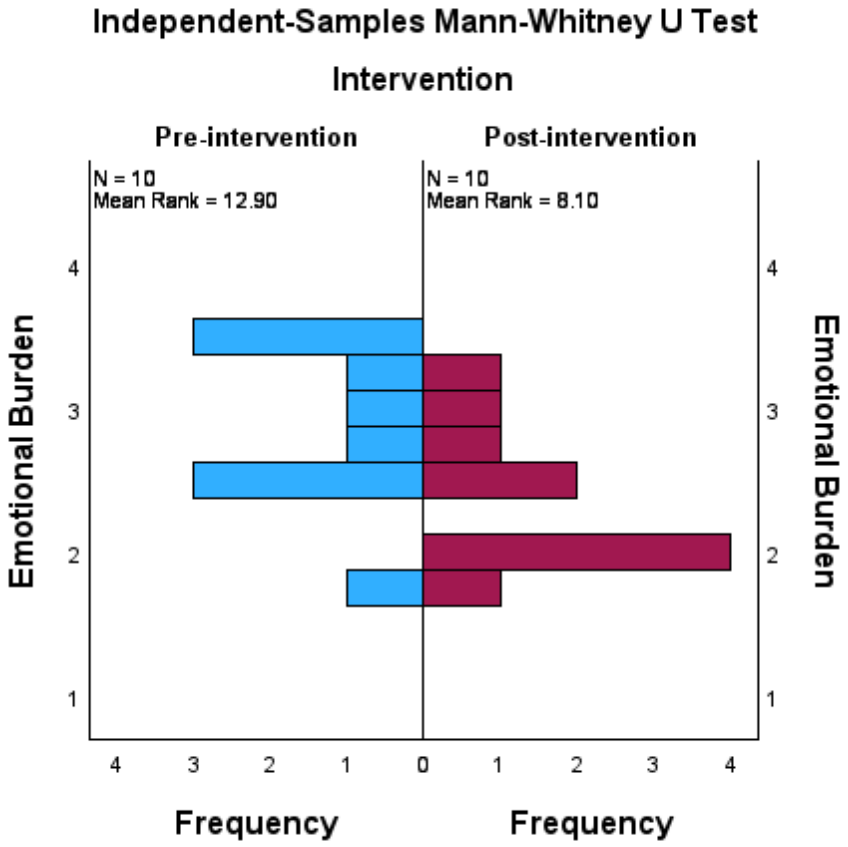
Appendix J

GMSS - Opensess



Appendix K

GMSS – Emotional Burden



Appendix L

GMSS – Worthwhileness / Trust

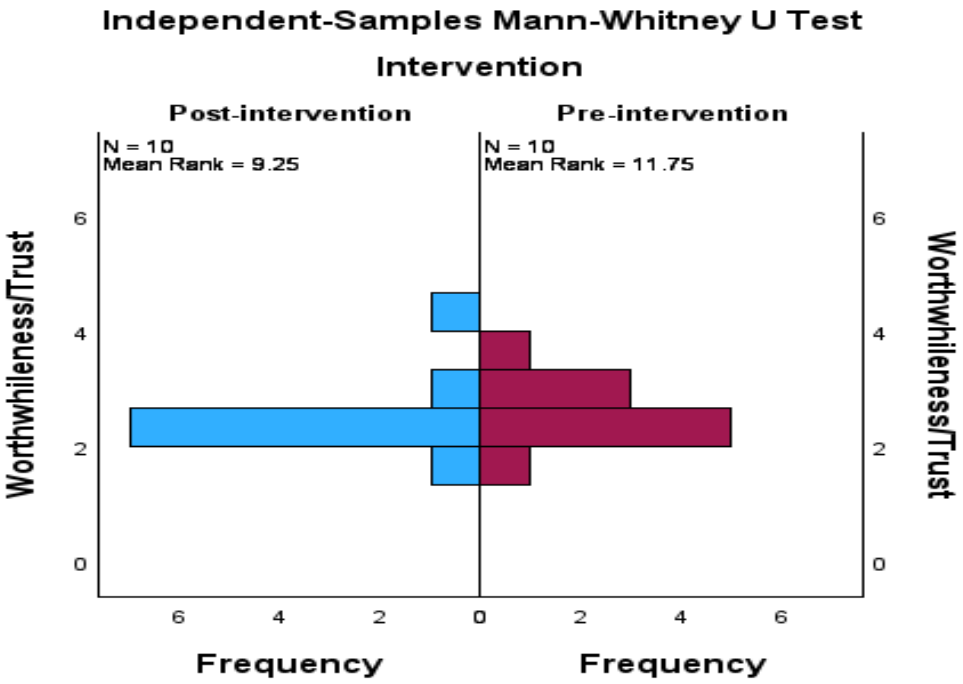


TABLE OF EVIDENCE

Citation	**Purpose**	**Sample/Setting**	**Methods (Design, Interventions & Measures)**	**Results**	**Discussion, Interpretation, Limitation of Findings**
Hougas III, J. E., Nichol, H. R., & Schafer, K. M. (2022). Patient satisfaction with professional continuous glucose monitoring in a diverse family medicine clinic: A pilot study. *Innovations in Pharmacy, 13*(2), 14-14.	To determine the patient experience after a single use of professional, blinded continuous glucose monitoring (CGM) with the iPro2 (Medtronic; Dublin, Ireland) in their primary care clinic.	Sample: 18-90 years of age, with a diagnosis of diabetes for at least one year, currently treated with insulin and with an A1C greater than 9% or any A1C if there was a concern for hypoglycemia and who was established with the clinic for at least one year and had a history of adherence. Exclusion: (1) If diabetes was managed by and outside specialist (2) if pregnant (3) on dialysis (4) or unable to consent. Sample size: Total (n) = 12 Women (n) = 66.7%	Design: Prospective Cohort Study Procedure: Participants were identified by physicians and then referred to Study Staff for participation. The Institutional Review Board of the University of Minnesota reviewed and approved this study. Intervention: The study consisted of two visits, the first two with a PharmD and the last with the referring provider. CGM was applied and the patients were asked to log point of care blood glucose,	Statistical Analysis & Results: PAID Questionnaire results indicated that 10/12 participants had a high amount of emotional distress form their diabetes. After the intervention, the HGM-SAT scores increased overall by 0.52. In six out of 27 questions, the mean changed towards decreased satisfaction after the intervention. Patients expressed CGM made it easier to accept	Discussion The experience of CGM in diverse communities has not been well studied. However, this study suggests that CGM is at least as acceptable to this patient population compared to self-monitoring of blood glucose. Interpretation CGMs are an additional tool that can be implemented in primary care to gain more powerful data to help patients with Diabetes achieve improved glucose control. Limitations

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
		Asian, n=7 Black/African American, n=2 White, n=2 Hispanic/Latino, n=1 Mean Age: 58 y.o. Setting: Patients were recruited from a single, urban, family medicine residency training clinic serving a diverse, predominantly underserved population	diet and activity initially for an average of 7 days. Patients completed a follow up survey at the end of the study visit. Measurement Problem Areas in Diabetes (PAID) questionnaire measured the current level of diabetes related emotional distress HGM-SAT tool designed to provide feedback on patient satisfaction and perceived impact of CGM on diabetes management and therapy. All questions on the surveys were crafted using a five-point Likert scale.	doing blood glucose testing and improved the management of diabetes even when not wearing the device.	Duration of Study: limited to an average of 7 days Use of interpreters could have increased bias. HGM-SAT tool was modified from CGM-SAT tool. Number of participants Half of the participants did not complete the food and activity log.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
Litchman, M. L., Ng, A., Sanchez-Birkhead, A., Allen, N. A., Rodriguez-Gonzales, B., Iacob, E., & Greenwood, D. A. (2022). Combining cgm and an online peer support community for hispanic adults with t2d: A feasibility study. *Journal of Diabetes Science and Technology, 16*(4), 866-873. doi.org/10.1177/19322296821103227	Determine if online support and CGM use in Hispanics with T2DM who do not use insulin is feasible, improves self-efficacy and blood glucose management.	Sample: Hispanic, Spanish speaking adults with T2DM Sample size: n=26 Setting: Salt Lake City, UT	Design: Mixed methods feasibility study Procedure: Paritcipants were recruited from the community via Spanish radio ads and flyers at events frequented by Spanish speaking adults. Intervention: Participants were provided with a CGM and online peer support community for 12 weeks. Measurement: Feasibiliy was measured via phone interview using a standardized interview guide.	Results: providing online peer support and diabetes self-management education and support tailored to the Hispanic population in Spanish-speaking adults with T2DM who use CGMs improved participant self-efficacy scores, was found to be feasible, acceptable and satisfactory by the participants. Improvement in A1C was noted. No improvement in TIR.	Discussion: Barriers encountered by the participants included the devices falling off and technology issues. Participants requested more information on ways to keep CGMs from falling off. Interpretation: CGM use and an online support community influence positive behavior change while addressing diabetes technology use disparities. CGM and online may be a promising intervention in addressing health disparities in Hispanics with T2DM. Limitations: Study was funded by Abbott Diabetes care.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
Lor, M., & Martínez, G. A. (2020). Scoping review: Definitions and outcomes of patient-provider language concordance in healthcare. *Patient Education and Counseling, 103*(10), 1883-1901. doi.org/10.1016/j.pec.2020.05.025		Sample: 50 studies Sample size: n/a Setting: n/a	Design: Literature Review Procedure: n/a Intervention: n/a Measurement: n/a	Results: 67 % of the reviewed studies associated improved outcomes with language-concordant care	Discussion: Multiple positive outcomes surrounding interpersonal relationship, access to care and patient satisfaction. Interpretation: Language concordant can be a useful solution in providing culturally and linguistically appropriate care. Language concordance needs further definition by health systems. Limitations: Only studies that defined language concordance and addressed health outcomes were included. Some relevant studies may have been omitted.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
Ni, K., Tampe, C.A., Sol, K., Richardson, D.B., Pereria, R. (2023). Effect of cgm access expansion on uptake among patients on medicaid with diabetes. *Diabetes Care, 1*(46). doi: 10.2337/dc22-1287	To explore the effect of full subsidies on CGM uptake and HbA1C outcomes in a U.S. adult population	Sample: adults with diabetes in a U.S. Medicaid program Sample size: n=3,036 Setting: Healthcare system in Colorado	Design: retrospective cohort study CGM uptake and adherence were assessed by CGM prescription and dispense data. Multivariate logistic regression evaluated predictors of CGM uptake. Pre- and post-CGM use HbA1c were compared	Results: CGMs are associated with improved HbA1C across all major racial/ethnic groups and effectiveness	Disparities with CGM uptake can be overcome by eliminating cost barriers.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
Oser, T. K., Hall, T. L., Dickinson, L. M., Callen, E., Carroll, J. K., Nease, D. E., & Oser, S. M. (2022). Continuous glucose monitoring in primary care: Understanding and supporting clinicians' use to enhance diabetes care. *The Annals of Family Medicine, 20*(6), 541-547. . https://doi.org/10.1370/afm.2876	To identify "characteristics associated with prescribing behaviors, openness to prescribing CGM, and to understand resources needed to support the use of CGM in primary care."	Sample: Primary care clinicians (Nurse Practitioners, Physician Assistants, Medical Doctors and Doctors of Osteopathy). Sample size: n=656 Setting: United States, 51 States represented by participants. Most participants worked in Family Practice or a Federally Qualified Health Center.	Design: Cross-sectional quantitative study Procedure: Participants were recruited from the American Academy of Family Physicians National Research Network, Meta-network Learning and Research Center, State Networks of Colorado Ambulatory Practices and Partners, and Wyoming Community and Practice-Based Research Network. An anonymous network-specific link was sent and participants were offered a $50 gift card.	Results: 46.6% had treated patients with a CGM but never prescribed one. 38.6% had never prescribed a CGM. 1.0% had never heard of a CGM. 89.5% were somewhat likely to prescribe a CGM in the future. 72.3% indicated that they would prescribe a CGM with additional training or consultation on issues related to insurance coverage. "Professional role, part-time employment, greater percentage of time spent delivering primary care, and greater	Discussion: Most patients with diabetes are managed in primary care, and primary care clinicians need to be able to prescribe and manage. Barriers to prescribing CGMs must be addressed as the evidence strongly supports their use. Interpretation: Primary care clinicians are open to using CGMs to help patients manage their diabetes but require additional resources and support. Additionally, once clinicians have the experience and become more comfortable with working with CGMs, they are more likely to prescribe them in the future.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
			CGM prescribing behaviors and resource needs of primary care clinicians were analyzed via a web-based survey. Intervention: web-based survey Measurement: Surveys were collected using Qualtrics web-based software and were collected between February and November of 2020.	distance from endocrinologist were significantly associated with ever having prescribed a CGM." Participants who previously prescribed a CGM were more confident in prescribing one and 7 times more likely to prescribe one in the future. Having 16 or more years in training and patient Medicare coverage were associated with increased confidence in prescribing CGMs.	"Continued expansion of Medicare and Medicaid coverage for CGM could also support more widespread prescription in primary care." Limitations: The invitation to participants outlined the survey was on CGMs. Therefore participants may have had a greater interest in CGMs vs non-participants which could have contributed to an overestimation of CGM experience. The response rate to the survey could not be calculated as the total number of recipients in the email lists was unknown.

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
Zahedani, D. A., Torbaghan, S.S., Rahili, S., Karlin, K., Scilley, D., Thakkar, R., Saberi, M. Noosheen, H., Perelman, D., Aghaeepour, N., McLaughlin, T., Snyder, M. P. (2021). Improvement in glucose regulation using a digital tracker and continuous glucose monitoring in healthy adults and those with type 2 diabetes. *Diabetes Therapy, 12*(7), 1871-1886.doi: 10.1007/s13300-021-01081-3	Evaluate use of "Sugar" Artificial Intelligence (AI) App with CGM to reduce hyperglycemia in early stages of glucose dysregulation who might benefit from lifestyle changes.	Sample: Healthy participants or with a diagnosis of prediabetes or non-insulin dependent T2D Exclusion: (1) Use of Vitamin C supplement exceeding 200% of the US recommended daily allowance at least 14 days prior to starting the trial (2) allergy to skin adhesives used in the trial (3) pregnant or lactating women (4) women who gave birth in the last six months (5) Medications: insulin, oral hypoglycemic medications, antipsychotics, oral corticosteroids, triphasic oral contraceptives, blood thinners (6) and those with an allergy to nuts. Sample size: Total (n) = 665	Design: Prospective, unblinded observational trial. Procedure: Recruitment via social media channels and online classified ads, targeting individuals from diverse geographic, socioeconomic, age and education levels. Individuals who met the online eligibility criteria further screened by clinical coordinators via telephone who confirmed eligibility and completed the enrollment. Intervention: Participants provided CGM, a smart watch for 10 days. No dietary recommendations.	Statistical Analysis: Wilcoxon signed-rank test was used to analyze TIR data obtained for the first two days and the last two days. Mann-Whitney rank test for continuous variables such as age & BMI. Comparisons statistically significant $p<0.05$. Results TIR improved significantly 51.4% demonstrated improved TIR by an average of 6.4% ($p<0.001$, Wilcoxon signed-rank test). Individual in all classes of glucose dysregulation	Discussion As CGM becomes increasingly popular, it is important to understand its effects and concurrent use with a digital health app that links glucose patterns to modifiable food choices and physical activity which ultimately may help to the prevention of T2D. Application of app results in significant TIR improvement. Improvement significant in group as a whole & more dramatic among those with suboptimal baseline TIR: those who identified as prediabetics or healthy. Interpretation those with normoglycemia and prediabetes respond well to CGM

Citation	Purpose	Sample/Setting	Methods (Design, Interventions & Measures)	Results	Discussion, Interpretation, Limitation of Findings
		Women (n) = 354 Men (n) = 190 Unreported or Other (n) = 121 Median age= 36 Setting: 47 U.S. States including the District of Columbia Outpatinet clinic	Two structured food challenges were included: oral glucose challenge on day 3 and mixed meal challenge on day 5 when each participant consumed the same macronutrients. Measurement Time in Range (TIR) blood glucose defined as 54-140 mg/dL for healthy and prediabetes, 54-180 mg/dL for T2D with the use of the Freestyle Libre CGM.	improved TIR significantly. There was a trend towards greater response in those who were younger. Those with prediabetes or identified as healthy or non-diabetic were also more likely to have improved responses in TIR.	Limitations Median Age of Participants: 36 Latino/Latinx/Hispanic Participants not accounted for – unclear if there were any.

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