A PRIMARY CARE TEXT MESSAGING INITIATIVE TO IMPROVE TYPE 2 DIABETES SELF-MANAGEMENT IN HISPANIC ADULTS

A Doctor of Nursing Practice Project Report

by

LISA POMPA OLIVARES

BS, Texas A&M University-Corpus Christi, 2001
MS, Texas A&M University-Corpus Christi, 2013

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This Doctor of Nursing Practice Project Report meets the standards for scope and quality of Texas A&M University-Corpus Christi College of Nursing and Health Sciences and is hereby approved.

Dr. Elizabeth Loika, FNP-C, PNP-C, DNP
Chair

Yolanda Keys, DHA, MSN, RN, NEA-BC, EDAC
Project Advisor

Mario A. Martinez, MD
Content Expert

Dr. Carmen Tejeda-Delgado, Ed.D
Graduate Faculty Representative

August 2020

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ABSTRACT

The purpose of this doctoral project is to improve the quality of care at a primary care clinic through the implementation of a text message intervention via a mobile phone device to improve glycosylated hemoglobin A1C levels, decrease body mass index (BMI), and increase diabetes self-management knowledge in Hispanic adults, aged 20 years or older, and diagnosed with type 2 diabetes (T2DM). A quality improvement (QI) design which included adult men and women with a hemoglobin A1C > 7% in a primary care office was used. T2DM is defined as glycosylated hemoglobin A1C that is greater than, or equal to, 6.5%. The optimal aim for effective control of T2DM is a maintained hemoglobin A1C level less than 7%. Intervention consisted of a power point presentation for the providers on updated management of care for patients diagnosed with T2DM. The results of a chart audit depicted improvement in knowledge and quality of diabetes practices among providers in the primary care clinic over time. The 3-month text messaging program consisted of 25 participants who were given educational material on T2DM. Participants received two text messages daily for 3-months with supportive, educational, and reminder texts regarding T2DM. Pre- and post-intervention measurements for mean hemoglobin A1C levels, DKT2 scores, and BMI were collected. Reductions in hemoglobin A1C measurements and BMI, and an increase in diabetic knowledge were observed. The mean pre- and post-intervention *p*-values demonstrated that the implementation of a text messaging program was statistically significant. Further investigation is needed for enhancing text message programs, such as the content and method of texting. Diabetic education via text messages has the capability to encourage modifications of one's daily routine thus reducing modifiable elements that raise one's chances of diabetes.

Keywords: Hispanic adults, diabetes, self-management, text messaging program

A Primary Care Text Message Initiative to Improve Type 2 Diabetes Self-Management in Hispanic Adults

Introduction

Type 2 diabetes mellitus (T2DM) has risen to epidemic proportions within the United States (US), as well as globally (Fortmann et al., 2017). Currently, it is the seventh leading cause of death in the US, and there are over 100 million adults living with this debilitating chronic disease, or its precursor, prediabetes (Centers for Disease Control and Prevention [CDC], 2017a). According to the National Examination Surveys from the US Department of Health and Human Services Office of Minority Health (OMH) (2016), Hispanic adults are 40% more likely to suffer death as a result of T2DM compared to their non-Hispanic adult counterparts. This striking disparity continues to worsen as the Hispanic population continues to grow. To reverse this trend, multiple, cost-effective and extended clinical interventions are central. Particularly, the use of innovative technology may empower individuals with knowledge and confidence to improve their self-care management and health outcomes. Targeted individuals for this quality improvement (QI) project includes the Hispanic adults who own a smart phone and evaluated in the primary care setting. A review of the literature demonstrates mobile phone technology, primarily text messaging, is a logical approach for these individuals (Arora et al., 2014; Dobson et al., 2017; Fortmann et al., 2017; Lim 2016; Peters et al., 2017). This type of technology allows for greater flexibility and educational opportunities arising from enhanced, direct patient - healthcare provider communication between in-person appointment intervals (Fortmann et al., 2017).

Background

Diabetes is a tremendous healthcare burden nationwide, with an increased prevalence throughout the state of Texas, when compared to the rest of the US (Texas Demographic Center [TDC], 2018). According to the American Diabetes Association [ADA] (2019a) report, the overall calculated expenses associated with individuals diagnosed with diabetes within the US in 2017 was approximately $327 billion dollars. Due to escalating expenses and wide-spread prevalence of diabetes across Texas, it is essential to effectively manage hemoglobin A1C levels in patients with diabetes. Diabetes mellitus is at a new record high in the US. In 2015, approximately 9.4% of the US population was diagnosed with diabetes; this population consisted of an estimated 30.2 million adults, ages 18 years and over (TDC, 2018). In comparison, 11.2% of Texans and 11.3% of those who resided in Nueces County were diagnosed with diabetes mellitus in 2015 (TDC, 2018). Between 1990 and 2010, the number of individuals who lived with diabetes more than tripled (TDC, 2018). Diabetes has ranked, and currently ranks, as one of the most common causes of death within Texas and the US (TDC, 2018). According to the International Diabetes Federation [IDF] (2020), the global number of individuals living with T2DM will be greater than 642 million by the year 2040. This epidemic has created a domino effect in healthcare; as the number of T2DM diagnosed adults increased, the elevated medical costs and economic losses have also ensued (Rowley et al., 2017). As witnessed at Primary Diagnostics Medical Center (PDMC), the clinical site for this QI project, the financial burdens placed on many patients ultimately led them to forego healthcare. This trend has resulted in poor glycemic control (Rowley et al., 2017). Without proper diabetes self-management and glycemic control, many individuals developed fatal, life-threatening health complications, such as heart disease, stroke, chronic kidney disease, neuropathy, amputation, and retinopathy or blindness (Waller et al., 2019). These T2DM-associated complications resulted in increased healthcare

costs not only for the affected individuals, but the entire US healthcare system (Hayes et al., 2016).

Adults are more inclined to develop T2DM if they are 45 years of age or older, have a family history of diabetes, or are overweight (CDC, 2017a). Diabetes is defined as a defect within the body, which elevates blood glucose levels above the normal limit. T2DM is characterized by impaired response of the body to the insulin, resulting in insulin resistance as well as failure to produce an adequate amount of insulin to regulate blood glucose levels (ADA, 2019c). A glycosylated hemoglobin (A1C) is used to estimate the average blood glucose level over the prior two to three months (approximately, 100 days). This level is monitored to assess blood glucose control over time (ADA, 2019c). The diagnosis of T2DM is considered when a hemoglobin A1C level is greater than, or equal to 6.5%, and fasting blood glucose is > 126 mg/dL (Vieria, 2018). According to the ADA (2019c), the optimal aim for effective T2DM control is to maintain hemoglobin A1C level less than 7%.

Review of the Literature

According to Peters et al. (2017), there is a need for enhanced approaches that enable timely healthcare provider follow-up assessment of blood glucose readings for more instantaneous interventions. Such interventions teach patient specific alternative actions necessary to improve diabetes self-management behaviors, which extends beyond the clinical setting, and is interwoven into a person's daily life. The literature has demonstrated a growing indication in favor of the use of mobile phones for this purpose (Peters et al., 2017). mHealth or mobile phone technology will be referred to throughout as text messaging. mHealth interventions are practical and effective in underserved, and ethnically diverse populations (Arora et al., 2014; Dobson et al., 2017; Fortmann et al., 2017). With many underserved populations now owning

mobile devices with internet capability, it could be inferred that mHealth would be a valuable platform to assist in the management of those with T2DM (Pew Research Center, 2015).

In a randomized, controlled trial (RCT) conducted by Fortmann et al. (2017), 126 individuals (low-income, Hispanic participants with inadequately managed T2DM) took part in the Dulce Digital Intervention (DDI) group, or the usual care (UC) group. The participants were then sent three text messages each day, which were either inspirational, informative, or indicated a need for action throughout the six-month time period. At baseline, the mean hemoglobin A1C was 9.5%, and standard deviation (SD) of 64.75 for the sample of 126 participants. At the end of the study, the Dulce Digital participants exhibited a significantly lower hemoglobin A1C level when compared with UC at the third month (mean hemoglobin A1C 8.5% compared to 9.3%, $p = 0.03$) and at the sixth month (mean hemoglobin A1C 8.5% compared to 9.4%, $p = 0.03$). Fortmann et al. (2017) found there was a significant decrease of mean hemoglobin A1C for the six-month time frame by 1% ($p < 0.05$).

There is strong evidence that regular reminders are an effective strategy to improve diabetes self-management (Agboola, 2016; Dobson et al., 2017; Dobson et al., 2018; Lim, 2016). In a systematic review conducted by Dobson et al. (2017), the author discovered seven studies met the criteria for RCTs studying the use of text messaging focused on self-management interventions to control hemoglobin A1C for those with inadequately managed T2DM. Three out of the seven studies conveyed a substantial reduction in the hemoglobin A1C by implementing the text messaging intervention from the beginning of the study to the follow up time period within the intervention group when compared to the control group ($p < 0.01$) (Agboola, 2016; Dobson et al., 2017; Lim, 2016). In a nine-month, two arm, parallel randomized controlled trial, conducted by Dobson et al. (2018), 366 participants, who were 20 years of age or older, with an

A1C level > 8%, were randomly selected (n=183 intervention; n=183 control). The study consisted of two groups, an intervention and a standard care group. The intervention group was sent customized text messages for a nine-month time frame and usual care. The text messages offered education, encouragement, and reminders associated with diabetes self-management and routine behaviors. The participants who were part of the control group were given usual standard care. Text messages were sent by a selected computerized program. At the end of nine-months, the authors found a reduction in the hemoglobin A1C level was significantly greater in the intervention group (mean -8.85 mmol/mol, SD = 14.84) when compared to the control group (mean of -3.96 mmol/mol, SD = 17.02), $p = 0.007$. The outcome demonstrated reasonable improvements in blood glucose management in adults with inadequately controlled hemoglobin A1C levels (Dobson et al., 2018).

The implementation of diabetic self-management education via text messaging enhances the management of individuals with T2DM, particularly in Hispanics. Text message reminders offered healthcare provider support leading to improved compliance with blood glucose testing and medication compliance (ADA, 2019c).

Description of Problem in Setting

The Primary Diagnostic Medical Center (PDMC) primary care clinic was selected for this project to assess the health care needs of Hispanic adult patients with T2DM seen at this clinic, as well as the clinic's need to better serve this population. The clinic is located in an underserved, low to moderate socio-economic area of Corpus Christi, Texas. The clinic serves a diverse patient population, including approximately 75% Hispanic/Latino, 25% Caucasian, and 15% African American and who speak both English and Spanish. On average, the clinic sees about 35 patients per day who are either insured or self-pay patients. A majority of the patient

population at the clinic site is adult Hispanics with minimal income. Thus, adherence to routine physician office visits is costly due to high deductibles and lack of transportation. Approximately 75% of the patient population at the clinic are Hispanic and diagnosed with a chronic illness, such as T2DM. In a typical week the clinic sees an average of 100 patients diagnosed with T2DM. An estimated 25% of the Hispanic adults in the clinic have controlled A1C levels < 7%. The clinic has one provider who is a nurse practitioner, who is under the supervision of a primary care physician. The initial evaluation revealed that T2DM patients, given oral dietary instructions, as well as direction on keeping a daily blood glucose log, were still non-compliant with these tasks. Therefore, patients remained at risk for additional comorbidities and elevated hemoglobin A1C levels, as a poor diet and uncontrolled T2DM is directly related to each of these. The non-compliance and uncontrolled hemoglobin A1C levels of Hispanic adults with T2DM at PDMC was the primary reason for undertaking the QI project in this clinic site. Text message reminder interventions revealed encouraging outcomes in individuals with chronic illnesses, with capability to attain extensive influence on specific patient populations such as Hispanic adults, and necessitate minimal supplies (Usherwood, 2017). Therefore, this QI project was foreseen to be beneficial at PDMC.

As part of the data gathering process, 175 patient chart reviews were performed at PDMC to identify those patients with uncontrolled hemoglobin A1C levels > 7%. The purpose of this QI project was to improve hemoglobin A1C levels and diabetes self-management behaviors using text messages in Hispanic adult patients with T2DM aged 20 years or older at PDMC clinic. The staff was eager to implement the text messaging intervention at the clinic and anxious to see the results.

Purpose and Aims

The purpose of this project was to improve hemoglobin A1C levels, enhance the quality of care, decrease patient's body weight, and increase diabetes self-management knowledge in Hispanic adults with T2DM at the clinic through the implementation of a mobile text messaging intervention. The clinical question that guided this project was: In Hispanic adults, diagnosed with T2DM in an outpatient clinic does the implementation of a text messaging intervention via a mobile phone device improve hemoglobin A1C levels, and reinforce diabetes self-management knowledge over a 3-month time frame? The American Association of Colleges of Nursing (AACN, 2006), Essential IV for advanced practice nurses consisted of engagement between provider and patient via text messaging through a mobile phone device and patient portal, to demonstrate application of this essential. For this QI project, utilization of both the patient portal system and mobile phone devices with text messaging capabilities for receiving and sending texts were suitable for the specific clinical setting. This essential exhibited the theoretical and innovative technological abilities of the project director (PD), which allowed creation and implementation of data gathering and evaluation strategy from diabetic patient medical records during the chart review process (AACN, 2006). The AACN's Essential VI, in inter-professional collaboration for improving Hispanic adult patients and diabetic population health outcomes, was utilized during the QI project. The advanced practice nurse directed inter-professional groups, including the supervising physician, specialists, management, and other advanced practice nurses, to examine current diabetes practice guidelines and clinic concerns regarding diabetic management through collaboration and teamwork at PDMC (AACN, 2006).

Aim #1: To decrease hemoglobin A1C levels in Hispanic adults, aged 20 years or older, with T2DM, in a primary care facility, in Nueces County. The intervention sent two daily text message prompts to participants, with reminders on checking blood glucose levels, taking their

prescribed medications, or exercising. Hemoglobin A1C levels were monitored every three months using the Afinion AS-100 capillary point of care tests (POCT) meter with results available through the electronic health record (EHR) at the clinic. The primary objective was to decrease mean hemoglobin A1C levels by 1 percentage within the QI project's 3-month time frame through the implementation of daily text message reminders regarding diabetes self-management.

Aim #2: To improve understanding and knowledge of diabetes self-management in a T2DM patients at PDMC. The objective was to increase mean post-test Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test (DKT2) score, and at least 1% weight reduction over the three-month time frame of the project (Fitzgerald et al., 2016). The DKT2 was used to analyze the participants' knowledge on diabetes, pre- and post- intervention implementation. Patient's body weight was also measured at the beginning and end of the intervention.

Aim #3: To improve the knowledge and quality of diabetes practices among providers in the primary care clinic. In clinic power point presentation intervention was conducted prior to the implementation of the diabetes management project to reinforce provider's knowledge of T2DM patient management, ensure appropriate documentation, diabetic teaching and health maintenance referrals. The information presented on the power point presentation was up-to-date evidence-based guidelines obtained from the American Diabetes Association. The objective was to implement change at the system level. The patient charts were audited at interval time frames to evaluate provider compliance with documentation of referrals to specialists, annual diabetic health maintenance orders, diabetic teaching, and scheduling of follow-up visits in patients

diagnosed with T2DM. A run chart was created to illustrate improvement in the quality of diabetes practices in patient management of T2DM among providers at the clinic.

Methods

Conceptual and Theoretical Frameworks

The Improving Our Workplace Award (IOWA) model, established by Marita G. Titler, is the guiding conceptual framework for the QI project concerning this intervention, as illustrated in Appendix 1. The IOWA Model is intended to influence medical practice by means of evidence-based practice, with the fundamental objective of resolving the scientific question, and foreseeing patients' outcomes (Titler et al., 2001). Components of the IOWA Model include: (1) isolate the problem, (2) establish a strategy, (3) arrange a panel, (4) collect data, (5) evaluate and combine the data, (6) establish the legitimacy and suitability of the data, (7) experimental modification, (8) decide if the modification is suitable for practice, (9) apply, and (10) distribute outcomes (Gawlinski & Rutledge, 2008). Lowering hemoglobin A1C levels of patients diagnosed with diabetes is an established goal for many healthcare providers in order to decrease diabetes related comorbidities, and mortality. With this in mind, the Project Director (PD) led an initial needs evaluation, which revealed 90% of patients were lacking the necessary education and knowledge of diabetes self-management. Additionally, the evaluation discovered that staff members at the primary care clinic were responsive to change, depending on the relevance of the technique, application, and presentation of the change. Executing this organized change to this specific patient population mandated active involvement of all colleagues, caregivers, and stakeholders. The IOWA Model stresses that an optimistic outcome is possible, once the changes are described, distributed, and established; the cooperation from the entire group was necessary for successful implementation and achievement of this specific intervention. The organized

change initiative presented the staff members and management of the PDMC an improved method to better manage a chronic disease. This was completed by enhancing the healthcare delivery system through the implementation of daily text messages to the target population.

The Health Belief Model (HBM) has been applied to understand a wide variety of health behaviors (Janz & Becker, 1984), and was utilized as the theoretical framework for this QI project, as depicted in Appendix 2. According to Becker & Janz (1985), three comprehensive aspects of health are examined when using the HBM; the first includes an individual's anticipatory health behaviors, which incorporate the encouragement of knowledge, healthy actions, self-efficacy, and modifications in one's behavior (Becker, Lois, Kirscht, Haefner, & Drachman, 1977). The intervention instituted in this QI project for improving diabetes management incorporated daily blood glucose monitoring, nutrition, and physical activity reminders with text messages. When implementing the HBM, it is understood there are multiple factors which can affect an individual with T2DM adhering to their plan of care. The probability of an individual's compliance with their plan of care is directly influenced by a group of beliefs, which include the perceived seriousness, and threat of the disease state to the individual. The comprehensive group of beliefs is demonstrated in Appendix 2.

Project Design and Ethical Considerations

This project was a QI initiative, which used text messaging via mobile phone device to improve patients mean hemoglobin A1C levels, and self-management behaviors in patients with T2DM, in a Nueces County primary care clinic. Potential barriers were examined which could have affected the results of the QI project included participants moving, or no longer willing to participate in the project, the cost of medications, and/or, technological errors with the mobile devices used by the participants. These factors were assessed by questioning individuals during

the enrollment process if they had any plans on moving, or changing providers during the 3-month time-frame. Medication costs were combatted by prescribing generic medications, and/or, offering samples and savings cards when diabetic medications were started. Lastly, prior to the start of this project, it was ensured that participants had a reliable mobile phone service provider, or an alternative number to be contacted at.

The project plan was reviewed and approved by the Texas A&M University-Corpus Christi Institutional Review Board (IRB) for project classification; and received a determination of "Not Human Subjects Research," and permission to proceed as a QI project (Appendix 3). Personal Health Information (PHI) was collected for the purpose of this QI project. The Chief Executive Officer (CEO) of the clinic provided a letter of support, agreed to fully support the project, and acknowledged the collection of PHI for the QI project's purpose only (Appendix 4). Participant demographic data collected from the EHR was stored on a data collection form, which was kept in a separate locked filing cabinet, and maintained securely. The patients' hemoglobin A1C levels, DKT2 scores, and body weights were also stored on a data spreadsheet, which was kept confidential, and required a username and password to access the information. The informed consents, obtained by the medical assistant (MA), prior to starting the intervention, was maintained as a scanned document in the EHR of each individual. The data will be kept for three years from the project's completion. At the end of this time period, the data will be destroyed.

Intervention

The QI project team consisted of the project director (PD) - a family nurse practitioner employed in this primary care practice, and four employees within the clinic including two medical assistants, a receptionist, and a phlebotomist. The project team’s general responsibility

was to identify eligible participants and assist with the enrollment process. The receptionist, who was qualified to verify insurance and schedule patient visits, identified individuals who met the inclusion criteria. The inclusion criteria obtained was from a preprinted database list compiled by the EHR system at the beginning of each day, for one week. The receptionist then asked the patient upon checking in for their appointment if they were interested in participating in the study. If the patient had an interest in participating, they were then appointed to a designated medical assistant who discussed the QI project intervention. The two medical assistants were qualified to administer medications, obtain vital signs, and verify medication lists prior to the visit with the provider. The PD trained the medical assistants, prior to starting the intervention, on the information needed from those willing to participate. The PD then orientated the participant on how to view and respond to the text messages once they were received by the individual's mobile device. The phlebotomist, who was qualified in collecting laboratory studies, then collected the baseline hemoglobin A1C levels of each participant, the MA obtained a baseline height, weight, and BMI, and had the participant complete the DKT2 at baseline and again at three months, post-intervention. The PD performed a baseline physical assessment on the patient at baseline and at three months. The participant sample was taken from patients attending the clinic during the first week of implementation of this QI project, and who met the inclusion criteria. The inclusion criteria included: classifies as Hispanic; is older than 20 years of age; had been diagnosed with type 2 diabetes for greater than 12 months; had an A1C of 7% or greater for last 12-months; had access to a mobile phone device adept for text messages, and was interested in participating. One hundred and fifty patients meeting this criterion had attended the primary care clinic within the past 3 months, therefore it was initially predicted that

approximately 50% of the patients may be interested, and thus a sample of 75 participants was projected.

Based on the HBM, an individual must trust and understand they are prone to a specific disease (perceived susceptibility), comprehend the dangers and effects the disease state mayhave on them (perceived severity), and adhere to the encouraging health behaviors, such as self-management in those individuals with T2DM (Dehghani-Tafti et al., 2015). An important concept noted in the HBM is increasing the communication between the health care provider, and the patient. The HBM highlights the use of technological products to support the patient's enthusiasm towards care and can assist the healthcare provider in discovering appropriate ways to integrate care, which is suited to the daily life of the patient. The HBM further recognizes educational resources, including the individual's capacity to grasp a concept or activity, as well as an individual's feeling of self-sufficiency or accomplishment (Smith, Men, & Al-Sinan, 2015). The content of the text messages created an opportunity for behavioral change. During the intervention, patients received two-daily text messages at different time intervals (8:00 am and 5:00 pm) for 3 months.

Once underway, the PD implemented the text messaging intervention by sending text message reminders and self-care diabetic education via a secure patient portal to the patient's mobile phone device. The messages were up-to-date with the current ADA guidelines and prewritten in both English and Spanish by the PD with the assistance of the IT tech prior to the implementation of the project. The text messages consisted of general diabetic educational messages ("Did you alternate your injection site today?"), prompts to become active and exercise ("Don't forget to exercise 30 minutes today?"), motivational messages ("Great job on drinking more water today!"), as well as prompts on blood glucose monitoring ("Did you check your

blood glucose before eating breakfast today?") and medication compliance ("Did you take your diabetic medication before dinner?"). See the detailed text messages in the appendix (Appendix 5). All text messages which were received and sent via mobile device, between the healthcare provider and participant, were tracked through the EHR system, eClinical Works. The PD contacted the participant if they did not respond for over a week to the text messages. The PD was alerted through the EHR system when the text message was successfully sent to the participant. Incoming messages from the participants were responded to by the PD daily by 5 pm. At the follow-up visit in April 2020, the participant had post-intervention weight, height, BMI measured by the MA, lab work drawn by the phlebotomist, DKT2, and patient satisfaction post survey of text message program.

Due to the unprecedented occurrence of the COVID-19 pandemic, the PD had to modify the QI project. Initially, the projected sample size consisted of 25 participants who were able to complete the study through the implementation of telemedicine to continue follow-up visits at the 3-month completion of the project. Five participants did not want to return to the clinic to have their hemoglobin A1C drawn; therefore, only 20 patients completed the project in its entirety. The five participants, who chose to wait until after the pandemic to return to the clinic for their hemoglobin A1C, chose to complete the post intervention DKT2 test via a telemedicine visit. These five individuals also chose to complete their patient satisfaction post survey of the text message program, weigh themselves at home and relayed their weight to the PD in a telemedicine visit, to calculate their post intervention BMI. In summary, 20 participants completed the entire QI project and five participants lacked their post intervention hemoglobin A1C but intend to complete the project once the pandemic is over. The team struggled and had to make modifications due to the Governor Abbotts Stay at Home Orders resulting from the

COVID-19 pandemic. The PD had to modify the text messages from the initial two text messages per day for seven days a week to two messages per day twice a week from March 30, 2020 through April 15, 2020. The PD decreased the number of text messages in an attempt to prevent overwhelming participants who were experiencing increased stress due to being athigher risk for COVID-19 based on their age and underlying comorbidity of T2DM.

Data collection

The data collection was conducted by the PD and consisted of the patients' demographic data consisting of age, ethnicity, and number of years diagnosed with T2DM. The initial demographic data was collected from the EHR when the project was implemented in January 2020. The initial weight, height, and BMI were collected during the pre-intervention visit at the start of the program in January 2020. Hemoglobin A1C levels, the DKT2 initial scores, and body weights of participants were also collected at the start of the intervention and at the three-month follow-up visit. The phlebotomist collected the hemoglobin A1C levels at the initial visit, and results were processed using the in-house Afinion AS-100 capillary POCT meter. This tool has been approved by the US Food and Drug Administration (FDA) as a valid and reliable method, which followed the National Glycohemoglobin Standardized Program-Align Percentages (FDA, 2019). This QI project was completed over a 3-month time-frame, from January 2020 through April 2020. For a breakdown of the time taken for each portion of this project, see Appendix 6.

Measurement Tools

The primary outcome of interest, hemoglobin A1C levels, are a 3-month average of an individual's blood glucose levels, which was analyzed using a baseline level, and 3-month hemoglobin A1C level post-intervention implementation, as described above. The increased knowledge and awareness of diabetes self-management was analyzed and scored with the DKT2,

which consisted of 23 general diabetes knowledge questions (Fitzgerald et al., 2016, pp. 186-187). The DKT2 has 2 sections that consist of 23 questions total. The first section of the DKT2 assesses one's overall knowledge and is based on 14 questions, and the second section consists of the insulin use portion based on 9 questions. Both sections are suitable for adults diagnosed with both types 1 and 2 diabetes. Both sections of the DKT2 can be utilized separately, however if both sections are used together it can be referred to as a global DKT (GDKT) score with a total of 23. The survey is scored based on the number of questions correct, with a score of 1 to 23 and 23 being the highest score possible. If the first section of the survey is scored the highest score possible is 14, and the second section with a score of 9 for a total of 23. The Diabetes Knowledge Test assesses general diabetic knowledge, diet, insulin, and self-care questions. An example question of the DKT2 is "The diabetic diet is: (a) the way most American people eat; (b) a healthy diet for most people; (c) too high in carbohydrate for most people; (d) too high in protein for most people" (Fitzgerald et al., 2016, p. 186).

The questionnaire was an acceptable, efficient, and inexpensive method of assessing a patient's general knowledge of diabetes, and diabetes self-care. In a study by Fitzgerald et al. (2016) the internal reliability of the DKT2 tool with a sample of 190 participants, was Cronbach's alpha > 0.70, signifying adequate reliability. This tool was, and is, available to providers, and scholars at no cost (Fitzgerald et al., 2016). The DKT2 pre- and post-test results were compared, and scanned into the participant's medical record within the EHR system. The participants' body weight was measured using the Health O Meter Professional stand-up calibrated scale in the primary care clinic, at the start of the project, and once implementation of the intervention had occurred, at 3-months.

Analysis Plan

Demographic data was analyzed using descriptive statistics in the SPSS v.25. The first aim was to decrease mean hemoglobin A1C levels by at least 1% from pre to post-intervention in Hispanic adults with T2DM in the clinic. The outcome measured was the mean hemoglobin A1C level, and the method used to analyze the data was a paired t-test comparing means to show if there was a significant pre to post-intervention difference. The second aim was to improve diabetic self-management education in Hispanic adults with T2DM in the clinic. The outcome measured was self-management survey scores, and the method of analysis was a paired t-test to determine if there was a significant pre to post-intervention difference. The third aim was to improve the knowledge and quality of diabetes practices among providers in the primary care clinic. The objective was to implement change at the system level by improved provider compliance with documentation for referrals to specialists, annual diabetic health maintenance orders, diabetic teaching, and scheduling of follow-up visits in patients diagnosed with T2DM. A run chart was created to illustrate improvement in the quality of diabetes practices in patient management of T2DM among providers at the clinic.

Results

Implementation Steps and Context

A total of 25 individuals participated in the study and meet the inclusion criteria for eligibility from January 15, 2020 to April 15, 2020. The final 3-month follow-up assessments were completed by April 20, 2020, with the implementation and utilization of telemedicine due to the COVID-19 pandemic. A total of 5 participants were unable to completely finish the project due to increased risk of exposure to COVID-19. These 5 participants were not able to come in the clinic to have their post-intervention hemoglobin A1C level drawn. However, with the implementation of telemedicine the 25 participants were able to complete the patient satisfaction

post survey of the text message program, the DKT2 post-intervention survey, height and weight measurements for BMI.

The implementation of telemedicine led to the utilization of up-to-date methods of communication with advanced technology for providing patient care. Unforeseen events occurring in the nation affected the clinic during the project, specifically the COVID-19 pandemic and the Stay at Home Orders by Governor Abbott for Nueces County, which took place in mid-March. These events led to increased stress, the inability of participants to leave their homes, fear of going out in the community, gym closures, and limited availability of food. Therefore, the COVID-19 pandemic played a role in the project because participants were not able to fully implement the recommendations and reminders regarding diet and exercise sent by text messages. The quality improvement objective for the project was also affected because the provider was not capable of physically following up with all the participants at the 3-month time frame. The alternative telemedicine visits were substantially helpful in completing the project, except for the 5 participants who were not physically able to return to the clinic for their post-intervention A1C level. The provider was still able to order and document on annual health maintenance referrals, diabetes education, referrals to specialists, and schedule follow-up visits. No adverse events were recorded from the study or protocol deviations.

Sample Demographics

Data analysis was conducted with SPSS Statistics Version 25. A descriptive analysis evaluating the outcomes of 25 participant's hemoglobin A1C, DKT2 scores, and BMI at months 0 and 3 was conducted using SPSSv.25. Paired *t*-tests were used to evaluate decreases in hemoglobin A1C, DKT2 scores, and BMI.

For this project, the subjects under investigation involved 25 participants (N = 25) 52% males and 48% females of Hispanic ethnicity. Participant descriptive statistics revealed the mean age of the participants (M=52.04, SD 13.034) with the youngest participant 23 years of age and the eldest 74 years of age, with the project objective focus of Hispanics aged 20 years or older. The mean height in inches for participants (N=25) is (M=65.20, SD 4.062), mean pre-intervention weight (M=213.3160, SD 47.40290), and mean number of years diagnosed with T2DM is (M=6.16, SD 3.287). (See Appendix 7, Table 1).

The number of text messages sent during the duration of the project were 125 messages total for the 3-month project. The mean number of text messages received by the participants (M=117.20, SD 1.080), [*t* (24), 542.531, *p* = .000], and the mean number of text messages with no response from the participants (M=18.20, SD 19.973), [*t* (24), 4.556, *p* = .000]. (See Appendix 8, Table 2).

A total of 25 participants originally agreed to the study and all of them concluded the study with the exclusion of 5 participants who were unable to return to the clinic for their post-intervention hemoglobin A1C measurement to be collected drawn as a result of the COVID-19 pandemic. These 5 participants were able to conclude the remainder of the project requirements with modifications made because of COVID-19 pandemic, which involved conducting their 3-month follow-up visit via a virtual telehealth visit.

The mean hemoglobin A1C percentage pre-intervention (M=10.57, SD 1.5393) and post-intervention (M=9.170, SD 1.5093), mean DKT2 pre-intervention (M=11.00, SD 4.610) and post intervention (M=19.24, SD 3.887), and mean BMI pre-intervention (M=35.33, SD 7.68233) and post-intervention (M=33.19, SD 5.89327). (See Appendix 9, Table 3).

Findings by Project Aim

The first objective of the project was to decrease hemoglobin A1C levels in Hispanic adults, aged 20 years or older with T2DM, in a primary care facility. The primary objective was to decrease mean hemoglobin A1C levels by 1 percentage within the QI project's 3-month time frame through the implementation of daily text message reminders regarding diabetes self-management. For analysis of the mean hemoglobin A1C, DKT2 scores, and BMI measurements, a paired sample *t*-test compared values between the pre- and post-intervention hemoglobin A1C measurements, DKT2 scores, and BMI results. (See Appendix 10, Table 4). The results found that the mean hemoglobin A1C percentage pre-intervention were (M=10.57, SD 1.5393), [t (24), 36.040, p = .000] and the post-intervention were (M=9.170, SD 1.5093), [t (20), 27.171, p = .000]. The pre- and post-intervention hemoglobin A1C level results for the paired sample t-test yielded a p score of .002, signifying the results were statistically significant ($p < .05$). There was also a significant decrease of mean hemoglobin A1C for the 3-month time-frame by 1.4% ($p < .05$).

The second objective was to improve understanding and knowledge of diabetes self-management in T2DM patients at PDMC. The objective to increase mean DKT2 post-test (Fitzgerald et al., 2016) score, and a decrease in body mass index by at least 1 point by the completion of the 3-month project. Pre- and post-intervention DKT2 scores were analyzed with SPSS v.25 revealing [t (24), -7.681, p = .000]. The results of an increased score on post-intervention DKT2 surveys illustrated DKT2 scores were significantly significant, ($p < .05$). Pre- and post-intervention BMI results [t (24), 2.483, p = .023], were statistically significant ($p < .05$). Mean BMI average decrease by one point over the 3-month time frame of the project depicted statistical significance ($p < .05$). (See Appendix 10, Table 4).

The third objective to improve the knowledge and quality of diabetes practices among providers in the clinic. The project analysis revealed effectiveness of continuing education for improvement of knowledge and quality of diabetes practices among providers in the clinic. The objective was met with the 3-month project because it warranted the implementation of change at the system level, and improved provider compliance and knowledge. (See Appendix 11, Table 5).

Project Evaluation

The scores of the patient satisfaction post survey of the text message program at the termination of the project revealed an encouraging response by the participants regarding the 3-month text messaging initiative to improve type 2 diabetes self-management (See Appendix 12). The number of surveys returned were (N=25) with a minimum score of 7/10 and a maximum score of 10/10. The mean score on the surveys returned was (M=9.68, SD .748), [t (24), 64.677, p = .000]. The patient satisfaction post survey scores of the text message program were statistically significant ($p < .05$). (See Appendix 13, Table 6).

Discussion

Summary

The project objectives were accomplished with improved quality of care at the clinic through the implementation of a text messaging intervention via a mobile phone device to improve hemoglobin A1C levels, decrease BMI, increase diabetes self-management in Hispanic adults, aged 20 years or older, and diagnosed with T2DM. The project also improved the knowledge and quality of diabetes practices among providers in the primary care clinic. The implementation of change at the system level resulted from the 3-month project. Participant involvement was continuous throughout the project. Survey outcomes were encouragingly

optimistic in the responses received by the participants. The purpose was accomplished, and the aims were met by the completion of the project.

Patient and Clinical Outcomes

Extensive arrays of changes at the clinic were communicated with the CEO, providers, and leadership management in forthcoming proposals for the clinic. There was discussion of additional text messaging programs for management of other chronic diseases. The project as a whole was successful despite the unplanned occurrence of the COVID-19 pandemic and its associated hindrances, such as gym closures and orders by government to Stay at Home. Despite COVID-19, the participants were willing to continue the project to the end with the implementation of telemedicine visits.

Descriptive statistics revealed, pre-intervention mean hemoglobin A1C levels for the participants (N=25) were on average of 10.57%, DKT2 score of 11 out of 23, and a BMI of 35.33. Evaluation at 3-months post-intervention showed that participants in the project had a mean hemoglobin A1C on average of 9.170%, a DKT2 score of 19.24, and a BMI of 33.19. The participants improved their hemoglobin A1C on average by 1.4% during the 3-month project. These results indicate that the use of a text messaging program to improve T2DM self-management in Hispanic adults is capable of promoting compliance to lifestyle changes accordingly decreasing amendable factors that increase one's changes of diabetes. The project also led to an increase in the clinics number of referrals for health maintenance and diabetic education as a result of increased knowledge and quality of diabetes practices among providers in the clinic.

A decrease in BMI and hemoglobin A1C levels and improvement on DKT2 scores were resulted and the utilization of a text message program focusing on diabetes self-management and

education was validated with a *p*-value < .05. The participants in this 3-month project yielded a statistically significant difference in pre- and post-intervention measurements.

Relation to other Evidence

This project revealed that text messaging interventions were helpful at improving mean hemoglobin A1C, DKT2 scores, and BMI levels among Hispanic adults aged 20 years or older diagnosed with T2DM. Other published systematic reviews, research studies, and QI projects compare to the results of this DNP project. Holcomb (2015) performed an integrated review of studies on approaches with short message service (SMS) involvement utilized to support the care of adults with T2DM, concentrating on the influence SMS features have on the results of hemoglobin A1C levels, medication compliance measures, and patient approval. The review recognized beneficial outcomes when communication was once a week and a time frame of 90-day (Holcomb, 2015). The compiled review of studies by Holcomb (2015) has proven that the implementation of SMS can be an essential component of a sustainable and successful intervention in the attempt to improve the management of adults with T2DM.

A controlled trial study by Quinn et al. (2016) performed a controlled trial study that evaluated the influences of a mobile education method on hemoglobin A1C levels in adolescent as opposed to elder participants across a 12-month duration. The study consisted of two groups, one was given mobile phone education, as the other was given typical care. The group given mobile phone education had a notable decrease in hemoglobin A1C level over the 12-month duration, evaluated against the group who received typical care. The study by Quinn et al. (2016) was statistically significant for managing T2DM in both the adolescent and elder participants (*p* < .0001).

Sutton (2015) performed a QI study evaluating the self-efficacy quality in terms of diabetes self-management. The study involved 20 participants (N=20) over a 3-month time frame who utilized a log book and self-efficacy scale. Sutton (2015) resulted improved self-efficacy (mean pre- and post-Diabetes Self-Efficacy score increase of 0.51) and hemoglobin A1C level, (mean pre- and post-hemoglobin A1C difference of -0.56).

Limitations

There are various limitations to this project that should be considered such as small sample size, lack of a full data set, gender inequality, and unforeseen events in the community. The small sample size is one limitation that may have affected the outcomes in this project. The small size of the sample makes it challenging to obtain decisions from the project statistics, particularly how successful the text messaging project was on average hemoglobin A1C level, DKT2 score, BMI, and diabetes knowledge. There was a lack of participants completing the entire 3-month project requirements. There was also lack of a full data set for analysis. Due to the COVID-19 pandemic, 5 participants were unable to return to the clinic to have their hemoglobin A1C level drawn at the end of the 3-month project due to concern of being exposed to COVID-19 while in the clinic. However, these 5 participants what to complete the project and have their lab work drawn after the risk of COVID-19 dissipates. Lastly, a greater part of the sample entailed males on average 52 years of age, even though enrollment equally pursued both men and women aged 20 years or older. The study also focused on only Hispanic adults who could lead to outcomes that are more specific for this particular ethnic and age group.

To minimize these limitations going forward one cannot predict what will occur in terms of unplanned events in the nation and society, such as COVID-19. One can plan ahead by having available alternative options or plans of care, such as telemedicine, when an unexpected situation

does not allow patients to follow up in office visit. The project could be offered to all patients in the clinic with any chronic illness to eliminate the focus of a particular age group or chronic disease.

Interpretation

Theory Components and Alignment of Concepts

This project engaged the use of text messaging to patients with T2DM to facilitate positive behavior changes in an effort to improve hemoglobin A1C levels. The project utilized the IOWA model as the conceptual model to sustain its scientific foundation. While, the Health Belief Model was used as the theoretical framework to encourage the health belief of the participant. The patient's engagement in healthy behavior changes provided the direction and structure necessary for enhanced regime adherence (Hunt et al., 2014). The DNP project presented guidance and direction to the purpose of the outcomes in the clinic setting.

The association among the concepts and theory elements were consistent with the aims and anticipations of the DNP project. The participant's commitment in behavioral health modification as a priority offered the essential pathway for improved compliance with diabetic treatment (Hunt et al., 2014). The concept and theory elements encouraged how the text messages were formulated, the frequency of the messages, and shared efforts of the providers. The project method facilitated the principal skill to offer indirect experiences and effective encouragement. The alleged benefit was the challenge for the project which could or could not be adequately convincing to modify one's actions. The project's structure displayed the theory's skill of accomplishment to effectively grasp an action. The final association was when the results of the project connected with the opinions of the participants. The awaited behavior modification was sponsored by the positive responses of the patient post satisfaction survey of the text

message program at the termination of the project. The conceptual model offered the possibility for continuing sustainability and reproduction of the project into other clinics in the organization.

The next Plan-Do-Study-Act (PDSA) cycle for improving the process change in the clinic may consider incorporating family members as part of the project to see if the results are similar or enhanced. In the next cycle, the PD could stress to the participants the significance of encouragement from relatives and friends. The PD can urge every participant in the next text message program to include a person they feel is significant to participate in the program with them. Presence of an encouraging individual may increase participant recollection in the project, emphasize key ideas of diabetes, and encourage participants to implement healthier regimes.

Conclusion

The DNP project proved innovative technology, such as implementation of a text message program, is supportive at improving mean hemoglobin A1C, DKT2 scores, and BMI levels among Hispanic adults aged 20 years or older diagnosed with T2DM. The use of a text message program promotes compliance to lifestyle changes and decreases amendable factors that have unfavorable changes on diabetes. The facility found that increased knowledge and quality of diabetes practices among providers in the clinic can lead to an improvement in quality measures such as compliance with referrals, annual health maintenance, and diabetic education. The facility also discovered improved quality of care at the clinic through the implementation of a text messaging intervention via a mobile phone device to improve hemoglobin A1C levels, decrease BMI, increase diabetes self-management in Hispanic adults, aged 20 years or older, and diagnosed with T2DM. The implementation of change at the system level resulted from the 3-month project. The take home message to other health care facilities from this project is that utilization of innovative technologies have the potential to overcome disease management

hurdles for both patients and healthcare providers. Trial and implementation of alternative patient supporting systems in the clinic can empower patient to improve self-management practices for adequate diabetes management.

The text message project findings can be applied within the organization for which this project was conducted to other chronic diseases, ages, and ethnicities to see if similar outcomes are obtained. The strategy for dissemination of the project results involves offering the project to other providers and staff of all four clinic locations using a power point presentation. The objective is ongoing development of the project with the Hispanic adult T2DM population in South Texas. The DNP project facilitated offering groundwork statistics that were achievable and can enlighten the following bigger project.

Further potential studies on the implementation of text messages may consider incorporating family members in the text message program. Encouragement from a support system may be particularly valuable when registering elders with chronic diseases, who are often assisted by relatives with their care. A substantial amount of information still needs further investigation in terms of enhancing text message programs. Upcoming research should consider examining the factors that affect the usefulness of text messages. Such as examining the program over a more extensive time frame to conclude if the duration of the program has an influence on the outcomes. Furthermore, effects of customized text messages require further investigation to determine if content and method of texting play a role in the outcomes of the program. Lastly, routine evaluation of the potential changes in the settings or reminders are required for determination of self-efficiency and useful of set messages sent via text.

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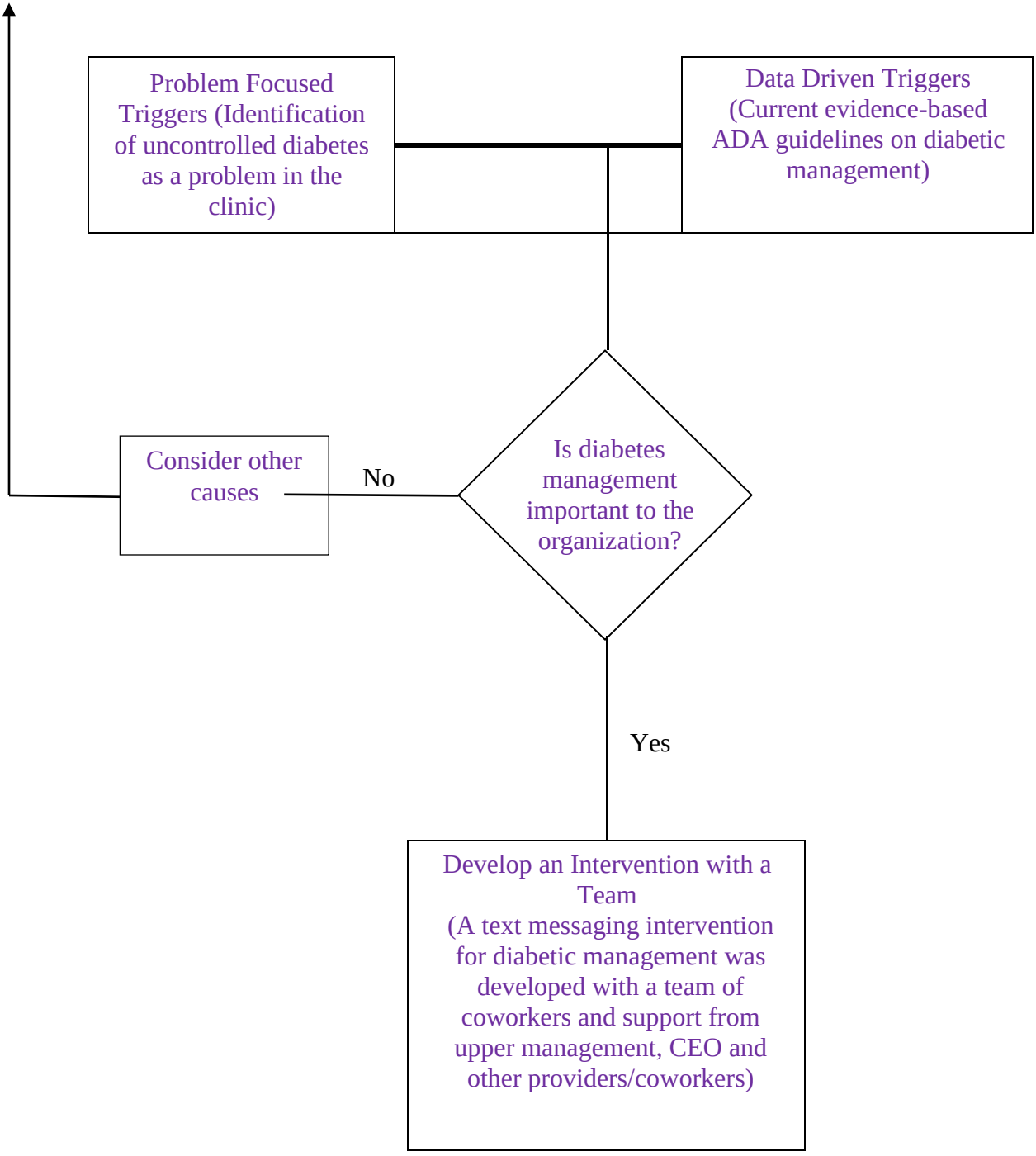
LIST OF APPENDICES

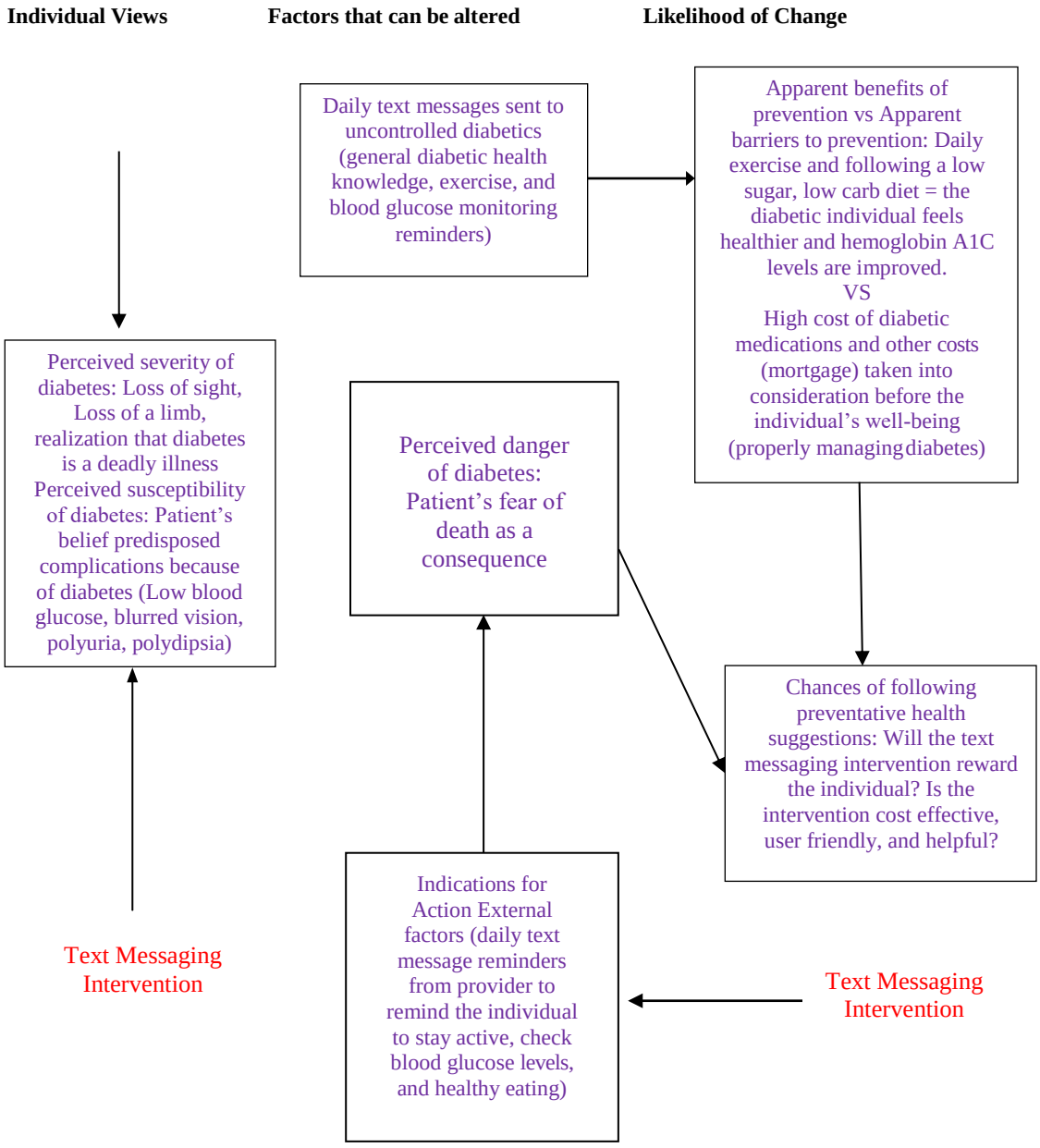
APPENDIX PAGE

APPENDIX 1: Implementation of the IOWA Model

The IOWA Model of Evidence Based Practice to Promote Quality Care for Diabetes Management



APPENDIX 2: Health Belief Model and Text Messaging with T2DM



Interactions of Text Messaging Intervention for Type 2 Diabetes Management with the Health Belief Model

APPENDIX 3: IRB LETTER

OFFICE OF RESEARCH COMPLIANCE
Division of Research and Innovation
6300 OCEAN DRIVE, UNIT 5844
CORPUS CHRISTI, TEXAS 78412
O 361.825.2497

Human Subjects Protection Program — Institutional Review Board

DATE: December 17, 2019

TO: Elizabeth Loika, College of Nursing and Health Sciences

FROM: Office of Research Compliance

SUBJECT: Not Human Subjects Determination

Activitiesmeetingthe DHHSdefinitionofresearchortheFDAdefinitionofclinicalinvestigationand involves human subjects are subject to IRB review and approval.

On December 17, 2019, the Texas A&M University-Corpus Christi Institutional Review Board reviewed the following submission:

Type of Review:	Not Human Subjects Determination
Title:	Improving A1C and Self-Care Knowledge using Mobile Text Messages in Hispanic Adults with Type 2 Diabetes.
Project Lead:	Elizabeth Loika
IRB ID:	NHS 66-19
Funding Source:	None
Documents Reviewed:	Olivares, IRB letter (Text Messaging) Olivares, L. IRB Form

Texas A&MUniversity-Corpus Christi Officeof Research Compliancedeterminedthattheproposed activitydoesnotmeetthe DHHSdefinitionofresearchorthe FDA definitionofaclinicalinvestigation.

Therefore, **this project does not require IRB approval**. You may proceed with this project.

This determination appliesonly to theactivities described in thedocuments reviewed. **Anyplanned changesrequiresubmission to the IRB toensure thattheresearchcontinues to meetcriteriafora non-human subject research determination.**

Please do not hesitate to contact me with any questions at irb@tamucc.edu or 361-825-2497.

Respectfully,

Matthew R. Gaynor, J.D. Digitally signed by Matthew R. Gaynor, J.D. Date: 2019.12.17 10:59:40 -06'00'

Office of Research Compliance

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APPENDIX 4: Facility Letter of Support

October 4, 2019

Dr. Sara Baldwin
Associate Dean for Academic Programs
College of Nursing and Health Sciences
Texas A&M University – Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412

Dear Dr. Baldwin,

The purpose of this letter is to provide Lisa Olivares, a Doctor of Nursing Practice student at Texas A&M University College of Nursing and Health Sciences, support in conducting a quality improvement project at Primary & Diagnostic Medical Centers of Texas. The project, *Improving HgBA1C and Self-Care Management using Mobile Text Messages in Hispanic Adults with Type II Diabetes*, entails implementation of a mobile phone text messaging intervention to deliver daily reminders to check blood sugar levels for patients with Type II Diabetes.

The purpose of this project is to improve HgBA1C levels and reinforce diabetes self-management behaviors in Hispanic adults aged 20 years or older with T2DM in a primary care clinic. Primary & Diagnostic Medical Centers of Texas was selected for this project because more than 75% of patients diagnosed with T2DM at PDMC Greenwood who were given dietary instructions did not comply with their prescribed diet and also demonstrated noncompliance with keeping ordered hand-written daily blood glucose logs to bring to their follow-up clinic visits to review with the provider. Lisa Olivares is employed at this institution and has an interest in improving care at this facility.

I, Dr Mario A. Martinez, Chief Executive Officer/Administer at Primary & Diagnostic Medical Centers of Texas, do hereby fully support Lisa Olivares in the conduct of this quality improvement project, *Improving HgBA1C and Self-Care Management using Mobile Text Messages in Hispanic Adults with Type II Diabetes*, at Primary & Diagnostic Medical Centers of Texas.

I also approve Lisa Olivares to access protected health information (PHI) for purposes of conducting this quality improvement project. She has signed a HIPAA release form and will comply with all related regulatory requirements.

Sincerely,

[Dr. Mario A. Martinez, Chief Executive Office/Administrator]

APPENDIX 5: Text Message Reminders

Text Message
Don't forget to exercise 30 minutes today?
Did you take your diabetic medications?
Did you remember to check your blood sugar this today?
Try to exercise at least 30 minutes a day. You can talk on your phone and walk.
Make a fist – now that's the portion size of your carb serving. Try to measure your carbs with each meal.
When you exercise make sure you check your blood sugar prior and take a glucose tab or a few peppermints with you.
Remember if you are thirsty or hungry drink an 8 oz glass of water first. You may just be satisfied with the water.
Try to eat only one serving of a carb with your meal. Moderation is key.
Remember to choose fruits that have lower carbs such as blueberries or raspberries.
Avoid beans with your meal – they have a lot of fiber but also a lot of carbs.
Try to eat healthy snacks such as string cheese, 8 almonds, or a boiled egg.
Remember when you start exercising – increase your activity slowly.
Are you stressed today? Try to take a walk – this helps relieve your stress and lower your blood glucose level.
Having trouble remembering to take your medication? Try setting your alarm on your mobile device to alert you when to take your medication.
Does checking your blood glucose cause you stress because it hurts your fingers? Try to poke the sides of your fingers instead and alternate fingers this can help.
Did you alternate your injection site today?
Have you had your vision checked recently? Call to schedule your yearly eye exam. Remember diabetes can cause vision problems, blindness, and retinopathy.
Remember if your craving a sweet – it's okay to eat a very small portion to satisfy your sweet tooth. Just remember moderation is key!
Don't forget to eat breakfast with your glipizide.
Remember one portion size is: 1 corn tortilla or ½ a cup of Spanish rice. So choose one at dinner – NOT both. See you can still enjoy your Mexican meal without depriving yourself.
If you don't want to go to the gym try going out with your friends to dance or shopping at the mall. These are both great ways to enjoy your exercise activity.
Did you plate look like this today at dinner? ½ veggies, ¼ carb, ¼ protein/meat. For dessert you can have some blueberries.
Try eating more veggies and low-fat protein like fish or chicken with your meals today.
Are you craving beans today? Surprise you can have some but remember moderation – so only ½ cup of beans.

APPENDIX 6: Project Timeline

Project Phase	Milestone	Estimated Month of Completion							
		Nov	Dec	Jan	Feb	March	April	May	July
Initiation	Project charter approved	11/19							
Planning	Project planning meeting			01/20					
	Project plan completed			01/20					
	Communication plan completed			01/20					
	IRB approved			01/20					
	Hardware and software approved			01/20					
Implementation	Training completed			01/20					
	Intervention started				02/20				
Monitoring	Mid-project evaluation complete					03/20			
	Post-test and analysis of outcomes						4/20		
Closing	Project presented to local providers and faculty								07/20

APPENDIX 7: Table 1 – Participant Descriptive Statistics

Table 1

Participant Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	25	23	74	52.04	13.034
Gender	25	1	2	1.48	.510
Height	25	59	73	65.20	4.062
Weight	25	128.00	329.00	329.00	213.3160
Years diagnosed with T2DM	25	1	13	6.16	3.287

APPENDIX 8: Frequency Statistics and *P*-Values for Text Messages

Table 2

Frequency Statistics and P-Values for Text Messages

	N	Minimum	Maximum	Mean	Std. Deviation	*t*	df	*p*-value (2-tailed)
3-mth # of Texts received	25	115	118	117.20	1.080	542.531	24	.000
3-mth # of Texts with no response	25	4	69	18.20	19.973	4.556	24	.000

APPENDIX 9: Pre- & Post-Intervention Scores

Table 3

Pre- & Post- Intervention Glycated Hemoglobin A1C, BMI, and DKT2 Statistics

	N	Mean	Std. Deviation	Std. Error Mean
A1C Pre-Intervention	25	10.57	1.5393	.3442
A1C Post-Intervention	20	9.170	1.5093	.3375
DKT2 Pre-Intervention	25	11.00	4.610	.922
DKT2 Post-Intervention	25	19.24	3.887	.777
BMI Pre-Intervention	25	35.3385	7.68233	1.71782
BMI Post-Intervention	25	33.1890	5.89327	1.31777

APPENDIX 10: Paired Sample t-Tests

Table 4

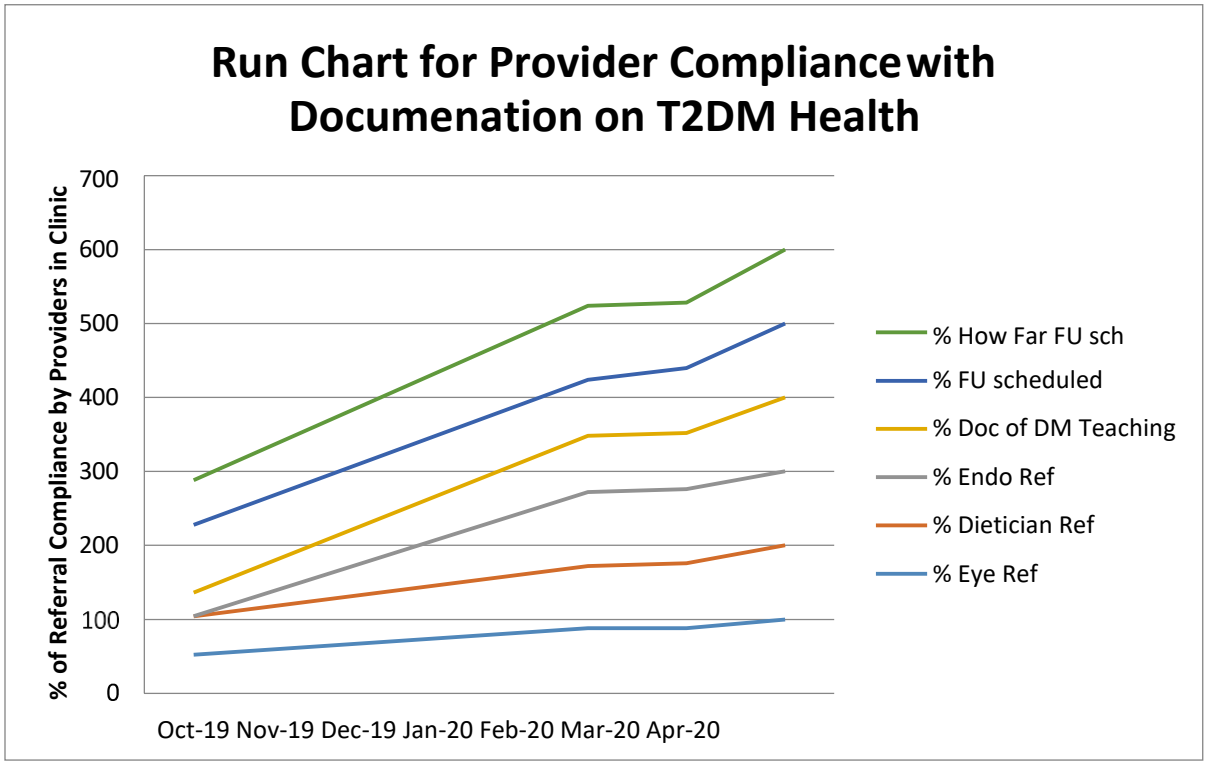
Paired Sample t-Tests: Changes in Hemoglobin A1C Levels, DKT2 Scores, and BMI

	Mean	*T*	*df*	*p*-value (2-tailed)	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference	
							Lower	Upper
A1C Pre- & Post-Intervention	1.4	3.516	24	.002	1.7809	.3982	.5665	2.2335
DKT2 Pre- & Post-Intervention	-8.240	-7.681	24	.000	5.364	1.073	-10.454	-6.026
BMI Pre- & Post-Intervention	2.14950	2.483	24	.023	3.87160	.86572	.33754	3.96146

APPENDIX 11: Run Chart of Provider Knowledge

Table 5

Run Chart of Knowledge & Quality of Diabetes Practices among Providers in the Clinic



APPENDIX 12: Patient Satisfaction Post Survey of Text Message Program

Topic of evaluation: A Primary Text Messaging Initiative to Improve Type 2 Diabetes Self-Management in Hispanic Adults

Name (optional):

Facilitator: Lisa Olivares, FNP-C

Date:

Please complete the evaluation form below for feedback on the text message program. Any additional comments can be added at the bottom. Thank you again for participating in the program and sharing your feedback.

1.) Did the text message program meet your expectations?

Yes Unsure No

2.) Were the text messages sent at appropriate times of the day?

Yes Unsure No

3.) Was the information presented in the text messages useful to you?

Yes Unsure No

4.) Did you find the text message program easy to use?

Yes Unsure No

5.) Did the facilitator discuss the text message program thoroughly prior to starting the program?

Yes Unsure No

6.) Was the length of the text message program appropriate?

Yes Unsure No

7.) Did the text message program interfere with your normal every day routine?

Yes Unsure No

8.) Did you learn new information on diabetes from the text message program?

Yes Unsure No

9.) Was the facilitator knowledgeable on the topic presented in the program?

Yes Unsure No

10.) Would you recommend this program to a friend?

Yes Unsure No

Additional Comments or Recommendations

_____

APPENDIX 13: Patient Satisfaction Post Survey Statistics and *P*-Value

Table 6

Pre- & Post-Intervention Patient Satisfaction Post Survey Statistics and P-Value

	N	Mean	Min	Max	STD Deviation	*T*	df	*p*-value (2 tailed)
Patient Satisfaction Post Survey Scores of Text Message Program	25	9.5	7	10	.748	64.677	24	.000