The Effectiveness of Telephone Follow-Up for Diabetes Management

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Abstract

Diabetes is the seventh leading cause of death in the United States with 30.3 million Americans having the disease and a cost of $327 billion. Approximately 300,000 people are affected in Kansas, a cost of $ 2.6 billion, and $6.7 billion in Missouri. The burden of diabetes to society includes increased resource expenditure and reduced productivity. This quasi-experimental quality improvement study, one cohort, with pre and post-test included eighteen adult participants with diabetes at one clinic in the central Midwest. Participants received telephone calls and short message services weekly for four weeks and then every two weeks for eight weeks. Fasting blood glucose levels, hemoglobin A1C, and a Summary of Diabetes Self-Care Activities Scale were collected pre-and-post intervention. Telephone follow-up reduced hemoglobin A1C and fasting blood glucose levels, and significantly increased adherence to diet, exercise, blood glucose testing, and foot care. Telephone follow-up to patients with uncontrolled diabetes can improve adherence to diabetes self-management skills.

Keywords: glycemic control, telephone follow-up, short message services, diabetes self-management, and fasting blood glucose.

The effectiveness of Telephone Follow-up on Diabetes Management

Diabetes is a growing epidemic disorder that includes a series of metabolic conditions associated with hyperglycemia (Egan & Dinneen, 2014). The community defines the disease according to the economic burden, including costly treatments, premature morbidity, and death. To individuals with diabetes, it is a comorbidity that requires daily monitoring of diet, blood glucose levels, regular intake of medications, numerous visits to the healthcare providers, and potential hospitalizations (Egan & Dinneen, 2014). As of 2015, there are 30.3 million Americans who have diabetes, and 23.1 million of these individuals are diagnosed with diabetes (Centers for Disease Control and Prevention [CDC], 2017). In 2017, the total cost of diabetes was estimated at $327 billion in the United States (CDC, 2017). Individuals with diabetes spend 2.3 times more on medical expenses than those without the disease (American Diabetes Association [ADA], 2017). In 2014, about 450, 000 patients visited the emergency room with hypo-or-hyperglycemia as the primary diagnosis, and increased numbers of admissions occur due to diabetes-related complications (CDC, 2017).

Technological advancements such as the internet, phone calls, and text messages have made communication easy. Still, telephone follow-up remains the most straight forward and most accessible tool for exchanging information, providing medical advice, identifying complications, and giving reassurance to the patients (Braun, Baidusi, Alroy, & Azzam, 2009). Therefore, telephone and short message services can be utilized to promote diabetes self-management, which can improve provider-patient relationships and reduce healthcare costs in the long run.

The burden of diabetes to society is imminent through the reduced productivity and resources expended by the individuals suffering from the condition (ADA, 2017). One of the

overarching goals for Healthy People 2020 is to reduce diabetes and the associated economic costs to improve the quality of life for all individuals who have or are at risk for diabetes (Office of Disease Prevention and Health Promotion, 2016). Therefore, it is crucial for advanced practice nurses and other healthcare providers to partner with patients to reduce the burden of diabetes on individuals and society.

Diabetes a Local Issue

In Kansas, approximately 293,860 people have diabetes, and 35.5% of the adult population has prediabetes (CDC, 2017). The ADA estimates that every year an additional 15,000 new cases in Kansas are added to the volume (ADA, 2017). In the Kansas City metro, about 300,000 people are affected by diabetes, and in Missouri, 10.2% of adults have diabetes (CDC, 2017). The burden of diabetes is estimated at $2.6 billion in Kansas and $6.7 billion in Missouri and does not include the emotional and psychological burden of diabetes on the family and the patient (ADA, 2017). The cost of diabetes may be higher than estimated due to the increased number of people diagnosed with the disease, inflated cost of living, and increased cost of medical supplies needed in the management.

Diversity Considerations

The study was carried out at a primary care clinic Kansas. The study participants reside in Kansas metropolitan, representing part of the estimated 300,000 individuals affected by diabetes. The individuals constitute various ethnic races, cultures, social, and educational backgrounds and face multiple challenges in disease management (ADA, 2017; CDC, 2017). The participants were within the ages of 30-75 years without a focus on a specific gender, race, or socio-economic group. The telephone follow-up (TFU) calls and short message services (SMS) were individualized to meet the diverse needs of the study population, considering factors affecting

care delivery and barriers to self-care. The diversity and number of the participants may not support the generalization of the intervention or findings to a specific race, ethnic group, or geographic area.

Problem Statement

Diabetes is the 7th leading cause of death (CDC, 2017) with disease complications, poor self-management, and lack of understanding of the disease and the treatment regimen significantly contributing to poor glycemic control and hospitalizations of affected individuals (Riegel, Jaarsma, Str, Ouml, &Mberg, 2012).

Intended Improvement with Purpose

Diabetes self-management is complicated. The patients have to weigh the available options and consequences of their actions, then decide how to self-manage their disease, which often requires partnership with the primary care provider to make informed choices (Riegel et al., 2012). This quality improvement study aimed at encouraging, educating, and supporting individuals with diabetes to take personal responsibility in disease management through TFU and SMS between outpatient visits. The primary purpose of the study was to evaluate the effectiveness of TFU and SMS in reducing fasting blood glucose levels, increasing self-management behaviors, and reducing diabetes-related hospitalizations in adults with diabetes. The secondary purpose was to achieve glycemic control, evidenced by a reduction of hemoglobin A1C (HbA1C) levels, hence slowing the progression of the disease and the associated complications.

Facilitators and Barriers

Critical facilitators for the study were positive patient attitudes toward the study, organizational culture, and staff at the study site. The identified entities eased the process of

chart review and identification of potential participants for the study and partnering with the study team leader for successful study completion. The quality improvement study was self-funded; therefore, funding was not a hindrance. The barriers included low enrollment of study participants, interruption of telephone connection due to unforeseeable conditions such as weather increment, or inability to afford telephone services. The TFU and SMS were time-consuming as some participants required more time than others on the telephone, which placed a constraint on the providers, inhibiting the sustainability of the study.

Review of Evidence

Inquiry

In the adult population, ages 30-75 years with uncontrolled diabetes, do telephone follow up calls and short message services between outpatient visits, improve diabetes self-management, reduce fasting blood glucose levels, and lower diabetes-related hospital admissions within three months at a primary care clinic in the Midwest?

Search Strategies

The literature search was completed using the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Medline Ovid, and Cochrane databases. Google Scholar was also accessed as a search engine for scholarly literature. The following keywords were used: glycemic control, telephone follow-up, short message services, diabetes self-management, fasting blood glucose, and diabetes-related hospitalizations (Appendix A). The literature search was limited to studies published between the years of 2009 and 2019, peer-reviewed publications, full text, adults over 18 years of age, an intervention of telephone follow-up, text or short message service and written in English. Exclusion criteria included studies older than 2009, children and adolescents, or older adults (Appendix B). The search resulted in three-level I

evidence studies, ten randomized control studies at level II, two quasi-experimental study at level III, two mixed cohort and two retrospective observational studies at level IV, one qualitative descriptive survey at level VI and one case study at level VII in accordance to Melnyk hierarchy of designs (Melnyk, & Fineout-Overholt, 2015; Appendix C).

Evidence by Themes

After evaluation of the evidence, four topics emerged: Diabetes Self-Management Education and Support (DSMES), diabetes self-management, telemonitoring in reducing hospitalizations and readmissions, and telephone support for other populations. The four topics are interlinked, and DSMES aims at promoting self-care behaviors that reduce diabetes-related hospitalizations. Self-management education and support can also be of importance to other populations dealing with chronic and acute conditions because they can be comorbidities with diabetes. Telephone support implies the use of telephone follow-up or utilization of the short message services to provide education or supportive services to the participants. The evidence supports and interconnects with the topics in the inquiry (Appendix D).

Diabetes self-management education and support

Diabetes education is the standard of care to increase knowledge, skill, and ability needed in the self-management of the disease; it is a continuous process that should happen at each patient encounter to support and encourage behavior required for the ongoing diabetes self-management (ADA, 2018; Beck et al., 2017). Most patients do not actively seek diabetes education or readily verbalize the challenges they face in self-care due to the nature of the problems, and their perception of the provider's goal is to provide the physical and technical aspects of care (Doss, DePascal, & Hadley, 2011; Zare-Farashbandi, Lalazaryan, Rahimi, & Zadeh, 2015). Healthcare providers actively provide DSMES at diagnosis of diabetes, annually,

when complications arise, and when a transition of care occurs (ADA, 2018; Beck et al., 2017).

Misunderstandings, misconceptions, and lack of knowledge of the disease contribute to poor disease management (Riegel et al., 2012; Zare-Farashbandi et al., 2015). Due to the disease chronicity, there is an increased need for regular follow-up and periodic reinforcement to achieve a change in behavior and sustain the same for the long-term (ADA, 2018; Beck et al., 2017; Shrivastava, Shrivastava, & Ramasamy, 2013). Diabetes self-management education and support is a powerful tool in the management of diabetes in the inpatient and outpatient settings for the prevention or reduction of diabetes-related hospitalizations (ADA, 2018; Aytekin, Ovayolu, & Ovayolu, 2016; Beck et al., 2017; Brown et al., 2017). Therefore, the result is improving clinical outcomes, quality of life, and reducing healthcare costs to individuals with diabetes. Diabetes self-management education and support can be accomplished by face-to-face interaction, use of print, and use of technological advances such as TFU and SMS (Beck et al., 2017; Braun et al., 2009).

Several studies have reported a decrease in HbA1C, an increase in adherence to the treatment regimen, and improved self-care behaviors due to DSMES in individual or group settings (Aliha et al., 2013; Aytekin et al., 2016; Nesari et al., 2010; Sesgin &Cinar, 2013). Diabetes self-management education and support, regardless of the setting, can reinforce self-management behaviors resulting in better diabetes outcomes to the individuals struggling with disease management. Diabetes self-management education and support is key to other components of diabetes management, including medication adherence, foot care, blood glucose monitoring, exercise, and healthy eating (McGloin, Timmins, Coates, & Boore, 2015; Zare-Farashbandi et al., 2015). Diabetes education impacts self-management behaviors, fasting blood glucose levels, and HbA1C resulting in better disease management and reduction of disease

complications and diabetes-related hospitalizations (Aliha et al., 2013; Aytekin et al., 2016; Nesari et al., 2010; Sesgin &Cinar, 2013). Therefore, DSMES, when provided in collaboration with the patient and other healthcare professionals, can lower the burden of the disease on individuals, families, and society.

Diabetes self-management

Diabetes self-management includes diet, exercise, foot care, medication adherence, and self-monitoring of blood glucose and is a tool for measuring the patient self-management of the disease (Lin et al., 2017; Miller &Fain 2006). Telephone follow-up has a positive impact on self-care behaviors including activity level, diet management, patient motivation in self-care, and patient trust in their providers due to the implied effect of the time spent on managing the patient's condition (McGloin et al., 2015). Telephone follow-up increases self-management, glycemic control, rate of self-monitoring, healthy coping, health behavior, self-efficacy, health status, and the likelihood of annual screening for some diabetes complications (Dennis et al., 2013; Haas et al., 2014; Miller & Fain, 2006; Walker et al., 2011).

Suksomboon, Poolsup, and Nge (2014) found a mean decrease in HbA1C of -0.38%, and Brown et al. (2017) reported an average reduction in HbA1C of 1.75% in the TFU group. Other studies reported significant changes in glycemic control and self-care behaviors in the TFU group evidenced by reduced HbA1C and increased self-efficacy scores, diabetes self-care scores, multiple behavioral changes, and compliance with the treatment regimen (Aytekin et al., 2016; Eisenberg, Hwa, & Wren, 2015; Greenwood et al., 2015; Kaur, Kajal, Kaur, &Singh, 2015; McGloin et al., 2015; Nesari et al., 2010; Walker et al., 2011; Zolfaghari, Mousavifar, Pedram, & Haghani, 2012). Other studies reported no significant change in HbA1C, but significant improvements in self-care activities and positive changes in healthy behaviors (Brown et al.,

2017; McGloin e al., 2015; Nundy et al., 2014).

One randomized controlled trial with three groups of patients representing the frequency of outpatient visits reported that TFU significantly improved adherence to medications, diet, and exercise in the intervention group and decreased mean HbA1C by 5.8% from baseline (Kaur et al., 2015). Wu et al. (2013) advocate for the use of TFU and SMS support for in-patients with diabetes in promoting self-care behaviors. Dobson et al. (2018) reported significant improvements in foot care behaviors with an adjusted mean of 0.85 (p<0.001), overall diabetes support 0.26 (p=0.03), and increased satisfaction levels with self-management support of blood glucose for the patients who received text messages.

Telephone support in reducing hospitalizations and readmissions

Evidence evaluating the impact of TFU or SMS on hospitalization or readmissions of individuals with diabetes was limited in publication. One study concluded that telephone follow-up calls reduced readmission rates, 5.8% in the intervention group compared to 8.6% in the control group (Harrison, Auerbach, Quinn, Kynoch, & Mourad, 2014). A systematic review of ten studies conducted by Jayakody et al. (2016) reported that five studies showed the effectiveness of telephone follow-up in reducing 30-day readmissions in patients with chronic cardiovascular disease, respiratory disease, and diabetes. Although the results from the Jayakody et al. (2016) study were inconclusive on the use of telephone follow-up in reducing patient readmissions, collaboration with primary care providers may have an impact on the readmission rates for individuals with diabetes.

Telephone support in other populations

Telephone follow-up has shown to be effective in other populations. The effectiveness of supportive education was studied for myocardial infarction patients (N=66), divided equally into

control and experiment groups (Mohammadpour, Rahmati Sharghi, Khosravan, Alami, & Akhond, 2015). The study found that patients in the experimental group who received supportive training had an 18% increase in self-care knowledge, motivation, and skills to perform self-care after discharge from a cardiac unit as compared to those in the control group who received no TFU (Mohammadpour et al., 2015).

Telephone calls to patients (N=56) after knee replacements resulted in a 16% increase in patient satisfaction (Potera, 2011). Patients also reported fewer symptoms of distress (pain, nausea, constipation, insomnia, and fatigue) because of post-discharge recommendations, which were addressed adequately during the follow-up calls (Potera, 2011). Wu et al. (2013) advocated for the use of telephone follow-up and SMS support to patients who were admitted with acute coronary syndrome in promoting self-care behaviors and the authors discussed a guideline on how to conduct a research study on the feasibility of the intervention.

Another study population is that of women diagnosed with gestational diabetes. Khorshidi and colleagues noted that the group that received TFU had significantly lower mean fasting glucose levels $p<0.05$ and significantly higher rates of postpartum glucose screening (Khorshidi et al., 2015). A study on patients who received a telephone follow-up post laparoscopic inguinal repair surgery, where the individuals' questions and concerns were answered during the TFU, found that 55 patients were satisfied with the call and did not want to schedule a follow-up face to face clinic visit (Eisenberg, Hwa, & Wren, 2015). Patients, especially those that drive long distances to the physician's office or in rural or remote areas with limited accessibility, can benefit from a telephone follow-up or SMS from a dedicated healthcare provider (Suksomboon, Poolsup, & Nge, 2014)

Theory

Dorothea Orem's theory of self-care and self-care deficit was the basis for the study supporting diabetes self-management (Mohammadpour et al., 2015; Punjani, 2013; Riegel, 2012; Younas, 2017). Orem's theory views humans in two perspectives, those who seek nursing help and those who provide nursing care and assume that nursing is a form of assistance for people who need it (the patients) for health promotion, disease prevention, and life sustenance (Younas, 2017). Self-care has the concepts of self-care agent and dependent-care agent (Orem et al., 2003). The patient is the self-care agent, who can personally tend to themselves, whereas the dependent-care agent is when the patient depends on someone else to offer the care (Orem, 1997).

Telephone follow-up provides an opportunity for direct communication with the self-care or the dependent-care agents, obtaining an understanding of the patient's progress, identifying barriers to self-care, and supporting the patient in becoming efficient at self-care. The theory of self-care deficit focuses on an individual's inability to meet their self-care needs due to aspects such as lack of knowledge, skills, and negative attitude towards self-care (Orem, 1997). The theoretical concepts are interrelated, and a break results in self-care deficit, warranting the need for TFU and SMS to restore the relationship and maintain self-care (Appendix E).

Methods

Institutional Review Board

The University of Missouri- Kansas City (UMKC) Institutional Review Board (IRB) approved the quality improvement study (Appendix F) as Not Human Subjects Research. The faculty reviewed the study and approved the quality improvement study, and the study site supported implementing the quality improvement initiative with the clinic patients.

Ethics

Patient privacy was maintained by referring to participants by case numbers. A list of names with their specific numbers was stored at the study site for Health Insurance Portability and Accountability (HIPAA) compliance. The participants' identities were disclosed to the study preceptor and the providers for collaboration in the management of diabetes. The participants were briefed on the study and the freedom to withdraw from the study at any given time and participants verbally consented. The participants who did not participate in the study received the usual standard of care for diabetes management at the clinic. The privacy and confidentiality of the study subjects were maintained throughout the study according to the HIPAA regulations (Kumar, Henseler, & Haukaas, 2009; Manti, & Licari, 2018). The patient information and identifiers were stored in the UMKC Research Electronic Data Capture (REDCap) web-based program for privacy and confidentiality, and only de-identified data were transferred to SPSS software for data analysis (Harris et al., 2019). There were no conflicts of interest identified with the investigator. Patient insurance covered the cost for most hemoglobin A1Cs, and some self-pay patients covered their costs except for two participants who could not afford the self-pay option. The total cost of the study was $250. The study team leader fully funded the study, with no grants or funding obtained from any other sources (Appendix G).

Setting and Participants

The study was implemented at a primary care clinic in the Kansas. Convenience sampling was used to recruit 16 study participants. The inclusion criteria were individuals who had type 2 diabetes with a HbA1C higher than 7%, were managed by a provider at the clinic, were 30-75 years of age, telephone access with messaging capability, and had the ability to monitor fasting blood glucose levels at home. Individuals with terminal illnesses under palliative care were excluded.

Evidence-Based Practice Intervention

Over fifty possible participants were contacted following chart review and discussion with the study preceptor or the provider. The prospective participants who met the inclusion criteria were contacted by the medical assistants at the clinic or the preceptor, who introduced the study team leader and both asked for permission to participate in the quality improvement study (Appendix H). Eighteen patients agreed to participate in the quality improvement study and gave verbal consent. Two participants were dropped from the study before any data collection occurred due to a lack of adequate translation services during the intervention and data collection.

The participants received standard diabetes education during their usual appointments at the clinic with their providers. The Summary of Diabetes Self-Care Activity (SDSCA) scale questionnaire was completed at the beginning of the study as a baseline and repeated after the study as a post-test (Appendix I). The initial HbA1C values were obtained from the medical record. A Chart review was completed for diabetes-related hospitalizations and the participants kept a log of fasting blood glucose for a week before and after the study intervention. The participants either called in the results of fasting blood glucose numbers or submitted them at the clinic visit. The data was recorded in the SPSS spreadsheet template (Appendix J). The participants received TFU and SMS once a week for the first month, then once every two weeks for the second and third months (October 2019-January 2020; Appendix K).

The follow-up calls included an assessment of the health status and potential barriers to medication adherence or treatment regimen, confirmation of upcoming appointments and laboratory tests, and discussion of patient concerns or questions. During the call, the study team leader reinforced education on diet, exercise, and self-care activities, and encouraged and

motivated participants toward achieving their treatment goals. The TFU participants were inspired to channel concerns or barriers to care to the study team leader, acknowledge receiving the SMS, and report the range of fasting blood glucose since the previous TFU. Concerns noted during the TFU were discussed with the primary care provider for further action, and the study team leader educated and coached the patient within the scope of practice. The study team leader conducted the TFUs.

In addition to TFU, the participants received short messages, that included brief, simple messages on diabetes or diabetes-management weekly for the first month, then twice a week for the following second and third months (Appendix L). Three attempts were made at different times of the day or days of the week if there was no response to the initial TFU call. Additional text messages were sent to the participant who missed the TFUs to engage the participant and address health status. At the completion of the study, the participants completed the SDSCA scale and submitted a week-long fasting blood glucose log to the clinic or called in the results. The HbA1C was collected if ordered based on the management guidelines, and chart review was completed for hospitalizations during the study (Appendix M).

Change Process, Evidence-Based Practice Model

The transtheoretical model (TTM) was utilized as a guide for behavior change to manage diabetes and reduce disease-related hospitalizations adequately. The TTM has five stages of pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska, DiClemente, & Norcros, 1992). The study team leader categorized the participants according to their stage of change on the TTM and used TFU and SMS to encourage participation and facilitate change in diabetes self-management behaviors for better disease management (Prochaska, DiClemente, & Norcros, 1992). Through TFU and SMS, the study team leader urged the participants to explore

the many benefits associated with diabetes self-management.

The Stetler model of evidence-based practice guided the inquiry and the study exploring the effects of TFU and SMS on diabetes self-management, fasting blood glucose levels, and diabetes-related hospitalizations (Stetler, 2001). The model integrates the following steps: preparation, validation, comparative evaluation/decision making, translation/application, and evaluation (Stetler, 2001). The model was utilized by the study team leader to evaluate the effectiveness of the intervention on participants as they decided to self-manage their diabetes. The model can also be used by other providers to integrate the TFU and SMS into their practice beyond the study completion. After study completion, the analyzed results were shared with providers and the medical assistants at the clinic. The primary care providers were encouraged to freely enroll individuals with diabetes in the Cornerstone-4-care, where the patients can receive calls from diabetes educators and educational email to support and motivate them in self-management of diabetes. The participants were encouraged to consider downloading the free mobile application to their phones to keep track of their self-management activities (Cornerstones4care, 2019).

Study Design

The use of telephone support in diabetes management study is a quasi-experimental design, one cohort, pre and post-test. Convenience sampling was used to select participants for the study. There was one cohort with pre-intervention and post-intervention measures of fasting blood glucose levels, diabetes self-management, and diabetes-related hospitalizations.

Internal and External Validity

Internal validity is the extent to which the follow-up telephone calls affect the change in fasting blood glucose levels, diabetes self-management, and hospitalization and not due to other

factors (Melnyk and Fineout-Overholt, 2015). The small sample size of 15 participants undermines internal validity. The use of the Summary of Diabetes Self-care Activities scale, which is a standardized tool, promotes internal validity. The pretest data were compared to the posttest data in one cohort. The study participants were of different ethnic groups, age range, and differing barriers to diabetes self-management, therefore, increasing the transferability of the intervention to other similar primary care settings.

Primary and Secondary Outcomes

The primary outcomes of the quality improvement study included reduced fasting blood glucose levels, improved adherence to diabetes self-management activities, and reduced diabetes-related hospitalizations. The expected secondary outcomes were reduced HbA1C and increased patient satisfaction.

Measurement Tools

Blood glucose, hemoglobinA1C, and hospitalizations. Fasting blood glucose was measured by examining the self-report of fasting blood glucose log. Hemoglobin A1C was analyzed by liquid chromatography of blood to determine the percentage of hemoglobin A1C, before, during, or after the study completion and compared to the previous values. Patient Hospitalizations were measured by chart review for hospital records and personal reports of hospitalization during the study (Appendix N).

Diabetes self-management. The SDSCA scale was utilized to measure the effect of TFU and SMS on diabetes self-management behaviors. A review of seven studies found consistencies as well as adequate test-retest reliability (r= 0.40) and criterion-related validity of the SDSCA scale (r=0.47) except for the specific diet (r= 0.23; Schmitt et al., 2013). One study found test-retest reliability of r=0.912 and $p<0.001$, Cronbach's alpha of 0.76, and the subscale reliability

as follows: diet 0.89, exercise 0.83, blood glucose testing 0.92, and foot-care 0.77 (AlJohani, Kendall, & Snider, 2016). The SDSCA took approximately 5-10 minutes to administer at pre-intervention and post-intervention. The study team leader purchased the SDSCA scale from Oregon Research Institute (Oregon Research Institute, n.d). Permission was obtained to utilize the tool and modify it for the study (Appendix O).

Satisfaction. Participant satisfaction was determined by answering survey questions, "How did this study help you? Would you recommend it to others?" The participants' reports could be unreliable due to patient subjectivity. Patient responses were recorded and summarized in the report.

Quality of Data

Physiologic data included fasting blood glucose levels and HbA1C, collected twice in the study, preintervention and post-intervention. The use of the SDSCA scale for measurement of self-care activities improved the quality of data due to the high validity and reliability of the instrument. The observed power for a one-tailed and two-tailed t-test hypothesis was not appropriate given the small study sample.

The systematic review by Suksomboon et al. (2014) was used as a benchmark for the proposed study when evaluating results for practice change (Polit and Beck, 2017). There were limited publications of systematic reviews on provider-initiated follow-up telephone calls and glycemic control. Therefore, the quality improvement study could be used to evaluate whether TFUs and SMS are evidence-based practice in diabetes management at the Argentine Family Health clinic. Telephone follow-up and SMS are adjunct to standard diabetic care and treatment regimens.

Analysis Plan

A statistical analysis computer software system, Statistical Package for the Social Sciences (SPSS), version 26, was used for data analysis. The Wilcoxon signed-rank test was used to analyze the differences between pre and posttest of each of the measured outcomes in the single cohort. Demographic data included gender, age, highest level of education, and employment status. Descriptive statistics were used to provide a summary of the data collected.

Results

Socio-Demographic Characteristics and Clinical Findings

The study was completed at a primary care clinic in Kansas between July 2019 through February 2020. The demographic and pretest data were collected in September and October 2020. After the completion of TFU and SMS interventions in January 2020, the post-test data was collected. It took about one month to collect the post data. Out of the sixteen participants at the beginning of the study, thirteen were able to submit their fasting blood glucose levels, answered the summary of diabetes self-management scale questionnaire, and have their blood drawn for the HbA1C if due. Two participants could not be reached and one did not check the fasting blood glucose levels.

The characteristics of the participants included an equal number of males and females in the study, a mean age of 53.25 years, the youngest age of 33 years and the oldest age of 71 years (See Appendix P, Table 1). Half of the participants were working full-time with one participant working part-time and the remaining were unemployed. The education level of the participants was varied from 3rd grade to a bachelor's degree, and the majority of participants had some high school education.

Telephone Follow-Up and Short Message Services

In the first four weeks of the intervention, the participants received an informative short

message on diabetes management efforts followed by a telephone call to inquire about their progress in the management of diabetes. The participants discussed various issues or new information they were learning about their diabetes. One patient reported not knowing of insulin injection site rotation, while others reported enjoying soaking their feet in warm water several times a week. The second phase of the intervention was from week 5-12, and the participants received short-messages and telephone follow-ups once every two weeks. Unfortunately, the timing coincided with the Thanksgiving, Christmas and New Year festivities which was a negative impact in achieving improvement outcomes for many patients who reported increased fasting blood glucose levels and the inability to manage their dietary intake of simple sugars. Each week, at least 12 participants were reached via telephone calls and short message services, but the average number of participants declined to 7-8 during the Thanksgiving and Christmas weeks.

Data collection at the study completion was a challenge that was overcome by the presence of the investigator at the study site; the participants readily cooperated for HbA1C blood draws, submission of their fasting blood glucose logs and the completion of the post-test SDSCA questionnaire. Eight out of the thirteen participants who completed the post-test met face to face with the study investigator and collaborated with their provider at the clinic setting.

Hemoglobin A1C and Fasting Blood Glucose Levels

At the end of the study, no statistically significant difference was found between the pretest and post-test HbA1C (Appendix P, Table 2). The mean HbA1C was 9.24, and the fasting blood glucose level was 192.84 in the pretest. The post-test means for the HbA1C and fasting blood glucose levels were 8.88 and 167.20, respectively.

Adherence to Self-Management Skills

Diet (p=0.05), physical exercise (p=0.05), blood glucose (p=0.05), and foot care (p=0.05) adherence improved between the pretest and post-test. (Appendix P, Table 3). Using the Wilcoxon signed-rank test, there were significant changes in self-management skills between the pre-test and post-test due to telephone follow-up and short message services.

Patient Hospitalizations

There were limited data to analyze for diabetes-related hospitalizations. One participant was hospitalized for two weeks before the beginning of the intervention. The hospitalization was due to an emergent surgery, which was not a complication or related to diabetes. The patient's recovery was followed during the study and the effects of the medications, such as the steroids on blood glucose, were discussed. No patient was hospitalized during or after the study, for any reason. For care of other chronic conditions, the patients continued to attend their appointments at the primary care clinic or collaborating specialized care such as cardiology and endocrinology for their other chronic conditions.

Patient Satisfaction

After the study completion, many of the study participants were asked, "how did this study help you? Can you recommend it to others?" and reported increased motivation to change for the better in the management of diabetes. Patients reported sharing text messages with other family members and friends to learn together to maintain or improve their health. The patients noted that the short messages gave them hope and direction and helped answer some of their questions about reasons to continue self-managing diabetes.

Discussion

Study Successes

The study found that telephone follow-up and short message services were effective in

increasing adherence to self-management skills of general diet, diabetes-specific diet, physical exercise, blood glucose testing and foot care. Also, mean HbA1C and fasting blood glucose decreased between the pretest and post-test values within the 12-week period. The decline in hemoglobin A1C and fasting blood glucose was clinically significant, and a positive change can translate to a delay in diabetes-related complications. For the patients who were reluctant to participate in the study, a positive change motivates them to engage in activities that lead to better management of diabetes.

Study Strengths

The study was conducted in a clinic serving patients from low-income households, with the majority being Hispanic. The patients from low-income families would pay for provider services at subsidized prices and the clinic negotiated a contract with other healthcare service providers to provide imaging and diagnostics at a subsidized rate. The availability of low-cost provider services eased access to the providers at the clinic. The medical staff, such as medical assistants and providers, collaborated effectively and assisted in the identification and recruitment of patients who met the criteria for participating in the study.

During the intervention, the providers were notified of the patients that were struggling with their blood glucose management. The study team leader-provider collaboration allowed the patients to access the provider physically or through telephone contact. The medical staff at the clinic were eager to assist in any way possible for improved patient outcomes, and they assisted in collecting the pretest and post-test fasting blood glucose levels and HbA1C. One of the providers at the clinic was overseeing the study and actively participated in patient recruitment. The study team leader would discuss any challenges encountered during the study, and the provider collaborated to eliminate the obstacles if possible.

The availability of drug samples at the clinic was essential to patient compliance. When the samples were not available, some patients had their medications changed to available samples for continued management of diabetes. On average, twelve of the sixteen participants were reached via telephone calls each week, and all sixteen participants received short messages on diabetes management. Due to work schedules, the participants received telephone calls at the preferred time, if they provided it to the study team leader. Most participants acknowledged receiving short messages.

Study Results Compared to Evidence in Literature

The study on the effects of telephone follow-up and short message services in diabetes management found a marked improvement in self-management skills including diet, physical exercise, blood glucose testing, and foot care. Other studies have shown that telephone follow-up and short message services led to improved adherence to the treatment regimen and self-management skills in individuals with diabetes (Aliha et al., 2013; McGloin et al., 2015; Nesari et al., 2010). The findings of the current study were consistent with those by Aytekin et al. (2016) and Kaur et al. (2015) that supported the use of telephone follow-up to provide consultation and education to patients with uncontrolled diabetes.

Telephone calls were utilized to reach and check patients' progress and identify and mitigate barriers to diabetes management. The short messages were used to educate the patients, consistent with the ADA recommendation of offering diabetes education to the patients (ADA, 2018; Beck et al., 2017). Both telephone and short message services have been found to improve self-management skills in diabetes management (Greenwood et al., 2014; McGloin et al., 2015; Nundy et al., 2014).

A study by Brown et al. (2017) found no statistical significance in HbA1C between the

individuals who received telephone follow-up compared to those that did not, similar to the current study results. Although there was no statistical significance in improvement, the reductions in the mean HbA1C and fasting blood glucose levels are relevant in delaying the incidence of complications related to uncontrolled diabetes (Brown et al., 2017).

Limitations

Internal Validity

The fasting blood glucose levels were based on patient reports which can be biased. The SDSCA scale is a reliable tool with test-retest reliability of r=0.912 $p<0.001$, Cronbach's alpha of 0.76, and subscale reliability as follows: diet 0.89, exercise 0.83, blood glucose testing 0.92, and foot-care 0.77 (AlJohani, Kendall, & Snider, 2016). Hemoglobin A1C is a reliable tool for measuring glycemic control in patients with diabetes (ADA, 2018). Lack of motivation for self-care activities can negatively impact the results of the study.

External Validity

The study took place in a clinic that serves insured, underinsured and uninsured patients. The patient population may not mirror many primary care settings, limiting the generalizability of the study findings. Due to the small number of participants and the study site, the sample may not represent the general population or the patients in the majority of the primary care clinics. Therefore, the results cannot be generalized to other sites, but the intervention may be transferable to other sites. The study did not consider other factors that can impact the ability of the patient to self-manage diabetes, such as the affordability of the medications or accessibility to primary care services, which can affect the results of the study. Some of the patients could not reached via telephone calls and others reported poor connectivity or disconnection to telephone mobile services, which represent factors that may not present in other clinic settings, impacting

generalizability.

Efforts to Minimize Limitations

When a patient reported issues with connectivity or not receiving the short message services, the study team leader re-sent the messages and discussed them with the individual. Some patients were not motivated to participate in the study or self-management skills actively. One patient reported stopping blood glucose self-monitoring because it was painful and the patient was educated on the importance of regular blood glucose monitoring, and the case was discussed with the provider at the site. Other patients, at one time or another, reported an inability to afford the medications, especially insulin. Although some patients had insurance coverage, there were high deductibles that the patient had to meet before the insurance paid for the prescriptions. Patients used less than adequate doses of insulin to extend Insulin medication availability. Some of the patients had their drug regimen changed after consultation with the providers. The final limitation was the language barrier. The majority of the participants spoke English as a second language; unfortunately, two participants who had consented to be in the study were dropped before pretest due to the study team leader's inability to speak Spanish. Although the participants spoke English, it had to be simplified and there may be some bias due to word selection.

Sustainability

Although there were improved diabetes self-management skills and reduced mean HbA1C and fasting blood glucose levels, a potential exists for decrease in self-care behaviors and glucose control without continued interventions. The study findings and limitations were shared with the providers and the medical assistants, and an agreement was present for continued telephone support to the patients. Although not regular, the clinic started conducting telephone

calls to patients with uncontrolled chronic conditions to improve patient outcomes. The clinic continues to motivate the patients to share the challenges they face in the management of diabetes and other chronic conditions. Short message services remain a challenge because the clinic does not have a mobile phone or short message service program. Instead, they provide educational materials to the patients in the form of brochures or printed material from the internet or evidence-based studies.

Interpretation

Expected and Actual Outcomes

Telephone follow-up and short message service intervention were expected to show increased self-management behaviors while decreasing HbA1C and fasting blood glucose levels. Adherence to self-care behaviors of diet, exercise, blood glucose monitoring and foot care improved significantly. Medication adherence increased from 5.94 days to 6.77 days of a week. Some of the barriers affecting medication adherence included the lack of medications due to the cost of medications or high deductibles.

A clinically significant reduction occurred in HbA1C and fasting blood glucose levels between pretest and post-test results. The lack of statistical improvement can be attributed to a lack of motivation to self-manage diabetes, lack of medications, or a small sample size. Patient education is essential, but access to the prescribed medication regimen is crucial in the management of diabetes. Participants reported a high cost of medications and minimizing the dosages to stretch out the length between medication refills. Some pharmaceutical companies have patient assistance programs, but the process was complicated, and some patients reported that the process was tedious and rejection of claims from the companies. Some patients were prescribed less effective medications due to lack of finances and access.

Intervention Effectiveness

Patients need constant reminders and motivation to adhere to self-care behaviors that improve blood glucose control. Text messages provided constant reminders and evidence-based reasoning for practices that led to improved self-care activities and better outcomes. One text message explained why diabetic patients need to check their feet daily, and on a telephone call, the study team leader answered the reason for rotating insulin injection sites. Patients reported feeling empowered through the telephone calls and some felt the need to share with other individuals the text-messages they received during the study. Patient motivation is a continuous process due to barriers that may arise at any given time or other stressors that impact self-care behaviors and affect glucose control in the long run. Combining two interventions such as telephone calls and short message services may be more effective that one. In contrast, short messages are quick and effective. Telephone calls make a personal connection and provide an opportunity to discuss barriers to care. The intervention applies to any practice but will potentially be more effective in a rural population or a clinic that serves low-income households, uninsured or underinsured. The intervention improves access to the provider, especially to those individuals who are not able to afford face-to-face contact with the provider.

Modifications that might improve the attainment of outcomes include one intervention at a time instead of two interventions simultaneously. It can be necessary for the study team leader to be present at the site at all clinic times to sustain the intervention and improve data collection. Face-to-face interactions with the participants before the study familiarizes the study team leader with the participants. Familiarity with the participants may enhance compliance with the intervention and diabetes management.

Impact to Health System, Costs and Policy

Improved self-care behaviors translate to improved glycemic control in the long term, which in turn leads to reduced diabetes-related complications and reduced healthcare costs for diabetes management. The barriers discovered during the study, such as the high cost and deductibles for medications, call on providers to support policies that improve patients' access to medications. Unless policies are enacted to promote patient access to medications, management of diabetes and other chronic diseases will remain complicated and high healthcare costs will remain a reality to many patients. The burden of diabetes to families and the economy are real, which calls for collaboration with other team members and legislators to improve patient access to providers and crucial medications.

The actual cost of the study was $250, which included the poster for dissemination of study, telephone services, the SDSCA scale, and $20 to cover the cost of hemoglobin A1C for two participants who were not able to afford the services. Due to the low cost of the intervention over a three-month-period, the study is economically sustainable. The study was self-funded.

Conclusion

The study on the effectiveness of telephone follow-up and short message services in the management of diabetes within three months showed improved adherence to self-management of the disease. The study showed a decrease in mean HbA1C and fasting blood glucose within three months. The follow-up telephone calls provide more frequent contact between the provider services and the patient and represent an efficient mode of identifying patient barriers to care or patient progress. The short message service provided a learning opportunity with a readily available referral source of information for the patient. One advantage of telephone follow-up is the provision of services for patients who are unable to present to the clinic due to work-related factors, or any other factors/barriers. Telephone follow-up and short message services in

combination or alone can be utilized in the management of other chronic diseases such as obesity, hypertension, hyperlipidemia and congestive heart failure.

Relevance to Practice

The study findings suggest that telephone-follow-up and short message services improved adherence to self-management skills of diet, physical activity, blood glucose testing, foot care, fasting blood glucose levels and HbA1C. The providers can utilize the telephone and short message services to initiate and reinforce change in behaviors and skills that improve diabetes management. The use of SMS is less time consuming and provides a referral source for the patients at a convenient time. Telephone and short message services can provide a channel for checking on the patients' progress and barriers to the effective management of diabetes and intervene promptly.

Future Recommendations

Future quality improvement studies are encouraged on a large sample of participants using similar interventions. Future quality improvement studies are also recommended in an urban setting with patients from different ethnic backgrounds and household incomes using similar interventions. The study on the impact of TFU and SMS on diabetes management can be transferable to other primary care clinic settings.

Dissemination

The study results will be shared with the healthcare providers at the study site and future practice sites of the study team leader. The study was accepted for poster presentation the National Evidence-Based Practice Conference in Iowa in April 2020 and the poster results were submitted for online display. Also, the study was accepted for a podium presentation at the Rocky Mountain Research Symposium 2020. A manuscript was submitted to the Journal of

Clinical Nursing for publication to disseminate evidence-based practice to improve diabetes self-management.

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Appendix A, Definition of Terms

Diabetes: a disorder that includes a series of metabolic conditions associated with hyperglycemia (high blood glucose levels). In the proposed study, the term will be used synonymously with type 2 diabetes.

Uncontrolled diabetes: Blood sugar levels are above-recommended target ranges including an A1C level above 7.0%

Fasting blood glucose levels: A test to determine how much sugar is in a blood sample after an overnight fast

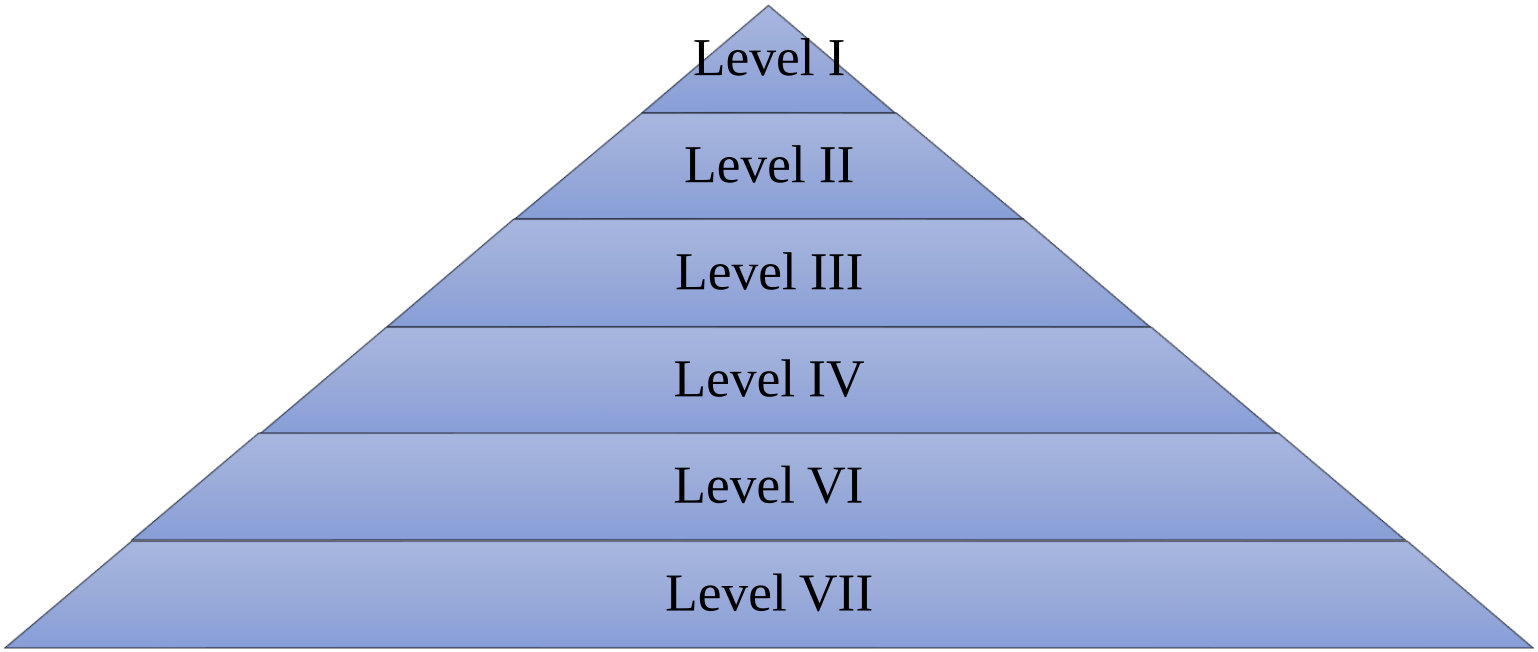
Diabetes Self-Management Education: ongoing process of facilitating the knowledge, skill, and ability necessary for diabetes self-care.

Study team leader: The person who is the lead investigator and has the primary responsibility of overseeing over a study.

Appendix B, DNP Study Logic Model

Student: Tabitha Bosire					
Inquiry, PICOTS: In the adult population, ages 45-64 years with diabetes, do telephone follow up calls and short message services between outpatient visits, improve diabetes self-management, reduce fasting blood glucose levels, and lower diabetes-related hospital admissions within three months at primary care in the Midwest?					
Inputs	**Intervention(s)** *Activities*	**Outputs** *Participation*	**Outcomes -- Impact** *Short*	*Medium*	*Long*
Evidence, sub-topics 1. Diabetes self-management education and support 2. Diabetes self-management 3. Telephone support in reducing hospitalizations 4. Telephone support in other populations **Major Facilitators or Contributors** 1. Positive patient attitude 2. Organizational culture 3. Clinic staff 4. Self-funding of study **Major Barriers or Challenges** 1. Insufficient enrollment 2. Language barrier 3. Interruption of phone services	**EBP intervention which is supported by the evidence in the Input column:** TFU and SMS offered weekly to individuals with uncontrolled type II diabetes. If the patient cannot be reached with a phone call, he/she receives an individually tailored SMS. **Major steps of the intervention (brief phrases)** 1. Chart review 2. Recruit potential candidates 3. Contact candidates 4. Consent 5. Pre-test 6. TFU and SMS intervention 7. Data collection at specific intervals until study completion. 8. Post-test.	**The participants (subjects)** 16 Adults ages 30-75 years. **Site:** Primary care clinic in Kansas **Time Frame:** July 2019 to February 2020. **Consent or assent Needed:** Participants gave a verbal consent to participate. **Other person(s) collecting data:** Staff at the clinic **Others directly involved in consent or data collection (yes/no):** Staff at the clinic assisted in obtaining consent.	**(Completed during DNP Study)** **Outcome(s) to be measured** **Primary**: Diabetes self-management, Fasting blood glucose, patient hospitalizations **Secondary**: Hemoglobin A1C Patient satisfaction. **Measurement tool(s)** 1. Summary of diabetes self-care Activities (SDSCA) 2. Self-report diary of fasting blood glucose 3. Chart review of record of hospitalizations 4. Hemoglobin A1C **Statistical analysis to be used** 1. Wilcoxon signed-rank test. 2. Descriptive statistics	**(after student DNP)** **Outcomes to be measured** Increased adherence to diabetes self-management skills Improved fasting glucose levels Increased patient participation	**(after student DNP)** **Outcomes that are potentials** Reduced incidence of diabetes complications. Reduced healthcare costs on diabetes care

Appendix C, Prisma of Literature Search



Key

Level I: 1 evidence-based practice Guideline, 2 Systematic reviews

Level II: 10 Randomized control trials

Level III: 2 Quasi-experimental studies

Level IV: 2 Retrospective Observational Studies, and 2 Mixed Cohort Study

Level VI: 1 Descriptive qualitative Survey

Level VII: 1 case study

Level of Evidence, Melnyk & Fineout-Overholt, 2015, adapted.

Appendix D, Synthesis of Evidence Table

First author, Year, Title, Journal	Purpose	Research Design[1], Evidence Level[2] & Variables	Sample & Sampling, Setting	Measures & Reliability (if reported)	Results & Analysis Used	Limitations & Usefulness
American Diabetes Association (2018). Diabetes advocacy: Standards of Medical Care in Diabetesd2018. Diabetes Care 2018; 41(Suppl. 1): S152–S153.	To evaluate quality of cares intended to provide the components of diabetes care, general treatment goals and guidelines, and tools to evaluate quality of care	Evidence-Based Guideline (EBPG) Level 1	N/A	N/A Different tools are utilized in the guideline.	ADA recommends diabetes education and self-care support to individuals with the disease. Offers an EBP guideline on standard diabetic care, tools to evaluate quality of care, and ADA's expectation for treatment and management of diabetes	Diabetes education is crucial to individuals with the disease, and the community at large. Effective diabetes management reduces the incidence of diabetes complications.
Beck, J. (2017). National Standards for Diabetes Self-Management Education and Support. *The Diabetes Educator*, *43*(5), 449-464	review the literature review on DSMES and ensure the national guidelines on DSMES align with current EBP and utilization standards.	SR of EBPG Level I evidence	The 10 Standards were divided among 20 interdisciplinary workgroup members. The members completed a current literature review for strongest evidence that supported the standards of care revision.	N/A	Literature supports use of DSMES supply patients with knowledge, skills, and ability necessary for implementing and sustaining behaviors needed for day-day disease self-management.	Technological advancements are changing how DSMES is delivered and utilized with positive outcomes.
Aytekin (2016). Does Telephone Follow-Up and Education Affect Self-Care and Metabolic Control in	Evaluate the impact of education and TFU on self-care and metabolic	RCT Level II evidence DV: Diabetes	88 patients, Control = 44 Intervention = 44	questionnaire form and the Diabetes Self-Care Scale Reliability not	Increased self-care in intervention group ($p<0.005$) Enhanced metabolic control evidenced by a	TFU and education can result in improved glycemic and metabolic control

Diabetic Patients? *Holistic Nursing Practice*, *30*(2), 70.	control in diabetic patients.	self-care, HbA1c IV: diabetes education, telephone follow-up	Hospital in Central Anatolia of Turkey	reported.	decrease in HbA1c, total cholesterol, triglycerides, LDLs, and Systolic BP.	
Zare-Farashbandi, (2015). How is health information received by diabetic patients? *Advanced Biomedical Research*, *4*(1), 126-126	Investigate the passive receipt and active seeking of health information by diabetic patients.	Level VI evidence: single survey study).	6426 diabetic patients, 362 selected by a stratified random sampling.	Longo information-seeking behavior questionnaire	Differences between passive information receipt (41.68) and active information seeking (39.20) considered as statistically significant ($P < 0.001$).	The most common information source by diabetic patients was practitioners; Patients do not actively seek information, but rely on providers as a source of information. Providers to actively offer education and support.
Sezgin (2013). Follow-up of patients with type 2 diabetes via cell phone: a randomized controlled trial. *Journal of Marmara University Institute of Health Sciences*, *3*(4), 173–183	Evaluate the impact of diabetes education via TFU or SMS metabolic control and social factors in patients with T2DM.	RCT Level II evidence DV: glycemic control IV: diabetes education, short message service.	120 diabetic patients, Random selection. 40 Control group, 40 education group, and 40TFU or SMS group. Marmara University Institute of Health Sciences	Data, Individual Diagnosis Follow-up Form with Diabetes (DBTTF), Multidimensional Diabetes Questionnaire, ruler digital weighing instrument.	HbA1c dropped 1.8% in education, TFU or SMS group. Fasting blood glucose dropped 38 mg/ dl in the TFU-SMS group, 36mg/dl in the control group, postprandial glucose dropped in only phone call SMS group (52 mg/dl); systolic pressure dropped in TFU-SMS and education groups.	TFU-SMS have given successful result on providing social compliance and optimal glycemic control
Aliha (2013). Group education and nurse-telephone follow-up effects on blood glucose control and adherence to treatment in type 2 diabetes patients. *International*	Evaluate the effects of group education and TFU on glycemic control and compliance with treatment regimen in individuals with diabetes	RCT Level II evidence DV: FBS, 2 hpp BS, HbA1C, compliance to treatment	62 Participants; random selection into control and intervention groups with 31 members in each. Diabetes clinic in Khomeini	SPSS software version 16 using independent *t*-test, paired *t*-test, Chi-square test, non-parametric tests, mixed model (ANOVA + repeated measure)	FBS, 2 hpp BS, HbA1C were improved in both groups post-intervention, but statistically significant in case group $P > 0.0001$. During study, percentage of patients with very good compliance in	Self-care group education and 12 weeks TFU led to improved metabolic parameters and adherence to treatment regimen in patients with diabetes.

journal of preventive medicine, *4*(7), 797-802.		regimen IV: self-care group education, telephone follow-up		and ANCOVA.	control group decrease from 12.5% to zero (0%), whereas in experiment group these amounts increase from 6.5% to 90.3% *P* > 0.0001.	
Nesari (2010). Effect of telephone follow-up on adherence to a diabetes therapeutic regimen. *Japan Journal of Nursing Science*, *7*(2), 121-128.	To determine the effect of TFU on adherence to treatment regimen in patients with T2DM.	RCT. Level II evidence. DV: Adherence to foot care exercise, medication taking, and blood glucose monitoring IV: 3-day diabetes care education Telephone intervention	61 patients, 31 in control group, 30 in intervention group. One patient from the control group dropped out. Iranian diabetes society	Questionnaire Five-point Likert scale Descriptive statistics ANCOVA	Significant improvement in adherence to self-management behaviors and treatment regimen for TFU group after three months.	Telephone intervention led to improved adherence to diabetic self-care behaviors which in turn yields a decrease in HbA1C. Therefore, a cost-saving measure, in the long term.
Dobson (2018). Effectiveness of text message based, diabetes self-management support programmed (SMS4BG): two-arm, parallel randomized controlled trial. *BMJ (Clinical research ed.)*, *361*, k1959.	To determine the effectiveness of a theoretically based and individually tailored, SMS-based DSMES in adults with poorly controlled diabetes.	RCT Level II evidence DV: HbA1c, self-care behaviors, diabetes self-efficacy IV: Tailored text messages.	366 participants, 16 years or older with poorly controlled diabetes. Primary and secondary healthcare services in New Zealand.	Stanford self-efficacy for diabetes scale Summary of diabetes self-care activities, two item diabetes distress scale, brief illness perception questionnaire.	Significant HbA1C reduction in intervention group (-8.85 mmol/mol) at nine months. Four secondary outcomes showed statistical improvements in intervention group.at nine months.	Individually tailored SMS-based DSMES can lead to improved glycemic control in adults with poorly controlled T2DM.
Brown (2017). Can follow-up phone calls improve patients self-monitoring of blood glucose? *Journal of*	Evaluate the effectiveness of TFU in improving the frequency of	Quality improvement study Level IV	41 patients, 21 in control group 1, and 20 in intervention group 2.	Chi square analysis pretest post-test score	No statistical significance in HbA1C between the two groups, but clinical significance in HbA1C was	the clinical significance in HA1C change in the TFU group supports the hypothesis that frequent patient-provider contact

Clinical Nursing, *26*(1–2), 61–67.	glucose monitoring in patients with T2DM to lower hemoglobin A1C.	evidence DV: HbA1C Glucose monitoring behaviors IV: Follow-up phone calls, Standard clinical care	Internal medicine clinic.	Reliability not reported.	determined in the TFU group.	can improve HbA1C, and self-management behaviors in patients with diabetes. Any positive change in the management of a chronic condition is considered victory.
Kaur (2015). Telephonic consultation and follow-up in people with diabetes: Impact on metabolic profile, quality of life, and patient compliance. *North American Journal of Medical Sciences*, *7*(5), 199	Study the impact of the frequency of consultation and TFU on glycemic and metabolic profiles, compliance to treatment regimen, and quality of life and to compare the effectiveness of different modes of follow-up.	RCT Level II evidence DV: Quality of life Compliance and adherence to treatment regimen. HbA1C IV: telephone call Clinic visit	120 Patients were randomly assigned to group A (rare, less frequent outpatient visits), B, (moderate, more frequent outpatient visits), and C (, more frequent outpatient visits) with weekly TFU Outpatient clinic	immunoassay, Quality of Life Instrument for Indian Diabetes Patients (QOLID) questionnaire, statistical analysis	The patients' compliance with treatment regimen was higher in group C, followed by groups B and A. There was a net decrease in adverse events with increased frequency of follow-up. Changes in HbA1C imply a positive impact of weekly telephonic consultation.	Patient compliance was more in the TFU group. Telephone intervention can be used as a monitoring tool as well as telemedicine. Significantly reduced HA1C levels improved compliance and adherence to treatment regimen in group C.
McGloin (2015). A case study approach to the examination of a telephone-based health coaching intervention in facilitating behavior change for adults with type 2 diabetes. *Journal of Clinical Nursing*, *24*(9-10), 1246-1257.	Examine the effectiveness of telephone empowerment-based health coaching as a cost-effective alternative to changing health behaviors of adults with Type 2 diabetes.	Mixed methods case study Level V evidence DV: Self-management, healthy behaviors such as exercise, eating habits, and smoking cessation IV: Telephone coaching	10 patients	Diabetes empowerment score, diabetes distress score, interviews,	Telephone empowerment led to improved self-responsibility and self-efficacy scores. Short-term benefits deteriorated after the cessation of the intervention advocating for ongoing telephone support to the individuals with T2DM.	Telephone coaching has a positive impact on health behaviors and facilitates increase in personal control of health, and builds confidence in self-management of diabetes.
Greenwood (2014). A comparison of in-	Assess the feasibility TFU,	RCT	150 patients, randomly	Survey and statistical analysis,	Behavioral goals were attained by 59% of in-	TFU has potential for similar results as in-

person, telephone, and secure messaging for type 2 diabetes self-management support. *The Diabetes Educator*, *40*(4), 516-525.	and SMS in offering DSMES compared to standard diabetes care, and to compare the clinical outcomes (HbA1C, LDL), behavioral goal achievement and health maintenance between the groups.	Level II evidence DV: Behavioral goal attainment, health maintenance, A1C and LDL levels. IV: Standard care, TFU, SMS.	selected, divided into three groups, control, TFU, and SMS. Diabetes clinic		person participants, 73% TFU, and 77% SMS. TFU and SMS are efficient in providing DSMES. Three brief contacts by TFU or SMS resulted in comparable outcomes to in-person visit.	person visits if there is a shorter interval between the patient-provider interactions via TFU.
Nundy (2014). How Do Mobile Phone Diabetes Programs Drive Behavior Change? Evidence from Mixed Methods Observational Cohort Study. *The Diabetes Educator*, *40*(6), 806–819	Investigate the behavioral effects of mobile phone-based intervention that combines automated text messaging and automated, interactive text messaging system	A mixed method cohort study Level IV evidence DV: self-care behaviors, health beliefs, self-efficacy IV: telephone educational messages and Mobile reminders	67 patients University of Chicago Medicine (UCM).	Comparative study analysis In-depth interviews (audiotaped). Summary of diabetes self-care activities measure, Morisky self-report of medication-taking behaviors, Diabetes self-efficacy scale, Risk-perception survey for diabetes.	Text-messaging intervention led to improvements in medication taking, glucose monitoring, foot care, exercise, and healthy eating and improvements in 1 or more measures of self-efficacy, social support, and health beliefs.	Telephone messages and reminders are effective in increasing diabetes self-care behaviors.
Suksomboon (2014) Impact of Phone Call Intervention on Glycemic Control in Diabetes Patients: A Systematic Review and Meta-Analysis of Randomized, Controlled Trials.	Assess the impact of TFU on glycemic control compared with standard clinical diabetes care.	meta-analysis of randomized control trial Level I evidence DV: HbA1C IV: Standard	Review of 203 articles, 953 patients.	Maastricht-Amsterdam scale Funnel plot and Egger's method Mean HbA1C levels calculated.	Telephone contact intervention was no more effective than standard clinical care in improving glycemic control.	Although there was no significant change in glycemic control, low-income patients or patients from low-socioeconomic groups may benefit from telephone intervention. Positive change is good

PLoS ONE 9(2): e89207		clinical diabetic care. Telephone calls				even if it is not significant.
Zolfaghari (2012). The impact of nurse short message services and telephone follow-ups on diabetic adherence: which one is more effective? *Journal of clinical nursing*, *21*(13-14), 1922-1931.	Compare the effectiveness of TFU and SMS on adherence to treatment regimen in T2DM within three months.	Quasi-experiment, two-group, pretest and post-test design. Level III evidence DV: Treatment regimen HbA1C levels IV: Telephone calls, SMS	77 Patients Diabetic clinic	Chi-square test, paired *t*-test, independent *t*-test, and Fisher's exact test	TFU and SMS yielded a significant improvement in HbA1C levels and adherence to the diabetic treatment regimen for three months.	TFU and SMS can be utilized to improve HbA1C and self-management in patients with uncontrolled diabetes.
Walker (2011). Results of a successful telephonic intervention to improve diabetes control in urban adults. *Diabetes Care*, *34*(1), 2-7.	Compare TFU with use of print materials in achieving glycemic control within one year.	RCT Level II evidence DV: Medication adherence, Self-care activities IV: Print materials, TFU	526 participants, 82missed follow-up HbA1C levels. Intervention group received TFU coaching and motivation. Setting not specified.	Four item Morisky self-reported medication-taking scale. Residuals-based regression diagnostics Statistical analysis Medication possession ratio Pharmacy claims data, HbA1c.	TFU led to a significant improvement in glycemic indices (p=0.04), increased medication adherence, and self-management behaviors.	TFU can offer motivation in diabetes self-management behaviors and medication adherence. Limitations: the dry-dot methodology for HbA1c contributed to greater variability in the measurement.
Jayakody, A., Bryant, J., Carey, M., Hobden, B., Dodd, N., & Sanson-Fisher, R. (2016). Effectiveness of interventions utilizing telephone follow up in reducing hospital readmission within 30 days for individuals with	Determine quality and effectiveness of TFU alone or in combination with other components in reducing 30-day readmissions among patients with cardiovascular	SR. Level I Evidence	Ten studies were identified, of which five were effective in reducing readmissions within 30 days.	A systematic search of MEDLINE, the Cochrane Library and EMBASE were conducted for articles published from database inception to 19th May 2015	In three studies, TFU in addition to pre-discharge support led to decreased 30-day readmissions. In two studies, provided TFU with pre- and post-discharge support included education, discharge planning, physical therapy, and dietary consults,	Evidence is inconclusive for the effectiveness of interventions utilizing TFU alone or in combination with other components in reducing readmissions within 30 days in patients with chronic diseases

chronic disease: a systematic review. *BMC health services research*, *16*(1), 403.	disease chronic respiratory disease, and diabetes.				medication assessment, home visits, and a resident curriculum, reported reduced 30-day readmissions.	
Harrison (2014). Assessing the Impact of Nurse Post-Discharge Telephone Calls on 30-Day Hospital Readmission Rates. *Journal of General Internal Medicine*, *29*(11), 1519–1525.	Assess the effect of post-discharge TFU on All-cause 30-day readmission in a general medicine population	Retrospective observational study Level IV evidence DV: readmission rates IV: TFU	5507 patients with diabetes discharged home from a tertiary care academic medical center.	ANOVA test Chi Squire test Fishers exact test	Patients who received a TFU were significantly less likely to be readmitted compared to those who did not [155 (5.8 %) vs. 123 (8.6 %), $p < 0.01$]	Telephone follow-up calls can lead to fewer readmissions
Eisenberg (2015). Telephone follow-up by a midlevel provider after laparoscopic inguinal hernia repair instead of the face-to-face clinic visit. *JSLS: Journal of the Society of Laparoendoscopic Surgeons / Society of Laparoendoscopic Surgeons*, *19*(1), e2014.00205.	Examine the feasibility and outcomes of TFU program for laparoscopic inguinal hernia repair	Retrospective study Level IV evidence DV: face to face clinic visit IV: Telephone follow-up	60 patients who had a laparoscopic inguinal hernia repair Patients received TFU 2 to 3 weeks after surgery. 50 patients were satisfied with TFU and did not want to schedule a clinic visit; five patients had a clinic visit.	Questionnaire	Telephone follow-up by a midlevel provider after laparoscopic inguinal hernia repair is feasible and effective in answering patient concerns and increasing patient satisfaction.	Telephone follow up by midlevel providers led to 90% positive outcomes. They were cost-and-time-efficient.
Khorshidi (2015). Effects of telephone follow-up on blood glucose levels and postpartum screening in mothers with Gestational Diabetes Mellitus. *Medical*	Evaluated the effects of TFU on fasting blood glucose levels during pregnancy and rate of postpartum screening	RCT Level II evidence DV: Fasting blood glucose levels,	80 Pregnant women with gestational diabetes prenatal clinic of Imam Khomeini hospital	Descriptive and inferential statistics were used to describe the data	TFU led to a significant decrease in mean level of fasting and 2 hours postprandial blood glucose levels at 28 weeks, and a further decrease in the two values at 36 weeks at	The study demonstrated that TFU can significantly reduce fasting blood glucose levels in mothers with gestational diabetes and increase the rate of postpartum screening

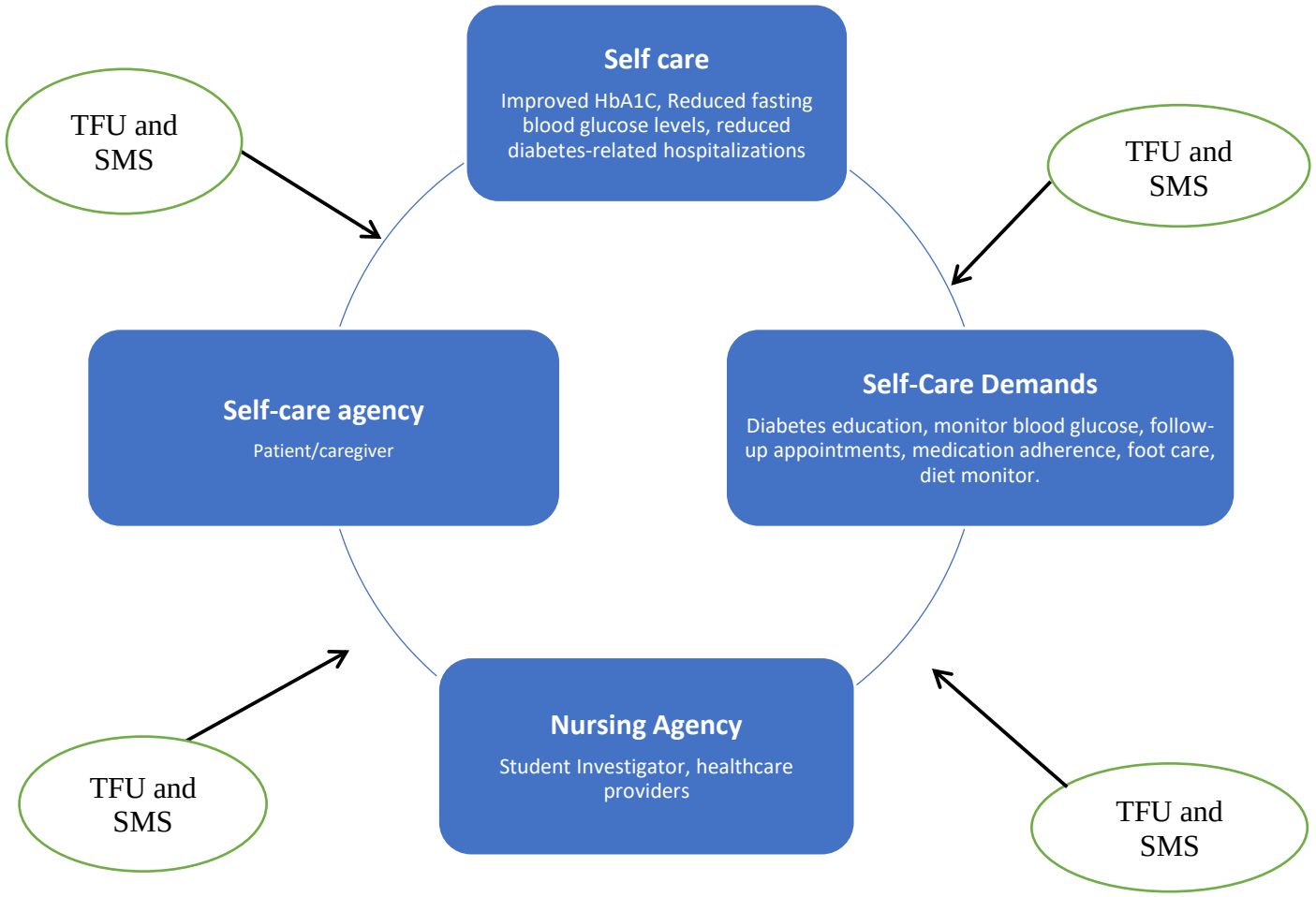
Journal of The Islamic Republic of Iran, *29*, 249.		postpartum glucose screening test. IV: telephone follow-up			P<0.05. Rate of postpartum glucose screening test was significantly higher in the TFU group (P<0.001).	test.
Wu (2013). Protocol for a randomized blocked design study using telephone and text-messaging to support cardiac patients with diabetes: a cross-cultural international collaborative project. *BMC Health Services Research*, *13*, 402.	Assess the feasibility and short-term efficacy of incorporating TFU and SMS in support of patient care in individuals with diabetes and cardiac disease.	RCT Level II evidence DV: self-care behaviors, self-efficacy IV: standard care, hospital education, TFU, and SMS	180 patients admitted to participating coronary care units with a diagnosis of acute coronary syndrome and T2DM for more than 1 year. Australia and Taiwan.	Questionnaires, summary of diabetes self-care scale, diabetes management self-efficacy scale	NA	The study provides a protocol/guideline. The study subjects are from two different countries with differing cultures. Challenges include an understanding of variations in research processes, healthcare personnel knowledge, and skill across the two countries.

Key

DV= dependent variable

IV= Independent variable

Appendix E, Theory Application Diagram



Appendix F, Quality Improvement Determination Letter (IRB)

5319 Rockhill Road

Kansas City, MO 64110

816-235-5927

umkcirb@umkc.edu

Dear UMKC Faculty with Tabitha Bosire,

A member of the UMKC Research Compliance Office screened your QI Questionnaire to project #2016068-QI entitled "The Effectiveness of Telephone Follow-Up for Diabetes Management" and made the following determination:

QI Determination: The study has been determined to be a quality improvement activity not requiring IRB review.

If you have any questions regarding this determination, please feel free to contact our office at 816-235-5927, umkcirb@umkc.edu, or by replying to this notification.

Note Regarding Publications: It is appropriate to disseminate and replicate QI/program evaluation successes, including sharing the information external to an organization. This may include presentations and publications. The mere intent to publish the findings does not require IRB review as long as the publication does not refer to the activity as research.

Thank you,

UMKC Institutional Review Board

Appendix G, Cost Table

Expense	**Unit Price**	**Actual Cost (in dollars)**	**Explanation**
Poster	$80	$80	Print the poster for presentation
Review of charts	$0/hour	$0	Chart review approximately 10 hours
Telephone calls and short message services	$ 25/month	$125	Uses the office phone that is paid per month
Blood draws	$35/person x16 people = $560	$ 20	HbA1C cost. I**nsurance will cover the cost.**
The Summary of Diabetes Self-Care Activities (SDSCA)	$25	$25	The SDSCA purchase from the Oregon Research Institute
Statistical Analysis SPSS software program	$35	$0	The program provided by UMKC **at no cost**
Total direct costs		**$ 250**	

Appendix H, Recruitment Material

Diabetes is the 7th leading cause of death in America and disease complications, poor self-management, and lack of understanding of the disease, and the treatment regimen are key contributors to poor management of the disease. Tabitha Bosire, a Doctoral of Nursing Practice student at the University of Missouri- Kansas City, will be conducting a study on the use of telephone follow-up and short message services in the management of diabetes. Tabitha will be under the supervision of our Nurse Practitioner, from July 2019 through February 2020. Will you like to be included in the Study?

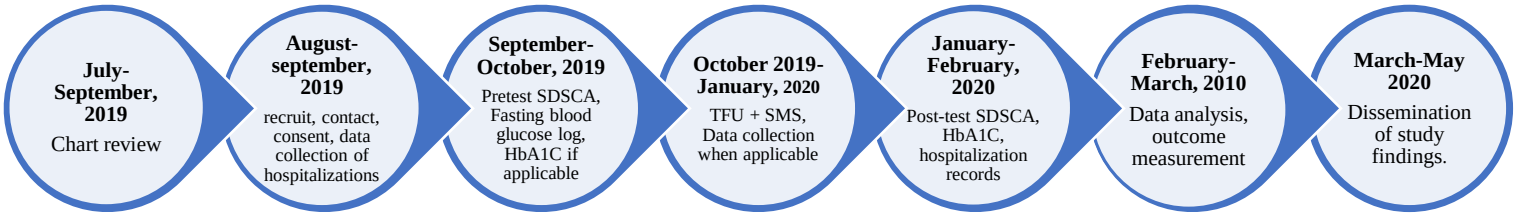
Appendix I, Summary of Diabetes Self-Care Activities Scale

Permission was granted to use the SDSCA tool for this study.

Appendix J, Data Collection Variables

	Name
1	ID
2	Race
3	Age
4	Education
5	Employment
6	Hours
7	HbA1C
8	BG
9	Diet
10	Exercise
11	BGT
12	Foot
13	Medication
14	Hospitalizati...
15	

Appendix K, Study Timeline Flow



Appendix L, Sample Short Messages

Safe yourself from diabetes foot infections by controlling your blood sugars. Inspect your feet daily, bathe in lukewarm water, cut your nails carefully, wear dry socks, and dry between your toes.

Do you know that if your blood glucose level gets too low, you can lose your ability to think? Or if it gets too high and stays high, it can cause damage to your body including poor vision? Our goal is fasting blood sugars of 80-130, and less than 180 1-2 hours after beginning to eat. Please check your blood sugars at least daily.

Diabetes is not terrible; there are many things you can do to prevent or delay problems from diabetes, such as monitoring your blood sugars, watching your diet, exercise, and taking your medications regularly.

Do you know that the more carbohydrates you eat at one time, the higher your blood sugars will rise? Spreading out your carbohydrates throughout the day can help keep your blood glucose levels at target range.

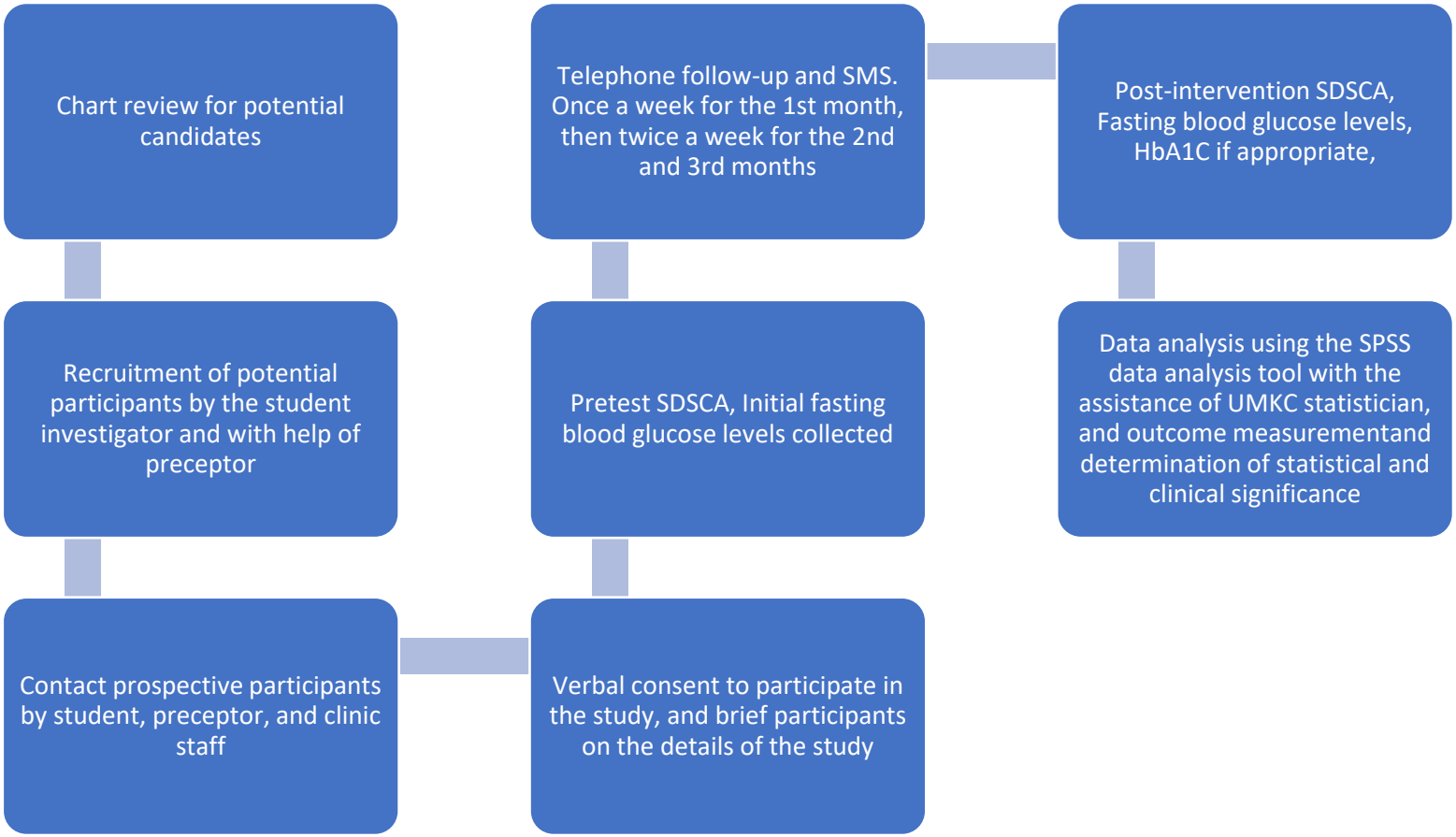
The amount of food you eat is closely related to blood glucose control. If you eat more food than recommended, your blood sugar goes up. Although carbohydrates have more impact on your blood sugars, the calories from all foods affect your blood glucose levels. Let us work on portion control.

Do you know that the “plate method” can help you manage diabetes? Plate method is where you fill half of your plate with vegetables, a quarter with some kind of protein, and a quarter with starch/carbohydrates such as rice, tortilla, potatoes, or pasta.

Do you know that brisk walking is a convenient, safe and cheap way of exercising? Give it a trial!!! It’s good for your heart and will help reduce your blood glucose.

Testing your blood glucose can be painful. Try using the sides of the fingertips and rotate your fingers. It can help minimize the pain.

Appendix M, Intervention Flow Diagram



Appendix N, Measurement Tools

	State	Measurement Instrument Name	Tool validity and reliability	Permission Need	Statistical Analysis
Primary Outcome	Fasting blood glucose levels	Self-report log	None	No	Wilcoxon signed-rank test Pretest, post-test
	Diabetes self-management	Summary of Diabetes Self-Care Activities (SDSCA) scale	Test-retest reliability r=0.912, Cronbach's alpha 0.76	Yes, will be purchased	Wilcoxon signed-rank test Pretest Post-test
	Diabetes-related hospitalizations	Chart review and self-report	None	No	Wilcoxon signed-rank test Pretest Post-test
Secondary Outcome	Hemoglobin A1C	Hemoglobin A1C	None	No	Wilcoxon signed-rank test Pretest Post-test
	Patient satisfaction	Simple Questionnaire	None	No	Wilcoxon signed-rank test
Demographics	Age, Race, Level of education, employment status	Not applicable	Not applicable	Not Applicable	Descriptive for each group.
Participant Completion of the Measurement Tool (Procedure): The participants were asked to keep a daily log of fasting blood glucose levels throughout the study. The first week of entry to the log was the pre-intervention data, and the last one in the final week of intervention. The participants can drop their fasting blood glucose log at the clinic for the study team leader or report the readings during TFU with the study team leader. The SDSCA scale was administered pre-intervention and post-intervention during TFU or an office visit at the clinic. HbA1C was done at least once during the study and compared to the previous recorded HbA1C in the chart. Patient satisfaction questionnaire was completed at the end of the study at the same time as the final SDSCA.					

Appendix O, Permission to Use Summary of Diabetes Self-Care Activities Scale

Deborah Toobert
To: Tabitha Bosire
Jun 6 at 12:50 PM

Dear Tabitha,

Thank you for your payment of $25 for permission to use the Summary of Diabetes Self Care Activities (SDSCA) in your study. Now that we have received your payment, you have our permission to use the English version of the Summary of Diabetes Self-Care Activities Questionnaire in your study and we will be able to provide answers to any questions you may have. We have attached the 2000 Diabetes Care article with the SDSCA psychometric information. At the end of the article, there is an appendix with the English version of the questionnaire, and the scoring information. We have also attached a user-friendly copy of the English version of the SDSCA instrument.

If you need a translation of the SDSCA please contact me first, as the SDSCA has been translated into many languages. There will be no further charge.

Please be sure to check our website first for the most frequently asked questions:

http://www.ori.org/sdsca

We wish you every success with your study,

Deborah

Deborah J. Toobert, PhD
Retired Senior Research Scientist
Oregon Research Institute
1776 Millrace Drive
Eugene, Oregon 97403

http://www.ori.org/

Appendix P, Statistical Analysis Tables

Socio-demographic information about participants (**Table 1**)

Variable	**Number (n)**	**Percentage**
Gender		
Male	8	50
Female	8	50
Age		
30-39	3	18.7
40-49	2	12.5
50-59	6	37.5
60-69	4	25
70-75	1	6.3
Employment Status		
Unemployed	7	44
Part-time	1	6
Full-time	8	50
Highest level of education		
0-8th grade	2	12.5
9-12th grade	10	62.5
>12th grade	4	25

Blood glucose levels, and diabetes-related hospitalizations before and after TFU and SMS

(**Table 2**)

Variable	**Pretest (Mean, SD)**	**Post-test (Mean, SD)**	**Difference (Mean)**	**Z-Value**	**Asymptotic significance (2-tailed).**
Fasting Blood Glucose levels	192.84, 52.38	167.20, 53.88	-25.64	-1.334	0.894
Hemoglobin A1C	9.24, 1.58	8.88, 1.44	-0.36	-1.33	0.182
DM-Related Hospitalizations	1	0		-	-

Comparison of Self-management behaviors before and after TFU and SMS (**Table 3)**

Variable	**Pre-test (mean, SD)**	**Post-test (mean, SD)**	**Difference**	**Z-value**	**Asymptotic significance (2-tailed)**
General Diet	2.31, 1.48	4.89, 0.90	2.58	-2.944	0.003
Specific diet	2.54, 0.82	5.05, 1.05	2.51	-2.944	0.001
Physical activity	0.97, 1.70	3.04, 2.30	2.07	-2.512	0.012
Blood sugar testing	4.50, 2.29	5.89, 2.27	1.39	-1.962	0.050
Foot care	4.36, 1.24	6.79.0.37	2.43	-3.114	0.002
Medications	5.94, 1.18	6.77, 0.83	0.83	-1.667	0.96

Mean: Average

SD: Standard deviation

Difference= Posttest-Pretest

UMKC Faculty DNP Study Letter

July 12, 2019

DNP Study Approval

UMKC DNP Student

This letter serves to provide documentation regarding Tabitha Bosire's Doctor of Nursing Practice (DNP) Study proposal. Ms. Bosire obtained approval for her study proposal, The Effectiveness of Telephone Follow-Up for Diabetes Management, from the School of Nursing and Health Studies DNP faculty on July 12, 2019.

If we can provide further information, please feel free to contact us.

Sincerely,

Cheri Barber, DNP, RN, PPCNP-BC, FAANP

Clinical Assistant Professor

DNP Program Director

UMKC School of Nursing and Health Studies

Lyla Lindholm, DNP, ACNS-BC

UMKC MSN-DNP Program Coordinator

Clinical Assistant Professor

DNP Faculty