

EDUCATIONAL TEXT MESSAGING TO IMPROVE KNOWLEDGE AND SELF-CARE
PRACTICES AMONG ADULTS WITH TYPE 2 DIABETES

A Doctor of Nursing Practice Project Report

by

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Submitted in Partial Fulfillment of the Requirements for the Degree of

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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.

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August 2022

DEDICATION

This work is dedicated to my mother who has been by my side through all my nursing programs. I truly appreciate her fervent prayers, encouraging words, and unending support.

ACKNOWLEDGEMENTS

First and foremost, I would like to acknowledge my Lord and Savior Jesus Christ. I thank the Lord for the wisdom, perseverance, and strength to complete this project. I give him the glory for all my academic achievements. I would also like to acknowledge my committee members: Dr. Gloria Park, Dr. Kyoung Lee, and Dr. Amy Houlihan. I am truly grateful for their guidance and support.

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ABSTRACT

Poor diabetes knowledge and self-care practices are correlated with impaired glycemic control and vascular complications among patients with type 2 diabetes. Diabetes education interventions are essential to improve diabetes self-management and reduce overall mortality; however, time pressures imposed upon healthcare providers limit the amount and quality of education provided in the primary care setting. The purpose of this project was to determine if an educational text messaging intervention would improve diabetes knowledge and self-care practices among patients with type 2 diabetes in a rural primary care clinic. A pretest-posttest, quasi-experimental design was utilized and twenty patients with type 2 diabetes were recruited for this project. Three distinct educational text messages were disseminated weekly for 12 weeks. Six educational domains were addressed: nutrition, physical activity, foot care, blood sugar management, behavioral support, and general diabetes knowledge. Pre- and post-intervention measures consisted of diabetes knowledge and self-care participation questionnaires. From pretest to posttest, considerable improvements were observed in diabetes knowledge scores (13.3% increase), the number of days per week participants engaged in healthy (general) eating habits (15.7% increase), and the number of days per week participants engaged in foot care practices (21.4% increase). The results of this project indicate that educational text messaging can improve diabetes knowledge, general eating habits, and foot care practices among patients with type 2 diabetes in a rural primary care clinic. Based on these findings, we recommend integrating educational text messaging into clinical practice.

Keywords: educational text messaging, type 2 diabetes, knowledge, self-care practices, rural primary care clinic

Educational Text Messaging to Improve Knowledge and Self-Care Practices Among Adults with Type 2 Diabetes

INTRODUCTION

Background

Type 2 diabetes (T2D) is an international health concern that affects nearly 21 million individuals in the United States (U.S.) and 462 million individuals globally (Bullard et al., 2018; Khan et al., 2020). Characterized by abnormalities in glucose, protein, and fat metabolism, diabetes is recognized as the eighth leading cause of mortality in the U.S. and the ninth leading cause of mortality worldwide (Centers for Disease Control and Prevention [CDC], 2022; Woo & Robinson, 2016; World Health Organization, 2021). Diabetes self-management is key to maintaining glycemic control, preventing vascular complications, and reducing overall mortality (Fenwick et al., 2013). Unfortunately, many healthcare providers (HCPs) do not have enough time to educate T2D patients about the salient aspects of their condition, including fundamental self-management skills. Sixty-two percent of rural counties do not have diabetes self-management education and support (DSMES) programs, further reducing access to diabetes education (CDC, 2018). The purpose of this quality improvement (QI) project was to explore innovative, educational interventions that can improve diabetes knowledge and self-care practices among T2D patients.

Review of Literature

Rushforth et al. (2016) conducted a qualitative systemic review and studied barriers to the successful management of T2D in the primary care setting. A total of 32 studies were reviewed primarily relating to general diabetes care and glycemic control (Rushforth et al., 2016). These authors found that time pressures imposed upon primary care practitioners significantly

interfered with their ability to provide high-quality diabetes care. Similarly, Sibounheuang et al. (2020) conducted a systematic review to identify factors that impact diabetes management. A total of 23 studies were reviewed that shadowed nine themes, including providers' perspectives on diabetes management. Consistent with prior research, Sibounheuang et al. (2020) found that provider time constraints were a notable barrier to providing optimal diabetes care.

Text messaging has been heralded as an effective, timesaving approach to disseminating patient education and was the primary intervention used in this project. An integrative systematic review of the literature was performed to evaluate the effectiveness of educational text messaging at increasing diabetes knowledge and self-care practices among T2D patients. Three randomized controlled trials were studied, with samples sizes ranging from 81-395 participants (Goodarzi et al., 2012; Peimani et al., 2016; Waller et al., 2021). Investigators disseminated educational messages that centered around diabetes knowledge, diet, exercise, blood glucose monitoring, and medication adherence (Goodarzi et al., 2012; Peimani et al., 2016; Waller et al., 2021). Results from these studies conclude that text messaging can improve diabetes knowledge and various self-care practices among T2D patients (Goodarzi et al., 2012; Peimani et al., 2016; Waller et al., 2021).

Problem Description in the Setting

This QI project was conducted at a rural primary clinic in the Southeast Texas region. An organizational assessment was performed, and HCPs stated that there was an unfortunate gap between the time allocated for chronic care health visits (typically 20 or 30 minutes) and the time needed to deliver comprehensive diabetes education. The American Association of Clinical Endocrinology (AACE) states that diabetes education and lifestyle therapies should cover five domains: nutrition, physical activity, sleep hygiene, behavioral support, and smoking cessation

(Garber et al., 2020). Many HCPs have difficulties delivering AACE-recommended diabetes education and addressing other concerns pertinent to the T2D patient (medication management, co-morbid disease management, lab review, and referrals) within a twenty- or thirty-minute time span.

Healthcare providers at the rural primary care clinic revealed that the local hospital no longer offered DSMES classes and reported that there were no diabetes educators affiliated with the organization. For these reasons, practitioners championed the idea of an educational text messaging project to improve diabetes knowledge and self-care practices among T2D patients. Given the vast number of patients who use digital technology daily, these practitioners regarded educational text messaging as a feasible endeavor with great potential. This QI project aligned with one of the facility's main goals: to facilitate the healing of all patients.

Project Purpose and Aims

The purpose of this QI project was to determine if educational text messaging would improve knowledge and self-care skills among adults with T2D in a rural primary care clinic in the southeast Texas region. The clinical question that guided this QI project was: Among adults with T2D in a rural primary care clinic, does participation in an educational text messaging intervention improve diabetes knowledge and increase participation in self-care skills over 3 months? Knowledge constructs were measured using the Diabetes Knowledge Questionnaire-15 (DKQ-15) and participation in self-care activities was measured using the Summary of Diabetes Self-Care Activities (SDSCA) scale. Primary goals for this QI project were to increase mean DKQ-15 scores and SDSCA scores by 10% by the end of the 3-month intervention. This QI project aligned with the American Association of Colleges of Nursing (AACN) Doctor of Nursing Practice (DNP) Essential IV: *Information Systems/Technology and Patient Care*

Technology for the Improvement and Transformation of Health Care. The project also aligned with the National Organization of Nurse Practitioner Faculties (NONPF) competency:

Integration of technology for knowledge management to improve health care. Digital technologies utilized in this project sought to improve the care provided to T2D patients.

Guiding Frameworks

Conceptual Framework

Everett Rogers' Diffusion of Innovations Theory hypothesized that change occurs according to a specific communication channel which begins with the introduction of a new idea and ends with the adoption or rejection of that idea (New South Wales Agency for Clinical Innovation, n.d.; Orr, 2003). Five steps associated with this communication channel include: knowledge, persuasion, decision, implementation, and confirmation. See Figure 1. Everett Rogers' Diffusion of Innovations Theory was selected as a conceptual framework for this project because it adequately reflected the "innovations" project participants encountered, starting with the presentation of new knowledge concerning diabetes management to the decision to accept or reject this instruction. One unique element associated with this theory was the concept of persuasion. Educational text messages were written with motivational undertones, with the goal of persuading participants to increase diabetes self-care practices.



Figure 1

Everett Rogers' Diffusion of Innovation Theory

Theoretical Framework

Dorothea Orem’s Self-Care Deficit Theory of Nursing is based on the notion that human beings can care for themselves (self-care agency) and when self-care is compromised (self-care demand), nurses can help regain this ability through direct care and educational support (nursing agency; Borji et al., 2017). See Figure 2. This theory was selected as the theoretical framework for this project due to its emphasis on self-care agency. Many patients with T2D can care for themselves but need the support and guidance of nursing professionals to adequately self-manage their condition. The director of this project was an advanced practice registered nurse who used text messaging to deliver high-quality diabetes education, with the overall goal of increasing diabetes self-care skills.

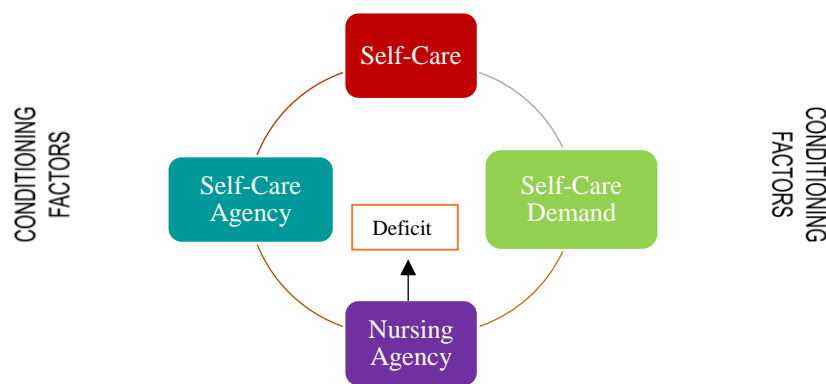


Figure 2

Dorothea Orem’s Self-Care Deficit Theory of Nursing

METHODS

Ethical Considerations

This project plan was reviewed by the Texas A&M University-Corpus Christi (TAMU-CC) Institutional Review Board (IRB) for project classification and received a determination of “Not for Human Subjects Research” and permission to proceed as a Quality Improvement project. See Appendix A to view the IRB determination letter. No site-specific IRB authorization

was obtained, as clinic administrators accepted the TAMU-CC IRB approval. Data was maintained per TAMU-CC IRB and the Health Insurance Portability and Accountability Act of 1996 (HIPAA) guidelines. Physical documents were stored in a locked cabinet and electronic data was stored in a password protected computer. Documents were shredded and electronic data was deleted after project completion. See Appendix B to view the HIPAA Confidentiality Agreement signed by the clinic manager and project director. The clinic administrator fully endorsed this project and signed a facility support letter, as denoted in Appendix C. Incentives, namely a \$10 amazon gift card, were provided to participants who completed all aspects the project (pretest, intervention, posttest). All incentives were funded by the project director.

Project Design

A pretest-posttest, quasi-experimental design was conducted. A 12-week educational text messaging intervention was employed to improve diabetes knowledge and self-care practices from baseline to follow-up. This methodology was chosen because patients must have a solid knowledge base before they can sufficiently engage in diabetes self-management activities. Healthcare providers at the rural primary care clinic have a strong interest in improving health outcomes by augmenting patient engagement and favored the idea of an educational text messaging project to accomplish those goals.

One risk inherent to this project was low participant recruitment secondary to the COVID-19 pandemic. To mitigate this risk, the project director engaged clinic staff in the recruitment process and utilized face-to-face and telephone recruitment methods. Low participant retention was another risk, due to the loss of interest in receiving text messages. Mitigating strategies included delivering messages sparingly throughout the week and checking-in with participants quarterly to show presence and increase retention.

Recruitment Methods

The initial plan for this project was to recruit African American and Hispanic American patients with type 2 diabetes. Research shows that these groups have poorer health outcomes when compared to White counterparts (Odlum, 2020). After completing an organizational assessment, it was evident that limiting the intervention to African American and Hispanic Americans would result in an extremely small sample size. The decision was made to restructure the project to target rural populations and include patients with T2D from all racial and ethnic backgrounds.

Project participants were recruited from the rural primary care clinic from January 3, 2022 to January 7, 2022. Inclusion criteria were (1) diagnosis of type of 2 diabetes; (2) aged 18 years or older; (3) able to speak or understand English; (4) able to read and write/type; and (5) owned a cellular phone or could obtain one with text capabilities. Patients with a diagnosis of type 1 diabetes or gestational diabetes were excluded from the project. Medical assistants and providers affiliated with the clinic informed the project director of patients who met inclusion criteria. The project director communicated with those patients face-to-face or via telephone, explained the nature of the project, and assessed interest in participation. Consistent with the convenience sampling recruitment method, each patient that expressed interest in participation was included in the project.

Intervention

The 12-week educational text messaging intervention commenced on January 10, 2022, with a total of twenty T2D participants. Each participant received three different educational text messages weekly designed by the project director in accordance with AACE guidelines. These brief messages, with word counts between 14 and 91 words, were delivered on Mondays,

Wednesdays, and Fridays at 12:00 pm via the EZ Texting digital platform. The project director loaded messages into the EZ Texting system a week prior to dissemination and messages were delivered at the appointed time. Messages promoting nutritional health were delivered during the first week and messages promoting physical activity was delivered during the second week of the intervention. Foot care and blood glucose monitoring strategies were delivered during the third and fourth week of the intervention, respectively. General diabetes knowledge, including pathophysiology education, was delivered during the fifth week of the intervention. Behavioral support strategies, including smoking cessation and sleep hygiene considerations, were delivered during the sixth week of the intervention. Message topics were repeated once during weeks seven through twelve of the intervention. To provide more in-depth information about a topic, links to the CDC and the American Diabetes Association website were included in some messages. See Appendix D to view messages dispersed to participants throughout the intervention. See Table 1 to view the intervention timeline.

Table 1

Intervention Timeline

Time Period	Text Message Content
Week One (1/10/22 – 1/14/22)	Nutrition
Week Two (1/17/22 – 1/21/22)	Physical Activity
Week Three (1/24/22 – 1/28/22)	Foot Care <i>*Check-In/Confirm Delivery of Message</i>
Week Four (1/31/22 – 2/4/22)	Blood Glucose Monitoring & Management
Week Five (2/7/22 – 2/11/22)	Diabetes Pathology
Week Six (2/14/22 – 2/18/22)	Behavioral Support <i>*Check-In/Confirm Delivery of Message</i>
Week Seven (2/21/22 – 2/25/22)	Nutrition

Time Period	Text Message Content
Week Eight (2/28/22 – 3/4/22)	Physical Activity
Week Nine (3/7/22 – 3/11/22)	Foot Care <i>*Check-In/Confirm Delivery of Message</i>
Week Ten (3/14/22 – 3/18/22)	Blood Glucose Monitoring & Management
Week Eleven (3/21/22 – 3/25/22)	Diabetes Pathology
Week Twelve (3/28/22 – 4/1/22)	Behavioral Support <i>*Check-In/Confirm Delivery of Message</i>

Text messaging was primarily unidirectional, and participants were advised to contact their HCP if they had any questions regarding message content. The project director sent text messages every three weeks asking patients if they received educational messages during the previous quarter. If there was no response, a second text message was sent. Participants were not dismissed from project if they failed to respond. Participants were only dismissed from the project if they failed to complete post-intervention survey.

Data Collection

Pre-Intervention Data Collection

During the recruitment period, the project director sent participants a link to their mobile phone with instructions on how to complete the pre-intervention survey. Powered by Qualtrics, this survey housed an informed consent disclosure and patients were asked to click “accept” if they consented to participation. Participants were instructed to enter their unique identifier code (date of birth in MMDDYY format) and the project director used this code to match pretest and posttest data. This code was also used to replace the participants’ name when entering their contact information into the EZ Texting system. Key demographic information was obtained, including participant age, race, gender, length of time since initial T2D diagnosis, highest level

of education, and current smoking status. The project director retrieved body mass index (BMI) and hemoglobin A1c (HbA1c) data from the electronic health record. All demographic data was recorded on an excel spreadsheet. Baseline DKQ-15 and SDSCA responses were recorded and stored in the Qualtrics database. All pre-intervention data was later transferred to the statistical package for the social sciences (SPSS) for analysis.

Post-Intervention Data Collection

During the first week of April 2022, the project director sent project participants a link to their mobile phone with instructions on how to complete a Qualtrics-based, post-intervention survey. Reminder text messages were sent to participants every 2 days (for a total of 3 texts) advising them to complete the post-intervention survey. Within the survey, participants were instructed to enter their unique identifier code, and DKQ-15 and SDSCA responses were obtained. Four satisfaction questions were presented regarding the value of educational text messages in facilitating diabetes self-management. See Appendix E to view the project satisfaction survey. Post-intervention data was stored in Qualtrics and later transferred to SPSS for statistical analysis. See Table 2 to view the data collection timeline.

Table 2

Data Collection Timeline

Time Period	Data Collected
Pre-Intervention (1/3/22 – 1/7/22)	Demographic Data DKQ-15 Responses SDSCA Responses
Post-Intervention (4/4/22 – 4/8/22)	DKQ-15 Responses SDSCA Responses Satisfaction Survey Responses

Measurement Tools

Several instruments were used in this project to measure diabetes knowledge and self-care participation, namely the DKQ-15 and the SDSCA. Intended for patients with type 1 and type 2 diabetes, the DKQ-15 is a 15-item questionnaire that measures general diabetes knowledge related to diabetes complications, nutritional and physical activity practices, blood glucose management, and medication adherence (Eigenmann et al., 2011). The SDSCA is an 11-item scale that measures adherence to recommended lifestyle therapies, including healthy diet and exercise practices, routine blood glucose monitoring, proper foot care routines, and smoking avoidance (Toobert et al., 2000).

Reliability and validity data for the DKQ-15 and SDSCA are noteworthy. The DKQ-15 has a test-retest correlation value of 0.62, indicating good test-retest reliability (Eigenmann et al., 2011). The DKQ-15 has good construct validity as well, with no significant differences noted between males and females ($t = 1.07$; $df = 97$; $p > 0.28$) and no significant associations with age ($r = 0.04$) or time since diabetes diagnosis ($r = 0.12$) (Eigenmann et al., 2011). All 15 items were administered to project participants, but two items were omitted from analysis as they solely targeted patients with type 1 diabetes and Australian audiences. Due to its origination in Australia, two questions on the DKQ-15 present blood glucose values in millimoles. According to Barsheshet et al. (2006), one millimole equals 18 milligrams per deciliter. Using this equation, the project director converted blood glucose values from millimoles to milligrams per deciliter for ease of comprehension. See Appendix F to view the DKQ-15 instrument.

Inferior to the DKQ-15, the SDSCA has a test-retest correlation value of 0.40, indicating good test-retest reliability (Toobert et al., 2000). Researchers state the SDSCA has good

criterion-related validity, with a mean correlation coefficient value of 0.23 when compared to other measures of diet and exercise (Toobert et al., 2000). The SDSCA was administered to project participants in its entirety, but two questions relating to blood sugar testing was omitted from analysis as several participants were not advised to gather daily measurements. See Appendix G to view the SDSCA scale.

Data Analysis

Demographic data, including patient age, race, gender, BMI, HbA1c level, smoking status, level of education, and length of time since T2D diagnosis, was analyzed for a descriptive statistic. Mean (with standard deviations) and frequency (percentages) were the primary statistical methods used to summarize demographic variables. A paired *t*-test was used to examine changes in diabetes knowledge, specifically changes in pretest and posttest DKQ-15 scores. A paired *t*-test was also used to examine changes in self-care participation, precisely changes in pretest and posttest SDSCA scores. Descriptive statistics and *t*-test values were computed using the SPSS 28.0 software program.

RESULTS

The structure and culture of the rural primary care clinic was conducive to project success. Healthcare providers were willing to address any questions the participant had concerning the educational text message and HCPs were willing to assist the project director with implementation of the intervention. Since text messages were delivered via a digital platform, day-to-day events at the rural primary care clinic did not significantly impact intervention implementation.

Participant Demographics

Sixty percent of intervention participants responded to the post-intervention survey. Twenty participants completed the pre-intervention survey, while only twelve of those participants, 60%, completed the post-intervention survey. Demographic data presented here represents participants who completed both surveys ($n = 12$, 60%). The mean age of participants was 62.3 ± 12.8 years. Most participants were White Americans ($n = 7$; 58.3%) who self-identified as female ($n = 8$; 66.7%). Most participants were non-smokers ($n = 10$, 83.3%), were diagnosed with T2D more than 5 years ago ($n = 8$, 66.7%), and reported that their highest level of education was a high school diploma ($n = 8$, 66.7%). See Table 3 to view participant demographics.

Table 3

Participant Demographics

Characteristics	
<i>N</i>	12
Age (year)	62.3 ± 12.8
Gender (%)	
Female	66.7
Male	33.3
Race/Ethnicity (%)	
Black	16.7
White	58.3
Hispanic	25.0
Highest Level of Education (%)	
Middle School	8.3
High School/GED	66.7
College Degree	16.7
Graduate Degree	8.3

Characteristics	
BMI (kg/m ²)	28.3 ± 6.5
Hemoglobin A1c (%)	7.4 ± 1.3
T2D Duration (%)	
Less than 1 year	8.3
Between 1 - 5 years	25.0
Greater than 5 years	66.7
Current Smoker (%)	16.7

Project Aim #1: Increase Diabetes Knowledge

One objective for this project was to increase diabetes knowledge among T2D patients, as evidenced by a 10% increase in mean DKQ-15 scores. Mean DKQ-15 scores increased markedly from pretest to posttest (16.0 to 19.2, 13.3% increase). See Table 4 for more details. After the intervention, participants were asked the following question: *Do you feel like the project improved your diabetes knowledge?* Each participant ($n = 12$; 100%) stated that this project improved their diabetes knowledge.

Table 4

Diabetes knowledge and self-care activity pretest and posttest scores

	Mean Pretest Scores	Mean Posttest Scores	Relative Change	<i>t</i>	<i>df</i>	<i>p</i> - value
Diabetes Knowledge Questionnaire - 15 (DKQ-15)	16.0	19.2	13.3%	3.4	11	0.006
Summary of Diabetes Self-Care Activities (SDSCA)						
General Diet	4.3	5.4	15.7%	2.4	11	0.031

	Mean Pretest Scores	Mean Posttest Scores	Relative Change	<i>t</i>	<i>df</i>	<i>p</i> - value
Specific Diet	4.7	4.6	-1.4%	-0.2	11	0.820
Exercise	3.2	3.4	2.8%	0.2	11	0.832
Foot Care	3.5	5.0	21.4%	2.1	11	0.058

Project Aim #2: Increase Self-Care Participation

The second objective for this project was to increase self-care participation among T2D patients, as evidenced by a 10% increase in mean SDSCA scores. With respect to the number of days per week participants engaged in a healthy eating plan (general diet), mean SDSCA scores increased substantially from pretest to posttest (4.3 to 5.4; 15.7% increase). With regards to the number of days per week participants ate fruits and vegetables and avoided high fat foods (specific diet), mean SDSCA scores decreased marginally from pretest to posttest (4.7 to 4.6; 1.4% decrease). Concerning the number of days per week patients engaged in 30 minutes of physical activity, mean SDSCA scores increased marginally from pretest to posttest (3.2 to 3.4; 2.8% increase). With respect to the number of days per week participants engaged in foot care practices, mean SDSCA scores increased appreciably from pretest to posttest (3.5 to 5.0; 21.4% increase). See Table 4 for further details. After the intervention, participants were asked the following question: *Do you feel like the project improved your self-care practices?* Most participants ($n = 11$; 91%) stated that this project improved their self-care skills.

Participant Satisfaction

Participants completed a survey that assessed their level of satisfaction with the educational text messaging project and their desire to receive educational text messages on a long-term basis. Participants were instructed to rank their satisfaction score from 1 (very

satisfied) to 5 (very dissatisfied). Each participant stated that they were either satisfied or very satisfied with the project. One participant replied to a text message by stating, *“I sure do thank you for your care about me.”* Another participant replied to a message by stating, *“Those messages have been very helpful thank you.”* Most participants ($n = 11$; 91%) expressed interest in receiving educational text messages from their HCP on a continual basis.

Missing Data

The initial project proposal included a plan to measure the impact of the intervention on smoking cessation. Nearly half of the participants who completed the pre-intervention survey identified themselves as smokers ($n = 8$, 40%); however, there was a limited number of repeat survey participants who identified as a smoker ($n = 4$, 33%). Thus, results were skewed when measuring the significance of the intervention on tobacco use. Of the four participants who identified as a smoker on the pre-intervention survey, two participants reported continued tobacco use in the post-intervention survey.

DISCUSSION

Diabetes-focused health visits are often limited to twenty or thirty minutes. Many HCPs find it difficult to manage the complexities of this condition and provide comprehensive diabetes education in a short time span. The purpose of this QI project was to determine if an educational text messaging intervention would increase diabetes knowledge and self-care practices among adults with T2D in a rural primary care clinic. Primary aims for this project were to increase mean DKQ-15 and SDSCA scores by 10%. The first aim was met, as mean DKQ-15 scores increased by 13.3% from pretest to posttest. After the intervention, participants were more knowledgeable about the pathophysiology of diabetes, associated complications, as well as nutrition and physical activity recommendations. Participants gained additional knowledge

concerning the negative implications of tobacco use and understood best practices concerning blood sugar management, foot care, and sleep hygiene.

The second aim of this project was partially met. Mean SDSCA scores on the specific diet domain decreased marginally (1.4%) and mean SDSCA scores on the exercise domain increased marginally (2.8%) from pretest to posttest. Mean SDSCA scores on the general diet and foot care domains increased by 15.7% and 21.4%, respectively, from pretest to posttest. After partaking in a 3-month educational text messaging intervention, participants engaged in healthier eating habits, examined their feet more regularly, and inspected their shoes more frequently to detect any objects that may cause injury. Participants were satisfied with the text messaging project and expressed interest in receiving educational messages on a long-term basis.

Key findings noted in this project are comparable to previous research. Hovadick et al. (2019) conducted a study whereby researchers reviewed 23 articles to analyze the effects of educational text messaging on diabetes knowledge and self-care promotion. Investigators in this study found that education delivered via text messaging improved diabetes knowledge, medication adherence, and participation in foot care practices (Hovadick et al., 2019). Similar outcomes were noted in the Dobson et al. (2018) study. These researchers conducted a randomized controlled trial (RCT) to assess the impact of educational text messages on diabetes self-management behaviors and found that foot care practices improved significantly after the text messaging intervention (Dobson et al., 2018). This QI project noted improvements in general dietary habits as well, consistent with prior research. Min (2020) conducted a QI project to assess the impact of mobile technology on diabetes self-management behaviors. Findings from this project revealed that education delivered via mobile technology significantly improved nutritional habits among patients with T2D (Min, 2020).

The success of this intervention was due in large part to the EZ Texting digital platform. Reliable and easy-to-use, this platform delivered educational messages to all participants without any technical difficulties. A second driver for intervention success was the inclusion of educational links. Nutrition and foot care messages included links to the CDC, which could have contributed to the sharp rise in general diet and foot care SDSCA scores. One major challenge in this project was tracking participant engagement. While the EZ Texting platform delivered messages to all participants, it was difficult to assess which patients opened the message and read the content in its entirety.

This QI project was the first of its kind at the rural primary care clinic and has changed the trajectory of healthcare delivery for this organization. Educational resources (diabetes educators, formal diabetes education classes, etc.) are sparse in rural regions and this QI project was an innovative approach to disseminating diabetes education. Improvements in diabetes knowledge and certain self-care practices were observed, which have the potential to improve clinical outcomes (optimal glycemic control, reduction of vascular complications, and improved quality of life) among project participants (Fenwick et al., 2013; Shrivastava et al., 2013).

Limitations

While this QI project was successful, it had several limitations. Only 60% of intervention participants responded to the post-intervention survey, which resulted in a very small sample size ($n = 12$). Due to the small sample size, outcomes observed in this project could have been overestimated and overvalued. Sending additional text reminders to complete the post-intervention survey and offering greater incentives (i.e., vouchers, gift cards, etc.) could have increased the pretest-posttest response rate. The pretest-posttest design used in this project could have led to a response bias as well, leading participants to select higher values on self-care

measures to satisfy the project director. Another limitation was participant demographics. Most participants in this project were White Americans; thus, results may not be generalizable to racial and ethnic minorities with T2D. Future interventions using educational text messages should include a large, diverse sample so results can be studied amongst different cultural groups and possibly generalizable to all T2D patients within the healthcare organization.

Interpretation

Dorothea Orem's Self-Care Deficit Theory of Nursing greatly contributed to the overall success of this project. The theory emphasized the importance of strengthening self-care skills, and the project director drafted educational messages accordingly (Borji et al., 2017). Educational messages outlined foods patients should limit (i.e., chocolate, ice cream, bacon, sausage, biscuits), encouraged the consumption of healthy foods (i.e., nuts, avocados, olives), and advised meticulous foot care (i.e., checking feet for cuts, blisters, ulcers). Following the guidance of Dorothea Orem's Self-Care Deficit Theory of Nursing led to the improvements noted in general eating habits and foot care practices. The motivational undertones of educational messages were heavily influenced by Everett Rogers' Diffusion of Innovations Theory, which surmised that the acceptance or rejection of instruction (or education) was influenced by the element of persuasion (New South Wales Agency for Clinical Innovation, n.d.; Orr, 2003). Several educational messages delivered in this project concluded by stating, "*Let's keep your heart healthy*" or "*Let's keep your feet healthy.*" Those simple, yet persuasive phrases could have contributed to the improvements noted in healthy eating habits and foot care practices.

While this QI project led to significant improvements in general eating habits and foot care practices, no improvements were noted in specific eating habits (fruit and vegetable consumption, avoidance of high fat foods) and small improvements were noted in physical

activity practices. Similar outcomes were noted in the Nepper et al. (2019) study, whereby no significant improvements in specific eating habits or exercise habits were observed secondary to educational text messaging. This QI project commenced in January; thus, it is possible that the cold weather diminished the desire to go outside and exercise. Social distancing guidelines secondary to the COVID-19 pandemic could have deterred participants' from going to the gym to exercise. Osteoarthritis and other debilitating medical conditions could be other reasons why participants in this project did not engage in regular physical activity. Low-income participants could have difficulties with purchasing fruits and vegetables, as these products tend to be more expensive than processed foods (Williams, 2009). Future interventions using educational text messages should detail the importance of fruit and vegetable consumption and list contact information for local food banks. Future projects using educational text messages should also describe "joint-friendly" exercises that can be performed by patients with musculoskeletal (MSK) disorders and detail exercises that can be performed in the home.

Sustainability Plan and Financial Implications

To sustain the improvements noted in this project, educational text messages should be disseminated to patients at least three times weekly on an indefinite basis. A medical receptionist or medical assistant should load messages (custom messages or the messages provided in appendix D) into the EZ Texting system once monthly and specify which day and time each message should be delivered. Expenses associated with educational text messaging are relatively low, as it costs approximately \$75 per month to deliver twelve messages to 20 patients (via the EZ Texting platform). Diabetes self-management training is a reimbursable service, particularly when submitting the G0108 current procedure terminology (CPT) code to insurers. The Centers for Medicare and Medicaid Services (CMS, 2021) reimburses providers \$56.18/patient for the

G0108 CPT code. If 20 Medicare patients participate in the educational text messaging project, the clinic's revenue would be \$1123.60/per month. In addition to increasing the clinic's revenue, the educational text messaging project may indirectly lower the costs associated with diabetes care in America (improved diabetes care leads to optimal glycemic control, a reduction in vascular complications, and fewer hospitalizations; Fenwick et al., 2013).

Conclusions

The results from this QI project demonstrate that educational text messaging is a viable strategy to increase diabetes knowledge, healthy eating habits, and foot care practices among patients with T2D. It is well-documented that educational resources, such as formal diabetes education classes and diabetes educators, are sparse in rural regions. Concomitantly, HCPs have little time to provide comprehensive diabetes education. Educational text messaging represents a feasible solution to both dilemmas. Educational text messaging encourages patients to assume an active role in their health and increases overall patient satisfaction. It has the potential to increase revenue for the healthcare organization and decrease the economic burden of diabetes in America.

This QI project was implemented in one rural primary care clinic but may be implemented in the other clinics associated with this organization, as each clinic has a large T2D population. Future QI projects using educational text messages should include larger sample sizes and patients from diverse ethnic and racial backgrounds. When revising the content of messages, one should consider including contact information for local food banks, "joint-friendly" exercises that can be performed by patients with MSK disorders, and workouts that can be performed in the home. Additional content should be integrated, including messages promoting medication adherence and proper insulin administration. Additional outcomes should

be explored, including the impact of educational text messages on weight reduction. Continuous process improvement is key to improving diabetes outcomes.

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APPENDIX A: TAMU-CC IRB Statement of Determination Letter



Date: December 01, 2021
To: Gloria Park
CC: Merlendi Brown, Tammy McGarity, DNP
From: Office of Research Compliance
Subject: IRB Declaration of Research Not Involving Human Subjects

Dear Gloria Park,

Activities meeting the DHHS definition of research or the FDA definition of clinical investigation and involve human subjects are subject to IRB review and approval. On 12/01/2021, the Office of Research Compliance reviewed the project below and determined that the proposed activity does not meet the FDA definition of a clinical investigation or DHHS definition of research.

Type of Review: Review Board Response Review Submission form
Title of Study: Text Messaging to Improve Knowledge and Self-Care Practices Among Rural Adults with Type 2 Diabetes
Principal Investigator: Gloria Park
IRB Number: TAMU-CC-IRB-2021-0321
Submission Action: IRB Review not Required for projects not meeting the definition of research

Therefore, this project does not require IRB review and you may proceed. This IRB Declaration is in effect from 12/01/2021 and does not expire.

Limits to this determination:

1. This determination corresponds with the versions of the application and attachments in the electronic system most recently approved as of the date of this letter. This determination is issued with the understanding the data collected will be used internally at the clinic site only and not be generalizable. Any planned changes require submission to the IRB to ensure that the research continues to meet the criteria for a non-human subject research determination.
2. This project may NOT be referenced as "IRB approved" or "research".

The following statement can be included in the manuscript: "This project was reviewed and determined to not meet the definition of research involving human subjects by the Texas A&M University IRB - Corpus Christi Institutional Review Board."

Please do not hesitate to contact the Office of Research Compliance with any questions at irb@tamucc.edu.

Sincerely,

Rebecca Ballard, JD
Office of Research Compliance

APPENDIX B: HIPAA Confidentiality Agreement

Calvary Medical Clinic



"Where Your Healing Begins"

CALVARY MEDICAL, PA BUSINESS ASSOCIATE AGREEMENT

This Privacy Agreement ("Agreement"), is effective upon signing this Agreement and is entered into by and between **Calvary Medical Clinic** ("Covered Entity") and Michael Brown (the "Business Associate").

1. **Term.** This Agreement shall remain in effect for the duration of this Agreement and shall apply to all of the Services and/or Supplies delivered by the Business Associate pursuant to this Agreement.
2. **HIPAA Assurances.** In the event Business Associate creates, receives, maintains, or otherwise is exposed to personally identifiable or aggregate patient or other medical information defined as Protected Health Information ("PHI") in the Health Insurance Portability and Accountability Act of 1996 or its relevant regulations ("HIPAA") and otherwise meets the definition of Business Associate as defined in the HIPAA Privacy Standards (45 CFR Parts 160 and 164), Business Associate shall:
 - a) Recognize that HITECH (the Health Information Technology for Economic and Clinical Health Act of 2009) and the regulations thereunder (including 45 C.F.R. Sections 164.308, 164.310, 164.312, and 164.316), apply to a business associate of a covered entity in the same manner that such sections apply to the covered entity;
 - b) Not use or further disclose the PHI, except as permitted by law;
 - c) Not use or further disclose the PHI in a manner that had **Calvary Medical Clinic** done so, would violate the requirements of HIPAA;
 - d) Use appropriate safeguards (including implementing administrative, physical, and technical safeguards for electronic PHI) to protect the confidentiality, integrity, and availability of and to prevent the use or disclosure of the PHI other than as provided for by this Agreement;
 - e) Comply with each applicable requirements of 45 C.F.R. Part 162 if the Business Associate conducts Standard Transactions for or on behalf of the Covered Entity;
 - f) Report promptly to **Calvary Medical Clinic** any security incident or other use or disclosure of PHI not provided for by this Agreement of which Business Associate becomes aware;
 - g) Ensure that any subcontractors or agents who receive or are exposed to PHI (whether in electronic or other format) are explained the Business Associate obligations under this paragraph and agree to the same restrictions and conditions;
 - h) Make available PHI in accordance with the individual's rights as required under the HIPAA regulations;

Cleveland Clinics
108 S. William Barnett Ave
Cleveland TX 77327
281-592-9775
Fax: 281-432-0548

Livingston Clinic
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Livingston, TX 77351
936-327-1055
Fax: 936-229-8800

Humble Clinic
8484 Will Clayton Pkwy
Humble, TX 77338
832-995-5200
Fax: 281-995-5201

- i) Account for PHI disclosures for up to the past six (6) years as requested by Covered Entity, which shall include: (i) dates of disclosure, (ii) names of the entities or persons who received the PHI, (iii) a brief description of the PHI disclosed, and (iv) a brief statement of the purpose and basis of such disclosure;
 - j) Make its internal practices, books, and records that relate to the use and disclosure of PHI available to the U.S. Secretary of Health and Human Services for purposes of determining Customer's compliance with HIPAA; and
 - k) Incorporate any amendments or corrections to PHI when notified by Customer or enter into a Business Associate Agreement or other necessary Agreements to comply with HIPAA.
3. **Termination Upon Breach of Provisions.** Notwithstanding any other provision of this Agreement, Covered Entity may immediately terminate this Agreement if it determines that Business Associate breaches any term in this Agreement. Alternatively, Covered Entity may give written notice to Business Associate in the event of a breach and give Business Associate five (5) business days to cure such breach. Covered Entity shall also have the option to immediately stop all further disclosures of PHI to Business Associate if Covered Entity reasonably determines that Business Associate has breached its obligations under this Agreement. In the event that termination of this Agreement and the Agreement is not feasible, Business Associate hereby acknowledges that the Covered Entity shall be required to report the breach to the Secretary of the U.S. Department of Health and Human Services, notwithstanding any other provision of this Agreement or Agreement to the contrary.
4. **Return or Destruction of Protected Health Information upon Termination.** Upon the termination of this Agreement, unless otherwise directed by Covered Entity, Business Associate shall either return or destroy all PHI received from the Covered Entity or created or received by Business Associate on behalf of the Covered Entity in which Business Associate maintains in any form. Business Associate shall not retain any copies of such PHI. Notwithstanding the foregoing, in the event that Business Associate determines that returning or destroying the Protected Health Information is infeasible upon termination of this Agreement, Business Associate shall provide to Covered Entity notification of the condition that makes return or destruction infeasible. To the extent that it is not feasible for Business Associate to return or destroy such PHI, the terms and provisions of this Agreement shall survive such termination or expiration and such PHI shall be used or disclosed solely as permitted by law for so long as Business Associate maintains such Protected Health Information.
5. **No Third Party Beneficiaries.** The parties agree that the terms of this Agreement shall apply only to themselves and are not for the benefit of any third party beneficiaries.
6. **De-Identified Data.** Notwithstanding the provisions of this Agreement, Business Associate and its subcontractors may disclose non-personally identifiable information provided that the disclosed information does not include a key or other mechanism that would enable the information to be identified.

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7. **Amendment.** Business Associate and Covered Entity agree to amend this Agreement to the extent necessary to allow either party to comply with the Privacy Standards, the Standards for **Electronic** Transactions, the Security Standards, or other relevant state or federal laws or regulations created or amended to protect the privacy of patient information. All such amendments shall be made in a writing signed by both parties.
8. **Interpretation.** Any ambiguity in this Agreement shall be resolved in favor of a meaning that permits Covered Entity to comply with the then most current version of HIPAA and the HIPAA privacy regulations.
9. **Definitions.** Capitalized terms used in this Agreement shall have the meanings assigned to them as outlined in HIPAA and its related regulations.
10. **Survival.** The obligations imposed by this Agreement shall survive any expiration or termination of this Agreement.

Calvary Medical Clinic

Sign: Amber Walters
Name: Amber Walters
Title: General Manager
Date: 9/8/2021

VENDOR:

Sign: Merendi Brown
Name: Merendi Brown
Title: Nurse Practitioner - DNP Student
Date: 9/8/21

Return to: Calvary Medical Clinic
Attn: Amber Walters
108 S William Barnett Ave
Cleveland, TX 77327

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APPENDIX C: Facility Support Letter



Calvary Medical Clinic

"Where Your Healing Begins"

September 8, 2021

JOSEPH GOIN, M.D.
Pediatrics/General Medicine
F A A P, F A B D A

Tantasha Jones, NP
Family Practice

Brittany Reynolds, NP
Family Practice

Latresha McBride, MD
Pediatrics

Wendy Sharp, FNP-BC
Family Practice

Susan Manuel, PA-C
Family Practice

Jennifer Livingston, PA-C
Family Practice

Karon Young-Lightbody, MD
Pediatrics

Dr. Raoul Perez, MD
Family Practice

Melanie Fombang, NP
Family Practice

Amber Walters
General Manager

Nancy Sanchez
Cleveland – Office Manager

Tammy Daniels
Livingston – Office Manager

Felicia Tousant
Humble – Office Manager

Dr. Tammy McGarity
DNP Program Coordinator
College of Nursing and Health Sciences
Texas A&M University – Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412

Dear Dr. McGarity,
The purpose of this letter is to provide Merlendi Brown, 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 Calvary Medical Clinic. The project, Text Messaging to Improve Self-Management Skills Among Adults with Type 2 Diabetes Mellitus, entails sending educational text messages to promote healthy dietary habits, physical activity practices, smoking cessation, blood glucose monitoring, and foot care strategies.

The purpose of this project is to determine if text messaging can improve diabetes self-management skills among adults with type 2 diabetes. Calvary Medical Clinic was selected for this project because formal diabetes education classes are sparse in rural settings and the findings of this project could benefit members of the community. Merlendi Brown is not employed at this institution but has an interest in improving care at this facility.

I, Dr. Joseph Goin, administrator at Calvary Medical Clinic, do hereby fully support Merlendi Brown in the conduct of this quality improvement project, Text Messaging to Improve Self-Management Skills Among Adults with Type 2 Diabetes Mellitus at Calvary Medical Clinic.

I also approve Merlendi Brown to access protected health information (PHI) for purposes of conducting this quality improvement project. She has signed a HIPAA release form.

Sincerely,

Joseph Goin, Doctor of Medicine
Administrator at Calvary Medical Clinic

APPENDIX D: Text Message Content for Project Participants

Domain	Content of Text Message
Nutrition (Intervention Weeks 1 & 7)	<p>M) Remember to eat five servings of fresh fruits (apples, bananas, raspberries, etc.) and vegetables (spinach, broccoli, etc.) every day. Fruits and vegetables can lower your blood sugar levels. Happy eating!</p> <p>W) Try to cut back on foods high in saturated fats, like chocolate, ice cream, bacon, sausage, and biscuits. Instead, eat food like nuts, avocado, olives. Let's keep your heart healthy!</p> <p>F) Count your carbohydrates! If you eat 1800 calories in a day, about 200 calories should come from carbohydrates. For more information, visit: https://www.cdc.gov/diabetes/managing/eat-well/diabetes-and-carbohydrates.html</p>
Physical Activity (Intervention Weeks 2 & 8)	<p>M) Try to exercise 30 minutes daily, 5 days out of the week. Brisk walking is a great form of exercise. Regular physical activity can lower your blood pressure, blood sugar, and cholesterol levels. Regular exercise can also improve your mood!</p> <p>W) Need motivation to exercise? Try to find a workout partner like a family member or co-worker. Working out with others can be fun and helps you achieve your health goals! For more information, visit: https://www.cdc.gov/diabetes/managing/active.html</p> <p>F) Try not to go two days in a row without exercising. The more you exercise, the more of a habit it will become.</p>
Foot Care (Intervention Weeks 3 & 9)	<p>M) Check your feet daily! Look for cuts, redness, ulcers, blisters, or any other changes to your nails or skin. If you notice any of these findings, contact your primary care doctor. For more information on how to keep your feet healthy, visit: https://www.cdc.gov/diabetes/library/features/healthy-feet.html</p> <p>W) Wash your feet daily with warm water. Make sure the water is not too hot. Dry feet completely and apply lotion to the top and bottom of your feet. Do not apply lotion between toes, as this could lead to an infection.</p> <p>F) Never go barefoot! Please wear socks and shoes when outdoors and wear socks and slippers/shoes when indoors. Also, please check your shoes before putting them on! Look inside your shoes for anything that could cause injury, like loose objects, pebbles, or rough spots. Check the bottom of your shoes for any nails or tacks that may injure your feet. Let's keep your feet healthy!</p>
	<p>M) Sweating, shaking, irritability/confusion, dizziness, excess hunger, and a fast heartbeat are signs of low blood sugar. If you are experiencing these symptoms, please check your blood sugar level. Blood sugar levels less than 70 mg/dL are considered low. You can</p>

<p>Blood Glucose Monitoring and Management (Intervention Weeks 4 & 10)</p>	<p>raise this level by drinking ½ cup of fruit juice or regular (not diet) soda. Wait 15 minutes then check your blood sugar level again.</p> <p>W) Feeling very tired, extremely thirsty, blurred vision, and urinating (peeing) more than usual are signs of high blood sugar. Please check your blood sugar levels if you are experiencing these symptoms. Typically, levels higher than 130 mg/dL before meals and 180 mg/dL two hours after meals are considered high. Follow your provider's recommendations for treating high blood sugar.</p> <p>F) If you become sick, check your blood sugar levels more often (every 2 to 4 hours). If you are extremely sick and unable to check your blood sugar levels, please contact your primary care doctor, or go to the nearest emergency department.</p>
<p>Diabetes Knowledge (Intervention Weeks 5 & 11)</p>	<p>M) Type 2 diabetes results when the body does not respond to or does not produce enough insulin, a hormone created by the pancreas. When this happens, blood sugar levels may increase. Blood sugar levels that remain high for a long period of time may lead to complications like heart disease, infections, blindness, kidney problems, foot ulcers, and loss sensation to hands and feet. Your doctor will likely check your kidney function levels and nerve sensation at least once yearly. Please make an appointment see your eye doctor once yearly as well!</p> <p>W) Your doctor may routinely order a hemoglobin A1c test. This provides an average of your blood glucose levels over 3 months. Hemoglobin A1c levels less than or equal to 7% lowers your risk of developing long-term diabetes complications.</p> <p>F) While there is no known cure for diabetes, you can control this condition by taking medications and/or participating in healthy lifestyle habits.</p>
<p>Behavioral Support (Intervention Weeks 6 & 12)</p>	<p>M) Try to get 6-8 hours of sleep per night. Getting sufficient sleep can help with controlling your blood sugar levels.</p> <p>W) Please avoid all tobacco products. Tobacco products may increase your blood sugar levels.</p> <p>F) Join an online diabetes support community! Research shows that individuals involved in these communities tend to have better blood glucose levels. <i>To join the American Diabetes Association (ADA) support community, visit: https://community.diabetes.org/join</i></p>

1. Rate your level of satisfaction regarding the educational text messaging project.
 - 1) Very Satisfied
 - 2) Satisfied
 - 3) Neutral
 - 4) Dissatisfied
 - 5) Very Dissatisfied
2. Do you feel like the project improved your diabetes knowledge?
 - 1) Yes
 - 2) No
3. Do you feel like the project improved your self-care practices (diet, exercise, foot care, etc.)?
 - 1) Yes
 - 2) No
4. Would you like to receive diabetes-related educational text messages on a long-term basis?
 - 1) Yes
 - 2) No

APPENDIX F: Diabetes Knowledge Questionnaire – 15

DIABETES KNOWLEDGE QUESTIONNAIRE TEST YOUR KNOWLEDGE AND UNDERSTANDING OF DIABETES AND ITS MANAGEMENT YOUR NAME:	
<p>Dear participant</p> <p>Please read the instruction for each question carefully as the required responses change from 'circle ONE answer only' to 'circle AS MANY as apply'.</p> <p>Please assist us by answering ALL questions on EVERY page.</p>	
<p>1. What is the ideal range for blood glucose (sugar) levels a person with diabetes should aim for? <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. 2 to 6mmol/L b. 7 to 13mmol/L c. 4 to 8mmol/L d. 4.5 to 15mmol/L e. Unsure 	<ul style="list-style-type: none"> c. It can help to regulate a person's mood d. It can reduce the risk of skin cancer e. It can lower cholesterol levels f. Unsure
<p>2. A blood test called HbA_{1c} (or A_{1c}) measures the average blood glucose levels over the past 2 to 3 months. What is the HbA_{1c} result that indicates a lowest risk of developing long-term diabetes complications? <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. Less than or equal to 7% b. Less than 8% c. 9% d. Less than or equal to 10% e. Unsure 	<p>6. How often should people with diabetes exercise or be physically active? <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. Most days of the week for at least 30 minutes b. Once a week for at least 30 minutes c. Once a month for one hour d. At least every fortnight for two hours e. Unsure
<p>3. Diabetes is a condition that: <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. Can be cured by adopting a healthy lifestyle b. Can be cured with tablets and/or insulin c. Is currently not curable d. Is always life threatening when first diagnosed e. Unsure 	<p>7. Well-managed diabetes decreases the risk of: <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. Kidney damage b. Blindness c. Melanoma d. Heart disease e. Foot ulcers f. Unsure
<p>4. Which of the following statements about diabetes and diet is true? <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. People with diabetes should eat a sugar free diet b. It is OK to eat fried take away food three times a week c. Red meat is a carbohydrate food d. A diet which is low in fat, high in fibre, low in added sugar is recommended for everyone with diabetes e. Unsure 	<p>8. What foot problems are people with diabetes most at risk of? <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. Poor circulation b. Loss of feeling in the feet c. Foot ulcers d. Hammer toe e. Infections f. Unsure
<p>5. Why is doing regular exercise or being physically active good for your health? <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. It can help to control blood glucose levels b. It can lower blood pressure 	<p>9. Why are people with diabetes advised to test their own blood glucose (BG)? <i>Please circle ONE option only</i></p> <ul style="list-style-type: none"> a. To alert them to changes in BG level patterns b. To help make decisions in relation to exercise, treating 'hypos' (low BG) or sick-day management c. It can make people more confident in looking after their diabetes d. All of the above e. Unsure
<p><i>(continued on next page)</i></p>	

<p>10. What should a person with diabetes do if s/he becomes ill (e.g. flu, gastric upset, infection)? <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. Check blood glucose level more frequently (every 2 to 4 hours) b. Stop taking all diabetes tablets and/or insulin c. Drink lots of non-sweet fluid if blood glucose levels are over 15mmol/L d. Seek medical attention if very unwell and unable to check blood glucose e. Try to do as much exercise as possible to lower blood glucose levels f. Unsure 	<ul style="list-style-type: none"> c. Immediately have some sugary food or drink (e.g. jelly beans, soft drink) d. Drink some diet soft drink e. Unsure 	
<p>The next question (No 15) is to be completed by people with or carers of people with type 1 diabetes only</p>		
<p>11. People with diabetes need a medical check-up of their eyes, nerve and kidney function at least: <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. Every month b. Six monthly c. Once a year d. Every two to three years e. Unsure 	<p>15. A person with type 1 diabetes feeling unwell and unable to eat should: <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. Check blood glucose and ketone levels at least every 2 hours b. Drink carbohydrate containing (sugary) fluids if blood glucose below 15mmol/L c. Go to the hospital if persistent vomiting and/or diarrhoea d. Stop taking all insulin e. Seek medical advice for adjusting insulin doses f. Unsure 	
<p>12. The National Diabetes Services Scheme (NDSS): <i>Please circle AS MANY as apply, or circle 'Unsure'</i></p> <ul style="list-style-type: none"> a. Allows members to purchase blood glucose testing strips at reduced price b. Offers members free syringes and insulin pen needles c. Is only available to people on low incomes d. Is available to people with all types of diabetes e. Is free to join f. Unsure 	<p>16. Finally, we would like to ask you some questions about yourself. This questionnaire is strictly confidential. Please assist us by answering all questions.</p>	
<p>The following questions (13 and 14) are to be completed by people taking diabetes medication (i.e. blood glucose lowering tablets or insulin) <i>If you are not taking any diabetes medication please go to question No 16</i></p>		
<p>13. Which of the following statements about diabetes medication is true? <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. If blood glucose levels are normal for two months, diabetes medication can be stopped b. Tablets for diabetes work by increasing blood glucose levels c. Regular medical check-ups are necessary to assess the need for adjustments to diabetes medication d. People taking diabetes medication do not need to worry about healthy eating e. Unsure 	<p>What is your age? years</p> <p>What is your gender? Female <input type="checkbox"/> Male <input type="checkbox"/></p> <p>How long have you had diabetes? years or months or days</p> <p>What type of diabetes do you have? Type 1 <input type="checkbox"/> Type 2 <input type="checkbox"/> Unsure <input type="checkbox"/> Other <input type="checkbox"/> please specify</p> <p>Do you take diabetes medication? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes <input type="checkbox"/> glucose lowering tablets and/or <input type="checkbox"/> insulin</p> <p>If you ticked insulin how many injections per day? <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> Other, please specify</p> <p>If you ticked glucose lowering tablets, how many different tablets? <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> Other, please specify</p> <p>Have you ever seen a Diabetes Educator? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Have you ever seen a Dietitian? Yes <input type="checkbox"/> No <input type="checkbox"/></p>	
<p>14. If a person with diabetes has a hypo (low blood glucose level) reaction, s/he should: <i>Please circle ONE answer only</i></p> <ul style="list-style-type: none"> a. Immediately take some insulin or diabetes tablets b. Rest and wait until s/he feels better 	<p>Thank you very much for completing this questionnaire!</p>	

Adapted from “Development and validation of a diabetes knowledge questionnaire,” by C. A. Eigenmann, T. Skinner, & R. Colagiuri, 2011, *Practical Diabetes International*, 28(4), pp. 166-170

APPENDIX G: Summary of Diabetes Self-Care Activities Scale

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.

Diet

Number of Days

1. How many of the last SEVEN DAYS have you followed a healthful eating plan? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
2. On average, over the past month, how many DAYS PER WEEK have you followed your eating plan? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
3. On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
4. On how many of the last SEVEN DAYS did you eat high-fat foods, such as red meat or full-fat dairy products? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

Physical Activity

5. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
(Total minutes of continuous activity, including walking).
6. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

Blood Sugar Testing

7. On how many of the last SEVEN DAYS did you test your blood sugar? Number of Days
- ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
8. On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health-care provider?
- ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

Foot Care

9. On how many of the last SEVEN DAYS did you check your feet? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
10. On how many of the last SEVEN DAYS did you inspect the inside of your shoes? ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7

Smoking

11. Have you smoked a cigarette, even a puff, in the past SEVEN DAYS? ☐0 No ☐1 Yes ≡
- 11a. If yes, how many cigarettes did you smoke on an average day?
- Number of cigarettes:

Adapted from “The summary of diabetes self-care activities measure: Results from 7 studies and a revised scale,” by D. J. Toobert, and S. E. Glasgow, 2000, *Diabetes Care*, 23(7), 943-950