Development and Evaluation using Digital Health Technology to Enhance Self-Management Behavior Among Adult Patients with Type 2 Diabetes Mellitus

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Title: Development and Evaluation using Digital Health Technology to Enhance Self-Management Behavior Among Adult Patients with Type 2 Diabetes Mellitus

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Abstract

Diabetes is an endocrine disorder that occurs when the pancreas is either not producing enough insulin for body or the cells are not responding to secreted insulin. The prolonged hyperglycemia will predispose individuals with type 2 diabetes mellitus to early development of diabetes-associated complications such as lower limb amputation, nephropathy, retinopathy, neuropathy, and cardiovascular sequela. Seven percent of the population of Prince George's County, Maryland has been diagnosed with diabetes, with most of these patients suffering from one or more diabetes-related complications attributed to lack of self-care management activities. This led to a quality improvement project to study the effects of a mobile self-management application on enhancing self-care management to keep plasma glucose level under control. The Chronic Care Model guided the implementation of this project. A quantitative methodology with a pre-test, post-test design was used. This project enrolled participants between the ages of 18 to 65 years receiving care in a wellness clinic located at Prince George County, Maryland. Statistical Package for Social Sciences (SPSS) version 25.0 was used to determine relation between use of the Glucose Buddy Pro mobile self-management app and participant self-care knowledge. The project found a statistically significant association between use of the app and participant knowledge.

Keywords: *Type 2 diabetes mellitus, Plasma glucose level, Knowledge for self-care, mobile self-App*

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ABBREVIATIONS

ADA – American Diabetes Association

APRN – Advanced Practice Registered Nurse

BMI – Body mass index

CCM – Chronic Care Model

DNP – Doctor of Nursing Practice

DSMQ – Diabetes Self-Management Questionnaire

EBP – Evidence-based practice

HbA1c – Hemoglobin A1c

PICOt – Population, Intervention, Comparison, Outcome, and Time

RCT – Randomized controlled trial

T2DM – Type 2 diabetes mellitus

CHAPTER ONE

THE PROBLEM

Problem Description

Diabetes mellitus is a chronic endocrine illness in which the pancreas either does not produce enough insulin to meet the body's needs or the cells do not respond to the insulin released. Diabetes is a major public health concern, affecting 422 million people in the United States in 2016. (World Health Organization, 2020). The American Diabetes Association (ADA)'s current guidelines define diabetes as having a fasting plasma glucose of 126 mg/dL, a glucose tolerance test of 200 mg/dL, or a hemoglobin A1c level (HbA1c) of 6.5% (ADA, 2017). Diabetes mellitus can be extremely debilitating.

There is an upward trend in the risk of diabetes mellitus among low-middle-income working-class Americans attributable to physical inactivity and obesity. This is because obesity causes insulin-mediated peripheral glucose uptake resistance, which is a characteristic of type 2 diabetes mellitus (T2DM). The area where the DNP candidate`s clinical assignment is headquartered, Prince George's County, Maryland, is primarily made up of low-middle-income families, most of whom are immigrants from different parts of the world. Most of these people do not have access to medical treatment, and they were shown to have poor diabetes control, especially in the early stages of the disease, which may lead to diabetic complications (Kumsar et al., 2019). As a result of the high prevalence of childhood and teenage obesity in Prince George's County, there has been heightened concern that the incidence of T2DM will continue to climb significantly (Prince George’s County Health Department, 2017). Evidence suggests that behavioral risk factors are to blame for an increase in the number of people with T2DM with one or two diabetes-related complications. (Prince George's County Health Department, 2017).

Diabetes-related complications such as non-traumatic lower extremity amputation, end-stage renal disease, blindness, cardiovascular disease, and neuropathy have a startling morbidity and mortality rate. Increasing patients' awareness of the disease's nature, complications, and control through education and knowledge can help patients become more involved in their own treatment, which can lead to reduced complications, lower morbidity and mortality, and improved quality of life (Ghimire & Devi, 2018).

A mobile self-management app is a cost-effective tool for patients with T2DM in Prince George's County for improving plasma glucose levels, increasing self-care knowledge, and delaying or preventing the onset of diabetic complications. Patients with T2DM using the app can receive self-management reminders at no cost, which will boost their chances of accepting the notion of self-care and diabetes self-management. This technology can improve communication between the patient and the health care practitioner. Patients with T2DM can find inspiration and motivation to learn new skills and gain knowledge for good diabetic self-care using apps like the Glucose Buddy Pro app (Lavelle et al., 2016). Individuals with T2DM will be more proactive in managing their diabetes with the use of this app, resulting in better health outcomes (Ghimire & Devi, 2018). The results from a study by Russell (2019) indicated that web-enabled technology provides a constant reminder to patients to engage in self-management activities helps to promote adherence in diabetic care.

Traditional care of T2DM requires a multidimensional and collaborative approach between physicians and patients. However, this sort of management strategy does not empower patients to be actively involved in their illness management. Instead, it establishes a platform in which the patient is not involved in the management of their disease at all; rather, the physician

makes all decisions for the patient (Russell, 2019). This type of approach prevents patients from learning new abilities for disease self-management.

Diabetes is a formidable public health problem. The financial cost of managing T2DM is enormous. According to the ADA (2018), the total projected cost of the illness in 2017 was $327 billion, which included $237 billion in direct medical expenses and $90 billion in lost productivity. In 2017, 24.7 million individuals were diagnosed with T2DM, or 7.6% of the population of the United States (ADA, 2018). The cost of buying diabetes medicine and other items was projected to be $15 billion for insulin, $15.9 billion for other anti-diabetic treatments, and $71.2 billion for excessive use of other prescription prescriptions (ADA, 2018).

The goal of an advanced practice registered nurse (APRN) is to enhance the quality and cost of care provided to the people they serve, as well as their overall health. As change agents, APRNs use evidence-based knowledge to improve their practice. T2DM is a global health issue that necessitates immediate action to improve the situation of diabetic people. According to the World Health Organization (2020), diabetes will become more common, with up to 366 million people worldwide estimated to be affected by 2030. T2DM is a chronic illness that can lead to problems if it is not effectively managed. Healthcare professionals, particularly APRNs, can address the knowledge gap in self-management of T2DM while also empowering patients to take an active role in their own treatment. According to the American Association of Diabetes Educators (2020), behavior modifications are a critical component in the management of T2DM. The role of the APRN in implementing a mobile app aimed at improving self-care behaviors among patients with T2DM is critical. Information about healthy eating, exercise, and minimizing risky behaviors linked to diabetes progression and the early development of diabetes-related co-morbidities are all examples of self-care activity. The use of a mobile self-

management software is based on evidence-based practice and is tailored to the needs, cultural orientation, and personal goals of every patient (Centers for Disease Control and Prevention, 2017). Patients with T2DM can be educated on how to eat well, exercise, cope with psychosocial concerns connected with diabetes, and have their plasma glucose levels monitored by an APRN. The evidence suggests that using mobile self-management apps as part of a patient's treatment plan can improve treatment outcomes. Patients with T2DM may be encouraged to use a mobile self-management app to gain information and skills for diabetes self-care, as well as to gain a better understanding of the diabetes disease process (Heter, 2019).

Rationale

Theoretical Framework

Chronic diseases are the leading cause of death and disability in the United States. Roughly half of the U.S. population suffers from one or more chronic diseases. Chronic disease is on the rise, posing a public health threat in both industrialized and developing nations. Every year, chronic diseases account for 70% of all deaths, or 1.7 million people (Potter & Wilson, 2017). Diabetes is a chronic illness with long-term effects. Self-management is vital for patients to avoid severe consequences and co-morbidities. Many of the projects to address this issue in primary care settings are based on the MacColl Institute for Healthcare Innovation at Group Health Cooperative's Chronic Care Model (CCM) (Davy et al., 2015). CCM is a framework for patient self-management and communication with their care team, community, and care provider (Potter & Wilson, 2017). For example, good interactions between a prepared proactive practice team and an informed empowered patient will result in greater patient self-care behavior. The CCM focuses on six areas for such changes: delivery system design, self-management aid, clinical information system, decision support, health system, and community involvement (Potter

& Wilson, 2017). The American Diabetes Association's guidelines of care recommend CCM as a way for improving diabetes therapy (ADA, 2017). CCM has informed diabetes treatment in several settings, and it has been demonstrated to support lowered HbA1c levels and improved cardiovascular risk factors (Potter & Wilson, 2017). This theoretical framework validates the importance of patient involvement and self-care attitude in monitoring their own plasma glucose level, which has been made possible by self-management education delivered via a mobile self-app.

Assumptions

There is an assumption of an individual's self-efficacy in this endeavor. Individual self-efficacy determines a person's ability to adjust their behavior to attain desired goals (Yu et al., 2020). Substantial levels of self-efficacy are required to carry out difficult tasks of lifestyle adjustments for better outcomes in people with T2DM (Yang et al., 2021). It is also assumed that the participants do not know much about diabetes and how to prevent it, which is one of the leading causes of health complications for diabetic patients. Delivering educational programs incorporating self-management skills can help to prevent diabetic complications like hyperglycemia (Lin et al., 2020). Another assumption in this study is that deploying an evidence-based diabetes self-management app is the best way to improve disease outcomes by facilitating self-care activities (Lin et al., 2020).

Specific Aims

It is unknown whether diabetes self-management education offered to adult patients aged 18-65 years with T2DM using the Glucose Buddy Pro app can improve diabetes self-management in patients seen at a primary care clinic in Prince George’s County, Maryland. There is no systematic, evidence-based program in place at the clinic to manage patients with

T2DM. However, evidence-based projects have demonstrated improved self-management with the use of digital health interventions. Typically, the clinic sees adolescents and adults with chronic diseases like diabetes, many of whom have uncontrolled plasma glucose levels, little to no understanding of the repercussions of hyperglycemia, and a lack of self-care expertise. Diabetes self-management education aims to enable diabetic patients to monitor their plasma glucose levels and improve their self-care management by bridging the management gap prevalent in these patients. Uncontrolled T2DM frequently leads to diabetes-related problems such as blindness, kidney failure, lower extremity amputation, cardiomyopathies, and other consequences (Chester et al., 2018), necessitating action to guarantee optimal diabetes management. From an assessment of 200 patients who came to the practice site clinic for the management of T2DM, it was discovered that 8% had already developed one or two diabetes-related complications, attributable to lack of proper self-management. Among those these patients, 20% had third stage renal disease, 50% had peripheral neuropathy, and 30% had developed other diseases including eye problems. Evidence-based studies show that the use of apps such as Glucose Buddy Pro could mitigate this health issue, which is why the DNP candidate chose this app to enhance patient`s self-management knowledge and skills with the aim of reducing the number of people developing diabetes-related complications at the project site. Thus, all patients with T2DM coming into the clinic incorporated this self-management app as part of their treatment plan.

Nature of Project Design

The impact of using a mobile self-management app on T2DM patients' self-management knowledge was assessed using a quantitative approach. The app provides regular reminders for self-management. Patient’s self-management knowledge was evaluated pre- and

postintervention. Diabetes Self-Management Knowledge Levels and Use of Mobile Self-Management App were the dependent and independent variables, respectively. The Diabetes Self-Management Questionnaire (DSMQ) was used to identify patients with knowledge of T2DM and a desire to alter their behavior (Schmitt et al., 2016). The tool primarily assessed patients' understanding of the illness process, survival skills, food essentials for planning healthy meals, medication adherence, sick care, foot care, and complication avoidance. Maintaining a Diabetes Self-Management Activity Log (CDC, 2017), which includes a record of daily fasting blood glucose values and a self-administered brief analysis practice questionnaire, was also part of the study data tool.

PICOt Question

In adult patients diagnosed with Type 2 diabetes mellitus (P), how does the use of the Glucose Buddy Pro mobile self-management app (I) versus the traditional method of care (patient waiting for clinician guidance) (C) affect self-care management (O) over 6 weeks(t)?

- P = Adults with Type 2 diabetes mellitus
- I = Use of Glucose Buddy Pro mobile self-management app
- C = Traditional method of care
- O = Self-care management
- t = Six weeks

The facts provided by the health department guided this PICOt question. Diabetes affects 7% of the population of Prince George's County, Maryland (52,448 persons), and the majority of these patients suffer one or more diabetes-related co-morbidities (Prince George’s County Health Department, 2017). According to data from the Prince George's county death register, diabetes was the fourth largest cause of death in the county, accounting for 4% of all deaths (Prince

George's County Health Department, 2017). Most inhabitants of Prince George's County do not have access to high-quality healthcare. By the time they present themselves at the clinic for a wellness visit, many patients, particularly those from minority groups, have no knowledge of self-care and already have one or two diabetes-related complications (Prince George's County Health Department, 2017).

Purpose of the Project

The purpose of this clinical improvement project is to determine if self-care knowledge levels as measured by the DSMQ in adult patients with T2DM who are being treated in a primary care setting in Maryland may improve after using the Glucose Buddy Pro self-management app. According to a recent study conducted by Rowley et al. (2017), 30 percent of Maryland residents with T2DM suffer diabetes-related problems, with most diabetic patients not engaging in diabetes self-management (Rotberg et al., 2016). This shows that T2DM has not been adequately treated, and any previous efforts taken prior to the introduction of a mobile self-management app were ineffective. The explanation for this was that people with T2DM have not engaged in self-care activities and have not experienced improved plasma glucose levels (Surucu et al., 2017). It is critical that the healthcare system adopts the use of a mobile self-management app with regular reminders as a standard of practice for the management of T2DM to close the gap left by prior traditional practices (Bene et al., 2019).

Definition of Terms

Body Mass Index (BMI): BMI is a calculation that takes a person's weight in kilograms and divides it by their square height in meters. It is used to determine if a person's weight puts them at risk of disease (Centers for Disease Control and Prevention, 2016a).

Co-morbidity: Having more than one disease or condition is referred to as co-morbidity (Centers for Disease Control and Prevention, 2016).

Diabetes: Diabetes is defined as a set of metabolic illnesses that result in hyperglycemia because of a deficiency in insulin synthesis, insulin function, or both (ADA, 2017). The autoimmune death of pancreatic cells is linked to the pathophysiology of diabetes, which results in a lack of insulin synthesis and insulin action resistance. Urine frequency, thirst, hunger, weight loss, and blurred vision are all common hyperglycemic symptoms. Ketoacidosis, a life-threatening consequence of untreated diabetes, is the most common (ADA, 2017).

Diabetes Self-care: Healthy coping, healthy eating, being active, taking medication, monitoring, reducing risk, and problem-solving form the framework for diabetes self-care. Education specialists can partner with people with diabetes, prediabetes, and cardiometabolic conditions to support informed decision making.

Mobile Self-management App: Apps that capture diabetes-related health data, provide education, and connect patients to support networks have the potential to help people manage their diabetes and improve their results (Yang et al., 2021).

Summary

In this chapter, the DNP student reviewed the significance and impact of the type 2 diabetes mellitus; described the theoretical basis and conceptual framework for the DNP Project; and provided specific aims including the PICOt question and purpose of this DNP Project.

In the next chapter, the DNP student will: describe the search strategy; introduce the Ohio State University Evidence-Based Practice model and its relationship to the project; and provide analysis and synthesis of supporting evidence related to this Quality Improvement Project and PICOt question.

CHAPTER TWO

LITERATURE REVIEW

Search Strategy

A comprehensive electronic database search was performed to further examine the APRN-led intervention using Digital Health Technology to enhance self-management behavior among adult patients with T2DM. The databases searched were: the Medical Literature Analysis and Retrieval System Online (MEDLINE) with Full Text, Health Source: Nursing Academic, ProQuest Nursing and Allied Health Source, Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus with Full Text, and the Cochrane Database of Systematic Reviews. Key phrases were chosen because they were directly related to the PICOt question: In adult patients diagnosed with Type 2 diabetes mellitus (P), how does the use of mobile self-management App [Glucose buddy Pro] (I) versus current state (Patient taking orders from clinicians on what to do) (C) affect self-care management (O) over 6 week-period (t)?

The Johns Hopkins Nursing Evidence-Based Practice Model was used to screen for research articles that addressed the PICOt topic with a main emphasis on high quality, consistent, and patient-oriented clinical evidence. The search strategy entailed the use of key search terms such as (Type 2 diabetes mellitus*) AND (“Mobile Tech* OR “reminder*” OR “mobile phone*” OR “cell phone*” OR “digital devise*” “App Tech*” OR “text message*”) (Appendix A). Out of the 581 articles returned from the database search, only 26 articles were included in the review based on their relevance to the PICOt question, publication date between 2017 and 2021, published in English, and available in full text or detailed abstract that gave insights of the entire study.

The English language was used as a search limiting term, and papers that did not address the PICOt question were removed. Exclusion criteria were used to guarantee that the literature search yielded high-quality material that could be understood in English. Finally, bibliographies from the selected research led to the discovery of other relevant literature.

Ohio State Evidence-Based Practice Model

Evidence-based practice (EBP) is a problem-solving strategy for health care delivery that incorporates the best evidence from well-designed research and patient care data, nursing skills, and patient preferences and values. EBP implementation is a process that starts with a clinical question or dilemma about an individual or group, searches for and evaluates the best research or evidence available, then applies those findings, along with clinical expertise and patient preferences, to a clinical question or dilemma using scientific theory and an EBP framework (Boltz et al., 2021). Evidence assessment necessitates a systematic approach using rigorous, accredited appraisal instruments, guaranteeing that the evidence obtained is based on strong research and suitable to the population in issue. The clinical choice for change is guided by synthesizing relevant data and combining it with professional skill and patient desire. Evaluation of the clinical change and its impact on the population are the last two steps of the EBP process. This EBP was created using an evidence-based method to provide reminders using a mobile self-management app with the goal of increasing adult patients' capacity to self-manage their T2DM and improving clinical outcomes. This EBP project was guided by the Ohio State EBP Model, which was created to assist providers understand how new ideas might be adopted into current practice (Murphy et al., 2018). In the context of this project, this EBP model involved covering diabetes and its present treatment, introducing the clinical issue, reviewing the body of evidence for data on change, describing the change implementation strategy, assessing the change

outcomes, and concluding with a discussion and future practice implications. Applying this EBP model to the Quality Improvement Project, the DNP student was able to establish that there is a gap in the management of T2DM and to propose a practice change to close that gap in clinical management of patients with T2DM (Melnyk et al., 2017).

To attain quality results, the Ohio State EBP model focuses on system-wide adoption of the new practice and EBP sustainability. There are five stages to the model:

- Evaluating organizational culture and preparedness for implementation in the healthcare system
- Identifying the EBP process's enablers and impediments in the organization
- Finding EBP mentors
- Putting the evidence into practice in the workplace
- Assessing the consequences of the practice change

Review of the Literature

The literature review was guided by the PICOt question. It was organized in themes and subthemes that allowed for the synthesis of the studies cited in the review.

Improvement of Self-Management and Reduction of Diabetic Symptoms

In the research done by Hou et al. (2018), it was found that mobile phone applications could be useful for self-management of diabetes based on 21 randomized controlled trials (RCTs) and systematic reviews. Key measures that were found to be important were the app functionality, tasks related to self-monitoring, data entry approaches, calculating insulin bolus, adjustment of medication, automated personalized feedback, effective display of blood glucose levels, and feedback from healthcare professionals in a frequent manner. The study separately analyzed the impact of the intervention for type 1 and type 2 diabetes, thereby demonstrating the

effectiveness of mobile applications towards better glycemic control for type 1 and type 2 diabetes patients. The authors supported the implementation of mobile applications for diabetes management.

A study by Jeffery et al. (2019), supported this argument by stating that mobile phone applications can be useful for the self-management of T2DM compared to non-app users. This qualitative study spanned three months and used the Health Belief Model and Technology Acceptance Model, and it indicated that there were improvements in self-management activities among T2DM patients who used mobile self-management apps. This was further supported by the fact that the apps can provide a visual representation of vital information, which can enhance patient convenience, support intuitive navigation, and promote informed self-care decisions. These outcomes could be applied to improve clinical practice and thereby enhance patients' health and wellness.

Based on a cross-sectional study, Guo et al. (2021) studied the relationship between mobile health literacy, diabetes self-care, and glycemic outcomes for patients with T2DM in Taiwan. It was found that mobile-based health education programs can improve self-care behaviors and knowledge among patients. This helped improve the patients' clinical outcomes, thereby showing how mobile health technologies relate to better health outcomes for Type 2 diabetes. This study also indicates how the applications can support improved well-being among patients and, therefore, the need to adopt eHealth technologies and services to motivate patients towards self-care and healthier lifestyles. However, the study mainly focused on participants who already have a good reading and writing ability, which excluded those who are not well accustomed to the use of apps.

Boels et al. (2018) studied the effectiveness of self-management education for diabetes using smartphone applications for patients diagnosed with T2DM using randomized control trials. It was seen that based on Fogg Behavior Model, Leventhal's Self-regulation Model, and the Health Belief Model, the use of apps could promote better self-management of diabetes among patients. It was further seen that better self-management improved HbA1c levels, blood pressure, BMI, lipid profile, waist circumference, hypoglycemic event frequency, and glucose variability among participants after a 6-month intervention using the mobile app. The study highlighted how mobile technology supports T2DM patients in better self-management, thus offering a cost-effective approach to reducing complications from the disease.

As per Agarwal et al. (2019), mobile-based applications can improve self-management for T2DM patients. The study involved the use of the BlueStar mobile application for a three-month and six-month intervention, which improved the HbA1c level by 0.21% to 0.42%. An exploratory method used in this paper helped to understand how the app helped to improve HbA1c levels from baseline levels and fostered positive behavior change. A multicenter RCT was used to collect a large amount of data, but there was a high dropout rate in the study (34.5%), and there were barriers among the participants in terms of using the app.

Offringa et al. (2018) used a retrospective cohort design study to discuss how digital applications for diabetes management can help to improve glycemic outcomes among people diagnosed with diabetes. The study involved 1799 participants (899 app users and 900 controlled participants). There were improvements measured across various health indicators such as average glucose level, frequency of a hyperglycemic event, and frequency of monitoring blood glucose level using the mobile platform. Every month, it was seen that there was an improvement in the blood glucose by 3.5% and reduced risk of hyperglycemic events by 10.7%.

The study was limited to self-reported demographic data, and the authors did not randomly assign the groups for using the mobile app.

Adu et al. (2020) did a study on the use of My Care Hub, a mobile phone application to improve diabetes self-management. The study used Health Behavior Change Theory to develop a RCT with 12 participants to improve the glycemic level and coping skills among the patients using the app. It supported better satisfaction among the patients, which in turn promoted better diabetes self-management outcomes. Various aspects were important for app usage such as daily login, browsing educational data, reading automated feedback, and graphical output generated by the app. The study also involved usability testing for the app to understand its usefulness, which highlighted a change proposal to involve phone applications for diabetes management. The paper, however, involved only a small sample size, which increased the risk of selection bias.

Wang et al. (2019) used a single-blind RCT to highlight the importance of mobile health applications towards continuous care for patients diagnosed with T2DM. The study highlighted the importance of continued care to improve the health outcomes of T2DM patients. Significant improvements were found in self-management abilities, levels of fasting blood glucose, and awareness of the disease among the patients. These three aspects are considered key predictors of positive health outcomes and faster recovery or management of T2DM. The study involved 120 patients diagnosed with T2DM who were randomly divided into the intervention and control groups to prevent selection bias. However, it involved a small sample size and a short follow-up time, which acted as limitations on the accuracy and generalizability of the study.

Self-Monitoring of Blood Glucose and Improved Fasting Blood Glucose

Several articles supported the need for effective self-monitoring of blood glucose levels, which is a major factor in self-management. According to Doupis et al. (2019), smartphone-based technology can be used for managing diabetes. It was found that the use of the technology helped to improve HbA1c levels and blood glucose levels using an interactive voice response system for mobile apps. It was found that due to the widespread use of Smartphones, it is possible for apps like Diabeo, BI to become popular in the future, which has the potential to enhance the utilization of healthcare resources and reduce health care costs. An open-level RCT was conducted for 13 months involving 191 participants aged 18 years or older who were diagnosed with T2DM, had inadequate glycemic control for more than three years, and had BMI less than 4kg/m2.

It was found by Buss et al. (2020) that mobile health technology can be used for the primary prevention of T2DM and cardiovascular diseases based on a systematic literature review. Nine journal articles were reviewed in the study that showed how a mobile-based health intervention app could reduce health risks like cardiovascular diseases and T2DM. It was further seen that these risks were reduced due to improvements in key measures like weight loss, reduction in waist circumference and BMI, improved HbA1c levels, lower fasting blood glucose level, better diet, increased physical activity, and healthier blood pressure levels. These factors not only reduce the risk of Type 2 diabetes but also cardiovascular diseases among patients.

In a study on the efficacy of telemedicine, De Groot et al. (2021) evaluated the importance of better glycemic control for patients suffering from T2DM. A telemedicine-based intervention was seen to positively impact HbA1c levels, fasting plasma glucose, weight, BMI, quality of life, cholesterol, triglyceride glucose levels, postprandial glucose, waist circumference, and systolic blood pressure. The use of a mobile app was found to have a lower risk of bias and,

therefore, to be useful for an RCT study. The study has a limited sample size that creates a risk of uncertainty in the self-care outcomes due to the high heterogeneity. However, the research findings helped to understand how mobile apps and telemedicine for diabetes management can be used to improve BMI and weight of T2DM patients.

Desveaux et al. (2016) proposed the use of mobile applications to improve self-management for individuals diagnosed with T2DM based on a waitlist RCT. It was found that after a three-month intervention of using the mobile application, an improvement of 95% in HbA1c and plasma glucose level was observed among T2DM patients. This highlighted the importance of using mobile apps for a diabetes education program for patients. The applications are cost-effective and easy to use, promoting better usability among the patients. A positive impact was found on the health outcomes for the patients using the app. However, it is important to note that mobile apps are often subjected to continuous updates and changes, which must be aligned with the need to maintain cost-effectiveness for prolonged usage.

Researching the impact of self-efficacy among patients with T2DM in a community hospital, Zhai & Yu (2020) found that health apps could improve hemoglobin level control and improve self-efficacy scores. A 6-month intervention using a health app improved HbA1c levels by 6.7, and self-efficacy scores improved by 119.2. Since the applications are flexible in terms of the user's needs and cost-effective, they can enhance the self-confidence of the patients towards self-management and reduce the risks of diabetes-related complications. This research involved a relatively smaller sample size (120 adult patients), which limited the generalizability of the outcomes, and it had a short follow-up period which affected the accuracy of the results.

Majithia et al. (2020) advocated using a monitor-driven virtual diabetes clinic to improve glycemic outcomes for patients diagnosed with T2DM based on a prospective trial. A virtual

diabetes clinic promoted easy consultation with endocrinologists that provided functions like life conferences and interconnectivity with devices. The virtual clinic could provide personalized lifestyle coaching and a live video consultation from specialists that improved HbA1c levels by 1.6% and body mass index by 33.75. Furthermore, the virtual clinics ensured continuous engagement between healthcare providers and patients, thereby promoting better prognosis and monitoring of patient conditions. However, unfamiliarity with the use of technology among patients is a major barrier to improving diabetes conditions using mobile apps.

Behavioral Changes

Diet. Patients with T2DM often must change their eating habits to keep blood sugar levels in check. The influence of regular reminders provided by a mobile self-management app on specific eating and nutritional behavior recommended to T2DM patients is measured in this study (ADA, 2017). While discussing a mobile lifestyle management program called Glycoleap for T2DM patients, Koot et al. (2020) used a single-armed feasibility study to find that Glycoleap could help to improve BMI and HbA1c levels. There was a significant improvement from the baseline levels at follow-up after one week, which also supported the high scalability for using the app. The study showed how mobile phone apps can support positive lifestyle modifications, an important measure for controlling the risk of complications from T2DM. The mobile program was also cost-effective and easily accessible to target populations, highlighting how it can be useful to help patients suffering from T2DM.

Yu et al. (2020) analyzed the effectiveness of intergenerational health programs for patients diagnosed with T2DM based on a longitudinal study. It was seen that with the use of mobile health applications, there were improvements in key self-care behaviors like testing of blood glucose level, healthy diet, regular exercise, and frequency of clinical visits. After four

months of intervention, the level of exercise increased by 0.68 days per week, smoking habits reduced by 0.44 days per week, blood glucose testing improved by 1.26 days per week, and healthy diet improved by 2.21 days per week. It was seen that the use of the app improved access to health care services for patients, especially in remote areas, thereby enhancing health care service delivery.

Physical Exercises. A study by Muralidharan et al. (2017) found that physical exercises, if tolerated by the patient, are part of activities T2DM patient can be reminded to engage in using the mobile app. Mobile health technologies can be used for both management and prevention of T2DM based on a narrative review of the literature. The study encourages the use of mobile health technologies through which better patient decisions can be supported barriers to healthcare access can be overcome. Key outcomes such as HbA1c levels, regular exercise, and a healthy diet were improved with mobile health applications, which reduced the cost of care. The authors further suggested that it is important for these applications to be visually appealing, share data in real-time, and motivate the users to use the app regularly.

Höchsmann et al. (2017) explored the usefulness of mobile game applications to improve important outcomes like physical activity and adherence to exercise routines among patients diagnosed with T2DM. According to the study, serious game applications for smartphones designed for diabetes management can promote regular physical activity among patients, especially those who are inactive or sedentary. It was also seen that innovative mobile-based games to improve BMI outcomes and physical activity are essential for diabetes self-management. The outcomes were lower weight, reduced waist and hip circumference, improved body composition, and lower resting blood pressure. Improvements in these health indicators

were achieved through regular use of the smartphone apps and associated with lower risk of T2DM and many other health conditions.

Weight Control. Cai et al. (2020) found that mobile application-based interventions can help to promote weight loss among patients with T2DM based on a meta-analysis of 14 studies. It was found that interventions using mobile apps reduced body weight and improved waist circumference, which are key measures that are important for diabetes management. It was seen that an intervention might not have a positive impact on the BMI of the patient. Mobile applications were found to have a lower risk of bias, which lent support to considering a mobile app intervention for reducing weight and waist circumference. The paper did not use a double-blinded approach, and a clear definition of the mobile app was also lacking in the research.

Cai et al. (2020) showed how mobile application interventions helped achieve better weight loss outcomes among T2DM patients using the random-effects model to conduct a meta-analysis. Fourteen RCT studies were evaluated in this research that measured key outcomes like the frequency of using mobile apps, weight, waist circumference, and BMI. It was found that the use of a mobile app reduced body weight up to 0.17kg, reduced waist circumference by 1.35cm, and improved BMI from 0.25 to 0.08 on average. Outcomes for a total of 2129 patients were evaluated based on the RCTs to reduce bias and promote a change proposal that involves using a mobile app to reduce waist circumference, BMI, and weight.

According to Cho et al. (2017), an internet-based health gateway device can support interactive communication between patients and providers that involves autonomic data uploading for better clinical efficacy. This can be useful for managing T2DM and enhancing glucose control, composition improvement, waist circumference, and HbA1c levels. A six-month intervention done during the study showed significant improvement across the major variables,

highlighting how an internet-based integrated healthcare system can be applied to manage T2DM. It was also found that the intervention was not associated with any adverse events. However, the paper was limited in its sample being taken from a larger RCT with a more diverse demography with varied requirements for intervention.

Medication Adherence. Medication adherence is one of the factors that helps in glycemic control, leading to the delay or prevention of diabetes-related complications. Huang et al. (2019) aimed to study how diabetes self-management apps can promote better medication adherence based on a systematic assessment. The authors evaluated 143 apps, which included 81 apps for Android OS and 62 for Apple iOS. It was found that these applications promoted various important functions like regular reminders to the user to take their medication and to measure the blood glucose levels regularly. The apps also helped track multiple medications, which allowed the users to remember each medication they needed to take along with its frequency. These aspects improved the blood glucose levels among the app users (70.4% for Android OS users and 88.7% for iOS users).

Quality of Life

Self-Care. Sun et al. (2019) studied the use of mobile phone-based telemedicine practice on older Chinese patients suffering from T2DM. Using an RCT, it was found that there was a significant improvement in HbA1c levels within the first three months compared to baseline value both in the intervention and the control group. The study involved 91 patients divided into an intervention group of 44 and a control group of 47. The research helps to understand the importance of mobile apps for managing diabetes. However, a key limitation of this study was that variables like living environment, history of drug allergies, birth history, history of smoking

and alcohol consumption, and personal/medical history, which had the potential to affect clinical outcomes, were not considered during the research.

Veazie et al. (2018) performed a rapid evidence review for mobile-based health applications and how they can influence diabetes self-management activities and outcomes. A systematic review was performed using technology assessments of 13 applications with population samples of 30-180 people aged 33-40 years. It was found that there was positive diabetes self-management behavior and lower HbA1c levels among patients using mobile apps. The apps were useful to deliver better health outcomes due to the regular reminders to the patients that helped track blood glucose levels regularly, manage HbA1c levels, improve medication usage, reduce weight, and improve physical activity. Software like Diabeo was shown to promote a significant reduction in HbA1c level in 6 months and was also useful for teleconsultation for the patients.

Patient Acceptance. According to Torbjornsen et al. (2019), user acceptance is an important aspect while evaluating the usefulness of mobile-based applications for T2DM patients. Based on the Theory of Acceptability, it was found that it is important to evaluate the patient's acceptance of the application to evaluate its effectiveness in T2DM management. Better acceptance of applications like mHealth App can help promote a better or healthier lifestyle among the patients and improve their blood glucose level. Since the apps are cost-effective and easy to use, the participants can start from the same point to reach their desired healthcare outcomes.

Surkan et al. (2019) posited that community-driven priorities could be useful for developing smartphone applications to leverage social networks while managing T2DM, especially within low-income neighborhoods. The study found that social network apps provided

a cost-effective approach for managing T2DM among low-income populations and high-risk groups for diabetes based on in-depth interviews and discussion forums. Since the mobile-based apps are cost-effective, they could apply to low-income populations and marginalized communities such as the African American population that the research focused on. However, the study did not apply any intervention, there was no distinction between diabetic and pre-diabetic patients, and it did not involve the patients' friends or family.

The most crucial aspect in keeping well-controlled blood glucose levels and preventing diabetic complications is self-management (Jeffrey et al., 2019). App use has been shown to lead to improved diets and attitudes toward diabetes self-management, as well as increased physical activity and blood glucose monitoring. Furthermore, a recent meta-analysis found that using diabetic apps as an adjunct to traditional self-management yields a clinically meaningful reduction in HbA1c, a long-term marker of blood glucose control, among patients with T2DM (Jeffrey et al., 2019).

Summary

In this chapter, the DNP student: described the search strategy, introduced the Ohio State University EBP model and its relationship to the project, and provided analysis and synthesis of supporting evidence related to this Quality Improvement Project and PICOt question.

In the next chapter, the DNP student will: review the structure and culture of the organization, project barriers and facilitators, organizational support, and key stakeholders; provide information about how the project benefitted the organization and patients/providers; describe the intervention of the Quality Improvement Project and how it impacted the Problem under study; and introduce measures for evaluating the outcome of the intervention.

CHAPTER THREE

METHODOLOGY

Context

The organizational structure aligns and connects parts of an organization so that it can perform optimally. It shows how work functions are divided within an organization and enables groups to collaborate within their respective functions to manage tasks. The Quality Improvement Project is taking place at Akachi Primary and Urgent Care, which is vertically structured. There is a Chief Medical Director who directs the affairs of the organization and ensures that the clinic performs at its best. The Chief Medical Officer is responsible for employee performance and coordination of patient care. The administrative officer is responsible for administrative functions such as the day-to-day running of the clinic, hiring, and paying staff salaries. The clinic's cultural norms provide opportunities for providers and other healthcare professionals to strive for excellence. There is always an environment that is very concerned about the well-being of patients and employees. This enables providers to provide services that are respectful of and responsive to diverse patients' health beliefs, practices, and cultural and linguistic needs. It contributes to increased access to high-quality health care that is respectful of and responsive to the needs of a diverse patient population.

Barriers and Facilitators

There were some barriers and facilitators experienced during the implementation of this Quality Improvement Project. The barriers were: (a) the stakeholders' resistance to change preventing buy-in; (b) recruitment of enough participants; (c) problems adopting the evidence; (d) lack of financial resources; € lack of trained personnel for implementation of this proposed practice change and f) other implementation difficulties. Stakeholder buy-in is the process of

convincing individuals with T2DM as well as healthcare professionals who will benefit to accept the practice change. Some stakeholders will be stuck in their old ways of providing or receiving care and will not be ready to accept the practice change despite improved outcomes. Some families were also found to believe that utilizing a diabetes self-care management app could only provide extremely limited levels of care. Participants' lack of knowledge and awareness of apps as healthcare aids, their views of disease severity, their technology and health literacy, and practical restrictions such as rural connectivity were all barriers to app use (Jeffrey et al., 2019).

Facilitators to the project were: (a) whether the organization supports or prioritizes the change; b) supportive leadership; c) perceived effectiveness; and d) flexibility regarding the implementation of the intervention. The facilitators for using the app by the individuals with T2DM were that the mobile app is user friendly and convenient because it can easily be downloaded in any technological device including smartphones.

Organizational Support

The DNP student obtained a contract with the management of the clinic before starting of this Quality Improvement project, and in a letter (Appendix B), the management of Akachi Primary and Urgent Care offered their full support via this contract.

Intervention

Design

This project's design was a quasi-experimental quantitative design. This design was chosen because it is consistent with the goal of this Quality Improvement Project. This type of design, according to Moran et al. (2014), is advantageous because it does not require randomization or a control group (Ahmed et al., 2018). It can measure changes in health-related outcomes after an intervention, which is not always possible with a true experiment (Ahmed et

al., 2018). Quasi-experimental designs compare groups formed through methods other than random assignment and can be used in place of true experiments (Melnyk & Fineout-Overholt, 2011). This design has the potential to rule out alternative explanations for the relationship between an intervention and the study's outcomes (Melnyk & Fineout-Overholt, 2011).

Purpose Statement

The purpose of this Quality Improvement Project is to determine if an APRN-led intervention using digital health technology to enhance self-management behavior among adult patients with T2DM. The goal of this project is to enhance self-management behavior such as adherence to lifestyle modifications (i.e., diet and exercise) and constant glucose monitoring with an effort towards reducing HbA1c levels and weight, in efforts to delay or stop the development of T2DM-related complications and associated medical, psychological, and financial burdens to the patient, family, community, and society as a whole. It is unknown whether diabetes self-management education offered to adult patients with T2DM via the Glucose Buddy Pro app can improve diabetes self-management while getting care at a primary care clinic in Prince George's County, Maryland. There is no systematic, evidence-based program in place at the clinic to manage patients with T2DM. Typically, the clinic sees adolescents and adults with chronic diseases like diabetes, many of whom have uncontrolled plasma glucose levels and have no understanding of the repercussions of hyperglycemia, as well as a lack of self-care expertise. Diabetes self-management education aims to enable diabetic patients to monitor their plasma glucose levels and improve their self-care management by bridging the management gap prevalent in these patients. Uncontrolled T2DM frequently leads to diabetes-related problems such as blindness, kidney failure, lower extremity amputation, cardiomyopathies, and other

consequences (Chester et al., 2018), necessitating action to guarantee optimal diabetes management.

From an assessment of 200 patients who came to the practice site clinic for the management of T2DM, it was discovered that 8% had already developed one or two diabetes-related complications, attributable to lack of proper self-management. Among those these patients, 20% had third stage renal disease, 50% had peripheral neuropathy, and 30% had developed other diseases including eye problems. Evidence-based studies show that the use of apps such as Glucose Buddy Pro could mitigate this health issue, which is why the DNP candidate chose this app to enhance patient`s self-management knowledge and skills with the aim of reducing the number of people developing diabetes-related complications at the project site. Thus, all patients with T2DM coming into the clinic incorporated this self-management app as part of their treatment plan.

The quasi-experimental design project will aim to provide a standardized and sustainable approach to diabetes prevention education to be used by primary care providers. The results of this project may aid primary care providers in reducing the burden from chronic disease management. Many of the diabetic patients from Akachi Primary and Urgent Care who have developed diabetic complications also have a lack of good self-management behavior. As a result, there is an urgent need to take action to improve self-management behavior in adults with T2DM to reduce the number of diabetic patients who develop diabetes-related complications earlier, resulting in a lower quality of life. According to Pantalone et al. (2018), patients with cerebral vascular accident and coronary heart disease had baseline HbA1c levels of 8%, indicating that diabetic patients with poor glycemic control are more likely to develop these complications. Preventing such complications will primarily be accomplished by emphasizing

the role of nonpharmacological self-management in the care of diabetic patients, particularly patients with T2DM (Azami et al., 2018).

Clinical Question

T2DM is one of the chronic diseases that, if not managed properly, can become incapacitating. In Prince George's County, Maryland, a high percentage of diabetics (about 16%) have one or more diabetes-related complications (Prince George's County Health Department, 2017). These people are mostly from minority groups and have little knowledge of how to manage their diabetes (Buss et al., 2020). It is the primary care provider's responsibility to implement strategies that will aid in addressing the health needs of patients with T2DM.

Furthermore, 13.2% of 190 patients who came to the project site for T2DM management had developed one or two diabetes-related complications. Those patients had HbA1c levels that were consistently higher than 10.5 percent, fasting blood glucose levels that were higher than 200 mg/dl (normal level 140 mg/dl), and a nerve function test that indicated peripheral neuropathy (Buss et al., 2020). Individual patients were empowered to take charge of their health plans and engage via a mobile self-management app in monitoring and stabilizing their plasma glucose levels. The app served as a reminder to these patients to self-manage their T2DM. This is the goal of the project presented by this clinical question:

Q1: In adult patients diagnosed with Type 2 diabetes mellitus (P), how does the use of the Glucose Buddy Pro mobile self-management app (I) versus the traditional method of care (C) affect self-care management (O) over 6 weeks (t)?

Study of the Intervention

Study Design

This project's study design was a quasi-experimental quantitative design. The design was chosen because it corresponded to the project goal of this Quality Improvement Project. The congruence between the project's purpose and the study design, as well as the data collection and analysis plan, is critical (Moran et al., 2014). This congruence is the most important factor in confirming the project's dependability and accuracy. The clinical question or issue always determines the project's design choice (Moran et al., 2014). Designs that compare groups generated by methods other than random assignment can be used in place of true experiments (Moran et al., 2014). When a true experiment is impractical, a quasi-experimental qualitative design is feasible and capable of measuring change in health-related outcomes after an intervention (Moran et al., 2014). This type of design can be effective in eliminating alternative explanations for the relationship between an intervention and study outcomes (Melnyk & Fineout-Overholt, 2015).

The pre-test/post-test design of this project was used to assess differences in self-management behavior among 25 adult patients with T2DM. Prior to the six-week intervention, participants' pre-intervention diabetes self-management behavior was collected for t-test analysis. The pre-intervention for self-care knowledge for the t-test analysis was administered prior to the six-week intervention in participants' homes to measure the gain in self-management knowledge.

The pre-intervention diabetes self-management behavior and knowledge data reported by participants were collected. The DNP student delivered education to participants about how to use the Glucose Buddy Pro app to support them in proper dieting, medication adherence, exercise, and regular self-monitoring of blood glucose. Each educational session lasted for 2

hours. All participants attended each group session. The purpose of this project is to determine whether the use of a mobile self-management affected selfcare management over 6 week-period.

Population and Sample

The population sample for this Quality Improvement Project were female and male adults, aged 18 to 65 years, who attended the clinic at Akachi Primary and Urgent Care. The ethnicities represented among the population sample included African American, Asian, Hispanic, Native American, Pacific Islander, and White. The plan for the project was to recruit a convenience sample of 25 participants with T2DM who met the inclusion criteria. A site authorization letter was obtained from the Akachi Primary and Urgent Care clinical administrator for the recruitment of the participants in the project.

The inclusion criteria were: (a) Adults aged 18 to 65 diagnosed with T2DM; (b) Have access to the Glucose Buddy Pro mobile self-management app; (c) Have experienced one or more diabetes-related complications; (d) Willing to participate; (e) Lives in Prince George's County and is an Akachi Primary and Urgent Care patient; (f) Can read and write. Exclusion criteria were: (a) if the diabetic patient was being managed for other chronic diseases but not diabetes; (b) if the provider did not focus on the impact of patient self-management behavior on T2DM; (c) if the self-management app was utilized through other methods of communication to promote diabetes compliance such as the use of other web-based interventions.

Data Collection

The DNP student asked the participants to fill out the Diabetes Self-Management Questionnaire (DSMQ) at the beginning of the first day of the 6-week process to measure a patient baseline of self-care management and knowledge (see Appendix C). While at the clinic, the DNP student delivered detailed explanations of the requirements of the Quality Improvement

Project to the participants including how to download the mobile self-management app on their phones. The DNP student asked the participants to continue following the reminders from their mobile self-management app to engage in self-management activities.

To recruit enough eligible participants, posters were strategically placed in patient waiting areas, exam rooms, and clinic bathrooms prior to recruiting participants for the project. The participants were also identified from the clinic's medical records, and they were notified about the quality improvement project during clinic visits by the nurse practitioner. Other Akachi Primary and Urgent Care providers were asked to refer diabetic patients who matched the initiative's inclusion criteria to the project. At the end of the six-week period, the participants returned to the clinic for the re-evaluation of their self-management behavior and knowledge after the intervention.

Measures

Instrumentation

The instruments used for data collection were the DSMQ, which contains participants' demographic details as well as self-management scores, and the Glucose Buddy Pro app. The DSMQ is a sum-scale instrument completed by the participant at the beginning and at the end of the six-week intervention. The Glucose Buddy Pro app was used by each participant to track their insulin and medication, exercise, monitor their blood glucose, and track their food intake. Schmitt et al. (2016) created the DSMQ at the Diabetes Academy Mergentheim Research Institute. It is the first German instrument aimed at diabetes self-care and was developed to assess metabolic control behaviors in adult patients with type 1 and type 2 diabetes on a common treatment regimen. It is a 16-question psychometric assessment that assigns a sum scale value to the participant's overall self-reported diabetes management skills. Seven of these items are

formulated positively and nine are formulated negatively in terms of what is considered effective self-care. The questionnaire allows for a 'Sum Scale' score to be calculated as well as the estimation of four subscale scores (Schmitt et al., 2016). The subscales were labeled 'Glucose Management' (items 1, 4, 6, 10, 12), 'Dietary Control' (items 2, 5, 9, 13), 'Physical Activity' (items 8, 11, 15), and 'Health-Care Use' based on their contents (items 3, 7, 14). One item (16) asks for an overall rating of self-care and should only be included in the 'Sum Scale.' This questionnaire was chosen because it was designed to assess self-care behaviors that are known to affect plasma glucose measurement (Schmitt et al., 2016).

Validity

The DSMQ is well-known and has been used to assess content, factorial, and convergent validity. Item 16 of the questionnaire significantly met (0.31) all variables except "avoidance of medical visits" according to factorial validity (Schmitt et al., 2016). The degree to which two construct measurements must be theoretically related is known as convergent validity (Polit & Beck, 2017). The DSMQ has connections with external criteria (patient characteristics, BMI, Summary of Diabetes Self-Care Activities scales, and HbA1c value) as seen in the entire sample and diabetes type-specific subsamples for convergent validity.

The supervisor and two experts, both of whom worked at Akachi Primary and Urgent Care, determined the face and content validity of the intervention's designated instrument. The experts were provided a draft copy of the questionnaire, as well as the study's goal and clinical questions, to evaluate for content relevancy, clarity of statement, and logical accuracy. Their ideas and corrections were used to make changes to the intervention's instrument. Judgmental and criterion validity support the use of digital health technology to improve self-management behavior among adult patients with T2DM. This is done by weighing expert opinions and

comparing the results of the measures (excellent glycemic control in patients with T2DM) to the gold standard (Polit & Beck, 2017).

Reliability

The reliability assessment revealed good internal consistency of the "Sum Scale" and satisfactory consistency of the subscales (Schmitt et al., 2016). The Cronbach's coefficients for the DSMQ subscales were 0.77 for 'Glucose Management,' 0.77 for 'Dietary Control,' 0.76 for 'Physical Activity,' and 0.60 for 'Healthcare Use,' respectively. A coefficient of 0.84 was found for 'Sum Scale.' The coefficients of the DSMQ scales were 0.68 (SD = 0.12) on average for the four subscales and 0.80 for the 'Sum Scale.' Repeating program evaluations with the same methods and equipment would increase the reliability even more. The 10-DEN scale was used to assess knowledge of diabetes self-management in the pre- and post-self-management behavior survey. In the pre- and post-self-management behavior survey, the Summary of Diabetes Self-Care Activities was used to assess self-management behaviors related to food, glucose testing, exercise, and diabetes medication compliance with the sole goal of improving plasma glucose levels (Schmitt et al., 2016).

Analysis

Data Analysis Procedure

Each participant who met the inclusion criteria was assigned a special number for an identification, such as participant #2, #3, or #6. Participants completed the DSMQ before and after the six-week intervention. Data were analyzed using SPSS 27. A paired samples t-test was done to test for differences in the participants' self-care management before and after the intervention. A p-value of less than 0.05 was required for statistical significance. Descriptive

statistics were used to show how many patients enrolled and completed the project as well as details about the demographics of the participants.

The data analysis included descriptive statistics of the participants' demographics. The demographic variables were age, income, gender, ethnicity, and employment status. Age and income were continuous variables, with their mean and standard deviations being tabulated. Gender was dichotomous, with two levels, male and female. Ethnicity and employment status were categorical.

There were five measures of self-management: self-care, glucose testing, medication adherence, exercise regime, and dietary regime. These were measured on an ordinal scale, with four levels: "Applies to me very much", "Applies to me to a considerable degree", "Applies to me to some degree", and "Does not apply to me". The scores were descending, with "Applies to me very much" scoring 3 and "Does not apply to me" scoring zero. A further variable was created, total self-management, which was the sum of the scores for the five measures. There were therefore six measures of self-management, which were recorded pre- and postintervention.

Statistical tests were used to ascertain if pre-intervention total self-management was influenced by demographic factors. Pearson's correlation was used to compare pre-intervention self-management with age and income. An independent paired samples t-test was used to compare the pre-intervention self-management scores of males and females. One-way ANOVAs were used to analyze race and employment status.

Participants' pre- and postintervention self-care, glucose testing, medication adherence, exercise regime, and dietary regime were compared using Wilcoxon's sign rank text. This was used because the dependent variable was ordinal, with a maximum range of four. It seemed likely that the assumptions of a parametric test would not be met. For the total self-management,

a paired samples *t*-test was used, though the assumptions of this test were considered. The difference scores (postintervention minus preintervention) were analyzed, using a histogram and the Shapiro-Wilk test.

Budget

The money spent to purchase materials to print the questionnaire was covered by the medical director of the clinic. The computer used in entering and saving data was the DNP student's personal computer. The questionnaire was distributed to each of the participants while on their office visit. The nurses who usually reached out to clinic patients also reached out to the project participants, and they were paid by the clinic. The only money spent by the project was about $300, which was used for entertainment for the participants.

Ethical Considerations

The project received an exemption letter indicating that it met the requirements of a quality improvement intervention (Appendix D). Following a review, Wilmington University's Human Subjects Review Committee determined that Human Subject Protection was not required in the implementation of this quality improvement project at this practice location (Appendix E). The project was carried out in strict accordance with the Health Insurance Portability and Accountability Act of 1996 to protect the privacy of patients' health information. Furthermore, the DNP student and practice personnel adhered to the Standards of Care for primary care practice. All data collected from participants for the purpose of evaluating this project were presented in aggregate form and devoid of any patient identifiers.

Every effort was made to ensure the accuracy of the data collected and to keep it in an easily retrievable format while maintaining patient confidentiality. To ensure security and confidentiality, patient data was de-identified and stored in a locked drawer in the office on a

password-protected folder and computer. These were only available to the DNP student. Each participant was given a one-of-a-kind identification number that they used throughout the project. These codes were saved in the previously mentioned locked folder.

Summary

In this chapter, the DNP student: reviewed the structure and culture of the organization, project barriers and facilitators, organizational support, and key stakeholders; provided information about how the project benefited the organization and patients/providers; described the intervention of the Quality Improvement Project and how it impacted the Problem under study; and introduced measures for evaluating the outcome of the intervention.

In the next chapter, the DNP student will review; The Project sample with appropriate descriptive statistics; Quantitative data analysis, key findings and its relevance to the rationale and specific aims.

CHAPTER FOUR

RESULTS

Sample Characteristics

The study had 25 participants, all diagnosed with T2DM. They were outpatients at a single urgent and primary care clinic in Maryland. All participants completed the study. The mean age of the participants was 44.15 years (*SD* = 15.45; range: 19-66 years). Fifteen (60%) participants were female, and 10 (40%) were male. Twelve (48%) participants identified as being White, seven (28%) identified as being Asian, and six (24%) identified as being African American, Hispanic, or Native American. Sixteen (64%) participants were employed, six (24%) were unemployed, and 3 (12%) were on disability. Participants mean income was 27643.60 (*SD* = 14726.03). Table 1 shows the full demographic data.

The main dependent variable was self-management score, which was a sum of the ordinal variables of self-care, glucose testing, medication adherence, exercise regime, and dietary regime. Tests were performed to check if preintervention self-management scores, as a baseline, were influenced by demographic factors. A *t*-test indicated no significant differences for gender, $t(23) = -1.28$, $p = 0.213$. One way ANOVAs indicated no differences for race, $F(1,21) = 0.003$, $p = 0.95$, or for employment status, $F(1,23) = 0.02$, $p = 0.90$. There was no significant correlation between preintervention self-management and age, $r(23) = -0.19$, $p = 0.37$ or income, $r(23) = 0.29$, $p = 0.16$.

Results

The five component parts of self-management were compared pre- and postintervention using Wilcoxon's signed rank test. In all cases there was a statistically significant improvement, at the $p < 0.001$ level (see Tables 2 and 3). Self-management, as the sum of the five components,

was compared, pre- and postintervention, using a paired *t*-test. However, it should be noted that the difference scores for self-management (postintervention minus preintervention) were not normally distributed using the Shapiro-Wilk test, $W = 0.91$, $p = 0.03$ (see Figure 1 for the histogram). The mean self-management score preintervention was 5.96 ($SD = 1.10$), and postintervention it was 12.04 ($SD = 1.10$; $M_{diff} = 6.08$). The improvement was statistically significant, $t(24) = -24.21$ (see Table 4 and Figure 2 for a box plot). These results indicate that the study's hypothesis, that an intervention based on mobile technology would improve T2DM patients' self-management behaviors, is supported.

Table 1

Demographic and Other Characteristics

Variable	*n* (%)	*M* (*SD*)
Age		44.16 (15.45)
Income		27643.60 (14726.03)
Gender		
Female	15 (60.00)	
Male	10 (40.00)	
Ethnicity		
African American	1 (4.00)	
Asian	7 (28.00)	
Hispanic	3 (12.00)	
White	12 (48.00)	
Native American	2 (8.00)	
Employment status		
Employed	16 (64.00)	
Unemployed	6 (24.00)	
Disability	3 (12.00)	

Table 2

Pre- and Postintervention Measures of Self-Management

Variable	*M* (*SD*)
Self-care	
Pre	1.48 (.51)
Post	2.60 (.50)
Glucose testing	
Pre	1.32 (.48)
Post	2.52 (.51)
Medication adherence	
Pre	1.44 (.51)

Post	2.68 (.48)
Exercise regime	
Pre	.96 (.61)
Post	2.12 (.60)
Dietary regime	
Pre	.76 (.52)
Post	2.12 (.53)
Total self-management	
Pre	5.96 (1.10)
Post	12.04 (1.10)

Table 3

Wilcoxon Test Comparing Pre- and Postintervention Measures of Self-care, Glucose Testing, Medication Adherence, Exercise, and Diet

Variable	Preintervention		Postintervention		Statistics		
	M	*SD*	*M*	*SD*	M_{diff}	*z*	*p*
Care	1.48	.51	2.60	.50	1.12	-4.46	<.001
Glucose	1.32	.48	2.52	.51	1.20	-4.14	<.001
Medication	1.44	.51	2.68	.48	1.24	-4.36	<.001
Exercise	.96	.61	2.12	.61	1.16	-4.17	<.001
Diet	.76	.52	2.12	.53	1.36	-4.32	<.001

Table 4

Paired Sample T-Test for Pre- and Postintervention Total Self-Management

Variable	Preintervention		Postintervention		Statistics			
	M	*SD*	*M*	*SD*	M_{diff}	*Df*	*t*	*p*
Total	5.96	1.10	12.04	1.10	6.08	24	-24.21	<.001

Figure 1

Histogram of the Difference Scores of Participants Pre- and Postintervention Self-Management

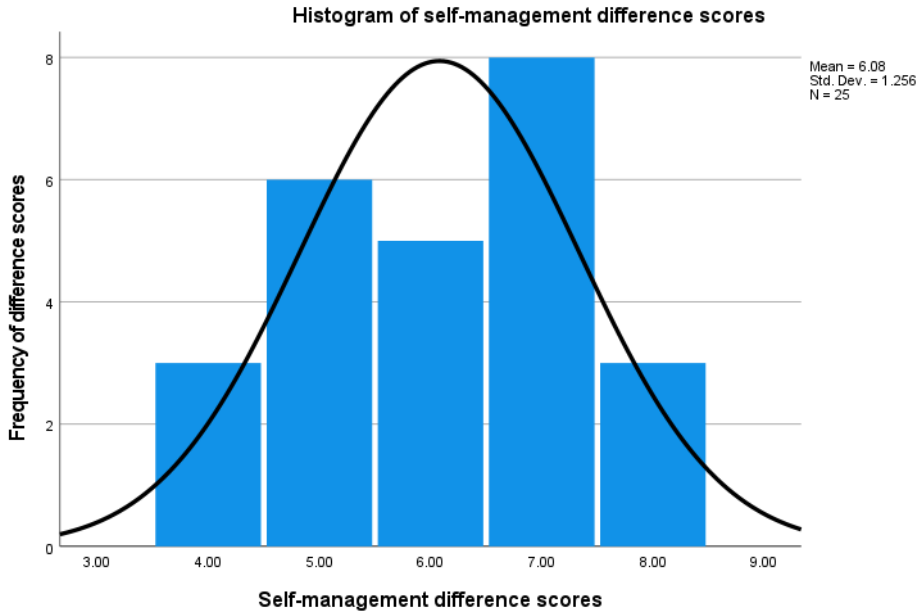
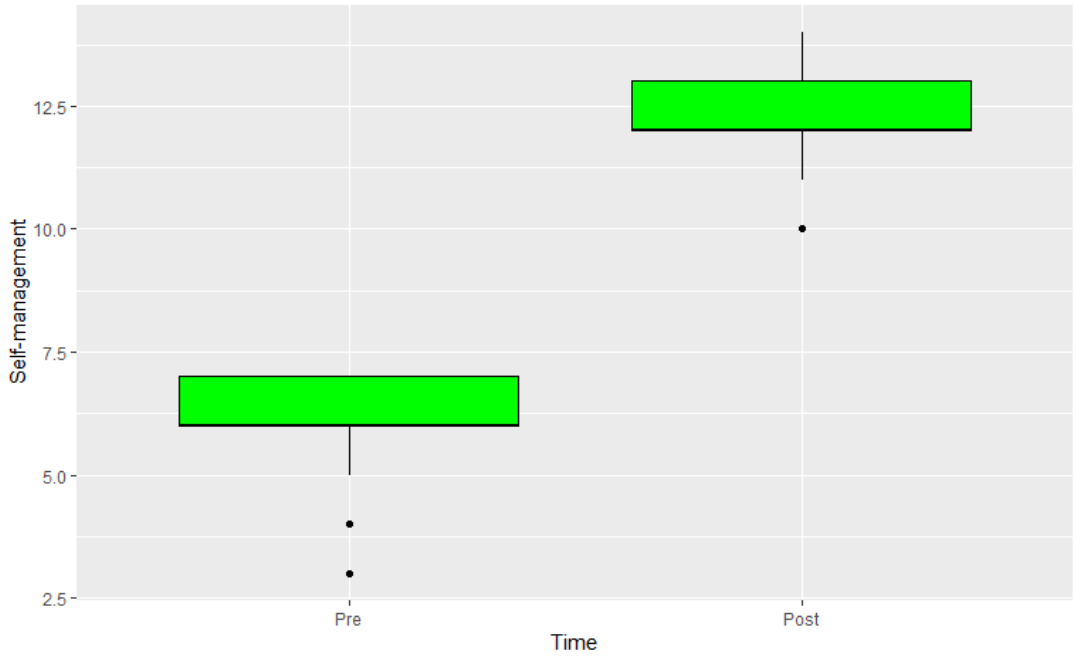


Figure 2

Box Plot of Participants' Pre- and Postintervention Self-Management scores



CHAPTER FIVE

DISCUSSION AND IMPLICATIONS

Interpretation

For diabetes self-management behavior as measured by the Glucose Buddy Pro app, the Shapiro-Wilk test ($W = 0.91$, $p = 0.03$) showed an improvement in T2DM patients' self-management behaviors after the intervention. After comparing participants' pre- and postintervention self-care, glucose testing, medication adherence, exercise regime, and dietary regime using Wilcoxon's sign rank text, it was determined that there was a statistically significant improvement in all five components of diabetes self-management behavior. The result for this Quality Improvement Project indicated that there was a correlation between using the Glucose Buddy Pro app to track self-care behavior and improved self-care behavior in patients with T2DM. The results of this project will be integrated into future practice.

Limitations

There some barriers and facilitators were experienced during the implementation of this Quality Improvement Project. The barriers encountered were: (a) The stakeholders' buy-in or resistance to change: (b) problems adopting the evidence; (c) limited financial resources; and (d) lack of trained personnel for implementation of the proposed practice change. Participants' lack of knowledge and awareness of apps as healthcare aids, views of disease severity, digital literacy, health literacy, and practical restrictions such as rural connectivity were all barriers to app use (Jeffrey et al., 2019).

Implications for Advanced Nursing Practice

The purpose of an APRN is to provide patients with better treatment at lower costs while also improving their health. As change agents, APRNs use evidence-based knowledge to

enhance practice. According to the World Health Organization (2020), the number of people with diabetes is expected to rise, reaching up to 366 million by 2030. T2DM is a chronic condition that, if not well-managed, can lead to complications. While enabling patients to take an active role in their own treatment, healthcare professionals, particularly APRNs (nurse practitioners), can address the self-care knowledge gap in patient self-management of T2DM. According to the American Association of Diabetes Educators (2020), behavior modifications are a key element in T2DM self-management. The APRN is a key advocate for patients, particularly those with T2DM, in the pursuit of better health outcomes. APRNs seeking to improve the self-care behavior of patients with T2DM can use apps like Glucose Buddy Pro, which have considerable potential to enhance the use of healthcare resources and lower costs (Sun et al., 2019). Information on healthy food, exercise, and minimizing risky behaviors linked to the early development of diabetes-related problems are all examples of self-care activity. By increasing patient participation, improving clinical guideline application, promoting patient safety, and lowering negative outcomes, mobile apps may benefit marginalized groups, including individuals who are not proficient in English language. Additionally, apps may improve patient-clinician communication through language- and literacy-specific information and visual aids, which may change how patients interact with healthcare providers.

Plan for Sustainability

The results of this project support future practice improvements. However, the DNP-prepared nurse has great responsibility in ensuring that the Glucose Buddy Pro app be implemented in practice. To sustain practice improvements, the DNP-prepared nurse will speak with the vendor of the app to provide free access to all T2DM patients receiving care at Akachi Primary and Urgent Care. The DNP-prepared nurse will also propose that the organization introduce the

digital app to every patient coming to the clinic. The DNP-prepared nurse will present the results of this study to other colleagues during staff meeting to encourage them to integrate the digital app in routine diabetic care, as it enhances communication and keeps the patient engaged.

Application of the DNP Essentials

The DNP essentials emphasize the foundational competencies that serve as the core of competencies for advanced nurse practice roles (American Association of Colleges of Nursing [AACN], 2006). The DNP essentials prepare all DNP students to be competent by expanding their knowledge to improve nursing practice and patient outcomes. DNP graduates develop leadership skills to strengthen practice and health care delivery and commit to advancing the profession. The DNP program emphasizes a practice-based focus and, with the essentials, prepares APRNs as competent, in-depth specialists, regardless of which of the 48 specialties they study (AACN, 2006). By focusing on these fundamentals, students can apply research findings in practice to improve patient outcomes. The DNP essentials emphasize EBP knowledge and innovation (AACN, 2006). Because DNP essentials are foundational outcome competencies for all DNP program graduates, nurses are able to not only obtain and maintain the most current, evidence-based knowledge to inform their practice, they also improve that practice to the highest level possible for the benefit of their patients and the health of the country and world (Smith et al., 2018). During the Quality Improvement Project, Essentials I, II, IV, V, VI, VII, and VIII were met.

Essential I: Scientific Underpinnings for Practice

Nursing practice is built on science. Essential I is a terminal academic preparation for nursing practice that reflects the complexity of practice at the doctoral level. This Essential prepares DNP graduates to translate scientific knowledge quickly and effectively to benefit their

patients (AACN, 2006). Diabetes is a disease that affects not only patients' physiology, but also their psychological state, which requires DNP graduates to remain current with the latest research findings and theories developed, tested, and accepted within a specific discipline (Zaccagnini & White, 2017). DNP graduates have a scientific foundation of knowledge, which is based on natural and social sciences such as human biology, physiology, psychology, and sociology, as well as from other domains such as chemistry, theology, philosophy, communication, physics, mathematics, chemistry, medicine, and zoology, and nursing theories (Smith et al., 2018).

As a DNP scholar, protecting subjects' privacy was critical, and ensuring that data obtained in this project remained confidential was a top priority. The use of ethical principles in the implementation of this CSP allowed for an assessment of how knowledge from other disciplines could be integrated into nursing science to perform at the highest level of nursing practice. Numerous articles were scrutinized to enhance self-care behavior in adults with T2DM and provide optimal healthcare outcomes. The best articles related to T2DM were chosen from many articles for this project via a literature review process. Previous scientific research was also used to emphasize the human response to illness and to develop potential treatment plans for CSP participants. Using Chronic Care model alongside EBP resulted in improved self-care behavior among patients with T2DM, leading to improved patient health outcomes.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

An organization's structure must remain conducive to the needs of the patients it serves. The organizational climate or characteristics of the organization, such as physical attributes, organizational structures, lines of communication, policies, and procedures, all have an impact

on how patient care is delivered (Smith et al., 2018). This fosters an environment in which healthcare providers share similar values and provide quality care. Client-centered care is the result of effective management and a supportive work environment in which patient care is prioritized. Continuous emphasis on meeting patients' needs by utilizing all available resources, processes, and components within the structure will aid in the delivery of client-centered care. Maintaining sensitivity to the specific needs of the patient population served by an organization is critical to fostering a quality care environment. A positive culture maintains a focus in which everyone's role is geared toward improving patient outcomes and providing patient satisfaction.

The success of an organization is dependent on several factors, one of which is the information systems used within the structure. This organization's parallel structure is consistent with the information systems implemented in various departments within its facility. A highly technical task-oriented environment is required due to the high volume of patients seen in this community clinic. Organizational culture, according to Sullivan et al. (2001), manages information technology processes that contribute to organizational growth and success.

Communication styles have an impact on the productivity of any organizational structure. When communicating with employees, leaders must keep the agency's culture and organizational structure in mind. Maintaining effective, consistent, and meaningful communication fosters employee empowerment and interpersonal relationships between leaders and followers. The organization's size and complexity contribute to the use of formal communication methods such as professional email or in-person meetings. Organizational effectiveness is dependent on professional communication to meet the facility's goals and needs. This essential was used repeatedly throughout the project to gain key stakeholder buy-in. In 2017, healthcare expenditures for diabetic patients in the United States totaled $327 billion

(ADA, 2018). Implementing a doctoral project aimed at slowing the progression of this disease offered long-term cost savings and a reduction in healthcare expenditures. A cost-effectiveness analysis of the implementation of this project was presented to the Medical Leadership Team at the clinic where the CSP was be implemented. The presentation to the Medical Leadership Team necessitated the use of advanced communication skills to build rapport and gain clinical support for this Project. For DNP scholars and healthcare leaders, the ability to communicate effectively is critical to the safety of the patient population. The cost-effectiveness of care, economics, and finance principles were applied to this project within an organizational leadership context for effective and realistic care delivery strategies, which improved patient outcomes.

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

Technology shapes and promotes the healthcare delivery system. Patient safety, consumer demands, and quality care based on best practices all drive advancements in health care technology. Technological advancements, according to Polancich et al. (2018), have improved medical practice. Technology assists health care professionals in their work and improves health care quality by lowering the occurrence of medical errors and improving communication among healthcare providers. At healthcare institutions, computer software has been used to assist healthcare professionals, providing them with information to facilitate rational decision-making in the patient's plan of care. Software with an accessible knowledge base is designed to assist clinical decision-making in conjunction with the expertise of the healthcare professional. Decision aids are a type of computerized support system that helps people make the best decision possible. In healthcare, these aids assist professionals in making medical diagnoses while taking individual preferences and a variety of options and aspects into

account. A decision support system, according to Milstead and Short (2019), assists individuals by providing them with the information they need to make informed decisions about patient care. Decision support systems are used to diagnose and manage patients who present with complex medical problems that exceed the primary care provider's knowledge and expertise. Technology is crucial in sustaining the infrastructure of quality health care.

DNP Essential IV was practiced using Athena Health, the electronic health information system used at the Akachi Primary and Urgent Care where this project was implemented. The DNP scholar monitored care outcomes by using advanced technical skills to access retrospective data available on the previous projects. The use of information technology resulted in a comprehensive analysis of the effects on self-care behavior of supplementing standard care for management of T2DM with a mobile app, and it supported the development of additional care programs to improve the quality of care for this patient population. Compliance with the Health Insurance Portability and Accountability Act of 1996 in the process of accessing patient information systems for data collection demonstrated leadership in relation to DNP Essential IV.

Essential V: Health Care Policy for Advocacy in Health Care

To address public concerns, public policy can be made by the public or by government officials, according to Mason et al. (2020). Making the legislative, judicial, or executive departments of government translate their goals into actions while advocating change to solve a problem is critical in public policy. According to Milstead and Short (2019), public policy entails bringing organizational issues to the attention of the government in order to get a response. That response is frequently in the form of a bill or law that is intended to achieve objectives or create initiatives to address an issue. In essence, private healthcare policy differs in that it focuses on the insured population and issues such as long-term care and care standards. Nurses have a

significant role in shaping healthcare policy in both the public and private sectors by speaking out on societal issues such as illness prevention and patient safety. Nurses can advocate for their patients and the community by working with politicians to implement new laws and regulations that improve healthcare.

Policymaking is a complicated process that incorporates involvement from legislators at all levels, including local, state, and national. Local policymakers frequently introduce legislation that has been brought to their notice by members of the community. State legislators shape health policy by identifying who is eligible for care under specific programs and by outlining problems that the public and private sectors must address (Mason et al., 2020). In the end, the president makes the final choice on policy. At the helm of national policymaking, the president advocates for ideas at the forefront of the nation's policy agenda.

One example of exercising DNP Essential V was educating fellow providers, ancillary staff, and policymakers in the setting where this Quality Improvement Project was conducted. Educating staff enabled a broader understanding of an existing health disparity within the community, as well as the need to improve health care delivery for adult individuals T2DM through innovative modalities.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

Today's healthcare environments rely on the contributions of highly talented and knowledgeable people from a variety of disciplines. The DNP scholar is an important component of the multidisciplinary team, and he or she must use advanced knowledge and leadership abilities to support patient-centered treatment (AACN, 2006). Patients in today's healthcare setting, according to Reeves et al. (2017), have complicated medical difficulties that necessitate

participation from multiple disciplines to manage health-related issues. The foundation of this professional model is that healthcare professionals share their skills and viewpoints to achieve a common objective of restoring or preserving an individual's health while pooling resources (Reeves et al., 2017).

This project required collaboration between healthcare professionals to improve T2DM patients' clinical outcomes. For example, a statistician was consulted as a third party to further examine each participant's data for the data analysis component of this project. Collaborating with a professional with statistical experience enabled a more thorough presentation of information, which helped connect the Quality Improvement Project results with enhanced clinical outcomes.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

DNP graduates work in increasingly varied environments in today's dynamic culture. Clients' health and wellness are dependent on concepts surrounding the delivery of culturally appropriate treatment. Culturally competent care, or sensitivity to concerns involving culture, color, gender, and sexual orientation, according to Castro and Ruiz (2009), is a substantial contributor to improved medical results and overall patient compliance. Health promotion and illness prevention must be tailored to patient cultural values and beliefs to be effective. The APRN must be willing to learn about different cultures' norms and values to develop a strong provider-client connection and empower the client. In these cases, the patient may become more willing to accept responsibility for his or her own healthcare. Patient satisfaction can improve because of culturally responsive care, and gaps in healthcare may be reduced for many of society's most vulnerable populations.

According to Washington et al. (2009), healthcare disparities are a major source of worry for healthcare workers, as evidenced by current research findings that show inconsistencies between length of life and quality of life among different ethnic groups. Many people of diverse cultural groups are stigmatized and stereotyped, which contributes to their mistrust of healthcare providers and the system in general. Immigrants from countries where adequate healthcare is scarce, and poverty is common arrive in the United States with complex medical issues and chronic diseases that necessitate a regimen tailored to their cultural demands. Medical translators must be used to overcome communication barriers so that accurate health histories and exams may be performed. Evidence suggests that behavioral risk factors are to blame for an increase in the number of people with T2DM who have one or two diabetes-related complications (Prince George's County Health Department, 2017). Low socioeconomic status, gender, race, and degree of education have all been shown to influence prevalence rates of T2DM. The Quality Improvement Project was created to fill gaps in the literature regarding improvement in self-care management of diabetes and the impact of innovation and technology by studying the impact of mobile self-care management programs. Based upon a community analysis, it was discovered that most of the individuals with T2DM in the community where this project was executed lacked self-care knowledge of diabetes. The inclusion of culturally sensitive examples for adopting mobile technology to enhance self-care behavior resonated well with the project participants.

Essential VIII: Advanced Nursing Practice

Advanced practice nursing, according to Howard et al. (2020), is the application of a broad variety of practical, theoretical, and research-based competences to phenomena experienced by patients within a specialized clinical area of the greater nursing field. Although

the function of the APRN varies, these nurses have a larger breadth of knowledge and the ability to make difficult decisions using EBP when it comes to nursing care issues (Howard et al., 2020). EBP, according to Howard et al. (2020), is the integration of best research evidence with clinical skills and patient values to provide optimal treatment. The best research comes from therapeutically relevant and patient-centered investigations. APRNs are clinical professionals who take a holistic approach to healthcare while using evidence-based practice to address a range of patient health needs. Because the APRN`s scope of practice is typically so broad, continuing education and a comprehensive knowledge base are critical to providing the best possible patient care. APRNs use EBP and the ability to obtain and critically analyze research to support the publication of scientific research on specific areas of interest (Howard et al., 2020).

The implementation of this Quality Improvement Project in a community health center allowed for high levels of critical thinking, independence, and decision-making, as well as the application of DNP Essential VIII. Because of the extensive literature analysis needed for this project, the capacity to objectively appraise research publications before incorporating findings into daily practice has improved. Collaborating with policymakers while developing this project required systems thinking while illustrating the costs and benefits of adopting evidence-based adjustments to enhance of self-care behavior among individuals with T2DM. The implementation of this practice improvement for T2DM treatment not only demonstrated a commitment to promoting best patient outcomes in the community health setting, but it also cultivated a culture of community awareness and education.

Conclusion

T2DM is a chronic, expensive, and complicated condition that needs ongoing medical care that goes beyond merely regulating blood sugar. This project was carried out using a

patient-centered theoretical framework due to the crucial role the patient must play. The research places a strong emphasis on the necessity of ongoing support for patient self-management, which translates to greater patient compliance and helps to prevent or lessen various problems associated with T2DM. This can be achieved by using all available resources to improve patient-provider connection and communication outside of scheduled office visits. It is also important to make use of mobile apps to enhance patient self-care behavior as part of the standard of care for T2DM in clinical practice.

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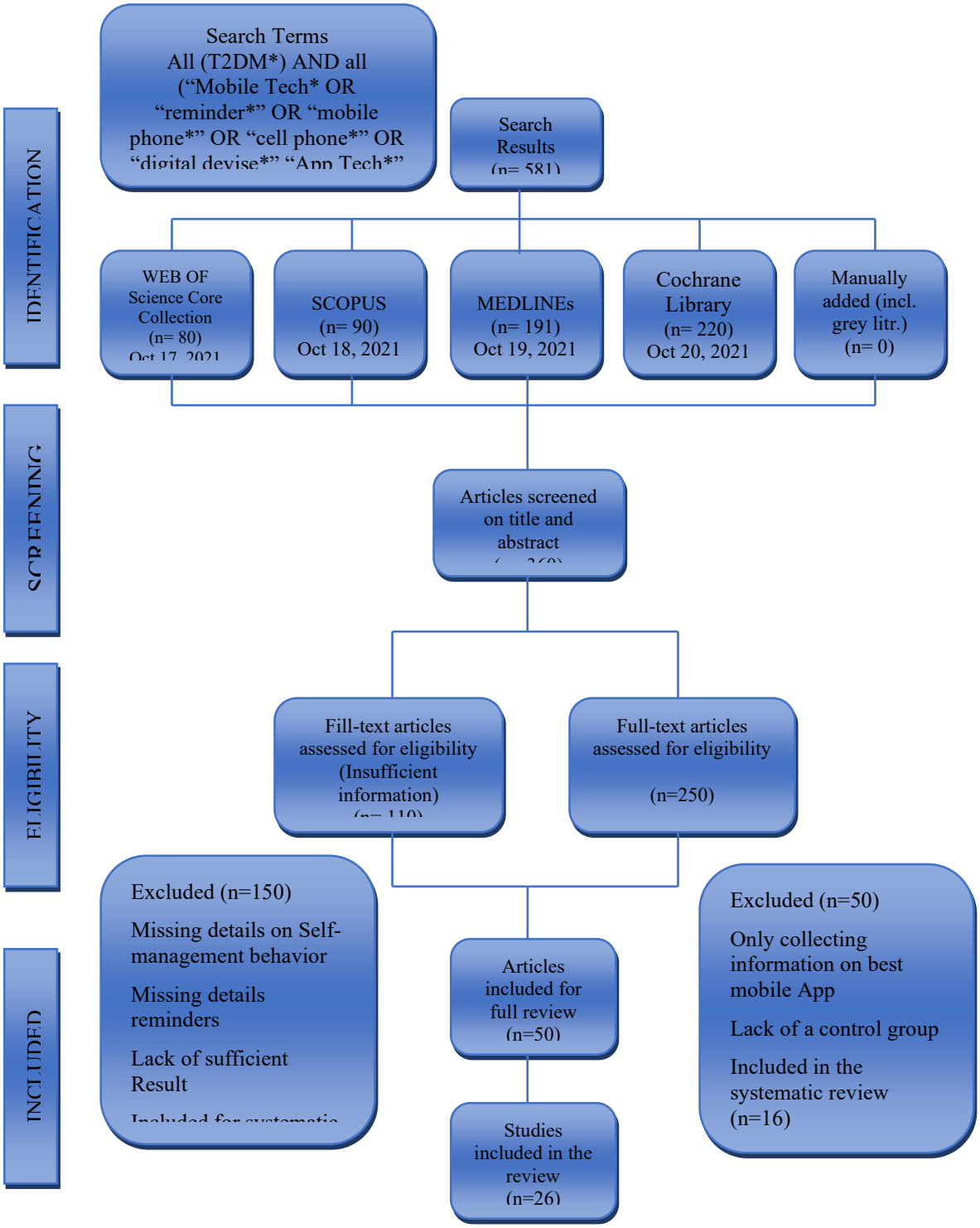
Appendix A

Search Strategy Schematic



Appendix B

HSRC Approval Letter

November 3, 2021

Dear Clement

Wilmington University's Human Subjects Review Committee (HSRC) is pleased to inform you that your Doctor of Nursing Practice project proposal ***An Advance Practice Nurse led intervention using Digital Health Technology to enhance self-management behavior among adult patients with type 2 diabetes mellitus*** was reviewed on ***November 2, 2021***. The project was categorized as ***Exempt*** and meeting the requirements of a quality improvement intervention. Your signed HSRC form is attached. Now that your DNP project has been approved by the HSRC, there are multiple elements with which you must comply. Wilmington University adheres strictly to these regulations:

1. You must conduct your DNP project exactly as it was approved by the HSRC.
2. Any additions or changes in procedures must be approved by the HSRC before they are implemented.
3. You must notify the HSRC promptly of any events that affect the safety or well-being of subjects.
4. You must notify the HSRC promptly of any modifications to your DNP project or other responses that are necessitated by any events reported in items 2 or 3.
5. Your approval is provisional if you require Institutional Review Board approval from your organization. Once organizational approval has been obtained, please submit your signed approval and completed IRB application to DNP Administrative Assistant via email.

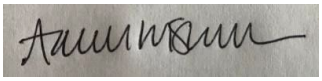
The HSRC may review or audit your project at random or for cause. In accordance with Wilmington University policy, the HSRC may suspend or terminate your DNP project if your project has not been conducted as approved and/or if other difficulties are detected.

While not under the purview of the HSRC, DNP students are responsible for adhering to US copyright law when using existing scales, survey items, and other works in the conduct of research/DNP projects.

In conclusion, you have developed an interesting evidence-based practice project aligned with the AACN DNP Essentials (2006). This is an important project for healthcare practices now and in the future. Best wishes for continued success.

Sincerely,

Angela Herman, DNP, RN
HSRC Committee Representative
Chair, Health Sciences Program
Assistant Professor
College of Health Professions



Aaron Sebach, PhD, DNP, MBA, AGACNP-BC, FNP-BC, NP-C, CLNC, CNE, CNEcl, SFHM
Chair, DNP Program Associate Professor
College of Health Professions

COLLEGE OF HEALTH PROFESSIONS

31 Reads Way, New Castle, Delaware 1972

Appendix C

- Diabetes Self-Management Questionnaire (DSMQ)

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.		**Applies to me very much**	**Applies to me to a consider-able degree**	**Applies to me to some degree**	**Does not apply to me**
1.	I check my blood sugar levels with care and attention. ☐ *Blood sugar measurement is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
2.	The food I choose to eat makes it easy to achieve optimal blood sugar levels.	☐3	☐2	☐1	☐0
3.	I keep all doctors' appointments recommended for my diabetes treatment.	☐3	☐2	☐1	☐0
4.	I take my diabetes medication (e. g. insulin, tablets) as prescribed. ☐ *Diabetes medication / insulin is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
5.	Occasionally I eat lots of sweets or other foods rich in carbohydrates.	☐3	☐2	☐1	☐0
6.	I record my blood sugar levels regularly (or analyse the value chart with my blood glucose meter). ☐ *Blood sugar measurement is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
7.	I tend to avoid diabetes-related doctors' appointments.	☐3	☐2	☐1	☐0
8.	I do regular physical activity to achieve optimal blood sugar levels.	☐3	☐2	☐1	☐0
9.	I strictly follow the dietary recommendations given by my doctor or diabetes specialist.	☐3	☐2	☐1	☐0
10.	I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control. ☐ *Blood sugar measurement is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
11.	I avoid physical activity, although it would improve my diabetes.	☐3	☐2	☐1	☐0

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.		**Applies to me very much**	**Applies to me to a consider-able degree**	**Applies to me to some degree**	**Does not apply to me**
12.	I tend to forget to take or skip my diabetes medication (e. g. insulin, tablets). ☐ *Diabetes medication / insulin is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
13.	Sometimes I have real 'food binges' (not triggered by hypoglycaemia).	☐3	☐2	☐1	☐0
14.	Regarding my diabetes care, I should see my medical practitioner(s) more often.	☐3	☐2	☐1	☐0
15.	I tend to skip planned physical activity.	☐3	☐2	☐1	☐0
16.	My diabetes self-care is poor.	☐3	☐2	☐1	☐0

Appendix D

Academic Agreement

WILMINGTON UNIVERSITY

College of Health Professions
Doctor of Nursing Practice Program

Academic Experiential Engagement Mentor Agreement

Agency: Akachi Primary and Urgent Care

Academic Experiential Engagement Mentor / Facility Representative

DR. MERCY U. ESEME (DNP, MSN, FNP, BSN)
(Please Print)

Position: Medical Director/Administrator

Address: 8957 Edmonston road, suite P
Greenbelt, MD 20770

Telephone: (410) 696-1989

I/we agree to allow CLEMENT M. EFOBI, who is a Doctor of Nursing Practice student at Wilmington University to work with me/our organization in order for the student to develop knowledge about a particular field of interest.

The student is a Registered Nurse, who holds a current Registered Nurse and/or Advanced Practice Registered Nurse licensure and professional liability insurance. Appropriate documentation of appropriate immunizations is on file.

Signature

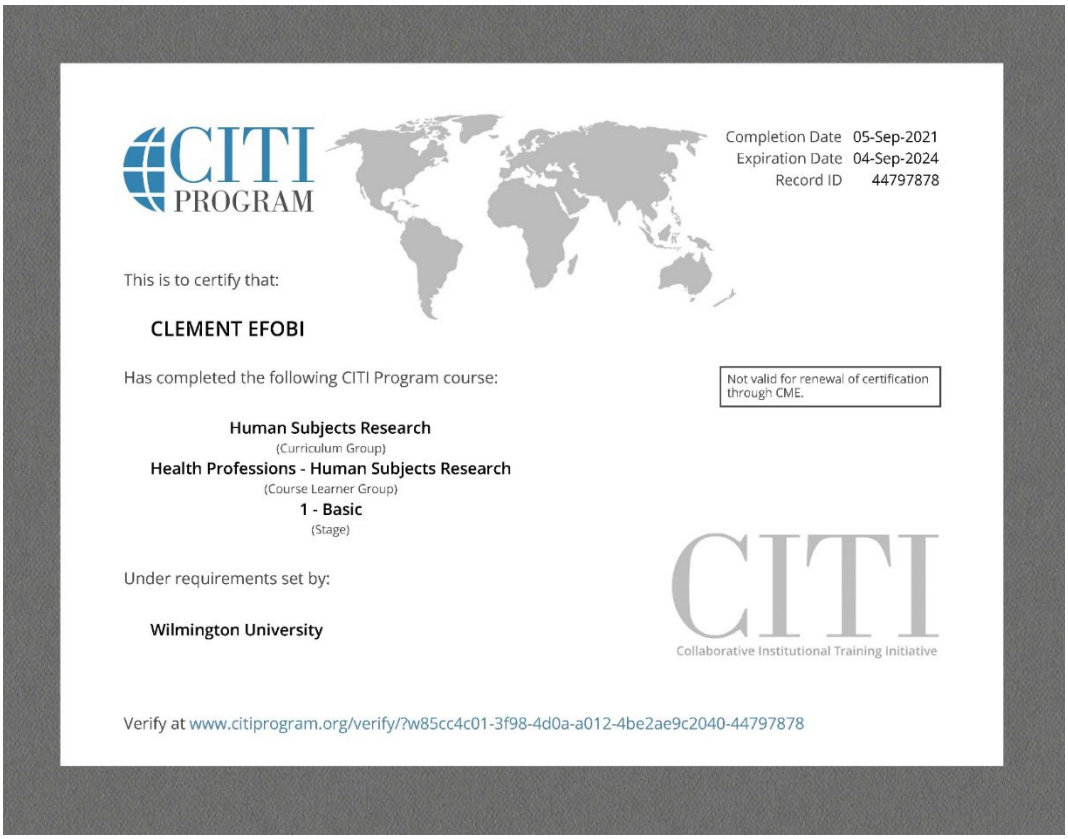
5-19-21
Date

Akachi primary and urgent care
8957 Edmonston RD
Greenbelt, MD, 20770
4106961989

Akachi primary and urgent care
8957 Edmonston RD
Greenbelt, MD, 20770
4106961989

Appendix E

Human Subjects Research Certification



CITI PROGRAM

Completion Date 05-Sep-2021
Expiration Date 04-Sep-2024
Record ID 44797878

This is to certify that:

CLEMENT EFOBI

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Human Subjects Research
(Curriculum Group)
Health Professions - Human Subjects Research
(Course Learner Group)
1 - Basic
(Stage)

Under requirements set by:

Wilmington University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w85cc4c01-3f98-4d0a-a012-4be2ae9c2040-44797878