FEASIBILITY STUDY USING A ONE-WAY AND TWO-WAY TEXT MESSAGING SELF-
MANAGEMENT PROGRAM IN A SAMPLE OF AFRO-CARIBBEANS WITH TYPE 2
DIABETES MELLITUS LIVING IN THE U.S. VIRGIN ISLANDS

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management
DEDICATION

This work is dedicated to my former, current, and future students and patients. You have educated me beyond any degree, humbled me time and time again, and caused me to grow in ways I could have never imagined.
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ABSTRACT

Type 2 diabetes is a global problem that has reached pandemic proportions. T2DM leads to significant premature morbidity and mortality. The risk for death among individuals with diabetes is almost twice that of individuals without diabetes. With the increasing onus of diabetes, an innovative and multifaceted approach to detection, self-management, screening, and delivery of care are needed. Non-white individuals suffer significant disparity in both the prevalence and treatment of T2DM. Among U.S. Virgin Islanders, there is an increased burden on Blacks, Hispanics, the poor, and those lacking education. There has been a rapid increase in the adoption of mobile technology and use of mobile technology for the promotion of health management behaviors in recent years. Mobile technology has allowed researchers to investigate the use of smartphones in health care support and interventions. However, the role and effectiveness of mobile technology remains unclear. The lack of evidence is particularly prevalent in underserved health care regions, such as the U.S. Virgin Islands. The purpose of the study was to explore the feasibility of using a SMS-based diabetes self-management program among Afro-Caribbean individuals with T2DM residing in the U.S. Virgin Islands. Participants in the feasibility study received a text message intervention related to diet and exercise over a two-week time frame. The mixed methods research indicated that a clinical research study able to achieve statistical significance is warranted on the topic. All participants viewed the one- and two-way text messaging intervention favorably with few drawbacks. Participants reported making better dietary decisions and becoming more active because of the text message intervention. Participants shared their desire for a long-term one- and two-way text messaging diabetes self-management program. However, as a feasibility study generalizability is limited due to the small non-representative sample size.
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DEFINITION OF TERMS

**A1C levels.** A1C (HbA1C) is a glycoprotein formed during the reaction between blood glucose and hemoglobin that is used as a tool for monitoring diabetes control in patients (Degeling & Rock, 2012).

**Afro-Caribbean.** People with African ancestral backgrounds who migrated via the Caribbean Islands (Agyemang, Bhopal, & Bruijnzeels, 2005).

**Blood glucose.** The amount of glucose in the blood. Elevated levels may indicate T2DM (Medline Plus, n.d.).

**Diabetes self-care behaviors.** Actions that contribute to the management of the disease, such as monitoring disease status and adjusting medication dosages as necessary (Free et al., 2013).

**Short message service (SMS).** Textual messages sent and received between SMS-enabled phones.

**Type 2 diabetes mellitus (T2DM).** A disease associated with elevated blood glucose levels, insulin resistance, and progressive beta-cell failure (Petznick, 2011).
CHAPTER 1: INTRODUCTION TO THE STUDY

Introduction

During the last two decades, the number of people diagnosed with Type 2 diabetes mellitus (T2DM) in the United States has more than doubled, reaching an estimated 30.3 million in 2017 (23.1 million diagnosed and 7.2 million undiagnosed; Centers for Disease Control and Prevention [CDC], 2017). Because the diagnosis of diabetes is underreported, the actual incidence is likely to be higher.

The diabetes epidemic is not limited to the United States. T2DM has become a global crisis. The disease affects an estimated 425 million people worldwide, a number expected to grow to 693 million by 2045 (International Diabetes Federation, 2017). According to Mohan et al. (2009), “Three key defects are known to drive hyperglycemia in patients with Type 2 diabetes throughout the world: insulin resistance, β-cell dysfunction, and excessive hepatic glucose production” (p. 107). Besides insulin resistance, T2DM is associated with older age, obesity, family history of diabetes and gestational diabetes, impaired glucose metabolism, physical inactivity, genetic risk, and ethnicity (Ley, Schulze, Hivert, Meigs, & Hu, 2017). According to the National Center for Health Statistics (Murphy, Xu, Kochanek, Curtin, & Arias, 2017), T2DM is the seventh leading cause of death in the United States. T2DM is also a leading contributor to racial and ethnic disparities in health outcomes, especially among minorities who are at an increased risk of developing the disease (CDC, 2017).

Problem

With the increasing burden of diabetes and its complications, early detection, proper self-management, aggressive screening, and delivery of care are needed. Despite significant improvements in T2DM management, a significant number of patients are still unable to reach
recommended therapeutic targets, resulting in worsening conditions. A variety of self-management interventions have been tested among individuals with T2DM, with some success. Such interventions include, self-management behavior education programs (Clarke, Baird, Perera, Hagger, & Teede, 2014; Davis et al., 2010; Sinclair et al., 2013), mindful eating techniques (Miller, Kristeller, Headings, & Nagaraja, 2014), virtual communities of support and education (Vorderstrasse, Shaw, Blascovich, & Johnson, 2014), goal setting (Miller & Bauman, 2014), mental contrasting (Adriaanse, De Ridder, & Voorneman, 2013), physical activity regimens (King et al., 2010), motivational interviewing (Minet, Lonvig, Henriksen, & Wagner, 2011), and family teamwork (Murphy, Wadham, Hassler-Hurst, Rayman, & Skinner, 2012).

A growing interest in the use of mobile technology for the promotion of health management behaviors has occurred in recent years. Increased ownership and use of smartphones and mobile technology have transformed many aspects of the daily lives of people in developed nations (Roess, 2017). Researchers have investigated the use of smartphones in health care support and interventions, including community health care education (LeFevre et al., 2017), off-site medical diagnosis (Laktabi et al., 2018), and treatment support in rural areas (Mallow, Theeke, Barnes, Whetsel, & Mallow, 2014).

With a specific focus on T2DM, several researchers have explored the use of smartphone applications to promote self-management behaviors for the disease (Arsand et al., 2012; Arsand, Tatara, Ostengen, & Hartvigsen, 2010; Demidowich, Lu, Tamler, & Bloomgarden, 2012; Tatara, Arsand, Bratteteig, & Hartvigsen, 2013). More recently, growing interest in the use of text messages for diabetes management has occurred. Several researchers have explored the systematic use of mobile text messaging programs for diabetes education and disease management (Franklin, Waller, Pagliarit, & Greene, 2006; Goodarzi, Issa, Alireza, Bahman, &
Mohammad, 2012; Hanauer, Wentzell, Laffel, & Laffel, 2009; Mulvaney, Anders, Smith, Pittel, & Johnson, 2012; Nundy et al., 2014; Olmen et al., 2013). According to Nundy et al. (2014), text message approaches “have emerged as a promising platform for behavior change” (p. 807). Their instantaneous delivery provides health care professionals opportunities to interact with patients in real time and with increased frequency than most traditional behavior change modalities (Nundy et al., 2014). Further, the low cost associated with text messaging provides more access to a larger percentage of the population (Smith, 2010). Although researchers have begun to explore the benefits of text messages on improving behaviors and outcomes for diabetic patients, studies regarding the potential benefits among specific, high-risk groups, such as Afro-Caribbeans, have yet to be conducted.

**Significance of the Problem**

The risk for death among individuals with diabetes is almost twice that of individuals without diabetes of similar age. In addition, the presence of diabetes almost doubles an individual’s risk of multiple vascular diseases (CDC, 2017). Adults with diabetes are two to four times more likely to die from heart disease or suffer a stroke than nondiabetics. In 2015, the death certificates of 789,535 individuals listed diabetes as the underlying cause of death, 252,806 deaths caused by diabetes (CDC, 2017). Diabetes is also the leading cause of kidney failure, new onset blindness, and nontraumatic amputations. In 2012, an estimated total of $245 billion was spent for both direct and indirect diabetes costs in the United States. The average medical expenditures among people with diagnosed diabetes were 2.3 times higher than those of nondiabetics (CDC, 2017).

T2DM is a growing problem that can severely affect the quality of life of patients, while wreaking financial havoc on individuals and the health care system, as a whole. Research
pertaining to the use of educational text messaging programs aimed at improving self-management behaviors of individuals with T2DM is still emerging. Because Afro-Caribbeans are an underserved minority at an elevated risk for developing T2DM (Pitts-Tucker, 2012), it is important to explore the effectiveness of self-management behavior interventions within this group. This research focused on the feasibility of educational text message interventions among other groups at elevated risks of developing T2DM. In addition, this researcher explored participants’ acceptance of the text messaging programs.

**Theoretical Framework**

Bandura’s (1977) self-efficacy theory formed the theoretical framework for the research. Self-efficacy, the focus of Bandura’s (1997) social cognitive theory, is conceptualized as an individual’s belief that he or she has the ability to behave or perform a specific way. This form of perceived self-efficacy is “defined as people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives” (Bandura, 1994, p. 81). Thus, self-efficacy can profoundly affect the way people behave and feel about themselves. In terms of health, the more convinced an individual is that a specific behavior can produce a desired health outcome, the more likely he or she is to adhere to the behaviors that will produce those results.

People’s beliefs about themselves are driven by four main sources of self-efficacy information: performance accomplishments (past experiences), vicarious experiences (observations of other), social performances (social persuasion), and physiological and emotional states (effects of moods or circumstances). These four sources of information lead to the formation of self-efficacy judgments, such as one’s beliefs in his or her ability to perform or behave in a way that will produce the desired outcomes. Such beliefs then have a direct influence
on the final behavior(s) produced. Self-efficacy is required to achieve tasks, reach goals, and maintain commitment to them. A weak sense of self-efficacy can hamper one’s abilities to complete tasks or reach goals. Without the belief in positive outcomes and one’s abilities to accomplish the required tasks to reach those outcomes, an individual’s ability to obtain such aspirations may be reduced. The self-efficacy component of Bandura’s (1997) social cognitive theory provided a helpful backdrop for examining the health management behaviors and perceived self-efficacy among individuals with T2DM.

**Background**

Type 2 diabetes is caused by a combination of genetic and environmental factors. Environmental factors, including sedentary lifestyles and poor eating habits, can result in changes to adipose distribution, which are primary causes for the increased incidence of the disease (CDC, 2015). Factors associated with obesity will remain the primary risk for diabetes development (CDC, 2017). Diabetes is associated with many comorbid conditions, including bone fracture, cancer, and heart disease. Further, diabetes reduces life expectancy by approximately 15 years (U.S. Department of Health and Human Services, Healthy People 2020, 2013)

In addition to the health issues caused by uncontrolled diabetes, the disease prevalence is a significant economic burden to the health care system. For example, in 2012, the total costs associated with diabetes in the United States were estimated at $245 billion. Of this figure, $176 billion were associated with direct medical costs and $69 billion with reduced productivity (American Diabetes Association [ADA], 2013). Individuals with diabetes have health expenses that are an estimated 2.3 times higher than nondiabetics. The average annual diabetes-related
cost for an individual is $13,700, which does not include costs related to increased absenteeism or disabilities associated with the disease (CDC, 2017).

Summary

T2DM is a growing epidemic with severe health and economic repercussions. Controlling the disease requires patients to demonstrate self-management behaviors. Thus, extensive research has been conducted on the use of various interventions for the promotion of self-management behaviors among individuals with T2DM. Recent researches have analyzed the emerging intervention of educational text messages; however, use of the intervention among the high-risk, underserved minority population of Afro-Caribbeans with T2DM has not been investigated.

This chapter included a discussion of the study’s problem, the significance of the problem, and a discussion of the conceptual framework. The researcher also briefly presented the background on the problem of T2DM in the United States. The following chapter contains an in-depth analysis of the existing body of research on diabetes, self-management, behavioral interventions, and demographic disease variables. A detailed presentation of the study’s methodology appears in Chapter 3. In Chapter 4 the researcher outlines the quantitative and qualitative data management processes and synthesizes the quantitative and qualitative findings. In Chapter 5 the researcher discusses the research study findings as they relate to the literature, describes limitations of the study, and provides implications and recommendations for future research.
CHAPTER 2: LITERATURE REVIEW

Introduction

The American Diabetes Association (ADA; 2018) recommends individualized plans for disease self-management because a variety of factors, including culture, can affect behavior and health outcomes. A number of studies have been conducted in the United States and the United Kingdom among participants with different cultural backgrounds (e.g., African American and Hispanic; Braginsky, Inouye, Wang, & Arakaki, 2011; Broom & Whittaker, 2004; Olmen et al., 2013; Nundy et al., 2014; Peyrot et al., 2012; Sinclair et al., 2013). Researchers have examined self-management and self-efficacy of Afro-Caribbeans residing in the United Kingdom.; however, no studies on disease factors among Afro-Caribbeans residing in the Caribbean islands were located for this review. Because of the potential effects of cultural factors on individuals’ self-management and self-efficacy behaviors (National Center for Chronic Disease Prevention and Health Promotion, 2016; Diabetes U.K., 2010; Noakes, 2010; Smith, 2012), this researcher examined those factors among Afro-Caribbeans who reside in St. Thomas, Virgin Islands.

Literature Review

Search Strategy

The researcher used several online databases to locate literature for this review, including CINAHL, EBSCO eBook collection, ERIC, InfoTrac, JSTOR, LexisNexis Academic, MEDLINE, ProQuest, Sage Journals, Springer, and WorldCat. Google Scholar and the Cochrane library were also used to locate additional articles. The following key words guided the search, diabetes mellitus, Type 2 diabetes, Virgin Islanders, Afro-Caribbean, diabetes self-management behaviors, diabetes self-management education, self-efficacy, social cognitive theory, SMP-TD2, SDSCA, Diabetes Self-Efficacy Scale, Control Scale from Diabetes Care Profile, Attitude Scale
Diabetes Care Profile, Diabetes Knowledge Score, text message interventions, SMS, smartphone, Mhealth, applications, apps, social support, activity trackers, and culturally adapted diabetes interventions. A total of 23 articles were selected for inclusion in the final review based on their relevance and age. Studies included were limited to those published within the last 5 years, with the exception of seminal literature.

**Type 2 Diabetes Mellitus**

T2DM is a condition characterized by elevated blood glucose levels and disturbances in the metabolism of lipids, proteins, and carbohydrates (Degeling & Rock, 2012). In the United States, an estimated 23.1 million people have been diagnosed with diabetes. In addition, approximately seven million are living with undiagnosed diabetes and 84 million have prediabetes (CDC, 2017). Diabetes presents significant burdens to public health in terms of economic costs, morbidity, and mortality (ADA, 2018). The mortality rates of diabetics with complications of heart disease and stroke are two to four times higher in diabetics than in nondiabetics (Sinclair et al., 2013). In 2012, the estimated cost of diabetes-related health care was $245 billion (CDC, 2017).

**Diabetes Self-Management Behaviors**

Effective management of diabetes is contingent on a patient’s diabetes self-management behaviors (DSMB). The optimal goal of diabetes self-management is to prevent long-term complications by controlling blood glucose levels and minimizing cardiovascular risks (Adriaanse et al., 2013). Successful diabetes self-management is reliant on an individual’s abilities to incorporate and adhere to self-care activities on a regular basis (Thoolen, De Ridder, Bensing, & Rutten, 2008). Self-care activities in a diabetes self-management program may include following a healthy diet, exercising, monitoring medication use, and regularly testing
blood glucose levels (Hampson, Glasgow, & Toobert, 1990). According to Adriaanse et al. (2013), the most effective self-management interventions for improving diabetes self-care behaviors are those that focus on behavioral change and proactive coping.

A variety of factors can affect DSMB, including self-efficacy, problem-solving (King et al., 2010), social support (Rosland et al., 2008), cognitive impairment (Feil, Zhu, & Sultzer, 2012), gender (Chlebowy, Hood, & LaJoie, 2013), and culture (Cha et al., 2012). Although substantial research has been devoted to DSMB intervention development and testing (i.e., Thoolen, De Ridder, Bensing, Gorter, & Rutten, 2009), researchers usually combine a multitude of self-regulation strategies, making it difficult to determine which aspects are most effective (Adriaanse et al., 2013). Therefore, “testing the effects of separate self-regulation strategies would help to shed more light on which strategies may be crucial in fostering diabetes self-management” (Adriaanse et al., 2013, p. 2).

**Incidence and Prevalence of Diabetes in African-Caribbean**

According to the Behavioral Risk Factor Survey, U.S. Virgin Islanders suffer disproportionately from diabetes with 12.1% of those living in the Virgin Island diagnosed with diabetes compared to 10.5% nationwide (National Center for Chronic Disease Prevention and Health Promotion, 2016). Among this population, there is an increased burden on Blacks, Hispanics, the poor, and those lacking education (Callwood, Campbell, Gary, & Radelet, 2012). Significant ethnic disparities in diabetes development and management exist among those of Black African and African-Caribbean descent (Noakes, 2010). According to Diabetes U.K. (2006), Black African and African Caribbean people are up to five times more likely to develop T2DM and experience earlier disease onset than Caucasians. Researchers have noted reduced insulin prescriptions and lower levels of HbA1c improvement among these ethnic groups (Millet...
et al., 2007). Pitts-Tucker (2012) reported that Afro-Caribbean people living in the U.K. were at least twice as likely to develop T2DM as those of European descent.

An important part of the increased incidence and risk of development for diabetes among Afro-Caribbean communities may be because of cultural ideals of beauty. Traditionally, these communities have viewed extra body fat as beautiful, while thinness has negative connotations of poverty and starvation (Diabetes U.K., 2010). However, excess abdominal fat is a known risk factor for T2DM. Specifically, “genetic differences in how the bodies of people from Black African-Caribbean community’s process and store fat can result in high blood fat levels and increased storage around the waist” (Diabetes UK, 2010, p. 5). Afro-Caribbean culture may also influence levels of physical activity and diet, which can increase diabetes risk factors. For example, traditional Afro-Caribbean dishes tend to be high in fat, salt, and sugar, which can lead to weight gain and increase the risks for developing T2DM (Diabetes U.K., 2010).

Because Caribbean and Latin American immigrants are more likely to be diagnosed with T2DM than non-Hispanic Whites (CDC, 2017), Smith (2012) conducted a study on the diabetes-related cultural beliefs of English-speaking Afro-Caribbean women. The researcher employed semistructured interviews and a cultural consensus analysis to examine reasons for the prevalence of T2DM among Afro-Caribbean women, and how culture may influence disease self-management among this population. The researcher reported that participants’ carbohydrate-laden diets, beliefs in traditional Caribbean medicine, and deep-seated religious faiths may affect behaviors related to diabetes self-management.

Noakes (2010) conducted a qualitative investigation of 14 Black African and African-Caribbean people with T2DM to explore treatment barriers and strategies to overcome them. The researcher conducted focus groups among insulin-dependent ($n = 6$) and noninsulin dependent ($n$
6) individuals with diabetes. Qualitative analysis revealed that perceptions regarding insulin were influenced by participants’ beliefs, qualities of life, education levels, and health systems. Data analysis also indicated that religion was influential in patient decision-making and self-care behaviors, and insulin-related barriers included fears of needles, self-injecting, and dosage regulation. In addition, participants demonstrated low levels of diabetes knowledge and expressed significant guilt and self-blame. In conclusion, Noakes made the following recommendations: (a) educational interventions must be designed and employed to raise diabetes awareness among Afro communities; (b) health care professionals can reduce patient self-blame and fears by educating patients about glycemic control and addressing patient fears; (c) additional research is needed to understand the views of Black Africans and Afro-Caribbeans regarding diabetes-related attitudes and appropriate cultural interventions.

Sobers-Grannum et al. (2015) conducted a systematic review and meta-analysis to identify the role that gender has with the diabetes in Caribbean individuals. The researchers found Caribbean women had a significantly higher risk of diabetes than men (Odds Ratio: 1.65, 95% CI 1.43, 1.91). Sobers-Grannum et al.’s research contradicts gender predominance from most other parts of the world where men are more likely to have diabetes. The researchers stated possible reasons for the gender difference, including excess rates of obesity and reduced physical exercise when compared with Caribbean males.

Compared to other ethnicities, the available diabetes-related literature on Afro-Caribbeans is scant, despite high incidences of T2DM among this group. Further, existing research on diabetes and Afro-Caribbeans has been conducted almost entirely on individuals who have emigrated out of the Caribbean (to the United States or the United Kingdom), which may influence cultural factors, causing results to vary from those Afro-Caribbean natives who still
reside in the Caribbean. For this reason, this researcher explored diabetes management and self-efficacy among Afro-Caribbeans residing in St. Thomas and St. John, U.S. Virgin Islands.

**Diabetes Self-Management Education**

Diabetes self-management education (DSME) is designed to support patient decision-making, problem solving, management, self-care behaviors, and collaboration with health care professionals to improve health outcomes and quality of life (Beck et al., 2017). Research indicates that DSME may help improve DSMB and blood glucose control (Sinclair et al., 2013). Adequate DSME is critical for reducing an individual’s risk for developing diabetes or managing the illness in individuals who already have the disease (Beck et al., 2017). According to Beck et al., DSME “is necessary to learn how to manage diabetes and prevent or delay the complications.” (p. 450). Nunez, Yarandi, and Nunez-Smith (2011) completed a mixed methods study of U.S. Virgin Islanders living with diabetes to explore the role of culturally-influenced views on DSMB and their effect on outcomes. The researchers found no association between diabetes knowledge and glycemic control but did find a positive association between diabetes knowledge and practice of self-management behaviors. Themes that emerged from the study included the strong relationship that culture and peers play on self-management behaviors. Additionally, the researchers found that the stigma of diabetes contributed to fear and was an important barrier in practicing self-management behaviors (Nunez et al., 2011).

The National Standards for DSME were designed by an ADA task force (Beck, et al., 2017). These standards are reviewed every 5 years for appropriateness, relevance, and scientific basis. The most recent update by the task force included the following 10 standards: internal structure, stakeholder input, evaluation of population served, quality coordinator overseeing
DSME Services, DSME team, curriculum, individualization, ongoing support, participant progress, and quality improvement (Beck, et al., 2017).

**Diabetes Self-Management Measures**

A variety of instruments exist to help patients and health care professionals assess DSMB. The following includes some of the most prominent instruments in current research.

**Hemoglobin A1C.** Efforts to identify and monitor T2DM have historically focused on blood glucose measurements; however, hemoglobin A1C (HbA1c) has emerged as another biomarker for tracking diabetes. HbA1C allows health care professionals to index blood glucose levels for more than 6 weeks. This may be advantageous to traditional blood glucose measurements, which just provide measurements for a single instance (Degeling & Rock, 2012). HbA1c is a glycoprotein formed during direct reaction between hemoglobin and blood glucose (Degeling & Rock, 2012). Because HbA1c is higher in individuals who experience prolonged periods of elevated blood glucose levels, it provides health care workers with a tool to monitor diabetes management, such as adherence to medication, diet, and exercise therapies (Broom & Whittaker, 2004). HbA1c levels are especially important to diabetics because vigilant exercise and diet habits are crucial to the management of diabetes, and HbA1c helps health care professionals assess patients’ self-management. Although self-control is a known factor in diabetes management, the HbA1c has been commonly used to reinforce and amplify glycemic control. (Degeling & Rock, 2012, p. 100).

**Diabetes Self-Efficacy Scale.** The 18-item Diabetes Self-Efficacy Scale (DSES; Lorig et al., 1996) was developed from the insulin management diabetes self-efficacy scale (Hurley, 1990), based on modifications that took place during a study on a population of Australian diabetics. The DSES was created to address inconsistencies present in research that involved use
of the insulin management diabetes self-efficacy scale. The 18-item DSES includes items that assess five subscales of diabetes self-management, including diet, self-treatment, routines, exercise, and certainty. The instrument assesses participants’ responses on a 10-point Likert scale ranging from 0 (not at all confident) to 10 (very confident). Rapley, Passmore, and Phillips (2003) reported that the DSES subscales were reliable over time, supported by factor analysis, and relevant to both insulin-dependent and noninsulin diabetics.

**Summary of Diabetes Self-Care Activities.** The original Summary of Diabetes Self Care Activities (SDSCA) (Toobert & Glasgow, 1994) is a brief self-report instrument used to assess self-management across five aspects of a diabetes management regimen, including general diet, specific diet, exercise, medication taking, and blood glucose testing. The revised version of the scale includes items on foot care (Toobert, Hampson, & Glasgow, 2000). The SDSCA is one of the most popular and frequently used assessments of diabetic self-management behaviors (Schmitt et al., 2013). Thus, the researcher chose this instrument as the self-management scale for this study.

**Mobile Phones and Health Care**

More than 95% of adults in the United States own a mobile phone (Pew Research Center, 2018). According to a 2017 report by the U.S. National Center for Health Statistics at the CDC, more than half of Americans have a mobile phone, but no landline telephone (Blumberg & Luke, 2017). Boulos, Wheeler, Tavares, and Jones (2011) explained,

> Smartphones have been one of the success stories of the last decade. In a relatively short period of time, smart mobile technology has penetrated significantly into society, capturing an entire age spectrum of subscribers in western industrialized nations, from school children to senior citizens. (p. 2)
Smartphones are a relatively new mobile phone technology that provides users with advanced computing and communications capabilities, such as Internet access and global positioning systems (Boulos et al., 2011). In addition to the standard voice and text features of mobile phones, smart phones provide users with a variety of other features, such as cameras and recording devices (Boulos et al., 2011), advanced operating systems, and access to email (Demidowich et al., 2012). Increasingly, smartphones are used as handheld computers because of their memory size, large screens, and advanced operating systems (Boulos et al., 2011). Smartphones often provide users with continuous access to information and social connectedness; thus, they hold “a lot of potential in particular for use in education, healthcare and medicine” (Boulos et al., 2011, p. 3).

Interventions via SMS and smartphone applications (apps) specifically developed for diabetes may help patients monitor diet, exercise, medication use, and maintain communication with their health care providers. Currently, no regulatory body or objective rating systems exists for this type of medical app (Demidowich et al., 2012). Although the FDA issued a draft for the regulation of mobile medical apps in 2011 (most recently updated in 2015), it is only applicable to apps that connect to medical devices or are intended to be used as medical devices (U.S. Food and Drug Administration, 2015). Therefore, the vast majority of apps are exempt from regulation.

In the United States, the fast increase in mobile phone use has transformed many aspects of life, including culture, community, relationships, and personal identity (Traxler, 2008). After a systematic review of the literature on 71 mobile phone applications developed to improve diabetes self-management, El-Gayar, Timsina, Nawar, and Eid (2013) found that the use of applications can improve adherence to DSMB regimens by improving self-efficacy. Research
indicates that the number of daily messages sent and received by users can be significant (Smith, 2010). As ownership of mobile phones and use of text messaging becomes increasingly common in the general population, the use of text messages for health care interventions is also growing (Bock, Heron, Jennings, Magee, & Morrow, 2012). According to Smith (2010), more than 85% of adults under the age of 35 engage in text messaging, with an average daily use of 40 messages.

In response to the growing trend in text messaging among the general population, the U.S. Department of Health and Human Services, Healthy People 2020 (2013) supported the development of a mobile health intervention program called mHealth. The use of text messaging technology in health care has many benefits as opposed to face-to-face interventions. Such benefits include providing health care professionals with the abilities to (a) deliver messages to patients at specific times and in specific settings (Cole-Lewis & Kershaw, 2010); (b) deliver multiple daily contacts over longer periods of time; and (c) tailor the content and timing of delivery to the needs of individual patients (Bock et al., 2012). According to Free et al. (2013), mobile technology is particularly helpful for providing individual support to patients because of its popularity, mobility, and technological capabilities.

Most mobile phone users carry their phones with them wherever they go. Therefore, text message interventions allow for the delivery of messages at the times when they are most relevant (Free et al., 2013). Another benefit of text messaging health interventions is the relative low cost. Programming can allow for the delivery of interventions to large populations at a cost that is comparatively less than many other interventions. Messages can also be personalized and tailored to patient age, ethnicity, sex, or other demographic characteristics (Free, Whittaker, Knight, Abramsky, & Rogers, 2009).
Text Intervention Example: Smoking Cessation

Bock et al. (2012) conducted focus group research to investigate participants’ preferences with text message intervention among a group of smokers. Study participants were between the ages of 18 and 35, were current daily smokers or individuals who had recently quit, and had access to mobile phones with text messaging capabilities. Three focus groups of six to eight participants were conducted \((n = 21)\). Bock et al. stated, “The focus groups themselves were designed as a semi-structured consumer-oriented approach to elicit reactions and opinions to proposed intervention elements as well as suggestions for additions or improvements” (p. 153).

The researchers reported widespread interested in the proposed text message program. Participants made a number of recommendations, including varying message content (such as smoking facts, motivational messages, and coping strategies); tailoring messages to individual goals, triggers, and progress; and generating their own text message content. Most of the participants requested an intervention that would last longer than the seven-week duration proposed by the researchers (Bock et al., 2012).

Participants also expressed interest in adding a social networking element to the intervention, which may be an important consideration for the design of a diabetes text intervention (Bock et al., 2012). The researchers explained, “Focus group members reported appreciating the opportunity to connect with other participants either via text messaging or as one participant explained, the program could develop into ‘Facebook for smokers’” (p. 157). As more mobile phone users also have the ability to access the Internet on their devices, an app that provides participants with remote access to online social support networks is another potentially valuable characteristic of health text message interventions.
**Diabetes Text Message Interventions**

Text message interventions for DSMB are still emerging. The following sections include recent studies on the use of text interventions for diabetes management. Kreuter and Wray (2003) described how individualized support systems may improve patient engagement and adherence to health-related self-management behaviors. Because adolescents often experience psychosocial barriers to diabetes self-care behaviors, Mulvaney et al. (2012) conducted a controlled pilot study on the effectiveness of a tailored text message patient support system for improving management behaviors. The researchers tested an intervention called SuperEgo, which was designed by diabetic adolescents and experts in diabetes adherence and care. Prior to the intervention, participants completed the Barriers to Diabetes Adherence assessment to determine each individual’s top three adherence barriers. Messages were then tailored so that 75% of the texts sent to each participant correlated with their biggest barriers.

Participants received approximately 10 text messages each week (Mulvaney et al., 2012). They each had login credentials for a website where they could view their messages, create their own texts, change or reschedule them, and search for and select messages associated with a particular goal. Participants also had the ability to nominate someone else to contribute messages to encourage self-management behaviors. In Mulvaney et al.’s (2012) research, 23 participants completed the study. Researchers reported that trial participants maintained their HbA1c levels (8.8%, SD 2.1) from baseline to 3-month follow-up. Those who did not receive the text intervention demonstrated generally worsening HbA1c levels by 0.98% to 9.9% (SD 2.3). Researchers concluded, “the study demonstrated that a mobile intervention with little or no additional clinical effort has the potential to improve clinical outcomes for adolescents with type 1 diabetes” (Mulvaney et al., 2012, p. 117).
Van Olmen et al. (2017) conducted another text message intervention on diabetic participants in each of the following countries: the Democratic Republic of Congo, Cambodia, and the Philippines. The study was a two-arm randomized controlled trial in which participants were randomly placed in an existing DSME program or a self-management education program that also included a text message intervention. The aim of the study was to explore the effects that text message intervention may have on health outcomes.

Prior to the intervention conducted by Van Olmen et al. (2017), teams in each country worked to optimize existing DSME programs in nine areas of disease management, including: (a) understanding of the disease; (b) diet; (c) exercise; (d) monitoring; (e) medication; (f) foot care; (g) tobacco and alcohol use; (h) patient records; and (i) problem-solving and empowerment (Van Olmen et al., 2017). Study variables the researchers initially aimed to assess included physical tests, interviews, and previously validated surveys and questionnaires. The Control Scale from Diabetes Care Profile (Fitzgerald et al., 1996), Attitude Scale Diabetes Care Profile (Fitzgerald et al., 1996), Diabetes Knowledge Scale (Fitzgerald et al., 1998; Garcia, Villagomez, Brown, Kouzakanani, & Hanis, 2001), and the Patient Assessment of Chronic Illness Care (Glasgow et al., 2005) are among the validated instruments the researchers planned to use. The participants received the intervention for 2 years and the primary evaluation measure was HbA1C pre- and postintervention. At the completion of the intervention, there was no statistically significant difference in A1C between the control and treatment group. However, overall the number of individuals with improvements in A1C was higher in the treatment group. The complexity and comprehensive of the study’s design provide a valuable framework for health researchers of text message interventions.
Dick et al. (2011) conducted a feasibility study of a text-based message system to assess logistical challenges and perceived benefits of an educational SMS-based messaging program in urban African American adults with Type 2 diabetes. Using educational text messages developed from the ADA recommendations for self-care, the messages included content on self-care recommendations, medication adherence, foot care, and blood sugar monitoring. The 18 study participants received the intervention for 4 weeks. Overall, participants were satisfied with the program but wished more control of the message content tailored according to their personal self-recommendation needs (Dick et al., 2011).

Using the same sample, Nundy et al. (2014) assessed the efficacy of the SMS messaging program. The research was centered on the efficacy of a theory-driven text message intervention for diabetics called CareSmarts. CareSmarts combines automated text messages and nursing support. In the study, 67 participants ages 19 and older with a diagnosis of either Type 1 or Type 2 diabetes completed the intervention and follow-up. Researchers employed mixed-methods procedures, including survey analyses and in-depth interviews to evaluate the program’s underlying theoretical model and its effectiveness for driving DSMB. Using the model, Nundy et al. posited, “self-management improves as a direct result of reminders (e.g., cuing) and informative texts by also indirectly through self-efficacy, social support, and health beliefs” (p. 807).

The heart of the CareSmarts intervention is an automated, interactive text messaging system that sends educational texts and reminders to patients about medication, glucose monitoring, exercise, nutrition, and foot care (Nundy et al., 2014). Patients respond to questions via text, and their enrollment is individualized, based on their medication and glucose monitoring regimens, self-management behaviors, and preferences for message delivery. The text system
dynamically modifies itself every 2 weeks according to patients’ preferences and their responses to texted self-assessment questions. The message database consisted of more than 800 messages, categorized as follows, education, encouragement, cues, assessments, and feedback.

Nundy et al. (2014) used the SDSCA (Toobert et al., 2000) to assess the following five areas of self-care (on a weekly basis): healthy diet, high fruit/vegetable and low-fat intake, exercise, blood glucose monitoring, and foot care. The researchers used the DSES (Sarkar, Fisher, & Schillinger, 2006) to assess participants’ confidence that they had the abilities to manage their disease. Medication adherence was assessed using the Morisky 4-Item Self-Report Measure of Medication-Taking Behavior (Morisky, Ang, Krousel-Wood, & Ward, 2008) and an item from the SDSCA. Nundy et al. assessed health beliefs using the Risk-Perception Survey for Diabetes (Walker et al., 2007) and the Diabetes-Related Health Problems.

As hypothesized, Nundy et al. (2014) reported that the intervention was associated with improvements in each of the five domains assessed for, as well as improvements in self-efficacy ($p = 0.01$), social support, ($p < 0.001$), and health beliefs ($p = 0.02$). The researchers made a few important additional conclusions as well. First, participants reported that interactions with remote nurses helped to increase their senses of support. This enforced participants’ connection to the program; thus, reinforcing the intervention. The researchers also found that the individual approach was beneficial to patients because not all participants valued the same program aspects equally (Nundy et al., 2014). For example, some found the educational component to be extremely beneficial, while others placed more value on texts reminding them to check glucose levels or take their medication. Finally, the researchers found that the content of the text messages effectively increased participants’ knowledge and influenced their opinions about the disease.
Bin Abbas, Al Fares, Jabbari, El Dali, and Al Orifi (2015) conducted a similar feasibility study on the use of an SMS messaging system and effect on glycemic control. The researchers used a larger sample size (100 participants) and a longer intervention period (4 months) to assess the effect of the intervention on glycemic control in individuals with diabetes in Saudi Arabia. The text messages were developed by diabetes specialists and included content on pathophysiology, etiology, diagnosis, diet therapy, and psychotherapy related to Type 2 diabetes. Participants received six one-way messages per week. The investigators found a significant improvement in participants fasting blood glucose, glycosylated hemoglobin, frequency of hyperglycemic attacks, and diabetes knowledge (Bin Abbas et al., 2015).

**Other Mobile Diabetes Interventions**

Other than text interventions, mobile phones may be used in additional ways to promote DMSB. Several diabetes-focused apps have been developed to help users monitor important management behaviors. Diabetes smartphone apps may include a variety of features, such as self-monitoring of blood glucose (through logs or graphic charts); diet monitoring (specifically tracking total carbohydrate and caloric intake); exercise monitoring; data sharing and social support; and text message reminders (Ristau, Yang, & White, 2013).

According to an analysis of 10 diabetes apps conducted by Arsand et al. (2012), the most useful features for motivated users with T2DM included (a) easy and reliable transfer of blood glucose information; (b) educational text message capabilities; (c) mobile T2DM diary; (d) diary integration with health care providers; (e) mobile diary for Type 1 diabetes; (f) picture diary; (g) automatic pedometer; (h) nutrition database; (i) context sensitivity; and (j) mobile blood glucose monitoring.
Demidowich et al. (2012) conducted a comprehensive review of Android diabetes apps available in 2011. According to inclusion criteria, only self-management apps that performed self-blood glucose or medication monitoring were evaluated, which left a total of 42 available apps. To score the usability, researchers evaluated the following six functions for each app: self-blood glucose monitoring, medication tracking, data graphing, data sharing, and ‘other’ data tracking (which included additional self-monitoring for factors, such as diet and exercise). The researchers concluded with recommendations for three apps based on their effectiveness and ease of use (Demidowich et al., 2012).

Tatara et al. (2013) conducted a 5-month trial on a self-management app for people with T2DM, called the few touch application. The aim of the study was to assess how individuals with T2DM and those at risk for developing the disease used and perceived the app. The few touch application connects to a blood glucose monitor to assess and track blood glucose levels. It also features diet and exercise monitoring, as well as goal-setting functions. The researchers used mixed-methods data collection and analysis techniques, which included data recorded from the blood glucose monitoring function, a participant questionnaire, and a focus group session. Tatara et al. noted clear correlations between users’ perceptions of application functions and usage. Thus, users who perceived the functions as helpful and user-friendly were more likely to demonstrate continued use, while those who were frustrated with the app or had problems with it or the blood glucose device it connected to were less likely to demonstrate regular, longitudinal use (Tatara et al., 2013).

El-Gayar et al. (2013) conducted a larger review on commercial diabetes applications and studies published between 1995 and 2012. The researchers noticed many of the same benefits reported by other researchers for mobile application use in the improvement of DSMB, such as
improving diet, exercise, and regular blood glucose monitoring. However, a number of issues were also reported. For example, although studies indicate that diabetes education is an integral component of DSMB (ADA, 2018), few of the applications examined contained an educational component. When educational components were included, El-Gayar et al. reported that “such information is often generic and is not personalized to the individual patient” (p. 259). Patients tend to emphasize the importance of automatic data entry (through integration with devices such as glucose monitors), yet only three of the 71 applications examined had such capabilities. Finally, the researchers reported that most applications failed to integrate with patients’ personal health records. In summary, patients did not perceive many of the available diabetes apps as useful because these apps appeared as an electronic version of paper-based logbook systems (El-Gayar et al., 2013).

El-Gayar et al. (2013) recommended the integration of additional capabilities to diabetes applications, such as personalized education, intelligent, data-based feedback, medication suggestions based on automated glucose data monitoring, and motivational tips. Further, none of the apps analyzed appeared to be based on any type of behavioral theory, although several useful models, such as social cognitive theory, self-efficacy, and the health belief model, have delivered positive outcomes for intervention design. Finally, most of the apps that the researchers reviewed failed to provide adequate data security or usability.

Goal Setting

Goal setting is a widely used behavioral change strategy that is regularly employed by health care professionals and diabetes educators (Fleming et al., 2013). The National Standards for DSME and Support promote the use of goal setting through specific, measurable, achievable, reasonable, and timely (SMART) goals (Beck et al., 2017). Miller and Bauman (2014) conducted
a comprehensive review of eight relevant studies to assess the use of goal setting in DSMB. The researchers found that improvements in self-efficacy, diet, physical activity, and HbA1c levels improved in some of the studies. Although goal-setting research in diabetes is limited, substantial evidence of its usefulness exists. To improve the effectiveness of goal-setting in DSMB interventions, the researchers made the following eight practical recommendations: (a) begin with assessment; (b) determine levels of commitment; (c) analyze actions required to meet goals; (d) assess self-efficacy for behavior change; (e) establish specific, challenging goals; (f) develop detailed action plans for achieving goals; (g) provide regular feedback and praise; and (h) set incrementally difficult goals for patients whose levels of commitment and ability are high (Miller & Bauman, 2014).

**Theoretical Framework**

The researcher theoretically framed this study around Bandura’s (1977) concept of self-efficacy. Self-efficacy is a tenet of Bandura’s (1977) social cognitive theory that is critical to behavior change (Bandura, 1997). Self-efficacy describes an individual’s confidence in his or her ability to successfully perform tasks or behave in specific ways (Bandura, 1977). Thus, in addition to catalyzing change, self-efficacy can significantly affect the way people behave and feel about themselves. In terms of diabetes management, the more convinced patients are that specific behaviors will improve health outcomes, the more likely they are to adhere to such management behaviors.

Self-efficacy is driven by four sources of information: performance accomplishments (past experiences), vicarious experiences (observations of other), social performances (social persuasion), and physiological and emotional states (effects of moods or circumstances). These information sources help individuals form self-efficacy judgments, or beliefs in their abilities to
perform or behave in a way that will produce desired outcomes. As these judgments directly influence final behaviors, a weak sense of self-efficacy can be detrimental to achieving goals and completing tasks. Without the belief in positive outcomes and one’s ability to accomplish the required tasks to reach those outcomes, an individual’s ability to obtain such aspirations may be reduced (Bandura, 1997).

Because effective, long-term self-management behaviors are strongly linked to self-efficacy, Bandura’s (1977) theory of self-efficacy was complementary to this research on the effects of a text message intervention on the DSMB of Afro-Caribbeans. Researches have used self-efficacy as a theoretical framework by many DSMB researchers. Presseau et al. (2014) employed constructs from behavioral theories, including self-efficacy, to assess the role that behavior constructs played in predicting actual behaviors among six diabetes health behaviors. Presseau et al. study included a total of 427 physicians and nurses and found that each of the three theories assessed accounted for a medium amount of variance with 12-month behavior change ($R^2_{adj} = 0.15$). In a study on the DSMB of Type 2 diabetics living in a rural area, Hunt et al. (2012) discovered that self-efficacy was a strong predictor of disease management behaviors and was significantly correlated with diet, exercise, and foot care ($p < 0.01$). The convenience sample of 152 participants was primarily African American (58.6%, $n = 89$) and female (65.8%, $n = 100$). Finally, Sharoni and Wu (2012) employed self-efficacy theory to test the association between self-efficacy and self-management behaviors in a sample of Malaysian patients with T2DM. The researchers surveyed a convenience sample of 388 Malaysians with Type 2 diabetes and found a positive relationship between self-efficacy and self-management behavior, which was statistically significant $r_s = 0.481$, $p < 0.001$. 

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Mastery

*Mastery* is an important aspect of self-efficacy, which refers to the successful completion of a task (Scholz, Sniehotta, Schuz, & Oeberst, 2007). According to social cognitive theory (Bandura, 1997), mastery and self-efficacy are reciprocal because the experience of mastering a task can improve self-efficacy when it is attributed to an individual’s competence. Consequently, self-efficacy and mastery create a self-perpetuating cycle in which increased self-efficacy facilitates increased mastery, which then increases self-efficacy even more (Scholz, et al., 2007). As Zulkosky (2009) explained, “Mastery experiences foster a feeling of confidence and an eventual feeling of self-efficacy, while failure in tasks fosters a low level of self-efficacy” (p. 96). The reciprocal relationship between mastery and self-efficacy has been demonstrated in smoking cessation studies (Kok, De Vries, Mudde, & Strecher, 1991; Mudde, Kok, & Strecher, 1995), and has a positive causal effect on behavior change (Scholz, et al., 2007).

The development of goals and plans to achieve them is essential to behavior change. For example, Scholz et al. (2007) explored the role of plan execution self-efficacy, which describes a person’s confidence in his or her ability to act as specified in personal action plans, in the mastery of associated tasks. Study participants included 122 cardiac rehabilitation patients who were assessed weekly for 6 weeks post-discharge. The researchers found that mastery and nonmastery of personal action plans had a causal relationship with plan execution self-efficacy. Thus, when exploring DSMB behaviors through a lens of self-efficacy, it is essential to consider the role of mastery and goal setting (Scholz et al., 2007).

Physiological Cues

Physiological cues are another important aspect of self-efficacy. According to Zulkosky (2009), self-efficacy is preceded by an individual’s experiences. Although these antecedents are
typically viewed as social and psychological constructs, such as persuasion, vicarious experiences, and task mastery, they may also be physiological in nature. Bodily experiences, such as feelings of anxiety, stress, or tension, can affect how an individual judges her or his abilities to complete a task (Zulkosky, 2009).

Self-efficacy can be related to a number of physiological responses, including endocrine, catecholamine, and endogenous opioid responses (McAuley & Blissmer, 1999). Indeed, self-efficacy is influenced by physiological and affective states (Rapley & Fruin, 1999, p. 212). For an individual who has to assume responsibility for managing an existing chronic illness, such as Type 2 diabetes, physiological cues may play a significant role in behavior modification, more than they do for individuals who are acting to prevent illness (Rapley & Fruin, 1999). For example, Rapley and Fruin (1999) explained,

> The person who decides to exercise to lose weight or to prevent osteoporosis would not have the same level of physiological cues as the person with Type 2 diabetes mellitus, who needs to exercise and lose weight to control blood sugar in order to avoid suffering the inevitable complications of the disease. (p. 212)

The physical symptoms associated with uncontrolled blood sugar levels serve as an indication that an individual must take action. Although the need to control blood sugar may be a strong motive, “the competing influence of physiological cues may adversely affect the choices people make and, hence, the outcome” (Rapley & Fruin, 1999, p. 212). Such physiological cues can help an individual manage diabetes and improve one’s sense of self-efficacy.

**Social Persuasion**

Social persuasion also plays a significant role in self-efficacy. Social persuasion describes the intentional influence one person exerts over another through the use of verbal reinforcement
of his or her ability to achieve certain tasks (Gleeson-Kreig, 2006). As Bandura (1977) explained, “although social persuasion alone may have definite limitations as a means of creating an enduring sense of personal efficacy, it can contribute to the successes achieved through corrective performance” (p. 198). Individuals who are socially persuaded to believe they possess self-efficacy to master certain tasks are more likely to do so. However, as Bandura explained, an important element in the effect of social persuasion is the provision of resources necessary to complete such tasks. Social persuasion can only improve self-efficacy if an individual is concurrently provided with the provisional resources needed to facilitate task completion. Absent of such resources, persuaders may actually become discredited and undermine an individual’s perceived self-efficacy (Bandura, 1977). Thus, in this research study, the text messages not only served as persuasive messages to encourage DSMB, but they also served to equip participants with the information needed to make positive behavioral changes.

**Modeling**

Finally, modeling can have a strong effect on self-efficacy. Much of human behavior is learned through modeling, which describes the process of observing others and mimicking their behaviors (Bandura, 1977). Modeling is a cognitive process that acts as an unarticulated way to guide others toward learning behaviors needed to acquire beneficial outcomes and avoid negative ones. According to Bandura (1971), an individual conceptualizes how new behaviors may be performed by observing others and utilizing information acquired during those observations to guide future behaviors. Bandura (1977) stated, “The initial approximations of response patterns learned observationally are further refined through self-corrective adjustments based on informative feedback from performance” (p. 192).
Summary

Diabetes is a significant health problem that researchers have studied in many different populations. Research substantiates the important role of DSMB and self-efficacy in disease management; thus, many DSMB interventions have been evaluated among a variety of populations. However, the effective use of SMS via smartphone technology alongside specific health care management strategies for T2DM remains unclear. This lack of information is particularly prevalent in underserved health care regions, such as the U.S. Virgin Islands with a high prevalence of T2DM in the Afro-Caribbean population. Thus, the purpose of the study was to explore the feasibility of using a SMS-based diabetes self-management program among an Afro-Caribbean population residing in the U.S. Virgin Islands.
CHAPTER 3: METHODOLOGY

Overview of the Study

The researcher of this study investigated the feasibility of a daily one- and two-way educational text messaging self-management program in eight Afro-Caribbean participants with T2DM. Feasibility studies are “pieces of research done before a main study in order to answer the question ‘Can this study be done?’ . . . used to estimate important parameters that are needed to design the main study” (National Institute for Health Research, 2017, “Feasibility Studies,” para. 8). Feasibility studies allow for the examination of the study methods and allow a researcher to assess the parameters for conducting a larger study (National Institute for Health Research, 2017). The feasibility study follows a descriptive mixed methods design.

The researcher recruited Afro-Caribbean patients with T2DM in the U.S. Virgin Islands. The patients were invited to participate in using the one- and two-way text messaging self-management program. This chapter details the purpose of the feasibility study, aims and objectives, research design, methods, and the researcher’s rationale for implementing the chosen design, the setting and population of the study, data collection methods, data analysis steps, and limitations of the study.

Purpose of the Study

The purpose of the feasibility study was to explore (a) the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM; (b) participants’ perceptions of the text messaging self-management program; (c) changes in reports of self-efficacy and self-management before and after text messaging program; and (d) the logistical challenges of recruitment and retention in the sample population.
The study aims were to (a) assess the feasibility of using a one- and two-way text messaging self-management program in an Afro-Caribbean population with T2DM; (b) explore participants’ perceptions of the text messaging self-management program; (c) compare perceptions of self-efficacy and self-management before and after text messaging program; and (d) determine the logistical challenges of recruitment and retention in the sample population.

Objectives at the end of this study allowed the researcher to present (a) the feasibility of a one-way and two-way text message intervention as a mechanism to aide in diabetes self-management in Afro-Caribbeans in the Virgin Islands, (b) participants’ perception of a one-way and two-way text messaging program as an aide to diabetes self-management, (c) perceptions of self-efficacy and self-management before and after text messaging program, and (d) barriers in the recruitment and retention in the sample population.

**Research Questions**

**Research Question 1.** What is the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM?

**Research Question 2.** What are the participants’ perceptions of the one- and two-way text messaging self-management program?

**Research Question 3.** What are the perceived diabetes self-efficacy and self-management behaviors of Afro-Caribbeans with T2DM, before and after a 2-week daily educational text messaging self-management program?

**Research Question 4.** What are the logistical challenges of recruitment and retention in the sample population?
Participants

Sample

Using a convenience sampling strategy, the researcher recruited 10 participants from a multispecialty health care practice group in the U.S. Virgin Islands. The number of participants decreased to 8 after the effects of Hurricane Harvey and Hurricane Irma. Two participants were unable to be reached after the natural disasters. The practice group has three locations in St. Thomas and St. John. These locations represent two of the four primary islands that make up the territory of the U.S. Virgin Islands. Approximately 48% (51,634) of the population of the U.S. Virgin Islands lives in St. Thomas and approximately 4,170 persons live in St. John (U.S. Census Bureau, 2011). Together, the islands equal approximately 50 square miles (World Atlas, 2018). St. Thomas and St. John are connected via hourly ferry and car barge service. Of the islands approximately 110,000 residents, 78% self-identify as Afro-Caribbean Black, 10% identify as White, and 12% identify as other (U.S. Census Bureau, 2011). Approximately half of the population was born in St. Thomas with the majority of those born off the island coming from the Greater and Lesser Antilles (U.S. Census Bureau, 2011).

Inclusion and Exclusion Criteria

The researcher obtained written permission from the chief executive officer/medical director to conduct the study (see Appendix A). Participants invited to participate in a feasibility study were Afro-Caribbeans living in the U.S. Virgin Islands, ages 18 and older, who had been diagnosed with T2DM, had a cell phone with SMS capabilities and were willing to receive text messages and paid for any phone charges associated with these text messages, and were current patients in one of the three locations of the multispecialty health care practice group in the U.S. Virgin Islands. Exclusion criteria included pregnancy, older than 65 years of age, unable to
exercise at a moderate or high intensity, or having any chronic diseases that would prevent exercise. Potential participants had A1C levels below 9.0%, consistent with good or fair control (U.S. Department of Health and Human Services, Healthy People 2020, 2013). Participants may or may not have been on medication. Additionally, type of medication did not affect eligibility to participate in the study. Neither medication use nor type influenced ability to participate in the study.

**Recruitment Plan**

Participants were referred to the researcher by their primary care providers who had received an overview of the study and agreed to refer patients for participation at the clinic. The researcher distributed fliers that provided an overview of the study. Potential participants were also encouraged to inquire about the study using the flier, which lead to a referral to participate from their provider at the clinic. The researcher did not refer potential participants to the study and none of the researcher’s patients were referred to participate. Informed consents were obtained from all participants prior to the study. The informed consent form described the purpose of the study, benefits of participation, and risks for participants. Additionally, the informed consent notified participants that there was no compensation for participation and that they had the right to voluntarily leave the study at any time, without consequence. These individuals were afforded the opportunity to take the informed consent home to review and follow-up with the researcher in 1 week.

Participants were enrolled into the study and registered their contact information for the daily educational text message program. The researcher recruited participants until a sample of 10 were secured. The enrollment period lasted 3 weeks.
Methods

Study Design

During the enrollment period, the researcher noted 1,006 eligible and ineligible patients presenting to the three clinical practice settings, 36 referrals for eligible patients, and 10 of the referred participants enrolled in the feasibility study. Attrition rate of those participants volunteering to enroll in the feasibility study was 20% \((n = 2)\).

The researcher used two tools to measure participant’s diabetes self-management and self-efficacy pre and post the text messaging program. Participants were given an assessment of DSMB using the Summary of Diabetes Self-Care Activities (SDSCA) measure instrument (Toobert et al., 2000). The DSES was used to measure participants’ self-reported perceptions of abilities to manage their diabetes and provide self-care for diabetes (Lorig, Ritter, Villa, & Armas, 2009). Additional demographic information was obtained from the self-report. The researcher explored the feasibility of the intervention through an analysis of participants’ perceptions about receiving the daily educational text message intervention.

Feasibility of the daily text message intervention. The researcher explored the feasibility of the intervention through an analysis of participants’ perceptions regarding receiving the daily educational text message intervention. A qualitative phenomenological design was employed to explore participants’ experience with the daily text message intervention. Participants were asked to detail their experience with the daily intervention within 2 weeks after intervention completion. The data were collected using semi-structured interviews comprised of an open-ended question and probes intended to elicit information from participants related to their “lived experience” of the daily text message intervention. These interviews lasted from 8 minutes to 46 minutes and were conducted via telephone. Through the interviews, the researcher
encouraged the participants to describe all aspects of their experience with the text messaging program.

The researcher recorded telephone interviews through the use of an application on the researcher’s private telephone and then transcribed verbatim. Data were solely accessible to the researcher for analysis and are presented in aggregate through thematic analysis. This data assisted in gauging the feasibility of implementing the intervention. The phenomenological analysis approach outlined by Hycner (1999) was used to analyze posttest interview data. First, the researcher read interview transcripts to get an understanding of what was said by each participant. The researcher then re-read and analyzed the transcriptions to develop themes, concepts, and models needed to make interpretations (e.g., Groenewald, 2004). Hycner’s stages of analysis include bracketing and phenomenological reduction, developing units of meaning, clustering the units and forming themes, summarizing each interview, and extracting general and unique themes to make a complete picture of the themes and the interactions.

The researcher examined participants’ specific word usage and intonation from the recordings. From this examination, themes and subthemes were developed. After completing the initial analysis, the researcher conducted member checking by sharing themes and results with participants to ensure their thoughts were accurately interpreted, as recommended by Moustakas (1994). The researcher will present findings in the results chapter of the dissertation, along with analysis from the quantitative portion of the study. This qualitative component was used to assess the feasibility of implementing daily educational text messages as an intervention for Afro-Caribbean individuals with T2DM.

**Recruitment and retention feasibility.** The researcher collected the practice and patient census data from each of the three clinical practice settings while simultaneously screening based
on the eligibility criteria and obtaining informed consent. The researcher analyzed the total census data, including how many patients met the eligibility criteria of the feasibility study. Out of those patients’ eligible, no participants enrolled by viewing the flyers located in the office and 10 patients enrolled from referral from their provider. After enrollment, data were collected to identify the number of participants that continued to participate in the study.

Figure 1. Patients data collected from the three clinical practice settings.

Setting

Participants were recruited from a multispecialty health care practice group in the U.S. Virgin Islands. The practice has three locations in St. Thomas and St. John. This practice group
was chosen because it affords direct access to the population of interest, Afro-Caribbean individuals with T2DM. The location provides comprehensive specialty care and urgent care to residents of the U.S. Virgin Islands and visitors. Together, the offices average 110 individual visits per day (Red Hook Office: 75; Yacht Haven Office: 27; St. John Office: 8). It was unknown what percent of the practice population was diagnosed with diabetes.

**Development of Text Messages**

The text messages developed for the purpose of this study were based on Bandura’s self-efficacy theory (Bandura, 1977). The content of the text messages was based on performance accomplishments, vicarious experiences, social performances, and physiological and emotional states. These information sources assisted individuals to form self-efficacy beliefs in abilities to perform or behave in a way to produce a desired outcome.

Text messages had been used in interventions within domains, such as smoking (Riley, Obermayer, & Jean-Mary, 2008), weight loss (Patrick et al., 2009), alcoholism (Suffoletto, Callaway, Kristan, Kraemer, & Clark, 2011), and diabetes (Franklin et al., 2006). The basis for these studies was that educational text messages developed participants’ sense of self-efficacy through educational empowerment and behavioral reminders. As educational tools, text messages may improve participants’ self-efficacy. For example, if an individual is trying to lose weight, but does not understand the role of calories in weight loss, information about the caloric deficit needed to create weight loss would empower them to lose weight. Such information may equip the individual with knowledge that improved self-efficacy for weight loss.

The researcher developed a text message database to include each of the five educational domains of the SDSCA (diet, exercise, foot care, glucose monitoring, and smoking). At the initial study visit, all participants received educational handouts on the five educational domains
of the SDSCA. The researcher reviewed the handouts with each participant. The educational handouts served the purpose of assuring that participants have basic expectations of the five behaviors of the SDSCA. Handouts were developed by the ADA (see Appendix B).

Of the text messages developed, 70% were structured as two-way messages to encourage participant engagement and guide behavior change and 30% were developed as one-way self-efficacy text messages. To create consistency, the text messages were packaged by topic. The text messages focused on a topic area for 1 week and then moved to a new topic (see Appendix C). On Day 7 of each week, the participant received a summary text for the topic of the week. The researcher sent the text messages from a web-based program during the intervention. The use of a web-based text message database program created by the researcher allowed the researcher to easily manage multiple conversations with different participants. Use of a web-based program also allowed easier tracking of participant responses. The initial education provided to participants was based on the five behaviors of the SDSCA as the initial intervention was expected to last four weeks. This time frame was shortened given the impact of two category five hurricanes on the islands.

Participants failing to respond to a two-way text message were sent one reminder message. If a participant failed to respond to a text message for more than 3 days, they were sent a text requesting a reply to continue or discontinue enrollment in the study. Those who did not respond to the request were automatically discontinued from the study. Those who opted out of the study via text message received one additional text message confirming their opt out choices and thanking them for participation in the study.
Subject Matter Experts

Content validity for the text messages was established prior to initiation of the study. The Lawshe (1975) method for the establishment of content validity was employed. Using the Lawshe method, the researcher chose a group of subject matter experts (SME) to evaluate each of the initial one-way or two-way text messages within the five categories. According to Lawshe, each item was rated by the SME as “essential,” “useful, but not essential,” or “not necessary.”

Wilson, Pan, and Schumsky (2012) found an error with the original calculation proposed by Lawshe and have published a corrected calculation of critical values necessary to establish content validity. In the study, five SMEs independently evaluated potential text messages for inclusion in the five categories of the text messaging program.

To be considered an SME, individuals must have been physicians, advanced practice providers, or professional nurses with significant practice or education with T2DM. SME were recruited from various primary care settings as well as a specialty provider (endocrinologist) from the islands of St. Thomas and St. John. These individuals had extensive clinical experience in the education of DSMB, as well as knowledge and work experience with Afro-Caribbean populations in the U.S. Virgin Islands.

Study Protocol and Data Collection

Participants completed the SDSCA before and after the self-care management text messaging program. The revised SDSCA comprises scales that assess a diabetes management regimen, which includes items measuring general diet, specific diet exercise, medication taking, blood glucose testing, and foot care (Toobert et al., 2000). The revised instrument is comprised of 11 core items from the original SDSCA, and an additional 14 items (Toobert et al., 2000). The
researcher used this tool to measure DSMB (see Appendix D). Permission was obtained from
the instrument developer prior to use (see Appendix E).

Participants completed the DSES before and after the self-care management text
messaging program. The 18-item DSES includes items that assess five subscales of diabetes self-
management, including diet, self-treatment, routines, exercise, and certainty. The instrument
assesses participants’ responses on a 10-point Likert scale ranging from 0 (*not at all confident*) to
10 (*very confident*; see Appendix F).

Text messages encompassed two aspects of the SDSCA (diet and exercise). Participants
received minimally one text message and a maximum of two text messages per day for the
duration of the intervention. The text messaging intervention comprised both one- and two-way
text messages with participants. Participants also received routine diabetic counseling that was
conducted as part of routine diabetes care. Participants’ first daily text message had content
validity established by SME. Because of the unique nature of the response required for the
second text message, each participant received an individually developed second text message
when a two-way text message was used and therefore it was unable to undergo content
validation. The text message database was checked four times daily during the intervention
phase. However, text messages were not sent during the hours of 9PM and 8AM. Messages
followed a 7-day sequence with Week 1: Diet and Week 2: Exercise. Given the difficulties with
communication and other pressing issues from the two national disasters, the researcher
concluded the study after 2 weeks. Initially, the intervention was 4 weeks with Week 3: Foot
Care and Week 4: Glucose Monitoring.

After participants had completed the 2-week self-care management text messaging
program, phenomenological interviews were conducted to capture the participants’ experiences
with using the text message program. The researcher explored aspects of the intervention that participants enjoyed, would improve, and what additional information they would recommend for inclusion. Three key informants or SMEs validated the interview protocol (see Appendix G) prior to use. These phenomenological interviews occurred via phone. All interviews were recorded using the researcher’s phone and a recording application that locally stores password-protected data. The data were then professionally transcribed for analysis. The identities of all interview participants were protected throughout the duration of the research study.

**Chronology and Timeline**

The researcher had initially developed a timeline for conducting the study ranging from February 2017 to March 2017. The researcher began recruiting participants in February 2017 for 3 days and then because of illness, returned to the U.S. mainland. The researcher returned to the islands for recruitment in June 2017. Study activities were to tentatively commence on September 4th, however because of the potential hurricane, the researcher held initiation. After realizing the massive impact the two hurricanes had on the island, the intervention did not begin until cellular communication methods were in place and a sense of normalcy had developed. Because of the disaster, the participant text messaging intervention occurred and data were collected during a 2-week period (instead of 4 weeks). Table 1 presents the timeline for the study.

**Table 1: Timeline for the Study**

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2016</td>
<td>Research Proposal submitted to the University of Hawaii</td>
</tr>
<tr>
<td></td>
<td>Institutional Review Board for Expedited Review</td>
</tr>
</tbody>
</table>
July 2016 Obtained IRB approval
September and October 2016 Complete content validity of text messages
February and June 2017 Recruit Participants for Participation in Project
October 2017 Implemented text message intervention
October 2017 Conducted Qualitative Interviews with participants
November 2017- June 2018 Data Analysis/Writing up results

**Instruments**

**Diabetes Self-Efficacy Scale**

The 18-item DSES (Lorig et al., 1996) was developed from the IMDES (Hurley, 1990), based on modifications that took place during a study on a population of Australian diabetics. The DSES was created to address inconsistencies present in research that involved use of the IMDES. The 18-item DSES includes items that assess five subscales of diabetes self-management: diet, self-treatment, routines, exercise, and certainty. The instrument assesses participants’ responses on a 10-point Likert scale ranging from 0 (not at all confident) to 10 (very confident). Rapley et al. (2003) reported that the DSES subscales were reliable over time, supported by factor analysis, and relevant to both insulin-dependent and noninsulin diabetics.

**Summary of Diabetes Self-Care Activities**

The original SDSCA (Toobert & Glasgow, 1994) is a brief self-report instrument used to assess self-management across five aspects of a diabetes management regimen, including general diet, specific diet, exercise, medication taking, and blood glucose testing. The revised version of the scale includes items on foot care (Toobert et al., 2000). The SDSCA is one of the most popular and frequently used assessments of diabetic self-management behaviors (Schmitt et al., 2013). Thus, it was chosen as the self-management scale for the research.
Variable or Operating Definitions

Afro-Caribbean is defined as individuals with African ancestral backgrounds who migrated via the Caribbean Islands (Agyemang et al., 2005). This demographic characteristic was screened prior to entry into the study from the demographic information provided to the clinic. Diabetes self-care behaviors are actions that contribute to the management of the disease, such as monitoring disease status and adjusting medication dosages as necessary (Free et al., 2013). The researcher assessed this using the SDSCA instrument. Diabetes self-efficacy is used to assess how confident individuals are in doing activities related to managing and providing self-care related to diabetes.

Data Management and Analysis

The researcher entered data into SPSS Version 22.0. Descriptive statistics were conducted to describe the sample demographics (age and gender) and the research variables used in the analysis. Frequencies and percentages were calculated for nominal data, such as gender. Means and standard deviations were calculated for continuous data, such as SDSCA score and perceived diabetes self-efficacy, and age (Howell, 2010).

Prior to analysis, data were screened for accuracy, missing data, and outliers or extreme cases. Descriptive statistics and frequency distributions were conducted to determine that responses were within possible range of values and that the data were not distorted by outliers. The presence of outliers was tested by the examination of standardized values. Standardized values were created for either subscale score and cases will be examined for values that fall above 3.29 and values that fall below -3.29 (Tabachnick & Fidell, 2013). Any participants with outlying variables were removed from the data set. Cases with missing data were examined for
nonrandom patterns. Participants who did not complete major sections of the survey instruments were excluded from analysis.

**Research Questions**

The researcher determined the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM by calculating the data for the total daily census of the three practice locations during enrollment. This process included data regarding how many patients met the eligibility criteria of the feasibility study (referrals from their provider and self-referred volunteers from fliers). Out of those patients eligible, the researcher calculated how many enrolled in the study. After enrollment, data were collected to identify the number of participants that continued with study participation. A dependent sample \( t \) test assumes normal distribution or a curve that was bell shaped and symmetrical. The researcher examined the assumption of normality with a one sample Kolmogorov Smirnov (KS) test.

The researcher performed phenomenological data analysis for each of the participant interviews. Elements examined from the phenomenological interviews included the actual words transcribed. During analysis of the transcriptions, the researcher noted the frequency of possible themes and subthemes (e.g., Groenewald, 2004). Chapter 4 includes the reported themes. Retention rate and reasons for refusing participation and not completing questionnaires were compiled and categorized to answer Research Question 4.

**Limitations and Threats to Validity**

Several limitations were inherent within the scope of this feasibility study. Results of feasibility studies are often over interpreted, both in terms of feasibility and acceptability (Arain, Campbell, Cooper, & Lancaster, 2010). Feasibility assessments can be misleading because of the
limited number of participants and the motivation that the researcher places into the study. Loscalzo (2009, p. 1694) stated,

With small sample sizes, the likelihood of observing even comparatively common occurrences is low. Yet even when no events of interest are observed, it may be necessary to estimate the true underlying event rate—or, at the very least, the upper limit of that event rate.

Participants in the research study took the SDSCA and perceived diabetes self-efficacy instrument both before and after participation in the text messaging program. Because they had taken the assessments previously, and were thus familiar with the instruments, they may have suffered from repeated testing effects, which may present a limitation any time that repeated measures are taken. However, this does not typically become an issue unless subjects are tested many times and become familiar with the instrument. If a participant has knowledge of the study, and their responses are used for analysis, this knowledge may skew the participant’s responses. Thus, the self-reporting nature of the survey may create bias where respondents did not answer truthfully to questions; this may cause validity issues regarding the instrument (Babbie, 2007).

Human Subject Considerations

Researchers conducting studies involving human subjects have a responsibility to inform and protect participants (Bloomberg & Volpe, 2012). In conducting this study, the researcher adhered to the ethical and moral guidelines prescribed by federal regulations and the University of Hawaii at Manoa Committee on Human Studies. University approval and continuing approval was obtained prior to and during the conduction of the study (Appendix H). Participants were referred to the study by their provider at the clinic. Additionally, recruitment fliers were placed at
the clinic to invite potential participants to inquire about the study and encourage practitioners at the clinic to refer individuals for participation.

The researcher used the University of Hawaii at Manoa informed consent document as the framework for obtaining written consent from study subjects. The informed consent introduced the study to the subject by explaining the purpose of the study, describing the procedures, disclosing the risks and benefits, establishing the role of the subject, and estimating the time involved. Study subjects were informed that any data collected would be de-identified and protected to ensure confidentiality. Participants were informed their participation was voluntary and they could drop out of the study at any time without any negative effect on their continued health care services. Participants did not receive compensation for participation in the study. There was a potential indirect benefit as the study may result in improvements in diabetes self-management and diabetes self-efficacy.

There is potential risk for participants if data are not handled securely. To extend confidentiality to participants, each individual in the study was assigned a research number. This information helped to code all data related to the participant and decrease the potential for data to be linked to individual participants. Hard copies of all data were stored in a locked file in the researcher’s residence where the data will be retained securely for a period of 3 years after the research completion. The document linking participant names and research number is stored separately from all study data. After expiration of the 3-year retention period, the researcher will permanently destroy all research-related data and information pertaining to this study.

Participants were asked to report any adverse events and to seek urgent care for any serious adverse events. Participants were asked to report non life-threatening adverse events to practitioners at the study site. Both life-threatening and non life-threatening adverse reports were
to be reported to the researcher. Non life-threatening adverse events included muscle and joint soreness often associated with beginning an exercise program or an increase in exercise from baseline. Potentially life-threatening adverse events that can range in severity from very mild to severe include hypoglycemia, hyperglycemia, and open sores and blisters. Life-threatening events include a very small risk of abnormal heart rhythm, heart attack, stroke, and potentially death. Overall, the widely accepted benefits of exercising for individuals with Type 2 diabetes should outweigh the risks. Participants were encouraged to use walking as the recommended exercise.

Summary

This chapter outlined the feasibility study, as well as the rationale for the study design. In addition, the setting and sample population were delineated and protocols for recruitment and carrying out the study. The researcher also described the procedures for collecting participant data. The treatment of the data and descriptive analysis used in addressing the hypotheses were also explained. Finally, limitations, threats to validity, and ethical concerns were addressed, with special consideration of the potential methods that may remedy these difficulties or harms.
CHAPTER 4: RESULTS

The purpose of the study was to investigate the feasibility of a daily one- and two-way educational text messaging program for the self-management in eight Afro-Caribbean participants with T2DM. The specific objectives of the investigation were to (a) assess the feasibility of using a one- and two-way text messaging self-management program in an Afro-Caribbean population with T2DM; (b) explore participants’ perceptions of the text messaging self-management program; (c) compare perceptions of self-efficacy and self-management before and after text messaging program; and (d) determine the logistical challenges of recruitment and retention in the sample population. The following research questions guided this study,

**Research Question 1.** What is the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM?

**Research Question 2.** What are the participants’ perceptions of the one- and two-way text messaging self-management program?

**Research Question 3.** What are the perceived diabetes self-efficacy and self-management behaviors of Afro-Caribbeans with T2DM, before and after a 2-week daily educational text messaging self-management program?

**Research Question 4.** What are the logistical challenges of recruitment and retention in the sample population?

In this chapter, the researcher presents the findings of the content validity analysis prior to outlining the quantitative data management process. The researcher then highlights the interview participant demographics before illustrating the qualitative data analysis process. The chapter includes the qualitative results before synthesizing the quantitative and qualitative findings. Finally, the researcher summarizes the chapter and provides a transition to Chapter 5.
Content Validity Analysis

The researcher assessed the validity of the two-way text messages using the Lawshe method. The Lawshe method provided a means to assess how essential the individual texts were within the text message intervention. There was a total of 41 text messages within the database. Five SMEs assessed each text message as useful, useful but not essential, or not useful. The database of text messages covered five domains. These five domains reflect the five educational domains of the SDSCA: diet, exercise, foot care, glucose monitoring, and smoking.

The researcher calculated content validity indices (CVIs) for each text message. CVI values for the text messages were 1 for the majority of text messages. The acceptable CVI (Polit, Beck, & Owen, 2007) in the study used for inclusion of messages was 0.78. Three text messages had a CVI value of 0.75 and were not used and two messages had CVI of 0 and were not used.

Enrollment and Recruitment

During the intervention, 1,006 patients were seen at the practice. Of those seen at the practice, 93 (9.2%) patients had T2DM. From the patients with T2DM, the researcher enrolled 10 patients who met the inclusion criteria. In the study, 26 patients refused to enroll in the study. Finally, 49 patients who visited the practice and had T2DM were excluded from the study. The highest number of patients was excluded from the study on June 13th. On that day, six patients were excluded from the study: two were excluded because of age (> 65), two were excluded because of A1c, and two were excluded because they were unable to text. The fewest patients were excluded on June 21st and June 22nd. On the 21st, one patient was excluded because of A1c level and on the 22nd, one patient was excluded because they were not Afro-Caribbean. Table 2 presents descriptive statistics for the number of patients seen at the practice, patients with T2DM, patients who enrolled, patients who refused, and patients who met the exclusion criteria.
criteria. Table 3 presents frequencies and percentages for the reasons patients were excluded from the study.

Table 2: Descriptive Statistics for the Number of Patients Seen, Patients With T2DM, Patients Enrolled, Refused, and Meeting Exclusion

<table>
<thead>
<tr>
<th>Description</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Patients Seen at Practice During Study Period</td>
<td>1006</td>
<td>100</td>
</tr>
<tr>
<td>Patients Seen with T2DM</td>
<td>93</td>
<td>9.2</td>
</tr>
<tr>
<td>Out of those Patients with T2DM (n = 93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients unable to be contacted / not invited to participate in study</td>
<td>34</td>
<td>36.6</td>
</tr>
<tr>
<td>Patients Met Exclusion Criteria and not Enrolled</td>
<td>49</td>
<td>52.7</td>
</tr>
<tr>
<td>Patients Met Inclusion Criteria and Enrolled (completed quantitative pre and post questionnaires)</td>
<td>10</td>
<td>10.7</td>
</tr>
<tr>
<td>Patients Completing the Study (completed pre and post questionnaires and post interview with researcher)</td>
<td>8</td>
<td>8.6</td>
</tr>
<tr>
<td>Out of those Patients who Met Inclusion Criteria and Enrolled (n = 10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unable to contact after natural disaster / Withdrawn from the Study</td>
<td>2</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Table 3: Frequencies and Percentages for Reasons for Exclusion (n = 49)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C_level</td>
<td>8</td>
<td>53.33</td>
</tr>
<tr>
<td>Unable to visit</td>
<td>6</td>
<td>40.00</td>
</tr>
<tr>
<td>Age</td>
<td>13</td>
<td>86.67</td>
</tr>
<tr>
<td>Nontexter/Not able to text</td>
<td>4</td>
<td>26.67</td>
</tr>
<tr>
<td>Pregnant</td>
<td>1</td>
<td>6.67</td>
</tr>
<tr>
<td>Not Afro-Caribbean</td>
<td>1</td>
<td>6.67</td>
</tr>
<tr>
<td>A1C and Age</td>
<td>2</td>
<td>4.08</td>
</tr>
<tr>
<td>Total Met Exclusion Criteria and Not Enrolled</td>
<td>49</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note. Total number of patients excluded exceeds 49 because some patients were excluded for multiple reasons.

Quantitative Data Management

Of the eligible patients, 10 completed the pre-intervention SDSCA and DSES questionnaires; eight participants completed the post intervention SDSCA and DSES
questionnaires. The researcher calculated descriptive statistics for participants’ age and gender data. Five participants were male (n = 5, 50%) and five were female (n = 5, 50%). Participants’ ages ranged from 41 to 59 years of age, with a mean age of 49.25 years (SD = 6.36).

**Mean Pre- and Post Intervention SDCA and DSES Scores**

Means and standard deviations were calculated for pre- and post intervention SDSCA and DSES scores (see Table 4). Patients scored highest on both measures at post intervention than at pre-intervention. Patients’ post intervention SDSCA score was 6.98 (SD = 1.12). Patients’ post intervention DSES score was 7.34 (SD = 1.11).

**Table 4: Mean Pre- and Post Intervention SDSCA and DSES Scores**

<table>
<thead>
<tr>
<th></th>
<th>Pre-Intervention</th>
<th>Post Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>SDSCA</td>
<td>2.47</td>
<td>1.14</td>
</tr>
<tr>
<td>DSES</td>
<td>2.60</td>
<td>0.98</td>
</tr>
</tbody>
</table>

**Composite Scores Calculated**

The researcher calculated composite scores for pre- and post intervention DSMB (SDSCA) and perceived diabetes self-efficacy. These scores were generated by calculating the mean of the items on each survey. The composite scores were then screened for outliers. The researcher calculated standardized values for pre- and post intervention SDSCA and DSES scores, with standardized scores higher than ± 3.29 indicating the presence of outliers (Tabachnick & Fidell, 2013). There were no standardized values more than 3.29 units from the sample mean, indicating no outlying values in the dataset. The researcher screened the dataset for accuracy using minimum and maximum values. These values were screened to ensure they were within the range of feasible values. None of the values assessed exceeded the possible values for the SDSCA and DSES variables.
Cronbach Alpha Tests of Reliability

Cronbach’s alpha tests of reliability were conducted for the SDSCA and DSES measures. Mean correlations for pairs of items were assessed and reported using Cronbach’s alpha coefficients (Brace, Kemp, & Snelgar, 2012). The coefficients were evaluated using the guidelines set forth by George and Mallery (2016), with coefficients higher than 0.7 indicating acceptable reliability. Table 5 presents the results of the reliability analysis.

Table 5: Results of the Reliability Analysis for SDSCA and DSES Pre- and Post Intervention Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>No. of Items</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SED</td>
<td>8</td>
<td>0.83</td>
</tr>
<tr>
<td>SDSCA</td>
<td>11</td>
<td>0.84</td>
</tr>
<tr>
<td>Post intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SED</td>
<td>8</td>
<td>0.67</td>
</tr>
<tr>
<td>SDSCA</td>
<td>11</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Kolmogorov-Smirnov Test

Prior to conducting the dependent sample t test analysis, the researcher conducted a Kolmogorov-Smirnov test to assess normality. Table 6 presents the results of the Kolmogorov-Smirnov test. The results of the analysis indicated that the assumption was not met for DSES pre-intervention. Because the assumption was not met, the researcher conducted the nonparametric equivalent of the dependent sample t test for DSES data.
Table 6: Results of the Kolmogorov-Smirnov Test of Normality

<table>
<thead>
<tr>
<th></th>
<th>Statistic</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-intervention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDSCA</td>
<td>.215</td>
<td>8</td>
<td>.200</td>
</tr>
<tr>
<td>DSES</td>
<td>.333</td>
<td>8</td>
<td>.009</td>
</tr>
<tr>
<td>Post intervention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDSCA</td>
<td>.185</td>
<td>8</td>
<td>.200</td>
</tr>
<tr>
<td>DSES</td>
<td>.159</td>
<td>8</td>
<td>.200</td>
</tr>
</tbody>
</table>

**Dependent Sample t Tests SDSCA Pre- and Post Intervention Scores**

The researcher conducted a dependent sample $t$ test between SDSCA pre- and post intervention scores. The results of the analysis were not statistically significant, $t(7) = -1.38, p = .210$. The findings indicate no statistically significant difference existed in participants’ SDSCA scores before and after the text message intervention. Table 7 presents the results of the dependent sample $t$ test.

Table 7: Results of the Dependent Sample $t$ test for SDSCA Pre- and Post Intervention Scores

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
<th>SE Mean</th>
<th>Lower</th>
<th>Upper</th>
<th>$t$</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-SDSCA – Post-SDSCA</td>
<td>-0.14</td>
<td>0.28</td>
<td>0.10</td>
<td>-0.37</td>
<td>0.10</td>
<td>-1.38</td>
<td>7</td>
<td>.210</td>
</tr>
</tbody>
</table>

**Wilcoxon Signed Rank Test Between DSES Pre- and Postintervention Scores**

The researcher conducted a Wilcoxon signed rank test between DSES pre- and post intervention scores. The results of the analysis were not statistically significant, $V = 6.00, z = -1.36, p = .172$. The findings indicate no statistically significant difference existed in participants’ DSES scores before and after the text message intervention. Table 8 presents the results of the Wilcoxon signed rank test.
Table 8: Results of the Wilcoxon Signed Rank Test for DSES Pre- and Post Intervention Scores

<table>
<thead>
<tr>
<th></th>
<th>V</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-DSES – Post-DSES</td>
<td>6.00</td>
<td>-1.36</td>
<td>.172</td>
</tr>
</tbody>
</table>

**Interview Participant Demographics**

The researcher initially recruited 10 interview participants; however, after natural disaster hit the island, two participants could not be contacted. A total of eight interviews were conducted for the qualitative portion of this mixed methods research study. For a small research study, eight participants were sufficient to reach data saturation (Braun & Clarke, 2013). Of the eight interview participants, there was an equal representation of male and female interview participants. The age range for participants was between 43 and 59 years old, leaving the gap from youngest to eldest at less than 20 years. Table 9 presents interview participant demographics.

Table 9: Participant Demographics

<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>43</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>59</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>41</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>57</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>52</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>46</td>
</tr>
</tbody>
</table>

*Note.* Participants 2 and 8 were not reported because they were unable to be contacted after the storm hit the island. The researcher did not renumber participants due to concerns about possible difficulties associated with renumbering participants with previously assigned participant numbers.

**Qualitative Data Analysis**

After transcription, the researcher began the process of familiarization with the interview data. Familiarization is the first step in the qualitative data analysis plan where the researcher
reads and rereads the interview transcripts to understand the content of the interviews. The process of familiarization is useful to introduce the researcher to the content of the interviews and begins the formal data analysis process. During this step, the researcher began to identify prominent patterns within participants’ narratives, such as prevalent topics mentioned across multiple participants. The researcher noted these patterns to help guide the data analysis steps. Table 10 outlines these patterns.

Table 10: Patterns Noticed During Familiarization Phase of Data Analysis

<table>
<thead>
<tr>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appreciated the reminder</td>
</tr>
<tr>
<td>Timing of the messages was good</td>
</tr>
<tr>
<td>Changed habits because of text messages</td>
</tr>
<tr>
<td>Eating better and being more active</td>
</tr>
<tr>
<td>Became more informed about diet and exercise</td>
</tr>
<tr>
<td>Messages were motivational</td>
</tr>
</tbody>
</table>

The researcher began the second phase of the data analysis process, coding the interview data. To accomplish this, the researcher uploaded the qualitative interviews into a computer-assisted qualitative data analysis software (CAQDAS) called NVivo 11. NVivo 11 is a data analysis tool that qualitative researchers use to help organize and manage the data analysis process (Bazeley & Jackson, 2013). After the researcher uploaded the interview transcripts into NVivo 11, the process of coding the data began. The researcher went line-by-line to identify meaningful excerpts that related to the topic under investigation. The researcher labeled these meaningful excerpts with descriptive titles that summarized the content of the individual code. This process continued until all the interview transcripts were line-by-line coded, leaving a compiled list of codes. Table 11 illustrates an example of the coding process.
After compiling the list of codes, the researcher began to assess the relationships that existed between them. This process entailed combining and assembling groupings of codes with similar relationships and labeling these relationships with titles. Reducing the codes to their core essences was useful to understand the prevalent themes that emerged from the data. The researcher continued this reduction process until no further reduction was possible, leaving only the core essences of the phenomenon under investigation. After creating these final themes, the researcher examined the themes against the data to ensure they captured participants’ experiences. After verifying their accuracy, the researcher began to define each theme. Three overarching themes emerged from the interviews: (a) Changes, (b) General Thoughts About Intervention, and (c) Recommendations and Feedback. The theme Changes had two subthemes that further explored the ways participants discussed the changes the intervention had on their lives. These two subthemes were (a) Improved Awareness and (b) Behaviors. Table 12 outlines the resulting themes, applicable subthemes, and the codes.

<table>
<thead>
<tr>
<th>Raw Data</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“You know, it kind of came at a good time, I guess, because the main focus wasn't really on my diabetes after everything happened.”</td>
<td>Good timing on messages</td>
</tr>
<tr>
<td>“I would say that it really caused me to focus on it when I'm really trying-- when I was really putting my focus into other things after the storm.”</td>
<td>Constant reminder</td>
</tr>
<tr>
<td>“I really liked it.”</td>
<td>Liked the program</td>
</tr>
</tbody>
</table>
### Table 12: Final Themes, Subthemes, and Codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subtheme</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes</td>
<td>Improved Awareness</td>
<td>(a) Constant reminder and (b) good timing on messages/came when I needed it</td>
</tr>
<tr>
<td></td>
<td>Behaviors</td>
<td>(a) Making better eating choices, (b) exercising more/making small changes to be more active, and (c) did not make changes</td>
</tr>
<tr>
<td>General Thoughts About Intervention</td>
<td>N/A</td>
<td>(a) Liked the program, (b) favorite part, (c) helpful information, (d) motivation, and (e) most text messages were realistic</td>
</tr>
<tr>
<td>Recommendations and Feedback</td>
<td>N/A</td>
<td>(a) Intervention was annoying sometimes, (b) wanted timing of messages to be consistent, (c) want intervention to be long term, (d) expensive to eat health/vegetables, and (e) hard to find locations to exercise/walk everyday</td>
</tr>
</tbody>
</table>

### Qualitative Results

Three final themes emerged from the data analysis process: (a) Changes, (b) General Thoughts About the Intervention, and (c) Recommendations and Feedback. The researcher included discrepant cases in the presentation of the results to ensure a complete and accurate representation of the data. The researcher used raw data excerpts to support the thematic findings.

#### Changes

The first theme, Changes, had two subthemes that represented the ways participants discussed how the text messaging intervention changed them. Participants felt the intervention helped them become more aware of their diabetes self-management and more conscious of the
consequences their behaviors had on their diabetes self-management. For this reason, the two subthemes were (a) Improved Awareness and (b) Behaviors. These two subthemes related to one another in that participants talked about how their improved awareness about their diabetes self-management influenced their behaviors. Table 13 highlights that all participants supported each subtheme. Sources referred to the number of participants whose codes supported the subtheme and references referred to the number of times all the codes were present in the subtheme.

**Table 13: Thematic Breakdown and Frequency**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subthemes</th>
<th>Codes</th>
<th>Sources</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes</td>
<td>Improved Awareness</td>
<td>(a) Constant reminder and (b) good timing on messages/came when I needed it</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Behaviors</td>
<td>(a) Making better eating choices, (b) exercising more/making small changes to be more active, and (c) did not make changes</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>

**Improved awareness.** Every participant felt the text messaging intervention increased awareness of their diabetes self-management by (a) being a constant reminder to them every day and (b) receiving the messages at beneficial times during the day. One participant explained the text message reminders helped him “whenever I was faced with a decision on what to eat or when to exercise” because the text messages “kept it at the front of my mind during the day” (Participant 1). The key for him was that he received it on his phone because “you have your phone in your pocket” so when it would “either beep or vibrate” he would have instant access to the text message (Participant 1). Participant 6 shared the convenience of the text message was a big positive of the intervention: “I am always with my cell phone and that way, when I got the reminder, it was when I wasn’t normally thinking about it.” One participant expressed a similar sentiment when she shared that because her cell phone was her “main form of communication,”
receiving the text messages made it not only “very quickly readable” but also “accessible” compared to “something through email” (Participant 9).

Participant 10 talked about how the text messages helped remind her “every day what I needed to accomplish for my diabetes.” She admitted the difficulty she had before the text message intervention to be mindful of her diabetes self-management because she sits “at a desk for work” and does not “move a lot” during the day (Participant 10). She felt the timing of the text messages were accurate because when it would be around lunch time, she would receive a text message about making healthy choices with food. As a result, she would “think about the text message” she received when deciding on what to eat for the day (Participant 10). Participant 6 shared a similar sentiment to Participant 10 regarding the timing of the text messages. She stated, “I would be headed to lunch or headed home, and I would get the reminder, and I’d be like ‘Oh, yeah. I gotta choose healthy choices’” (Participant 6). Participant 5 admitted that after joining the text message intervention, he began to look forward to the text messages every day because “it cues you” and “reminds you” to be aware of diabetes self-management.

Every participant felt the intervention helped them become more aware of their diabetes self-management, but a few participants explained how the intervention came at the right time, meaning after the storm hit the island. Participant 4 stated the text message intervention “really caused me to focus on it (diabetes self-management) when I’m really trying—When I was really putting my focus into other things after the storm.” To him, it was valuable to have a reminder during the recovery of the island because without it, his diabetes self-management may not have been a priority. This participant felt the text message format was a positive delivery method because it was a quick blurb that took “two to three minutes for me to read the text messages.”
but made him “ponder them (the text message) throughout the day” and “make healthy choices” (Participant 4).

Another participant shared a similar sentiment to Participant 4 and acknowledged that before the text message intervention, she “wouldn’t be thinking about it” because of the other concerns regarding the storm (Participant 6). Participant 6 shared how getting the text message would bring it to the forefront of her mind and she found the timing of the text messages to be beneficial. This participant admitted her “diabetes has really been on the back burner because there’s a lot going on” since the storm hit, but felt “it probably was best for this to go on right now” since it helped remind her about her diabetes self-management (Participant 6). Participant 7 shared a similar sentiment to Participants 4 and 6 regarding the timing of the intervention. He felt it helped remind him to “take care of myself in order to take care of my family” instead of feeling as if “my sugar is just not the most important thing” (Participant 7).

**Behaviors.** Seven (87.50%) out of eight participants felt the text message interventions made them change their eating habits and exercise habits, whereas one (12.50%) did not report any changes to her behaviors. Participant 3 did not report any changed behaviors because of the text message intervention, but noted that as a working mother, she found it difficult to find the time to incorporate the suggestions made by the text messages. She explained, “when my children grow up and they’re out of the house,” she would “have the time” to dedicate to implementing the changes the text message intervention discussed (Participant 3). Nonetheless, she felt the text message intervention taught her “about the choices that you can, you can make” regarding diet and exercise (Participant 3).

One participant talked about how the text message intervention made him change his routine lunch destination. Participant 1 shared that usually “when I would go eat lunch, um, on
my lunch hour, I would get some Rotee,” which he admitted “may not be the best choice” for him. After the text message intervention started, he stated how he “would go to Subway” instead of Rotee and eat “a lettuce wrap” instead of his usual lunch order (Participant 1). Although he admitted that he may not “meet the requirements” of vegetable servings a day, he explained how he has “been making sure that I eat more of those” than he did before the intervention (Participant 1). The text message interventions helped him decide to make a healthier decision for lunch, something several participants reiterated during their interviews. Participant 10 expressed a similar sentiment about changing her behavior to “eat more vegetables” and “take care of myself” since the text message intervention. She explained that before the intervention, she would eat a lot of carbohydrates throughout the day beginning with “bread, fruit, or, um, lots of oatmeal with sugar and things” (Participant 10). Since the intervention, she is “trying to cut down on the carbs a lot” by having “an egg with protein” for breakfast (Participant 10) and drinking more water instead of juice.

One participant mentioned sharing the text messages with his wife and using those to help both of them make healthier food choices. Participant 7 shared that because his wife does the primary cooking for the household, he would share the messages and recommend doing “something else for dinner” like “maybe have chicken instead” of “oxtail stew.” He believed the text messages helped him “when I was out at work, um, having lunch or something” because he would make a healthier choice that was “a better choice for me” (Participant 7).

For many participants, the text message interventions helped them make small changes in their everyday routines. Participant 4 explained a small change he made in his daily routine because of the text message intervention:
I’ve cut out my carbs a bit more and tried to eat more proteins. Um, and what I’ve really worked on is trying to get that—some walking in every day. Um, you know, I do do things like park farther away from the store, or, um, you know, walk when I-- walk where I wouldn’t have walked, or you know, take an extra trip around the store. Or at work, maybe in my lunch break, um, I take a little walk instead of [not] and go eat my lunch somewhere else.

Participant 4 would make the effort to be active for longer periods of time because of the text message reminders he received. Participant 7 expressed a similar sentiment regarding parking further away when he shared, “when I went to the store” he would “park farther away” from the entrance because it helped him be more active.

Exercise was an important change that participants noted during their interviews, whether taking the stairs instead of the elevator or taking a walk on the beach, participants talked about how the text message intervention helped them be more active. Participant 9 shared that she would “use the stairs instead of, you know, taking the elevator” so that she could “exercise more” in her daily life. She explained that on the island, “places to go walking are very limited,” especially without sidewalks along the majority of the streets (Participant 9). Participants noted the difficulty with finding a flat and even surface on the island to work out, which made the beach a perfect location for many participants. Participant 1 shared, “when I go to the beach, I walk along the beach instead of sitting there” because “it’s a flat, um, even surface” that he could walk on.

**General Thoughts About Intervention**

Every participant talked about their general thoughts regarding the intervention. Participants enjoyed the text message intervention and liked the program overall, and some
specifically felt they learned more about self-managing their diabetes because of the helpful information the text messages conveyed. Others liked the motivational and interactive aspects of the text message intervention in which they would respond to a question or prompt in the text message. Table 14 outlines that all participants supported the theme. Sources referred to the number of participants whose codes supported the theme and references referred to the number of times all the codes were present in the theme.

Table 14: Thematic Breakdown and Frequency (General Thoughts About Intervention)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
<th>Sources</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Thoughts About Intervention</td>
<td>(a) Liked the program, (b) favorite part, (c) helpful information, (d) motivation, and (e) most text messages were realistic</td>
<td>8</td>
<td>52</td>
</tr>
</tbody>
</table>

Every participant enjoyed the text message intervention and cited their favorite aspects of the text message intervention. These responses ranged from liking the text message interventions because of the information they learned about diabetes self-management to the applicability of the text messages in their everyday life. Every participant enjoyed learning about diabetes self-management tips, such as the ones the text message intervention taught them. Participant 1 stated that he liked “the information I was given and how it was given” because it made it “very clear” for him how it influenced managing his diabetes. His favorite aspect of the text message intervention was the “daily dietary reminders” because “they were educational” and informative to him (Participant 1). By having that reminder, it helped him be aware of increasing his consumption of vegetables and decreasing unhealthy food choices. Participant 3 talked about how informative the text message interventions were for her, even though she was not able to implement any changes during the 2-week intervention she was interested in applying some of the things she learned into her diabetes self-management routine. She shared during her
interview “the thing I like the most is that I learn things about diet and exercise that I didn’t know about before” (Participant 3). Although she may not have been able to make the changes she wanted to make, the information she learned would help her make good choices going forward for herself and her family.

Every participant noted the informative aspect of the text messages as a benefit to them because they learned more about healthy eating and exercise. Participant 7 felt the facts he learned from the text messages were the most helpful aspect of the intervention. He shared that learning about “how many fruits and vegetables I should actually have” was insightful because “I could compare it to what I have been doing and then, what I need to do” to meet those requirements (Participant 7). Learning about food choices was his favorite aspect of the text message intervention because although “I may not feel like I have 20 minutes to exercise,” “every time I eat, I can kind of make a choice and I liked that” (Participant 7). This participant was more empowered in making better and healthier decisions for himself when he ate because of the informative text messages.

Participant 9 similarly expressed he liked the “educational points” in the text messages, specifically the ones concerning diet. He admitted during his interview that it was because of “poor eating habits” that he “got my diabetes in the first place,” so having something that was “easy to follow” and could “improve my sugar levels” was a big benefit to him (Participant 9). Participant 6 explained how she thought the text message intervention was realistic in helping her “just do 10 minutes a day” of walking. She felt the text messages were “helpful because they were motivating and informational” about “why exercise is good for my diabetes” (Participant 6).
A couple of participants noted the interactive text messages as their favorite aspect of the text message intervention. Participant 5 shared that having a “follow-up” message about an activity or behavior, like walking for 10 minutes or drinking enough water, was helpful to keep him focused on implementing the changes in his daily life. One participant explained the interactive text messages were his favorite aspect of the 2-week intervention:

I really like that it said, “Do this,” and then sometimes you would say things like, “Did you do this today?” And I would say, you know, “Yes I did,” or, “No, I didn't.” And then based on that, I would get a response, which was kind of like customized to me. I thought it was kind of, uh, a program that everyone just got these messages and everything. So it was really nice to know that like my responses mattered, and then, um, my focus was changed a little bit. (Participant 4)

For Participant 4, having individual responses to the text message intervention had a positive effect on his experience of the intervention. Another aspect he enjoyed was that each week focused on one particular area, such as spending “one week on activity” outside of a gym with “walking and moving, and then next week it was all focused on eating habits” and “changes I could make to my diet” (Participant 4).

Participant 10 talked about how the interactive motivational text messages were her favorite part of the text message intervention. She explained how the text message would remind her that “the day is early” and “you can still get this in for the day” to help motivate her to “go take a walk or, you know, make a better [diet] choice” (Participant 10). The text messages motivated her “to make a better choice with food and to try to move more” while reminding her about the health benefits associated with the choices, which helped her be more aware of her choices (Participant 10).
**Recommendations and Feedback**

Every participant provided their recommendations and feedback regarding the text message intervention. Some participants talked about wanting the timing of the text message interventions to be consistent day-to-day, whereas others talked about the logistical concerns about affording expensive fresh vegetables. Every participant wanted to see a long-term text message intervention because they felt it was extremely useful to them. One participant felt the text message reminders, although useful, were annoying and another felt the intervention, although informative, was unrealistic for her busy working life. The feedback these participants provided may provide useful considerations for future researchers who wish to employ a text message intervention for diabetics. Table 15 outlines that all participants supported the theme. Sources refer to the number of participants whose codes supported the theme and references refer to the number of times all the codes were present in the theme.

Table 15: Thematic Breakdown and Frequency (Recommendations and Feedback)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
<th>Sources</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendations and Feedback</td>
<td>(a) Intervention was annoying sometimes, (b) wanted timing of messages to be consistent, (c) want intervention to be long term, (d) expensive to eat health/vegetables, and (e) hard to find locations to exercise/walk everyday</td>
<td>8</td>
<td>41</td>
</tr>
</tbody>
</table>

A few of participants recommended sending the text messages at consistent times of the day. One participant mentioned that she received a text message at “a weird time” instead of close to a typical “meal time” (Participant 6). She recommended that the intervention “should be like twice a day at consistent times” so that individuals could predict when the text message would arrive (Participant 6). Another participant explained that he wanted more frequent text messages during the day because they “would keep me on track” with making healthier choices.
(Participant 1). This was especially true about the text messages revolving around making better choices with diet, which he admitted he would keep in mind that day and maybe the next, but at the end of the week, he would feel “like I may be like falling into my old habits” without the consistent reminders (Participant 1).

Some participants talked about the difficulty associated with finding a location to exercise, especially on an island where “there are not sidewalks like in the States” (Participant 9). As a result, this limits the places were individuals can “find a place to walk and exercise” since they are not able to “walk through neighborhoods” like they are in the States (Participant 9). Participant 1 shared his belief that “it’s harder to exercise in the Virgin Islands because there’s not very good access to, you know, areas where you could walk much.” This participant elaborated that because there are not a lot of areas where he can walk, “I have to travel to, um, the VI National Park” to find “walking space to go and do my walking,” which after a full day of working “was a bit difficult” to accomplish (Participant 1). Participant 3 expressed a similar sentiment about the difficulty in finding a “flat surface where, you know, you can walk and exercise” outside of a gym. The island has “limited spaces to exercise” because of the lack of sidewalks along the roads; therefore, “you have to drive” to a park or “spend a lot of money on a gym” what is not “very big” (Participant 3).

Another significant concern for Participant 3 was the cost of vegetables on the island. She shared that on the island, there was not a large “selection of food” available at a low cost outside of select fruit options they grew on the island (Participant 3). Participant 3 explained that while she would “love to eat all of those vegetables” to meet the daily requirement, but “it’s very expensive” to purchase those vegetables. Participant 3 added,
[On] the island, the limiting factors of what's available to eat. I mean, the only thing that you can consider healthy, um, is Subway. And, um, you know, that there’s not really any other much of a choice. And the salads and the other restaurants are very expensive. It’s like $14 for a salad and where as it's, you know $6, you know, for a sandwich.

Participant 3 shared during her interview that it was very “expensive to eat healthy” on an island, where fresh produce was often shipped over, which only added to the cost of those items. Although she expressed her frustration about the circumstances surrounding the dietary and exercise recommendations the text messages shared, this participant stated that after her children are out of the house, she would have more options to implement those changes. She recommended the text message intervention should take into consideration the “full-time parent” with “multiple children” to give suggestions about “exercises to do at home, um, you know, while bathing your children or something like that” to make it more accessible for her (Participant 3).

When asked about his recommendations for the text message intervention, Participant 4 felt it would be beneficial for the intervention to “be more customizable” to an individual’s “main goals.” He felt that would help each individual focus on areas important to them, but still address all the areas related to diabetes self-management. Participant 9 suggested that at the end of the week, each person should have the opportunity to have a transcript of “your responses” to each question “so you could review it and then be reminded of what you were asked” during the week. Although she found the text message intervention helpful, it was annoying to her that the reminders would keep “reminding me of the choice, of the choices that I make” and the effect they had on “my body” (Participant 9). She explained how “it was helpful” for her to be aware of
those choices, but that it was also “annoying at the same time because, you know, when I went to lunch, then I would think about the message that I got” (Participant 9). As a result, she would consider other choices for her meal, which she found annoying.

Every participant wanted to see the program continue for a long-term period because it helped them. One participant wished the program went on for “3 months” so that he could “look at my blood work and see how it may have improved” his sugar levels (Participant 1). He felt that seeing a positive effect the intervention had on his blood work “would be my motivation to continue” with the changed behaviors and diet (Participant 1). Every participant reiterated this sentiment about wanting to be a part of the intervention long-term because they felt the text message intervention made them more informed about how making small changes in diet and behavior could positively influence their health and diabetes self-management.

**Synthesis of Findings**

The quantitative findings did not indicate any statistically significant differences in participants’ scores on the DSES and SDSCA pre- and postintervention. This quantitative finding indicated that the educational text messaging self-management program did not influence participants’ diabetes self-efficacy and diabetes self-care activities. Although participants did not indicate statistically significant changes in these two measures, interview participants talked about how they implemented dietary and exercise changes in diabetes self-management. Interview participants shared their perceptions of the text message intervention, with every participant reporting an improved awareness of diabetes self-management techniques. Seven (87.5%) of the eight interviewed participants indicated changes regarding diet and exercise as a result of the text message intervention.
Chapter Summary

The researcher presented the findings of the mixed methods research study in this chapter. The first research question asked about the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM. The findings indicated that a clinical research study able to achieve statistical significance is warranted on the topic.

The second research question pertained to participants’ perceptions of the one- and two-way text messaging diabetes self-management program. Overall, every participant viewed the one- and two-way text messaging intervention favorably with few drawbacks. Every participant felt the text messaging intervention helped them become more aware of their DSMB and provided them with information about how to make positive changes in their existing behaviors. They enjoyed the text message reminders, which helped them keep their diabetes self-management at the forefront of their minds. The participants reported making better dietary decisions and becoming more active because of the text message intervention. Participants shared their desire for a long-term one- and two-way text messaging diabetes self-management program.

The third research question focused on the perceived DSMB (SDSCA) and perceived diabetes self-efficacy of Afro-Caribbeans with T2DM, before and after a 2-week daily educational text messaging self-management program. The findings indicated that no statistically significant difference existed in participants’ SDSCA scores before and after the text message intervention. The findings indicate that there was no statistically significant difference in participants’ DSES scores before and after the text message intervention.
The fourth research question pertained to the logistical challenges of recruitment and retention in the sample population. The findings indicated that the exclusion criteria itself was a limiting factor. The study excluded individuals older than the age of 65. Many individuals in this age range had text-message capable phone and used text messaging frequently. In addition, recruitment becomes a challenge in a busy primary care office when individuals are primarily there to monitor their health status and may have little interest in participating in a research study. In Chapter 5, the researcher will discuss the findings of the research study as they relate to the literature. The researcher will present the implications of the findings for future researchers and practitioners before outlining the limitations and recommendations for future researchers.
CHAPTER 5: DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

The uses of test messaging to influence health care behaviors and outcomes for diabetic patients are found in the literature. However, studies on the potential benefits among specific, high-risk groups, such as Afro-Caribbeans, have yet to be conducted. Therefore, the purpose of this mixed methods feasibility study was to explore (a) the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM; (b) participants’ perceptions of the text messaging self-management program; (c) changes in reports of self-efficacy and self-management before and after text messaging program; and (d) the logistical challenges of recruitment and retention in the sample population.

In this final chapter, the results from the study are summarized and discussed. In the study, the researcher’s focus was the feasibility of using a SMS-based diabetes self-management program in an Afro-Caribbean population residing in the U.S. Virgin Islands. Bandura’s (1977) self-efficacy theory was used as a framework for analyzing the phenomenon, specifically the quantitative pre- and postintervention SDSCA and DSES questionnaires (n = 8) and qualitative participant post interview (n = 8) results. Finally, the chapter presents the limitations of the study and directions for future research.

Summary of Study

T2DM is a considerable health problem that results in significant morbidity and mortality and is associated with major racial and ethnic disparities (Murphy et al., 2017). Research has demonstrated the role that DSMB and self-efficacy have in the management of T2DM. Additionally, emerging evidence demonstrates the important role that information technology, specifically smartphone applications and SMS interventions, may have in improving glycemic
control and DSMB among individuals with T2DM (Arambepola et al., 2016). Thus, the purpose of this study was to explore the feasibility of using a SMS-based diabetes self-management program in an Afro-Caribbean population diagnosed with T2DM residing in the U.S. Virgin Islands. The researcher investigated the feasibility of a daily one- and two-way educational text messaging self-management program in Afro-Caribbean participants with T2DM and the participants’ perceptions of the text messaging self-management program. The researcher explored the pre- and post quantitative SCDAS and DSES scores of eight participants and their perceived self-efficacy and self-management before and after the text messaging program in post intervention interviews. Finally, the researcher examined the logistical challenges of patient recruitment and retention.

Discussion

Four research questions guided this study. The following sections detail each question.

Research Question 1. What is the feasibility of using a one- and two-way educational text messaging self-management program in a sample of Afro-Caribbean patients with T2DM?

During the intervention, 1,006 patients were seen at the practice with 93 (9.2%) patients having T2DM. Of the 93 patients, 27.9% refused enrollment in the study. Although there is not extant literature regarding research participation and refusal of Afro-Caribbean Americans, evidence is related to other underrepresented minorities who share commonalities with Caribbean Americans. Reduced participation in research studies by minorities is supported by research (Luebbert & Perez, 2015). Lack of knowledge regarding cultural norms and differences, mistrust, stigma, and lack of a research design that is congruent with the culture have been some of the reasons that minority participation remains low (George, Duran, & Norris, 2014). In addition, research has historically been developed by White researchers for White participants.
The development of a culture and system of research for nonminority individuals has led to incorrect assumptions of recruitment and retention strategies for ethnic minorities.

In this study individuals were referred by their health care provider or through advertisement in the clinical practices. Research on recruitment strategies for minorities has demonstrated approximately 24% of individuals participating in a study do so because of health care provider referral or advertisement (Graham, et al., 2017). The majority of Black individuals who participate in research studies are recruited from health fairs, referred from family or friends, or through houses of worship.

Out of the 93 patients with T2DM, 49 (52.7%) were ineligible to participate. The primary reasons for ineligibility were age older than 65 years or having an A1C level that is considered out of control. Anderson and Perrin (2018) analyzed mobile technology use by age and found that 59% of individuals in the 65- to 69-year-old range and 49% of 70- to 74-year-olds use smartphones and mobile technology. Participation by individuals in this age group may be beneficial to increasing recruitment. Shea et al. (2009) discovered that telemedicine interventions with individuals with poorly controlled diabetes improved glycemic control and moderated term outcomes. For this reason, including individuals with poor glycemic control should be considered for participation in a future study.

**Research Question 2.** What are the participants’ perceptions of the one- and two-way text messaging self-management program?

Participants’ perception about the one- and two-way text messaging self-management program was overly positive. The themes that emerged from the qualitative analysis were similar to other studies regarding text messages in participants with diabetes. Common themes included improved awareness, behavior, and motivation (Bergner, Nelson, Rothman, & Mayberry, 2017).
Every participant felt the intervention helped them become more aware of their diabetes self-management, but a few participants explained how the intervention came at the right time, meaning after the storm hit the island.

**Research Question 3.** What are the perceived diabetes self-efficacy and self-management behaviors of Afro-Caribbeans with T2DM, before and after a 2-week daily educational text messaging self-management program?

There were no statistically significant differences found between participants SES and SDSCA scores before and after intervention. As a feasibility study, the research was not designed to achieve statistical power. Although the qualitative data support the utility of the intervention, future studies may be designed to achieve statistical power and with a timeframe that can measure other changes, such as glycosylated hemoglobin or anthropomorphic measurements, which are frequently reported in text messaging studies. This study provided promising results with a short intervention period (two weeks). However, the study demonstrated no significant improvements in SES scores (Quinn, Khokhar, Weed, Barr, & Gruber-Baldini, 2015). Holtz and Lauckner (2012) conducted a systematic review of 21 research studies using mobile interventions in individuals with diabetes. Self-efficacy was measured by five studies and no study illustrated statistical changes, although four of the studies were pilot studies. All studies showed positive self-efficacy changes.

**Research Question 4.** What are the logistical challenges of recruitment and retention in the sample population?

The fourth research question pertained to the logistical challenges of recruitment and retention in the sample population. The findings indicated that the exclusion criteria were a limiting factor, as the study excluded individuals older than the age of 65. Many individuals in
this age range had text-message capable phones and used text messaging frequently. In addition, the researcher revealed recruitment was a challenge in a busy primary care office when individuals are primarily there to monitor their health status and may have little interest in participating in a research study. Prior researchers have found success using alternative venues for the recruitment of minorities, as opposed to traditional flyers or medical provider referral (Diaz, 2012). Future research should include local wellness fairs, faith-based organizations, and have a higher level of focus on community (family and friend) referrals to enroll higher numbers of eligible T2DM patients.

**Limitations**

This research has several limitations that limit its generalizability and the conduction of further analysis with data. Although the sampled demographic was similar in prevalence of T2DM to the population of the U.S. Virgin Islands, patients at the practice may not represent the population as a whole. The practice where the study was completed accepts payment for health care services through participating provider organizations (private insurance companies), cash, or the U.S. Centers for Medicare & Medicaid Services, traditional Medicare program. The practice does not participate in the federal and territorial sponsored Medicaid program, which provides coverage for 22% of U.S. Virgin Islanders (Medicaid and CHIP Payment and Access Commission, 2018). Additionally, approximately 30% of the individuals in the islands are uninsured. In addition, the practice operates on a fee-for-service model without sliding scale assistance. Given these distinctions, the population at the practice is likely not reflective of the demography, education, and income of the territory as a whole.

The population of St. Thomas and St. John differs from the other main island, St. Croix. St. Thomas is primarily composed of U.S. Virgin Islanders (native born with Afro-Caribbean
descent) or emigrants from other Afro-Caribbean islands. Approximately 17% of the individuals in St. Thomas are native Spanish speakers. St. Croix has a large Hispanic influence with generations of emigration from Puerto Rico and the Dominican Republic. Approximately, 35% of the population of St. Croix speaks Spanish as a first language. Other limitations include that participants in the research study took the SDSCA and perceived diabetes self-efficacy instrument both before and after participation in the text messaging program. Because they had taken the assessments previously and were thus familiar with the instruments, they may have suffered from repeated testing effects.

The effects of Hurricanes Irma and Maria in September 2017 were not only a limitation of the study, but they also shaped the delivery, format, and timing of the intervention. There is a paucity of research on natural disasters and their relationship with clinical research. Of the research that exists, most focus on the disaster or post-event. The primary objectives of what is documented are on the vulnerability of population, timelines for IRB approval, and difficulties with tracking of participants.

The timing of the intervention was scheduled to begin on Monday September 5th, 2017. Several days before the scheduled intervention start date, the researcher decided to delay because of the pending storm and the unknown significance of the event. On September 6th, Hurricane Irma hit St. Thomas as a Category 5 hurricane with 185 miles per hour (mph) sustaining winds with gusts to 220mph. The hurricane caused a loss of all electricity, Internet connectivity, and cellular communication methods to St. Thomas and St. John. Two weeks later, on September 19th, Hurricane Maria struck the U.S. Virgin Islands as another Category 5 hurricane. Although the winds caused significant damage during Hurricane Maria, flooding was a larger problem because of the speed of the storms movement through the atmosphere. As of April 2018, power
was restored to approximately 90% of U.S. Virgin Islands residents and businesses. Cellular network reach has been restored to 75% of coverage areas and business Internet was reaching 95% of customers. However, home Internet was unavailable to customers. Given the significance of these events, the intervention date was delayed until October 2017 when most participants had mobile messaging services. By the time of study implementation, everyday way of life was developing a new normal, which included moving for one participant and unemployment for two participants.

**Recommendations for Further Study**

This mixed method feasibility study provides a foundation for future research to better understand the challenges associated with T2DM for Afro-Caribbean individuals living in the U.S. Virgin Islands. In addition, this research sets the stage for a larger pilot study to provide further analysis for the conduction of a clinical trial regarding a text message intervention with this population. Based on the study findings, the three areas of focus for future research endeavors are (a) inclusion of a population that closely monitors the U.S. Virgin Islands population; (b) the use of recruitment strategies that would allow for increased participation in the study; and (c) collect more demographic variables and consider the collection of laboratory or anthropomorphic measurements to provide further variables for analysis in combination with increasing the timing of the intervention.

**Recruitment of a Representative U.S. Virgin Islands Population**

In addition to recruitment from private health clinics, public clinics and community-based health centers should be utilized to provide a study population that more closely mirrors the age, socioeconomic status, and health care payer status (government, private, or no insurance) of the larger U.S. Virgin Islands population. In addition, future research may include individuals with
glycosylated hemoglobin levels considered “out of control,” as the intervention may provide a benefit to this population. Future research must also include adults of all ages who are able to use text messaging devices as the number of older adults who use mobile technology is constantly increasing.

**Recruitment Strategies to Increase Participation**

The use of a referral (either self or via a provider) in this study resulted in a low participation rate. Graham et al. (2017) demonstrated that approximately 75% of research participation by Black individuals occurs from health fair recruitment, family or friend referral, or by recruitment in place of worship. Although the generalizability in Black American and Black Afro-Caribbean Americans may not be equitable, evidence supports this approach (Graham et al., 2017). Given the number of private companies that sponsor employee health fairs on an annual basis in the U.S. Virgin Islands, this may be the most viable option for inclusion in future research.

**Collect More Demographic Variables and Increase Timing of Intervention**

Future researchers should consider a pilot study and the addition of laboratory values and anthropomorphic measurements in combination with increasing the study timeframe to allow for richer data collection and the ability to detect changes in self-efficacy, DSMB, and clinical metrics. The rationale for the inclusion of these variables is that multiple other researchers have included them in their text message intervention research and it would allow for comparison with other research.

**Summary**

In this chapter, the results from the study suggest the participants found the use of text messaging helpful in keeping them mindful of their T2DM management. These text reminders
aided participants in thinking about their diet. However, as a feasibility study, there were study limitations, such as generalizability related to a small sample size and unknown effects on participants related to the natural disasters.

In this study, Bandura’s (1977) concept of self-efficacy appeared to be a useful framework to explore smart phone text messaging interventions. With the exponential growth and adaption of technology, creative interventions, such as smart phone text messaging, may be helpful in improving self-efficacy and the overall health of populations. In addition, with the increasing morbidity and health care costs related to T2DM, mobile text messaging interventions may offer a promising addition to current practice to increase self-efficacy in patients diagnosed with DSMB, and may subsequently improve their clinical outcomes.
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doi:10.1371/journal.pone.0126799


https://doi.org/10.1177/0145721706298198


https://doi.org/10.1111/j.1744-6198.2009.00132.x
APPENDIX A: SITE PERMISSION TO CONDUCT THE STUDY

October 23, 2015

To Whom It May Concern:

Andrew Storer, DNP, ACNP, FNP has described his proposed research to me, titled, “Feasibility Study of Text Messaging on Self-Management Behaviors, Self-Efficacy, and HbA1c Levels in Afro-Caribbeans with Type 2 Diabetes Mellitus Living in the Virgin Islands.” Our organization is a private entity without a institutional review board. Therefore, we would like the University of Hawaii Institutional Review Board to approve the research on our behalf. As President, Medical Director, and Owner of Red Hook Family Medical Group, I approve of this research to occur with our patients and administrative records.

Sincerely,

Dr. Siri Akal, MD
President, Owner, and Medical Director
APPENDIX B: SUMMARY OF DIABETES SELF-CARE ACTIVITIES

QUESTIONNAIRE

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

Diet

1. How many of the last SEVEN DAYS have you followed a healthful eating plan?
   □ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7

2. On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?
   □ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7

3. On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?
   □ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7

4. On how many of the last SEVEN DAYS did you eat high-fat foods, such as red meat or full-fat dairy products?
   □ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7

Physical Activity

5. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity?
   □ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7

   *(Total minutes of continuous activity, including walking).*

6. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?
Blood Sugar Testing

7. On how many of the last SEVENDAYS did you test your blood sugar?
□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

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

Foot Care

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

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

Smoking

11. Have you smoked a cigarette, even a puff, in the past SEVEN DAYS?
NO □ YES □

11a. How many cigarettes did you smoke on an average day?
Number of cigarettes: ________
Additional Items for the Expanded Version of the Summary of Diabetes Self-Care Activities

Self-Care Recommendations

1A. Which of the following has your health-care team (doctor, nurse, dietitian, or diabetes educator) advised you to do? Please check all that apply.

a  □  Follow a low-fat eating plan

b  □  Follow a complex carbohydrate diet

c  □  Reduce the number of calories you eat to lose weight

d  □  Eat lots of food high in dietary fiber

e  □  Eat lots (at least 5 servings per day) of fruits and vegetables

f  □  Eat very few sweets (for example, desserts, non-diet sodas, candy bars)

g  □  Other (specify: ______________________________________________________)

h  □  I have not been given any advice about my diet by my health-care team

2A. Which of the following has your health-care team (doctor, nurse, dietitian, or diabetes educator) advised you to do? Please check all that apply.

a  □  Get low level exercise (such as walking) on a daily basis

b  □  Exercise continuously for a least 20 minutes at least 3 times a week

c  □  Fit exercise into your daily routine (for example, take stairs instead of elevators, park a block away and walk, etc.)

d  □  Engage in a specific amount, type, duration, and level of exercise

e  □  Other (specify: ______________________________________________________)

f  □  I have not been given any advice about exercise by my health-care team
3A. Which of the following has your health-care team (doctor, nurse, dietitian, or diabetes educator) advised you to do? Please check all that apply.

a  □ Test your blood sugar using a drop of blood from your finger and a color chart  
b  □  Test your blood sugar using a machine to read the results  
c  □  Test your urine for sugar  
d  □ Other (specify: __________________________________________)  
e  □ I have not been given any advice about my blood or urine sugar level by my health-care team  

4A. Which of the following medications for your diabetes has your doctor prescribed? Please check all that apply.

a  □ An insulin shot 1 or 2 times a day  
b  □ An insulin shot 3 or more times a day  
c  □ Diabetes pills to control my blood sugar level  
d  □ Other (specify: __________________________________________)  
e  □ I have not been prescribed either insulin or pills for my diabetes

Diet

5A. On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day? 
□ 0  □ 1  □ 2  □ 3  □ 4  □ 5  □ 6  □ 7
**Medications**

6A. On how many of the last SEVEN DAYS, did you take your recommended diabetes medication?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

**OR**

7A. On how many of the last SEVEN DAYS did you take your recommended insulin injections?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

8A. On how many of the last SEVEN DAYS did you take your recommended number of diabetes pills?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

**Foot Care**

9A. On how many of the last SEVEN DAYS did you wash your feet?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

10A. On how many of the last SEVEN DAYS did you soak your feet?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

11A. On how many of the last SEVEN DAYS did you dry between your toes after washing?

☐ 0  ☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7

**Smoking**

12A. At your last doctor’s visit, did anyone ask about your smoking status?

☐ 0  No  ☐ 1  Yes

13A. If you smoke, at your last doctor’s visit, did anyone counsel you about stopping smoking or offer to refer you to a stop-smoking program?
14A. When did you last smoke a cigarette?

- □ a  More than two years ago, or never smoked
- □ b  One to two years ago
- □ c  Four to twelve months ago
- □ d  One to three months ago
- □ e  Within the last month
- □ f  Today
From: Deborah Toobert [mailto:***********]

Sent: Wednesday, July 22, 2015 7:56 PM

To: acstorer@gmail.com; Lindsey Baker; Carol Metzler

Subject: sdsca

Dear Andrew,

I have been away from my email on vacation for the past couple weeks. You do have our permission to use the SDSCA in your study.

I will send you a more formal notice when I return. Meanwhile could you please access our website for a copy of the measure, and answers to questions?

www.ori.org/sdsca

Many thanks for your payment,

Deborah Toobert
APPENDIX D: DIABETES SELF-EFFICACY SCALE

We would like to know how confident you are in doing certain activities. For each of the following questions, please choose the number that corresponds to your confidence that you can do the tasks regularly at the present time.

- How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Totally confident</th>
</tr>
</thead>
</table>

- How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Totally confident</th>
</tr>
</thead>
</table>

- How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Totally confident</th>
</tr>
</thead>
</table>

- How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Totally confident</th>
</tr>
</thead>
</table>
• How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?

   Not at all 1 2 3 4 5 6 7 8 9 10 Totally confident

• How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?

   Not at all 1 2 3 4 5 6 7 8 9 10 Totally confident

• How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?

   Not at all 1 2 3 4 5 6 7 8 9 10 Totally confident

• How confident do you feel that you can control your diabetes so that it does not interfere with the things you

   Not at all 1 2 3 4 5 6 7 8 9 10 Totally confident
APPENDIX E: EXIT INTERVIEW PROTOCOL

Probing and additional questions based on answer. (Probe Examples: “Tell more more”, Use of Silence, Echo Technique or Use of Active Listening, Making Affirmative Statements)

Describe to me your experience with receiving daily text messages?

In general, do you think the cell phone system helped you in any way?

What did you like about the text messages?

What did you dislike about the text messages?

What information in the text messages did you find useful? Not useful?

What behaviors have you started doing differently since the beginning of the intervention (receiving text messages)? May need examples.

Which specific messages or aspects of the program were helpful and why?

What what you do differently? Keep the same?

Would this be something you would consider doing long term?

Since the text messaging program ended how have things been different for you?
APPENDIX H: IRB APPROVAL

TO: Wang, Chen-yen, Nursing, University of Hawaii at Manoa
    Sorensen, Andrew
FROM: Lin-deshetler, Denise, Dir, Human Stds Prog, Biomedical IRB

PROTOCOL TITLE: A Feasibility Study Using a One Way and Two-way Text Messaging Self-Management Program in a Sample of Afro-Caribbeans with Type 2 Diabetes Mellitus Living in the Virgin Islands
FUNDING SOURCE: NONE

PROTOCOL NUMBER: 2016-30238
APPROVAL PERIOD: Approval Date: July 13, 2016
                  Expiration Date: June 30, 2017

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Under an expedited review procedure, the research project identified above was approved for one year on July 13, 2016 by the University of Hawaii Institutional Review Board (UH IRB). The application qualified for expedited review under CFR 46.110 and 21 CFR 56.110, Category 4, 7b.

This memorandum is your record of the IRB approval of this study. Please maintain it with your study records.

The UH IRB approval for this project will expire on June 30, 2017. If you expect your project to continue beyond this date, you must submit an application for renewal of this Human Studies Program approval. The Human Studies Program approval must be maintained for the entire term of your project.

If, during the course of your project, you intend to make changes to this study, you must obtain approval from the Human Studies Program prior to implementing any changes. If an Unanticipated Problem occurs during the course of the study, you must notify the Human Studies Program within 24 hours of knowledge of the problem. A formal report must be submitted to the Human Studies Program within 10 days. The definition of an “Unanticipated Problem” may be found at the HSP Policies & Guidance website, www.hawaii.edu/researchcompliance/policies-guidance, and the report form may be downloaded from the website www.hawaii.edu/researchcompliance/report-protocol-violation-or-unanticipated-problem.

You are required to maintain complete, accurate, and current records pertaining to the use of humans as participants in your research. This includes all information or materials conveyed to and received from participants as well as signed consent forms, data, analyses, and results. These records must be maintained for at least three years following project completion or termination, and they are subject to inspection and review by the Human Studies Program and other authorized agencies.

Please notify this office when your project is complete. Upon notification, we will close our files pertaining to your project. Reactivation of the Human Studies Program approval will require a new Human Studies Program application.

Please contact this office if you have any questions or require assistance. We appreciate your cooperation, and wish you success with your research.
Office of Research Compliance
Human Studies Program

TO: Wang, Chen-yan, Nursing, University of Hawaii at Manoa
FROM: Storer, Andrew, DNP, Nursing, University of Hawaii at Manoa
PROTOCOL TITLE: A Feasibility Study Using a One and Two-way Text Messaging Self-Management Program in a Sample of Afro-Caribbean with Type 2 Diabetes Mellitus Living in the Virgin Islands
FUNDING SOURCE: NONE
PROTOCOL NUMBER: 2016-30238
APPROVAL PERIOD: Approval Date: July 19, 2017 Expiration Date: June 30, 2018

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Under an expedited review procedure, the research project identified above was approved for one year on July 19, 2017 by the University of Hawaii Institutional Review Board (UH IRB). The application qualified for expedited review under CFR 46.110 and 21 CFR 56.110, Category 4, 7b.

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APPENDIX I: EDUCATIONAL HANDOUTS

Best Foods for You:
Healthy Food Choices for People with Diabetes

Making Choices
Managing diabetes from day to day is up to you. A large part of it is making choices about the foods you eat. Everyone knows that vegetables are healthier than cookies. But there are also best choices within each food group.

A best choice is a food that is better for you than other foods in the same group. Best choices are lower in saturated fat, trans fat, added sugar and sodium than similar foods.

Nonstarchy Vegetables
- The best choices are fresh, frozen and canned vegetables and vegetable juices without added salt (sodium), fat or sugar such as:
  - Asparagus
  - Green beans
  - Carrots
  - Cabbage
  - Eggplant
  - Cauliflower
  - Broccoli
  - Mushrooms
  - Tomatoes
  - Spinach
  - Onion
  - Peppers
- If using canned veggies, drain and rinse them with water to wash away about 40% of the sodium.

Fruit
- The best choices are fresh, frozen and canned fruits without added sugars such as:
  - Apple
  - Blueberries
  - Orange
  - Grapefruit
  - Grapes
  - Peaches
  - Pear
  - Plums
  - Cherries
- If you use canned fruit in syrup, drain and rinse the fruit with water to wash away the extra syrup.

Milk
- The best choices are milk and yogurt without added sugars such as:
  - Fat-free or low-fat milk (1%)
  - Unflavored soy milk
  - Plain, nonfat yogurt
  - "light" yogurt

Grains and Starchy Vegetables
- The best choices are whole grain foods, beans, peas and lentils and starchy vegetables without added fats, sugars or sodium.

Best Choices of Whole Grain Foods
- Look for cereals, breads, and grains with these whole grains as the first ingredient:
  - Whole wheat flour
  - Whole oats/oatmeal
  - Whole-grain corn/corn meal
  - Popcorn
  - Brown rice
  - Whole-grain rye
  - Whole-grain barley
  - Wild rice
  - Buckwheat/buckwheat flour
  - Triticale
  - Bulgur (cracked wheat)
  - Millet
  - Quinoa
  - Sorghum
- Choose cereals with at least 3 grams of fiber and less than 6 grams of sugar per serving.

Best Choices of Legumes and Lentils
- Beans such as black, pinto and kidney
- Lentils and dried peas
- Fat-free refried beans and vegetarian baked beans

For more information visit diabetes.org or call 1-800-DIABETES
**Best Choices of Starchy Vegetables**
- Acorn squash
- Butternut squash
- Green peas
- Corn
- Parsnip
- Pumpkin
- Sweet potato
- Plantain

**Protein**
- The best choices are plant-based protein foods, fish, chicken, and lean meats such as:
  - Beans and lentils
  - Nuts and seeds
  - Fish and seafood
  - Eggs and cheese
  - Chicken, turkey, and duck without the skin
  - Buffalo, rabbit, and venison
  - Lean cuts of beef, lamb, and pork such as chuck, rump roast, round, sirloin, T-bone steak, and tenderloin

**A great protein choice.**
Dried beans, hummus, lentils, nuts, soy-based “nuggets” and “burgers” are examples of plant-based protein foods. Use them in your meals instead of beef, poultry or fish.

**Fats**
- Best choices or “good fats” are unsaturated fats like omega-3, monounsaturated and polyunsaturated fats:
  - Avocado, olives and seeds such as flax, pumpkin or sesame
  - Nuts such as almonds, brazil, cashews, hazelnuts, peanuts, pine, pecans, pistachios, and walnuts
  - Oils such as olive, canola, corn, flaxseed, safflower, soybean and sunflower
  - Salad dressings and mayonnaise

**Go Easy**
- Avoid regular soda, fruit punch, sports drinks, sweet tea, and other sugary drinks. Choose water and calorie-free drinks instead.
- Cut back on high calorie snack foods and desserts such as chips, cookies, cakes, and ice cream.
- Replace “bad” fats from fatty meats, full fat dairy, lard, butter and sour cream with “good” fats.
- Keep portions small.

**Foods I Like**

**Omega-3 Fatty acids are good for your Heart.** When picking your fat sources, consider these foods:
- Albacore tuna, mackerel, halibut, herring, salmon, sardines, and trout
- Flaxseeds and English walnuts
- Oils such as canola, soybean, flaxseed, and walnut

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Looking for healthy recipes and food tips? Sign up for our FREE online resource, Recipes for Healthy Living at diabetes.org/recipes.

1-800-DIABETES (1-800-342-2383)
www.diabetes.org

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The Diabetes Advisor

Taking Care of Your Feet

Check Your Feet Every Day
- Look for cuts, bruises, or swelling.
- See your healthcare provider right away if there are any changes or if you hurt your feet.

Wash Your Feet Every Day
- Use warm water and a mild soap. Avoid soaking since it can dry out the skin and lead to cracks.
- Dry them carefully, especially between the toes.

Keep Your Skin Soft and Smooth
- Rub a thin coat of skin lotion (lotion, cream, or petroleum jelly) over the tops and bottoms of your feet, but not between your toes.

If You Can See and Reach Your Toenails, Trim Them When Needed
- Trim (and file) your toenails straight across.
- Ask for help trimming your toenails if you have trouble reaching them or cannot see well enough to do it safely.

If you have corns or calluses, ask your healthcare provider to trim them for you.

Wear comfortable shoes and socks that fit well and protect your feet.

Check the inside of your shoes each time you put them on to be sure the lining is smooth. Shake them out to remove any loose objects.

For more information about the American Diabetes Association, visit professional.diabetes.org/PatientEd or call 1-800-DIABETES (342-2383).
All About Quitting Smoking

Are you ready to quit smoking? You can find a way to do it. Once you’ve quit, you’ll feel healthier right away. And you’ll be healthier for the rest of your life. The benefits start within minutes after you’ve quit.

What are the benefits of quitting smoking?
You’ve probably already heard that smoking is bad for your health. But do you know all the benefits of quitting?
When you quit smoking, you will
- lower your risk for a heart attack or a stroke
- reduce your risk for some kinds of cancer
- cut your risk for emphysema (a lung disease), chronic bronchitis, and cataracts
- be able to breathe easier
- (for pregnant women) lower your risk for delivering your baby too early and having a baby with a low birth weight
- increase your energy level
- have fewer wrinkles
- have better-smelling hair, breath, and clothes
- stop exposing your family and friends to secondhand smoke
- save money

Tips to help you quit smoking
Things to do before you quit
Take steps to get ready to quit smoking.
☐ Make a list of your own reasons for quitting. Put your list where you’ll see it every day.
☐ Choose a date to quit. Make sure it’s a time when your life is calm and you’re not under a lot of stress.
☐ Tell your family and friends about your plan to quit. Ask them for their help and understanding.
☐ Ask a friend who smokes to think about quitting with you.

Once you’ve quit smoking, you’ll be healthier for the rest of your life.

Ways to quit
There are lots of ways to quit smoking. Some people use a combination of ways.
☐ Talk with your health care provider about what would work best for you. Or get free telephone counseling by calling your state’s “quitline.” Find your state’s program by searching online using the word “quitline” and the name of your state.
☐ Quit all at once—also called “going cold turkey.” Throw away your cigarettes, matches, lighters, and ashtrays.
☐ Taper off. Quit smoking by cutting back over several weeks.
☐ Use a nicotine patch, gum, inhaler, or nasal spray.
☐ Ask your health care provider for a prescription medicine to help you quit.
☐ Talk with your health care provider about whether counseling, acupuncture, or hypnosis would be helpful.
☐ Take a quit-smoking class or join a support group.
E-cigarettes should not replace smoking or be used to help quit smoking.
Diabetes and Smoking: Double Trouble
Smoking and diabetes can be a dangerous combination. Diabetes raises your risk for a heart attack, a stroke, blood vessel disease, nerve damage, kidney disease, and other health problems. Smoking also ups your risk for health problems. Diabetes and smoking means double trouble, but you'll earn double rewards when you quit.

My plan for quitting smoking
Get started with your plan to quit smoking by adding your answers.

• I want to quit smoking because
  
  Example: I want to stay healthy and be around for my family.

• I haven't quit smoking before because
  
  Example: I didn’t think I could do it.

• [Or] I've tried to quit smoking before but
  
  Example: I started smoking again when I was stressed out from my divorce.

• To keep from starting smoking again, I’ll do this:
  
  Example: I’ll find new ways to cope with stress.

• Instead of smoking, I’ll cope with stress by doing this:
  
  Example: I’ll take deep breaths for several minutes and relax.

• The following people can help me quit smoking:

  Example: My kids will be my “cheerleaders.”

• I’ll take these steps to quit:

  Example: I’ll use a nicotine patch and take a quit-smoking class.

• The hardest times to not smoke will be these times:

  Example: Right after meals.

• When I feel like smoking, I’ll do this instead:

  Example: I’ll get up from the table right after a meal and brush my teeth.

• To keep from gaining weight after I quit smoking, I’ll do this:

  Example: I’ll walk for 30 minutes a day, 5 days a week.

• To reward myself, I’ll do this:

  Example: I’ll take the money I would have spent on cigarettes, put it in a jar, and spend it on something special.

• I’ll quit smoking on this date:

  Example: I’ll quit on my birthday.
**Be More Active**

Along with healthy eating, being active can help manage diabetes.

Being active can lower your:
- blood glucose (sugar)
- blood pressure
- cholesterol

It also:
- lowers your risk for heart disease and stroke
- relieves stress
- makes your heart, muscles, and bones strong
- helps insulin work better
- improves your blood flow
- keeps your joints flexible

**What kinds of physical activity should be part of my routine?**

You should include three kinds of activities:
- aerobic exercise
- being active throughout the day
- strength training

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**Real-Life Stories from People with Diabetes**

These people chose to add physical activity to their daily routine. Here’s why:

**Darlene S.** My little girl wanted me to walk with her to the playground. When I told her I couldn’t walk that far, she said we should start walking a little each day so I’ll be healthy and live a long time.

**Charlie M.** After my heart attack, I started walking almost every day but I didn’t keep it up. I remember how great I felt—I had lots of energy. I’d like to get back into that routine so I can feel that great again.

**Rosita S.** The day I couldn’t fit into my size 14 pants, I said to myself, “That’s it! It's time for me to lose weight.”

**Sadie F.** I want to set a good example for my grandson so he won’t get diabetes. He’s only 9 but he’s already heavy and the kids make fun of him. Maybe we can go for walks together.

How about you? Do you have a reason to become more active? Write it here:

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For more information visit [diabetes.org](http://diabetes.org) or call 1-800-DIABETES
Aerobic exercise

Aerobic exercise is activity that gets your heart rate up and helps your body use oxygen better. For most people, it's best to aim for a total of about 30 minutes a day, at least 5 days a week of aerobic activity. If you are trying to lose weight, you may need to do at least 60 minutes a day.

If you haven't been very active recently, start out with 5 or 10 minutes a day. Work up to more time each week. Or split up your activity for the day. Try a brisk 10-minute walk after each meal. Make it fit your schedule. Check what you'd like to try:

- take a brisk walk
- go dancing
- take an exercise class
- go swimming or do water aerobics
- ride a bike
- play basketball or soccer

What are some other ways you could get aerobic exercise?

Being active throughout the day

In addition to formal exercise, there are many ways to be active throughout the day. Being active helps burn calories. If you sit all day, think of ways to move more. Place a check mark next to things you'd like to try:

If You Sit At Work

- Take the stairs instead of the elevator
- Walk during your lunch break
- Get up once an hour and take a quick walk
- Stand up and stretch often
- If you take the bus, get off a stop early and walk the rest of the way
- Use a speaker or cell phone so you can pace around when on the phone
- Try some chair exercises

At Home

- Take the dog for a walk
- Do yard work such as gardening, mowing the lawn or raking leaves
- Do housework such as vacuuming, dusting, or washing dishes
- Play catch or throw a Frisbee with your kids or grandkids
- Walk in place during the commercials of your favorite television show
- Carry things upstairs or from the car in two trips instead of one
- Walk around the house or up and down stairs while you talk on the phone

For more information visit diabetes.org or call 1-800-DIABETES
While You’re Out and About

- Walk instead of drive, if you can
- Park farther away from the store and walk
- When on a car trip, stop every few hours to stretch and walk around

What are some other ways you could be active during the day?


Strength training

Do strength training 2 to 3 times a week. It helps build strong bones and muscles. This makes everyday chores like carrying groceries easier for you. Strength training can also help to prevent weight gain. Here are some ways to do it:

- Lift light weights at home.
- Use an exercise video that shows you how to use canned foods to lift weights.
- Join a class that uses weights, elastic bands, or plastic tubes.

What are some ways you could do strength training?


What should I do to get started?

These steps will help you get ready for a routine that’s safe and fun.

- Talk to your health care team about what is safe for you.
- Choose what you’ll do and make a plan.
  Think about what activities you think you can do. Start slowly. Write down exactly what you’ll do, where and when you’ll do it, how often, and for how long. Plan how you’ll reward yourself for your efforts. For example, some people treat themselves to a movie when they meet their goal for the week.
- Learn your blood glucose response to exercise.
  Everyone’s blood glucose response to exercise is different. Checking your blood glucose before and after exercise can show you the benefits of activity. You also can use the results of your blood glucose checks to prevent low blood glucose or high blood glucose.
- Learn how to avoid low blood glucose or hypoglycemia.
  Keep in mind that low blood glucose can occur during or after physical activity. Low blood glucose is most likely if you:
  - take insulin or certain diabetes pills
  - skip a meal
  - exercise for longer than usual
  - do strenuous exercise

If you often have trouble with low blood glucose when you are active, eat a snack before exercise. Talk to your health care team about what you can do. You may need a change in your medicine.

For more information visit diabetes.org or call 1-800-DIABETES
If your blood glucose is high before you exercise (above 300 mg/dl), physical activity can make it go even higher. So be cautious about doing something active.

**Treating Low Blood Glucose**
During activity, check your blood glucose if you are hungry, nervous, shaky, or sweating. If your blood glucose is 70 mg/dl or below, have 4 to 6 glucose tablets. You can also have 1/2 cup (4 ounces) of fruit juice or regular soft drink to raise your blood glucose. After 15 minutes, check your blood glucose again. If it’s still below 70, have another serving and repeat these steps until your blood glucose is at least 70.

**Safety Tips**
- Plan to have water and snacks handy during activity.
  Drink plenty of water before, during, and after activity. If you are at risk for low blood glucose, always carry a source of carbohydrate so you’ll be ready to treat low blood glucose.
  - Wear a medical identification bracelet, necklace, or a medical ID tag to protect yourself in case of emergency.
  - Wear shoes that fit well and socks that do not irritate your feet.
  - Decide how you’ll keep track of your progress.
You may find it helpful to write down what physical activity you’ve done each day. You can write it in your journal. For example, you can make a note of what you did and how long you did it. Some people enjoy using a step counter, also called a pedometer, to see how far they’ve walked.

**What keeps you from being active?**
If you’re not active, it’s likely that you have at least one reason why. Perhaps you’ve never been very active. Maybe you’re afraid you’ll get low blood glucose.
Think about what’s keeping you from being active. Then look into ways to overcome the barriers.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>* I don’t have time to exercise for 30 minutes a day.</td>
<td>Do as much as you can. Every step counts. If you’re just starting out, do 10 minutes a day and add more little by little. Work up to 10 minutes at a time, three times a day.</td>
</tr>
<tr>
<td>* I’m too tired after work.</td>
<td>Plan to do something before work or during the day.</td>
</tr>
<tr>
<td>* I don’t have the right clothes.</td>
<td>Wear anything that’s comfortable as long as you have shoes that fit well and socks that don’t irritate your skin.</td>
</tr>
<tr>
<td>* I’m too shy to exercise in a group.</td>
<td>Choose something you can do on your own. Try to follow along with an aerobics class on TV. Or, go for a walk.</td>
</tr>
</tbody>
</table>

For more information visit [diabetes.org](http://diabetes.org) or call 1-800-DIABETES
<table>
<thead>
<tr>
<th>Barriers</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't want to have sore muscles.</td>
<td>Exercise shouldn't hurt if you go slowly at first. Choose something you can do without getting sore. Learn how to warm up and stretch before you do something active and how to cool down afterward.</td>
</tr>
<tr>
<td>I'm afraid I'll get low blood glucose.</td>
<td>If you're taking a medicine that could cause low blood glucose, talk to your health care provider about ways to exercise safely.</td>
</tr>
<tr>
<td>Walking hurts my knees.</td>
<td>Try chair exercises or swimming.</td>
</tr>
<tr>
<td>It's too hot outside.</td>
<td>If it's too hot, too cold, or too humid, walk inside a shopping center.</td>
</tr>
<tr>
<td>It's not safe to walk where I live.</td>
<td>Find an indoor activity, such as an exercise class at a community center.</td>
</tr>
<tr>
<td>I'm afraid I'll make my condition worse.</td>
<td>Get a checkup before you get started. Learn what's safe for you to do.</td>
</tr>
<tr>
<td>I can't afford to join a fitness center or buy equipment.</td>
<td>Do something that doesn't require fancy equipment, such as walking or using cans of food for weights.</td>
</tr>
<tr>
<td>Exercise is boring.</td>
<td>Find something you enjoy doing. Try different activities on different days.</td>
</tr>
<tr>
<td>What are your barriers?</td>
<td>What are some solutions?</td>
</tr>
</tbody>
</table>

- Be flexible with your plan.

For example, you could plan to get off the bus one stop earlier. Don't be too hard on yourself if you can't. For example, if it's raining, you may not want to walk outside. On those days, choose something else. It's more important to reach your long-term goal than to follow the plan from day to day.

Finding time to be active takes planning. You can do it. The rewards are big! If you need help getting started, talk to your health care team.

Looking for healthy recipes and food tips?
Sign up for our FREE online resource, Recipes for Healthy Living at diabetes.org/recipes.

1-800-DIABETES (1-800-342-2383)
www.diabetes.org
Know Your Blood Sugar Numbers

If you have diabetes, keeping your blood glucose (sugar) numbers in your target range can help you feel good today and stay healthy in the future.

There are two ways to measure blood glucose.

1. The A1C is a lab test that measures your average blood glucose level over the last 2 to 3 months. It shows whether your blood glucose stayed close to your target range most of the time, or was too high or too low.

2. Self-tests are the blood glucose checks you do yourself. They show what your blood glucose is at the time you test.

Both ways help you and your health care team to get a picture of how your diabetes care plan is working.

About the A1C test

Why should I have an A1C test? The A1C tells you and your health care team how well your diabetes care plan worked over the last 2 to 3 months. It also helps decide the type and amount of diabetes medicine you need.

What is a good A1C target for me? For many people with diabetes, the A1C target is below 7. You and your health care team will decide on an A1C target that is right for you. If your A1C stays too high, it may increase your chances of having eye, kidney, nerve, and heart problems.

How often do I need an A1C? You need an A1C at least twice a year. You need it more often if it is too high, if your diabetes treatment changes, or if you plan to become pregnant.

What if I plan to become pregnant? Talk with your doctor before you get pregnant. Your doctor can help you reach an A1C target that allows a healthy baby to develop. If you are already pregnant, see your doctor right away.

About self-tests for blood glucose

Why should I do self-tests? Self-tests can help you learn how being active, having stress, taking medicine and eating food can make your blood glucose go up or down. They give you the facts you need to make wise choices as you go through the day.

Keep a record of your results. Look for times when your blood glucose is often too high or too low. Talk about your results with your health care team at each visit. Ask what you can do when your glucose is out of your target range.

How do I check my blood glucose? Blood glucose meters use a small drop of blood to tell you how much glucose is in your blood at that moment. Ask your health care team how to get the supplies you need. They will also show you how to use them.

“I bring my self-test record when I visit my doctor. We talk about what makes my blood glucose go up or down and what to do about it.”
What is a good target range for my self-tests? Many people with diabetes aim to keep their blood glucose between 70 and 130 before meals. About 2 hours after a meal starts, they aim for less than 180. Talk with your health care team about the best target range for you.

Can my blood glucose get too low? Yes it can. If you feel shaky, sweaty, or hungry, do a check to see if it is below your target range. Carry something sweet with you at all times, such as 4 hard candies or glucose tablets. If your blood glucose is too low, eat the candy or glucose tablets right away. Let your health care team know if this happens often. Ask how you can prevent it.

How often should I check my blood glucose? Self-tests are often done before meals, after meals, and at bedtime. People who take insulin need to check more than those who do not take insulin. Test whenever you want to know your blood glucose.

Are there other numbers I need to know? Yes, you need tests of your blood pressure and cholesterol (a blood fat). You and your health care team need to decide the best targets for these too. Keeping them in your target range can help lower your chances for having a heart attack or stroke.

How do I pay for these tests? Medicare and most insurance pay for the A1C, cholesterol, and some self blood test supplies. Check with your insurance plan or ask your health care team for help. For more on Medicare visit www.medicare.gov/health/diabetes.asp.

What is it for me? Finding the time to check your blood glucose can be a struggle. It is also hard when your glucose levels do not seem to match your efforts to manage your diabetes. Keep in mind that your self-test and A1C results are numbers to help you, not to judge you.

Many people find that self-testing and using the results to manage their diabetes pays off. They are more able to take charge of their diabetes so that they can feel good today and stay healthy in the future.

John visits his health care team

John and his health care team use all of his test results to get a picture of how his diabetes care plan is working.

At each visit, John and his team:

- Look at his A1C, self blood glucose test record, cholesterol, and blood pressure results.
- Check to see if he is reaching all his targets.

At his visit today, John’s A1C is too high. He and his health care team talk about what he can do to get closer to his target A1C.

Together they decide that John will:

- Increase his walking time to 30 minutes every day before dinner.
- Self-test after dinner to see if being more active lowers his blood glucose.
- Call his doctor in 1 month for a change in medicine if his self-tests are still out of his target range.