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Adaptation of Diabetes Self-Management Program

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Abstract

Problem/Significance: Diabetes is a major public health problem in Bermuda. According the national survey conducted in 2014, diabetes prevalence in Bermuda (13%) is higher than in the US (9.4%). A quality improvement project was initiated at the BEAMS Primary Care Clinic to improve diabetes care. A retrospective chart review conducted from September 2019 to December 2019 at the clinic revealed that 20% of their patients had diabetes. The mean HbA1c of type 2 diabetics was 8.96 [6.5-12.9] and only 33% had documented diabetes self-management education. There was no structured diabetes self-management program at BEAMS.

Sample/Setting: Adult Bermudians ages 18-64 with type 2 diabetes who received care at BEAMS were invited to participate in the quality improvement project.

Purpose: The purpose of the project was to adapt a structured diabetes self-management program and assess the impact of the program on clinical outcomes.

Process objectives: Creation and approval of referral resources by July 2020, completion of program related food/exercise logs by July 2020, development of education packet by July 2020, enrollment of 75% of all diabetics in diabetes self-management program by July 2020, 100% of participants receive reminder phone calls 2 weeks before start of program, and all participants enrolled in the DSME/S program complete at least 50% (at least 6 out of 12) of visits with NPs by October 2020.

Outcome objectives: A 10% increase in self-care behavior, self-efficacy, diabetes knowledge scores and a 10% decrease in HbA1c from baseline to 3 months post intervention.

Methods: A pre-and post-test design was used. Each patient received nurse practitioner-led individualized diabetes self-management sessions for 30 minutes twice per month for 3 months. Patients were asked to complete three surveys: Diabetes Knowledge Test, Diabetes Self-Efficacy Scale, Diabetes Self-Care Behaviors scale, and HbA1c was measured at baseline and 3 months post baseline.

Results: The novel coronavirus (COVID-19) epidemic was a major barrier in implementing the project. A total of 12 patients completed pre-intervention surveys, but only 5 completed the post-intervention surveys. Despite the challenge, the program was found to be feasible and showed improvement in diabetes self-care, knowledge, and HbA1c. Diabetes self-efficacy scores decreased after the intervention.

Recommendations: Lack of improvement in patient self-efficacy may have been caused by the many challenges the patients faced during the pandemic, including lack of access to food. Utilizing telehealth technology and delivering the diabetes self-management sessions virtually may help increase patient participation. Expanding the program to pre-diabetics and extending session times to from 30 minutes to 1 hour are possible strategies to improve patient self-efficacy.

Keywords: Diabetes; Complications; Bermuda; Self-management program

Adaptation of Diabetes Self-Management Program

High prevalence of diabetes mellitus is a major public health problem in Bermuda. According to a 2014 national survey, Bermudians had higher rates of diabetes (13.0%) compared to the US (9.4%) [1]. In Bermuda, one in three hospital admissions (there is only one hospital on the island) is due to a diabetes related complication. The prevalence of diabetic kidney disease and lower limb amputations, common complications of diabetes, in Bermuda are amongst the highest in the world [2].

The high prevalence of diabetes and its complications are not due to Bermudans' lack of access to primary care. According to the 2014 national survey, 92% of Bermudians had health insurance and received regular medical care. Poor diet and inadequate physical activity may have contributed to the high prevalence of diabetes amongst Bermudians. According to the national survey, only 18.1% of Bermudians consumed five or more fruits and vegetables per day [2]. It was estimated that 94% of all foods that Bermudians consume were imported from outside of the country and were highly processed. This survey also indicated that nearly 50% of the population reported consuming sugary beverages daily. Moreover, it was revealed that 27.1% of the total population did not meet the national exercise recommendation of 150 minutes of physical activity weekly.

The aforementioned is concerning since 66.7% of Bermudians were overweight or obese, condition known to contribute to the development of diabetes. Despite the obvious risk of developing diabetes, only 44.4% of the population recalled getting lifestyle advice from their primary care practitioners. Therefore, adapting diabetes self-management programs in primary care settings is a top priority for the Bermudan government.

Problem

BEAMS primary care clinic is committed to improving diabetes care in Bermuda. One strategy to improve the care for patients with diabetes at the clinic is to adapt a diabetes self-management program and provide it to the patients. According to stakeholder interviews, adults aged 18-64 who receive care at BEAMS Primary Care Clinic are at high risk for poor diabetes self-management, due, in part, to the lack of an on-site structured diabetes self-management program.

The chart review of diabetic patients from August 2019 to December 2019 (n=15) revealed that prevalence of diabetes at the clinic is higher (20%) than the already high national average (13%). According to the chart review, the mean HbA1c of patients with type 2 diabetes at the clinic was 8.96 [6.5-12.9]. According to the 2019 American Diabetes Association position statement, controlled diabetes is defined as having an HbA1c of less than 7. The mean HbA1c level at BEAMS clinic was higher than 7, which suggests their diabetic population is not adequately controlled. During the same chart review, it was also found that only 33% of the diabetic patients had documented diabetes self-management education/support during their primary care visits. This is alarming because in 2016 the ADA recommended that all persons with diabetes receive diabetes self-management education and ongoing support [3].

There are many effective strategies to improve diabetes self-management. Diabetes Self-management Education and Support (DSME/S) programs have been proven to be effective in improving clinical outcomes, lowering HbA1c levels, lowering self-report of weight, and reducing the overall cost of providing care to diabetic populations [3]. It has also been well documented in the literature that individual sessions for diabetes self-management education and ongoing support are as effective in improving patient outcomes as when the program is offered in group sessions [4].

Stakeholders at BEAMS are dedicated to improving management of diabetes at the clinic. The medical director at BEAMS identified lack of structured diabetes self-management one of the significant barriers to achieving optimal clinical outcomes for patients with diabetes. Moreover, the possibility of having a structured diabetes self-management program was discussed with BEAMS' patients. Fifteen patients were interviewed during their primary care clinic visits and all expressed interest in participating in the program.

Purpose

The purpose of this project was to develop a structured diabetes self-management program for BEAMS' primary care clinic patients. The short-term goal of this program was to increase diabetes self-care behaviors, self-efficacy in adhering to the self-management recommendations, and diabetes knowledge. The long-term objective of this program was to improve patients' HbA1c levels, which are a good indicator for improvement in clinical outcomes for type 2 diabetics.

Significance

Healthy People 2020, the Pan American Health Organization (PAHO), and the World Health Organization (WHO) identify type 2 diabetes as a major global health concern for all adults aged 18 and older. According to a PAHO report, Type 2 diabetes accounts for 90% of all diabetes cases in Pan American countries. The primarily cause of Type 2 diabetes is modifiable risk factors such as obesity, physical inactivity and high calorie diets [5]. It was further estimated by WHO that there are currently 62 million adults living with diabetes in the Americas and that number is expected to expand to 109 million by 2040 [5]. In 2015 the health expenditure for diabetes was 382.6 billion dollars in the Americas, which

translates to 14% of the total health care budget [5]. The overall cost of health care for persons with diabetes is three times higher than persons without the disease. Without major interventions in diabetes care, the health care expenditure related to this disease is expected to rise to 445.6 billion in the Americas by 2040.

Ineffective diabetes management causes early mortality as well as the development of associated chronic complications such as cardiovascular diseases, neuropathy, chronic kidney disease, blindness, foot ulcers, and amputations. In fact, persons affected with diabetes are three times more likely to die of cardiovascular diseases than their non-diabetic counterparts [5].

Although diabetes and its complications are largely preventable, there is a widespread lack of quality health care services and knowledge of disease progression measures are widespread. PAHO suggests that persons with diabetes be recommended daily consumption of fruits and vegetables, 30 minutes of physical activity daily, and the maintenance of a healthy weight [5]. Moreover, it is recommended that patients with diabetes should receive counseling from their health care providers regarding maintaining a healthy lifestyle and adhering to medication regimens to achieve adequate control of blood glucose levels. Effective diabetes self-management strategies are crucial in helping to thwart the expected trajectory of diabetic disease.

Primary care facilities are an opportune place to manage diabetes. Often persons with diabetes are already engaged with their primary care providers and can easily be identified, which overcomes the initial barrier to effective diabetes management. One of the recommended strategies for diabetes management is to utilize an individualized approach. An individualized approach focuses on managing diabetes through direct interventions [5]. The main objective outlined by Healthy People 2020 is to increase the proportion of persons diagnosed with diabetes who receive formal diabetes education [6]. The international community has recognized the importance of reversing the tide of diabetes and has set the stage for interventions through WHO Global Strategy for the Prevention and Control of Chronic Diseases, The Global Strategy on Diet, Physical Activity, and Health, and Regional Strategy on Chronic Diseases [5]. The United Nations General Assembly has recognized the burden of diabetes, and since then PAHO has collaborated with Caribbean nations to improve strategies for diabetes management. Moreover, PAHO is currently providing assistance to Caribbean nations for the development and implementation of face-to-face and telehealth diabetes education programs for persons with diabetes [5].

PAHO is taking two key actions for improving diabetes management in primary care. The first is encouraging the development of standards of care and disease management in the primary care setting. The aim of this action is to identify gaps in care and to create community programs that provide support to persons with diabetes with the overall goal of improving disease management. The second action is to promote patient education programs that use evidence-based strategies to promote increased physical activity and healthy eating with an aim of preventing secondary complications of diabetes. The high prevalence of diabetes is causing problems for the government of Bermuda, such as: decreased productivity in working populations increased GDP spending on health care, contributing to poor health outcomes, and reducing the effectiveness of the healthcare system [7]. The rising prevalence of diabetes is considered of national urgent and the Bermuda Ministry of Health has formed a partnership with PAHO to help combat this crisis [7].

Evidence-based Strategies to Improve Diabetes Self-Management

DSME/S programs are evidence-based diabetes self-management programs that promote improvement in patient knowledge, skills, and clinical outcomes, such as HbA1c levels [8]. There are many different ways to adapt a DSME/S program in a primary care setting. In a recent literature review, the authors identified a total of 13 DSME/S studies that were designed specifically to reduce HbA1c levels [9]. DSME/S was delivered through individual education (41.5%), group education (29.7%), a combination (17.8%) of individual and group, or remotely (10.2%). DSME/S was provided by various health care providers, such as physicians, nurse practitioners, nurses, and dieticians. Single providers were the most common means to deliver the DSME/S interventions (60.2%). Average duration of the interventions was 3 months, which ranged from less than 1 month to 24 months. The duration of the intervention for individual DSME/S programs ranged from 3 to 6 months. The interval to the follow-up in which HbA1c was measured to assess the success of the intervention ranged from less than 1 month to 3 months or greater [9].

Environmental Context

Bermuda is a British island territory located in the North Atlantic Ocean which in 2017 had a total population of 65, 441. Bermuda is a small island where the per capita income is about $94,000, which places the country in a higher-income category. As such, one would expect to see health statistics comparable to other higher-income countries like the United States, United Kingdom, and Japan (http://www.gov.bm, 2019). BEAMS primary care clinic is located in Hamilton, which is the central parish of the British Territory. BEAMS is a small organization that has a total census of approximately 300 patients. There are three staff members at the clinic: one physician, one secretary who doubles as a medical technician, and a nurse practitioner. According to a chart review conducted in 2020, 70% of the clinic population was of African ancestry, 57% was female, 74% was between the ages of 18-64, and it was determined that 20% of the population at BEAMS had type 2 diabetes.

Project Objectives

- Creation of referral resources and a referral protocol with approval by site director by July 2020.
- Completion of all program related materials; completion of food/exercise logs by July 2020.
- Development of education packet containing all required materials by July 2020.
- Enrollment of 75% of all diabetics in EMR into DSME/S program by July 2020.
- Completion of reminder phone calls to 100% of participants 2 weeks before start of program.
- Completion of at least 50% (6 out of 12) of visits with NPs by all participants enrolled in the DSME/S program by October 2020 (Table 1).

Process Objective	Design	Sample	Measure	Data Type/Source	Analysis Plan
Enroll 75% of all diabetics into DSME/S program within 3 months.	Descriptive	BEAMS administrative assistant	Review Electronic Medical Record review, track ICD 10 code for type 2 diabetes diagnosis	Interval Count number of patients with ICD 10 diagnosis for type 2 diabetes in EMR.	Review EMR. Calculate percentage of patients that were enrolled into program. Total patients enrolled in program/Total type 2 diabetes population X 100
All participants enrolled in the DSME/S program was complete 50% (at least 3out of 6) visits with NP during 3-month program.	Descriptive	BEAMS patients	Review electronic medical record for "kept" appointment visits with nurse practitioner.	Interval Count number of participants that had "kept" appointments in EMR.	Review EMR. Calculate number of "kept" and "unkept" appointments in EMR for each patient and determine percentage. Kept – Unkept/Total appointments X 100
Education packet was completed within 3 months.	Descriptive	BEAMS nurse practitioner	Develop DSME/S education packet for program. **AADE7 Self-Care Behaviors®**	Nominal Y/N Determine if packet was completed with necessary components: CDC recommended education materials, food/exercise/medication adherence logs, referrals to specialists.	Review CDC recommended education materials, logs, referrals with key stakeholders. Determine if materials had been completely put together.

Table 1: Process Objective Table.

Impact objectives

- By October 2020, the program participants' self-care knowledge scores were to increase by 10% from baseline to 3 months post-intervention.
- By October 2020, the program participants' self-care behavior scores were to increase by 10% from baseline to 3 months post-intervention.
- By October 2020, the program participants' diabetes education test scores were to increase by 10% from baseline to 3 months post-intervention (Table 2).

Outcome objectives

- By October 2020, the program participants' HbA1c levels were to decrease by 10% from baseline to 3 months post-intervention.

Outcome Objective	Design	Sample	Measure	Data Type/ Source	Analysis Plan
At the conclusion of the DSME/S program participants demonstrate a 10% increase from baseline on perceived self-efficacy knowledge related to managing their diabetes as measured on pre/post-test by conclusion of 3-month program.	Quasi-experimental Pre/post test	BEAMS Patients	Review EMR and check for pre/post survey results Diabetes Self-Efficacy Scale which is an 8-item self-report scale designed to assess confidence in performing diabetes related activities was utilized. Pearson's correlation coefficient of 20.46 (*P*, 0.0001) between the DMSES UK and the problem areas in diabetes scale demonstrated criterion validity. Intra-class correlation between data from 67 of these participants was 0.77, demonstrating test-retest reliability. The correlation coefficients between item scores and total scores were .0.30. Cronbach's alpha was 0.89 over all items.	Interval Review EMR Pre/post intervention	Calculate change from pre and post survey results. **((after value – before value) / before value) * 100 = % change.**
At the conclusion of the DSME/S program participants was demonstrate 10% increase from baseline on knowledge of self-care behaviors related to diabetes as measured on pre/post-test by conclusion of 3-month program.	Quasi-experimental Pre/post test	BEAMS Patients	Review EMR and check for pre/post survey results. Diabetes Self-Management Questionnaire (DSMQ) 6 item questionnaire to assess self-care activities associated with glycemic control Overall internal consistency (Cronbach's alpha) was good (0.84),	Interval Chart review, review EMR Pre/post intervention	Calculate change from pre and post survey results. **((after value – before value) / before value) * 100 = % change.**
At the conclusion of the DSME/S program participants was demonstrate a reduction in HB A1c levels of at least 10% from baseline by conclusion of 6-month program.	Quasi-experimental Pre/post test	BEAMS Patients	Review online lab results.	Interval Review online lab result system. Pre/post intervention	Calculate change from pre and post survey results. **((after value – before value) / before value) * 100 = % change.**

At the conclusion of the DSME/S program participants was demonstrate a 10% increase from baseline in diabetes knowledge as measured on pre/post-test by conclusion of 6-month program.	Quasi-experimental	BEAMS Patients	Review EMR and check for pre/post survey results Brief Diabetes Knowledge Test (DKT) (Fitzgerald et al., 2016). The (DKT) is composed of 23 multiple choice questions divided in two sections. The first section has 14 items, assesses the general knowledge. The second section constitute of 9 items for insulin use. The DKT is a reliable and valid tool for the assessment of knowledge among diabetic patients. For the purpose of this study, the first section with 14 items was used since it is specific for Type 2 diabetes. The coefficient alphas demonstrated reliability for both the general test (.77) and the insulin use subscale (.84). The validation comparisons proved to be similar; different results occurred between samples but when combined demonstrated validity.	Interval Review EMR for pre-post test results	Calculate change from pre and post survey results. **((after value – before value) / before value) * 100 = % change.**

Table 2: Outcome Objective Table.

Framework

Health Brief Model: The Health Belief Model (HBM) was used to guide the program (Figure 1). The HBM is an effective framework for designing and implementing diabetes education interventions and control programs [10]. HBM has been shown to promote self-care behaviors in patients with type 2 diabetes [11]. The HBM was derived from psychological and behavioral theories; the desire to avoid disease or to get well if already affected and the belief that a specific health action will prevent or cure a disease.

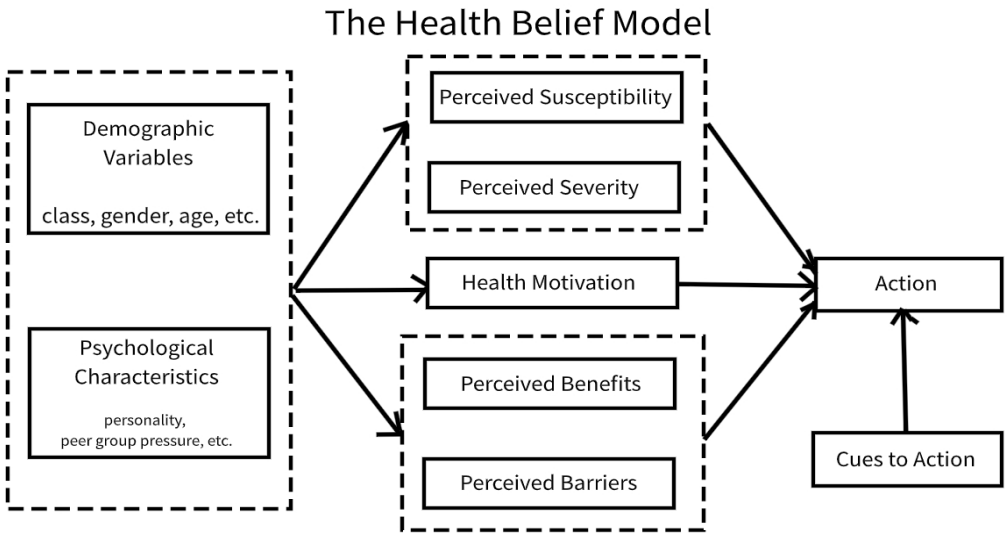


Figure 1: The Health Belief Model.

There are four original constructs of the HBM: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. The construct of perceived susceptibility was applied to the initial individual sessions. During the first session the patients' Hb A1c and pre-survey results were analyzed. By sharing the results with patients, the NP was able to amplify their perceived susceptibility to developing advanced diabetic disease. The construct of perceived severity was used during in the initial session through discussion of

the severity of their disease progression as it relates to their target Hb A1c goals. Patients' perceived benefit was high because this was a new program at BEAMS and the patients have a high expectation that the program would benefit their health (e.g., improved HbA1c level). Perceived barriers were assessed at the beginning of the session. The NP knowledge of these barriers to guide her educational session and discuss the strategies to reduce the barriers.

Precede-Proceed Model (PPM)

The PRECEDE portion of the PPM is the assessment phase. The assessment phase includes social, epidemiologic, educational and ecological, and administrative and policy assessment [12]. Each element was assessed and the information collected during the assessment was used in developing this program. The social assessment includes assessment of clients' perceived values and beliefs related to eating, exercising, and other healthy behaviors known to be factors contributing to the development and control of diabetes. This was assessed utilizing the Self-care and Self-efficacy surveys. The epidemiological assessment includes assessment of the community's perceptions of health challenges that are known to contribute to the development of diabetes. These challenges were assessed with the Self-care and Self-efficacy pre-surveys. The educational and ecological assessment included assessment of the predisposing factors of the population as it relates to diabetes and behavior change. This assessment was done with Diabetes Knowledge Test and baseline HbA1c level. The administrative and policy assessment includes assessment of current organizational guidelines related to diabetes such as referring patients to endocrinology if HbA1c is above 9 after the 3-month intervention (Figure 2).

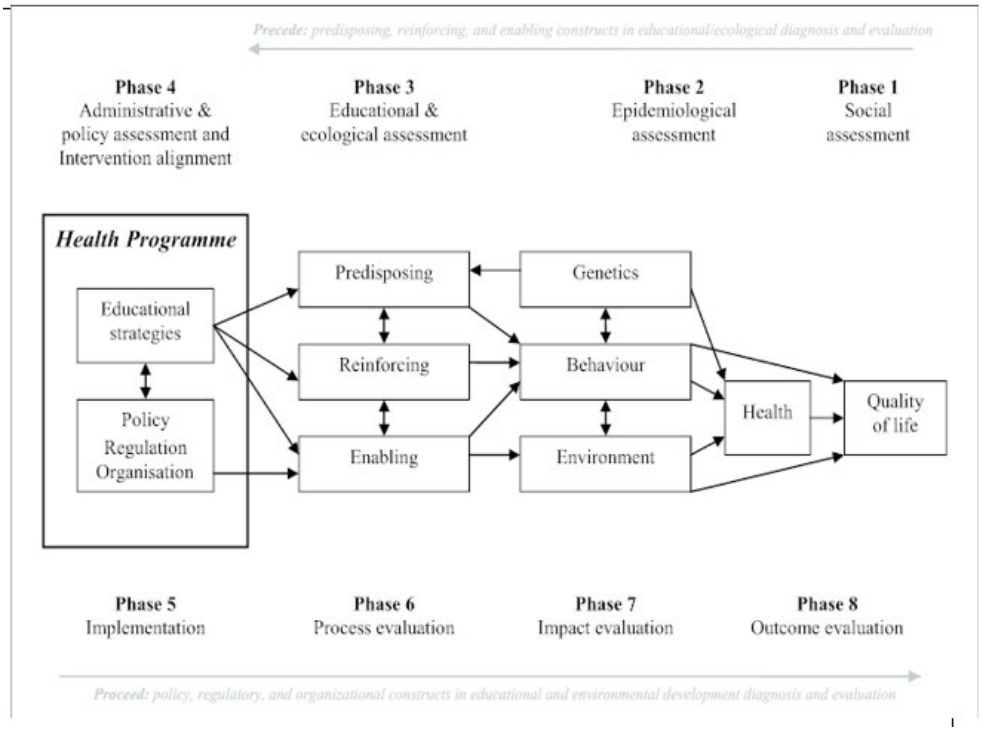


Figure 2: Precede-Proceed Model.

PROCEDE stands for Policy, Regulatory, and Organizational Constructs in Educational Diagnosis and Evaluation. The PROCEDE portion of the PPM involved the identification of desired outcomes, program implementation, and consists of four components: implementation, process evaluation, impact evaluation and outcome evaluation. Implementation was used to design the intervention, assess availability of resources and to implement the program. Process evaluation determined if the program reached the targeted population and achieved the process objectives. Impact evaluation was used to evaluate the change in the program participants' behavior after implementation, resulting in improved scores on post-intervention surveys. Lastly, outcome evaluation was used to identify the changes in health outcomes related to diabetes, as determined by improved Hb A1c levels.

Methods

Implementation

The implementation of this program consisted of four phases: Phase I, Education and Recruitment; Phase II, Maintenance; Phase III, Evaluation; and Phase IV, Sustainability (Table 3). The intervention was to develop a diabetes self-management program for type 2 diabetic patients at BEAMS by integrating diabetes self-management education and support into individual diabetes management primary care sessions. This individualized diabetes self-management project had been piloted at BEAMS and was found to be feasible in delivering unstructured education in 30-minute increments. A similar program had been delivered in the primary care setting utilizing 30-minute education sessions over a 3-month period [10]. Patients were scheduled for the sessions by the administrative assistant.

Phase 1: Education & Recruitment	Phase 2: Maintenance	Phase 3: Evaluation	Phase 4: Sustainability
Train front desk staff (administrative assistant)	Begin diabetes self-management sessions	Post-tests survey analysis	Consider collaborating with Bermuda Diabetes Association
Develop recruitment process	Continue recruitment process	Clinic staff interview	Consider including pre-diabetic patients into program
Establish tracking system (EMR)	Reminder phone calls	Evaluate EMR (Opimantra) and online lab system (Shuynet)	Continue EMR (Opimantra) and online lab system (Shuynet) for tracking and long-term evaluation
Identify pre/post-surveys, exercise/food log, referral materials/process	Administer pre-test surveys, exercise/food logs, referrals as appropriate		

Table 3: Implementation Table.

The timeline for this program intervention was 3 months, which is consistent with the recommended timing of evaluating HbA1c levels in diabetic patients and in the Deghani-Tafty et al. study [10]. The patients were advised to come 15 minutes early for their appointments to ensure adequate time for the surveys and to prevent late start times for the sessions. All other workflow stayed consistent with existing BEAMS procedures. The individual diabetes self-management sessions occurred in 30-minute increments and were available Tuesdays and Fridays, 8am to 5pm.

Program Content

The educational content used in the diabetes self-management program was adapted from the CDC toolkit (Figure 3). The CDC's evidence-based toolkit was developed to increase the development and accessibility of diabetes self-management programs globally. It provided resources and practical guidelines for developing and implementing diabetes self-management programs. The most useful components of this toolkit included resources for information on internal structure, stakeholder input, evaluation of population served, quality coordinator role, DSME/S team members, curriculum, individualization, ongoing support, participant progress, and quality improvement [13]. The toolkit also outlined the curriculum components needed to be consistent with the 7 Standard AADE components which were: pathophysiology and treatment options, healthy eating, being active, medication usage, monitoring health data, preventing/detecting/treating acute and chronic complications, healthy coping, and problem solving [14]. In addition to the teaching components, the toolkit also provided validated evaluation tools, such as pre- and post-program surveys, exercise/food logs, and specialist referral resources.

Figure 3: Session Content.

Evaluation Procedures

The process evaluation phase of the PPM was determined by examining how many diabetics were enrolled in the program and the attendance rate of those enrolled (Table 4). The total number of diabetics enrolled in the program was determined by comparing results of an ICD 10 type 2 diabetes EMR search to the list of the participants enrolled in the diabetes self-management program. The attendance rate was calculated by dividing the number of total scheduled visits that were kept by each participant enrolled in the program. This was done by the nurse practitioner reviewing the EMR with assistance from the administrative assistant.

The impact evaluation phase determined how the intermediate changes were evaluated (Table 4). At the beginning of the diabetes self-management program the nurse practitioner provided the pre-intervention test to the patients for evaluation of self-efficacy, self-care, and knowledge related to diabetes. After giving the pre-intervention tests the nurse practitioner documented the result in the EMR. Thereafter, the nurse practitioner provided intensive education for 3 months and at the conclusion of the program the nurse practitioner administered the post-intervention tests. The percentage of change was calculated at the conclusion of the program.

The outcome evaluation phase determined if the program goals were met. The goals were to improve self-efficacy related to diabetes self-management recommendations through 1) improving the patient's diabetes self-care behaviors by utilizing evidence-based tools recommended by the CDC, 2) increasing the patient's diabetes self-efficacy by utilizing evidence-based education tools recommended by the CDC, 3) improving the patient's diabetes knowledge by utilizing evidence-based tools recommended by the CDC, and 4) lowering the patient's overall HbA1c levels through his or her adherence to the components of the diabetes self-management program. The aforementioned was evaluated by determining the participants' pre/post-intervention test results and HbA1c levels at the conclusion of the program. The evaluation of the post-intervention test results was done by viewing the results that had been documented in the EMR by the nurse practitioner. To evaluate HbA1c levels, each participant was provided with an order to have HbA1c levels drawn at the conclusion of the program, and the nurse practitioner looked up the results in the online lab result system Shuynet.

Phase 5: Implementation	Phase 6: Process Evaluation	Phase 7: Impact Evaluation	Phase 8: Outcome Evaluation
Administrative assistant to enroll Participants into DSME/S program using ICD 10 search for type 2 diabetes coding in electronic medical record. Nurse practitioner to give patients an order for baseline HbA1c during first visit. Nurse Practitioner to administer pre-survey to evaluation baseline self-efficacy knowledge during first visit. Nurse Practitioner to administer pre-survey to evaluation baseline self-care behaviors during first visit. Nurse Practitioner to administer pre-survey to evaluation baseline diabetes knowledge of DSME/S program. Nurse Practitioner to give participants education packet in which includes: exercise/ diet adherence logs, diabetes education materials recommended by CDC, referrals to specialists during first visit. Nurse Practitioner to see participants once every 2 weeks for 3 months for 30-minute sessions. Education packet to be reviewed, diabetes education reinforced and follow up regarding specialist visits.	Check electronic medical record to determine if 75% of all type 2 diabetics at BEAMS were enrolled in program. Check electronic medical record to determine if participants completed 50% of all DSME/S sessions. Determine if DSME/S education packet includes all pertinent components such as AADE7 Self-Care Behaviors®	Nurse Practitioner to give patient order for HbA1c during last visit. Nurse Practitioner to administer post-survey to evaluate baseline self-efficacy knowledge during last visit. Nurse Practitioner to administer post-survey to evaluate baseline self-care behaviors during last visit. Nurse Practitioner to administer post-survey to evaluate baseline diabetes knowledge during last visit.	Determine if there was an increase by 10% from baseline of participants' perceived self-efficacy in managing their diabetes on post-survey by conclusion of 3-month program. Determine if there was an increase by 10% from baseline of participants' perceived self-care behaviors in managing their diabetes on post- survey by conclusion of 3-month program. Determine if there was a10% increase from baseline in diabetes knowledge as measured on pre/ post-test by conclusion of 3-month program. Determine if there was a reduction in HbA1c levels of at least 10% from baseline by conclusion of 3-month program.

Table 4: Evaluation Table.

Participants

There were 12 participants, (20% of target population), all adult Bermudians with type 2 diabetes who received care at BEAMS. Because 20% of the patient population at BEAMS had diabetes, it was estimated that approximately 60 patients were potentially eligible to participate in the program. All participants voluntarily agreed to enroll in the on-site diabetes self-management program with the incentive of not having to pay the regular $25 copay for diabetes management visits. The eligibility criteria for participating in the program was restricted to type 2 diabetic patients who receive care at BEAMS primary care clinic and to adult Bermudians aged 18-64 who had diabetes. Although pre-diabetic patients were referred to the program, they were excluded from data analysis as they did not meet the inclusion criteria.

Measures At the beginning and end of the diabetes self-management program, the nurse practitioner asked all participants to complete the following surveys.

Diabetes Self-Care Behaviors

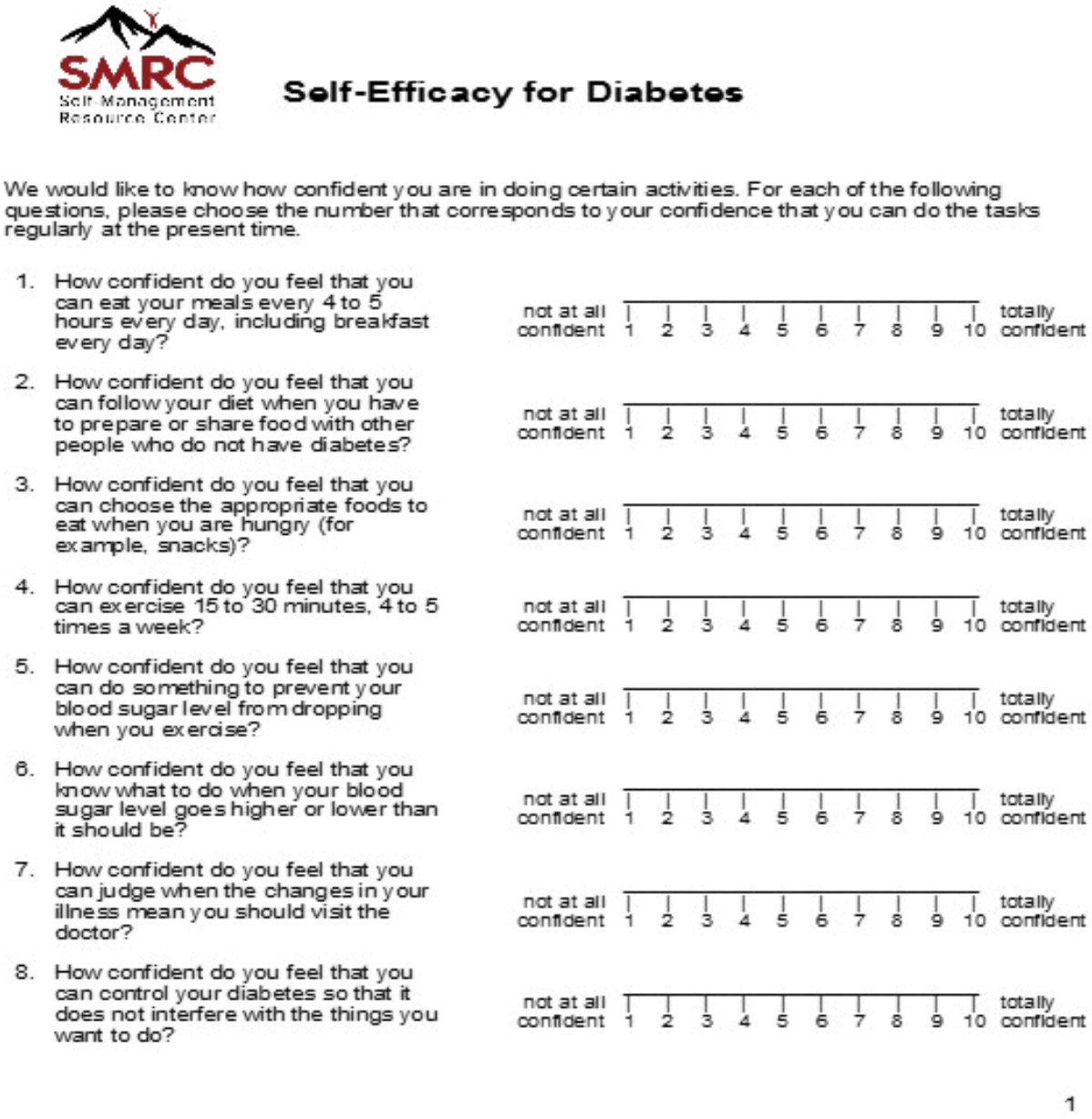
The Diabetes Self-Care Activities (SDSCA) was used to assess patients' adherence to self-care behaviors. This is an 11-item scale in which patients are asked to rate the frequency of their diabetes-specific self-care behaviors (e.g., foot checking) in the previous 7 days. This measure of diabetes self-care behaviors was used to evaluate changes in the patients' self-care behavior at baseline and 3-months post baseline (Figure 4).

	Items
	Original [8]
	Diet
1	How many of the last SEVEN DAYS have you followed a healthful eating plan?
2	On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?
3	On how many of the last SEVEN DAYS did you eat five or more servings of fruit and vegetables?
4	On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?
	Exercise
5	On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (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 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 SEVEN DAYS did you test your blood sugar?
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?
	Foot Care
9	On how many of the last SEVEN DAYS did you check your feet?
10	On how many of the last SEVEN DAYS did you inspect the inside of your shoes?
	Smoking
11	Have you smoked a cigarette – even one puff – during the past SEVEN DAYS?

Figure 4: Diabetes Self-Care Scale.

Diabetes Self-Efficacy

The Diabetes Self-Efficacy Scale (DSES) was used to measure the patient's confidence in performing diabetes related activities (e.g., How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?). This is an 8-item self-report scale and the scores ranged from 0 (not confident at all) to 10 (completely confident). The higher the score the more confident a patient felt in performing the behavior. This measure of diabetes was used to evaluate changes in patients' confidence in adhering to self-care activities at baseline and 3-months post baseline (Figure 5).



SMRC
Self-Management Resource Center

Self-Efficacy for Diabetes

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.

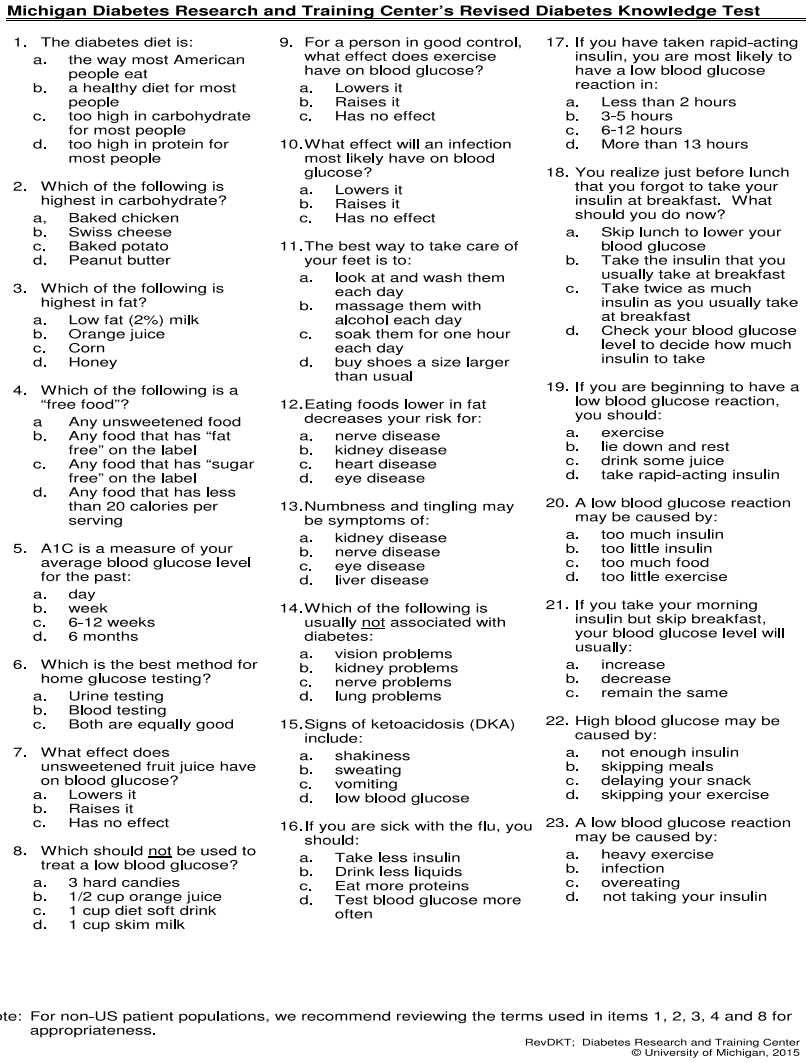
1. How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
2. How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
3. How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
4. How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
5. How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
6. 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 confident	1	2	3	4	5	6	7	8	9	10 totally confident
7. How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident
8. How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?	not at all confident	1	2	3	4	5	6	7	8	9	10 totally confident

1

Figure 5: Self-Efficacy for Diabetes.

Diabetes Knowledge Test

The Diabetes Knowledge Test (DKT2) consists of 23 knowledge test items that represent a test of general knowledge of diabetes. Only the first 14 questions were utilized, as all of the patients had type 2 diabetes. Each patient was asked to answer the multiple-choice questions (a,b,c,d,). The mean accuracy and standard deviation of each question was calculated for each question and the total mean score. This measure was used to evaluate the patients' diabetes knowledge at baseline and 3-months post baseline (Figure 6).



Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test

1. The diabetes diet is:
   a. the way most American people eat
   b. a healthy diet for most people
   c. too high in carbohydrate for most people
   d. too high in protein for most people

2. Which of the following is highest in carbohydrate?
   a. Baked chicken
   b. Swiss cheese
   c. Baked potato
   d. Peanut butter

3. Which of the following is highest in fat?
   a. Low fat (2%) milk
   b. Orange juice
   c. Corn
   d. Honey

4. Which of the following is a "free food"?
   a Any unsweetened food
   b. Any food that has "fat free" on the label
   c. Any food that has "sugar free" on the label
   d. Any food that has less than 20 calories per serving

5. A1C is a measure of your average blood glucose level for the past:
   a. day
   b. week
   c. 6-12 weeks
   d. 6 months

6. Which is the best method for home glucose testing?
   a. Urine testing
   b. Blood testing
   c. Both are equally good

7. What effect does unsweetened fruit juice have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect

8. Which should not be used to treat a low blood glucose?
   a. 3 hard candies
   b. 1/2 cup orange juice
   c. 1 cup diet soft drink
   d. 1 cup skim milk

9. For a person in good control, what effect does exercise have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect

10. What effect will an infection most likely have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect

11. The best way to take care of your feet is to:
   a. look at and wash them each day
   b. massage them with alcohol each day
   c. soak them for one hour each day
   d. buy shoes a size larger than usual

12. Eating foods lower in fat decreases your risk for:
   a. nerve disease
   b. kidney disease
   c. heart disease
   d. eye disease

13. Numbness and tingling may be symptoms of:
   a. kidney disease
   b. nerve disease
   c. eye disease
   d. liver disease

14. Which of the following is usually not associated with diabetes:
   a. vision problems
   b. kidney problems
   c. nerve problems
   d. lung problems

15. Signs of ketoacidosis (DKA) include:
   a. shakiness
   b. sweating
   c. vomiting
   d. low blood glucose

16. If you are sick with the flu, you should:
   a. Take less insulin
   b. Drink less liquids
   c. Eat more proteins
   d. Test blood glucose more often

17. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:
   a. Less than 2 hours
   b. 3-5 hours
   c. 6-12 hours
   d. More than 13 hours

18. You realize just before lunch that you forgot to take your insulin at breakfast. What should you do now?
   a. Skip lunch to lower your blood glucose
   b. Take the insulin that you usually take at breakfast
   c. Take twice as much insulin as you usually take at breakfast
   d. Check your blood glucose level to decide how much insulin to take

19. If you are beginning to have a low blood glucose reaction, you should:
   a. exercise
   b. lie down and rest
   c. drink some juice
   d. take rapid-acting insulin

20. A low blood glucose reaction may be caused by:
   a. too much insulin
   b. too little insulin
   c. too much food
   d. too little exercise

21. If you take your morning insulin but skip breakfast, your blood glucose level will usually:
   a. increase
   b. decrease
   c. remain the same

22. High blood glucose may be caused by:
   a. not enough insulin
   b. skipping meals
   c. delaying your snack
   d. skipping your exercise

23. A low blood glucose reaction may be caused by:
   a. heavy exercise
   b. infection
   c. overeating
   d. not taking your insulin

Note: For non-US patient populations, we recommend reviewing the terms used in items 1, 2, 3, 4 and 8 for appropriateness.

RevDKT; Diabetes Research and Training Center
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Figure 6: Diabetes Knowledge Test.

HbA1c

The effectiveness of the intervention was measured by determining the HbA1c levels prior to intervention and 3-months post intervention.

Procedure

The administrative assistant reviewed the EMR to identify the type 2 diabetics at BEAMS by searching for the corresponding ICD 10 code. Once individuals with type 2 diabetes were identified the administrative assistant called each patient to introduce them to the program and to determine if they were interested in enrolling. The interested persons were then enrolled in the program and received a reminder phone call 2 weeks prior to the start of the program. During the reminder call the patients were asked to arrive 15 minutes prior to their scheduled times.

The nurse practitioner reviewed the list of potential participants and made sure that a baseline HbA1c level was documented in the EMR. Prior to the first visit, the administrative assistant gave each participant the three pre-intervention tests (paper packet) to be completed prior to their first session during the established check-in process. The pre-intervention tests were collected by the

administrative assistant and placed in a folder at the front desk. The nurse practitioner at BEAMS clinic was then responsible for delivering the diabetes self-management sessions to the clients.

The program consisted of six sessions, two per month, each lasting for 30-minutes. The total duration of the program was 3 months. At each session the nurse practitioner assessed the clients' learning needs and interest, then had the client choose the three most important topics to discuss. The topics not discussed in the session were covered in a handout given to the patient which included all of the topics for that session. This program included three months of direct education, physical examination, and medical management as appropriate.

At each subsequent session, clients were given a chance to ask any questions unanswered from the previous session. The nurse practitioner utilized food/exercise logs from the CDC tool kit as appropriate and based on the participants' self-management needs. The nurse practitioner documented the patients' HbA1c level at baseline and gave an order for another HbA1c 3 months post baseline. The patients' self-care behaviors, self-efficacy and diabetes knowledge were assessed using pre-intervention and post-intervention surveys. Patients were referred to a specialist when required per CDC guidelines (HbA1c above 9).

Human Subjects & Ethical Issues

Rush University's Institutional Review Board determined that this pilot program was non-human subject's research. The patients' privacy was protected by utilizing anonymized data with no patient identifiers. Additionally, data was collected, analyzed and presented anonymously.

Results

Patient characteristics

There were 12 patients enrolled in the program, which was 20% of the total diabetic population at BEAMS' clinic. The mean age of the participants was 53 years and the mean number of years of education was 12.8. Most participants were insured (92%), married (58%), women (66%), and of African descent (100%) (Table 5). All patients were asked to complete the three surveys described below. However, some patients were unable to complete the pre/post-intervention surveys during the time allotted (30 minutes) for the nurse practitioner sessions.

	Result
Age (yrs.) M, SD	53.0, 6.6
Gender n (%)	
Women	8(66.0)
Men	4 (33.0)
Race n (%)	
Black	12 (100)
Health Insurance n (%)	
Insured	100%
Education (yrs.) (M, SD)	12.8, 1.0
Employment status n (%)	
Employed	11(92)
Unemployed	1(8)
Marital Status n (%)	
Married	7 (58)
Unmarried	5 (42)
Religious preference	
7th day Adventist	5 (42)

Table 5: Demographic Table.

Diabetes Self-Care scale

The mean score for the pre-intervention test was 1.8 (SD-1.1). The mean post-intervention test score was 2.5 (1.2) on the 11-point Likert scale. The Diabetes Self-care scores (SDSCA) indicated that the most frequent measured behaviors amongst the patients were consuming high-fat foods, foot checking, healthy eating, and consuming five or more fruits and vegetables per in the last 7 days. The least frequent behavior amongst the group was cigarette smoking. After the intervention the most frequent measured behaviors were checking blood sugar and following a healthful eating plan. The least frequent were cigarette smoking and consuming high-fat foods (Table 6).

Question #	Pre X (SD)	Post X (SD)
Q1	2.0	3.8
Q2	1.9	3.0
Q3	2.0	2.6
Q4	2.3	0.8
Q5	1.1	2.4
Q6	0.6	2.8
Q7	0.7	3.6
Q8	0.7	3.6
Q9	2.1	3.4
Q10	1.3	1.4
Q11	0.0	0.0
Total Mean Score	1.8 (1.1)	2.5 (1.2)

Table 6: Diabetes Self-Care Scale score per question (n=12).

Diabetes Self-efficacy Scores

The mean score for the pre-intervention test was 4.8 (SD-1.1). The post-intervention test score was 6.7 (SD-1.1) on the 8-point Likert scale. The Diabetes Self-Efficacy Scale (DSES) revealed the questions about which the patients had the most confidence were feeling in control of diabetes so that it doesn't affect things that they want to do, ability to select healthy foods when hungry, and the ability to identify when illness requires a visit to a provider. The questions about which they felt the least confidence were feeling that they can eat meals every 4-5 hours daily, including breakfast, confidence in preventing low blood sugar with exercise, and confidence in preventing low or high blood sugars. After the intervention the behaviors about which they felt most confident were being able to accurately judge when changes in illness necessitates a provider visit and being able to do something to prevent blood sugar levels from dropping during exercise. The behaviors about which they felt least confident were being able to eat every 4-5 hours daily and knowing what to do when blood sugar levels are outside of normal range (Table 7).

Question #	Pre X (SD)	Post X (SD)
Q1	6.0	4.8
Q2	6.7	6.6
Q3	6.6	7.0
Q4	6.4	6.0
Q5	6.2	8.0
Q6	6.3	5.8
Q7	6.6	8.6
Q8	6.8	6.8
Total Mean Score	4.8 (1.1)	6.7 (1.1)

Table 7: Diabetes Self-efficacy Scale score per question (n=12).

Diabetes Knowledge Test Scores

The mean score for the pre-intervention test was 3.2 (SD-0.3) and the post-intervention mean test score was 2.3 (SD-0.6) on the 14- point Likert scale. The questions most frequently answered correctly were about knowing that an infection will raise blood glucose levels, knowing the effect of exercise on blood glucose levels, and knowing that checking home blood glucose levels is the best method for monitoring diabetes at home. The three questions tied for being the most frequently answered incorrectly were: the first was related to identifying the highest-carbohydrate food; knowing which food was considered a "free food"; correctly identifying numbness and tingling as a sign of nerve disease. After the intervention the questions most frequently answered correctly were knowing what HbA1c measures and knowing the effect of fruit juice on blood glucose. The question least frequently answered correctly were about the best way to take care of feet and knowing the effect of an infection on blood glucose levels (Table 8).

Question #	Pre X (SD)	Post X (SD)
Q1	2.0	2.2
Q2	2.8	3.2
Q3	2.3	1.4
Q4	2.8	3.0
Q5	2.3	3.0
Q6	2.3	1.8
Q7	2.3	2.0
Q8	2.8	2.6
Q9	1.8	1.8
Q10	1.8	1.6
Q11	1.7	2.0
Q12	2	2.6
Q13	2.1	2.8
Q14	3.1	2.8
Total Mean Score	3.2 (0.3)	2.3 (0.6)

Table 8: Diabetes Knowledge Test score per question (n=12).

HbA1c levels.

The pre-intervention HbA1c range was 6.5-13.0 with a mean of 8.73. The post-intervention HbA1c range was 6.2-9.6 with a mean of 7.5.

Objectives

Three of six process objectives were met. The unmet objectives were: the start date was delayed by one month and only (n=12) 20% of the target population participated in the program; only 42% of the participants received reminder phone calls 2 weeks prior to the start of the program; and only 25% of the target population completed 50% (3 out of 6) of the sessions (Table 9). All impact objectives were met except for one, the diabetes self-efficacy score had decreased by 3% at 3-month post intervention. Preliminary results suggest that the outcome objective was met: The HbA1c level improved by 16% in 5 patients. The data collection of HbA1c levels is still ongoing and expected to be completed by January 2021. There was a high prevalence of Seventh Day Adventists, who were vegetarians, did not smoke or drink alcohol, and already understood the importance of maintaining a healthy lifestyle another unexpected result was a high prevalence of patients who already checked their feet and engaged in regular foot care. This is because Bermuda is a sub-tropical island where many wear sandals year-round. The preliminary program results were shared internally at BEAMS and the final results will be shared with the Bermuda Ministry of Health and potentially the Pan American Journal of Public Health.

	Pre-Survey	**Post-survey**
Diabetes Self-efficacy Scale	How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do? 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? How confident do you feel that you can eat your meals every 4-5 hours every day, including breakfast every day? How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	How confident do you feel that you can judge when the changes in your illness mean you. Should visit the doctor? How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise? How confident do you feel that you can eat your meals every 4-5 hours every day, including breakfast every day? How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?
Diabetes Self-care Scale	On how many of the last seven days did you eat high fat foods such as red meat or full-fat dairy products? On how many of the last seven days did you check your feet? Have you smoked a cigarette-even one puff-during the past seven days? On how many of the last seven days did you participate in a specific exercise session other than what you do around the house or as part of your work?	How many of the last seven days have you followed a healthful eating plan? On how many of the last days did you test your blood sugar? Have you smoked a cigarette-even one puff-during the past seven days? On how many of the last seven days did you eat high fat foods such as red meat or full-fat dairy products?

Diabetes Knowledge Test	What affect does an infection have on blood glucose levels? For a person in good control, what effect does exercise have on blood glucose levels? Which is the highest carbohydrate food? Which of the following is a "free food"?	A1c is a measure of your average blood glucose level for the past? What effect does unsweetened fruit juice have on blood glucose? The best way to take care of your feet is to? What affect does an infection have on blood glucose levels?

Table 9: Survey question Analysis.

Discussion

This project was implemented at BEAMS Primary Care Clinic to develop a structured diabetes self-management program for diabetic patients. The findings suggest that the individualized diabetes self-management program was effective in improving diabetes self-care, knowledge, and HbA1c levels. The percentage of improvement of diabetic self-care was 48% 3 months post intervention. This is consistent with a Turkish study which revealed 76% improvement of self-care agency in 391 diabetics [15]. In our study, the post-intervention self-efficacy score was not an improvement as it went down 3%. The result was inconsistent with a similar study conducted in Saudi Arabia with 61 patients with diabetes. In that study, patients' self-efficacy improved by 30% after the intervention ($p<0.05$) [16]. Although our study did not show improvement in self-efficacy, both studies reported improvement in knowledge and self-care behaviors. However, it is important to note that improvement in patient knowledge was much smaller (14%) in our study than in Katip's study (77%). Rickheim examined 170 type 2 diabetics after receiving diabetes self-management education sessions [4]. It was found that there were improvements in HbA1c levels at 6 months post baseline (1.8%). This is consistent with the improvement in HbA1c levels seen in our study. In our study, the mean HbA1c at post intervention was 7.5, a significant improvement over the 8.73 pre-intervention level [17-20].

A major challenge to program implementation was a delay in starting the program, which resulted in many fewer participants. It is presumed that the COVID-19 pandemic had an effect that reduced the number of participants. Originally the nurse practitioner's schedule was reserved mostly for those individuals who have diabetes but the schedule had to be opened up to include all chronic disease patients (including pre-diabetic patients) to maintain acceptable provider productivity levels [21-23].

Before COVID-19 the nurse practitioner was seeing approximately 43 diabetic patients regularly for unstructured comprehensive diabetes self-management visits. The results suggest that there was a large drop in participation in comprehensive diabetes self-management sessions after of the COVID-19 pandemic. Although COVID-19 precautions were taken (handwashing, mask wearing and open windows) it is presumed that many diabetic patients did not feel comfortable physically coming into a medical office twice per month for in-person visits [24,25].

Recommendations

Strengths of this pilot program include improvements to scores in participants' self-care and diabetes knowledge post-intervention test surveys and HbA1c levels. Although this was a very small study, the findings suggest that the program has potential to positively impact patient outcomes [26]. Finally, because the nurse practitioner's schedule was opened up to include pre-diabetic patients, this served as a port of entry for this subset of patients into the program. Limitations of this pilot program were the small sample size, homogeneous racial background that the HbA1c was not drawn immediately before the start of the program, and that patients had their HbA1c drawn at multiple laboratories, which made tracking the results difficult [27].

Due to the small sample size it is difficult to generalize the results. A recommendation for the future is to consider delivering the program remotely by utilizing video conferencing to increase access to the program during the COVID-19 pandemic. However, providers need to be flexible and utilize telephones as needed because not all patients at BEAMS have internet access at home. Inclusion of pre-diabetic patients is also recommended because the program contents are relevant for pre-diabetes and early introduction of educational content may help improve their self-efficacy. Increasing the length of the sessions to 60 minutes may also be helpful in improving patients' self-efficacy. The program was feasible at a primary care clinic and resulted in some improvements in patient clinical outcomes. However, it is difficult to determine the effectiveness of the program with a small number of participants. This program should be replicated in another clinic with a larger sample size to validate the results [28].

Sustainability

BEAMS' plan for sustainability is to continue this program as a part of routine practice and to expand it to include the pre-diabetic population. Expansion of this program is possible because reimbursement for diabetes self-management education is a part of the Standard Health Benefit (SHB) and it is mandated that all health insurance providers cover this benefit in Bermuda. Therefore, there is unlimited reimbursement for diabetes self-management and the provider can deliver diabetes self-management education in the one-on-one setting.

One of the recommendations from the BEAMS administrator was to utilize an individual nurse practitioner for the diabetes self-management program and to bill each session as a provider visit. Each visit was reimbursed fully by health insurance and there was no copay required of the patient. This is accepted practice in Bermuda because diabetes self-management program sessions will also include a physical assessment and medical management. The diabetes self-management program delivered through individual nurse practitioner sessions is a financially sustainable model for BEAMS [29,30].

Diabetes self-management programs are not common in Bermuda. There is a HEARTS initiative, which is a national recommendation in Bermuda to deliver diabetes self-management programs in the primary care setting. A similar program called "Know Diabetes by Heart" has been successfully implemented in the United States [17].

There is an exciting opportunity for the BEAMS clinic to collaborate with the HEARTS initiative to implement individualized diabetes self-management programs in the primary care setting on the island. It might be beneficial to contact the American Diabetes Association as this program expands island-wide to anticipate potential barriers and facilitators [31].

Conclusion

Incorporating a structured diabetes self-management program into existing diabetes management primary care visits was effective in improving HbA1c levels. This health care delivery model was feasible in Bermuda and should be utilized in other Caribbean countries to improve diabetes care. Our collaboration with the Bermuda Ministry of Health will help to disseminate this program and to reduce the burden of noncommunicable disease. The management of diabetes is a major public health priority in Bermuda and developing a diabetes self-management program in the primary care setting that is easily replicable is the first step in helping to improve diabetes-related clinical outcomes in Bermuda.

References

1. Centers for Disease Control and Prevention (2019) National Standards for DSMES.
2. Ministry of Health, Seniors and Environment (2016) Steps to a Well Bermuda: Health Survey of Adults in Bermuda 2014. Government of Bermuda.
3. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, et al. (2016) Diabetes Self-management Education and Support in Type 2 Diabetes: A Joint Position Statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. Clin Diabetes 34: 70-80.
4. Rickheim PL, Weaver TW, Flader JL, Kendall DM (2002) Assessment of group versus individual diabetes education: a randomized study. Diabetes Care Feb 25: 269-274.
5. Pan American Health Organization (2020) Diabetes.
6. Office of Disease Prevention and Health Promotion (2020) Healthy People.
7. Government of Bermuda, Ministry of Health (2017) Department of Health: Proposed national plan to halt the rise in obesity and diabetes.
8. Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, et al. (2015) Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. J Acad Nutr Diet 115: 1323-1334.
9. Doyle G, O'Donnell S, Quigley E, Cullen K, Gibney S, et al. (2017) Patient level cost of diabetes self-management education programmes: an international evaluation. BMJ Open 7: e013805.
10. Dehghani-Tafti A, Mahmoodabad SSM, Morowatisharifabad MA, Ardakani MA, Rezaeipandari H, et al. (2015) Determinants of Self-Care in Diabetic Patients Based on Health Belief Model. Global Journal of Health Science 7: 33-42.
11. Saran R, Li Y, Robinson B, Ayanian J, Balkrishnan R, et al. (2015) US Renal Data System 2014 Annual Data Report: Epidemiology of Kidney Disease in the United States. Am J Kidney Dis 66: S1-305
12. Green LW, Kreuter MW (2005) A framework for planning. In: Health program planning: An educational and ecological approach (pp: 1-28). Boston: McGraw Hill.
13. American Association of Diabetes Educators (2019) Cultural and heath literacy considerations with diabetes.
14. American Association of Diabetes Educators (2019) Standard 6 Curriculum.
15. Unsal-Avdal E, Arkan B (2014) Individual and Group Education in Diabetes and Outcomes. Aquichan 14: 138-147.
16. Min D, Cho E (2018) Associations among health behaviors, body mass index, hypertension, and diabetes mellitus: A path analysis. Medicine (Baltimore) 97: e10981.
17. Sanchez EJ, Cefalu WT (2019) Know Diabetes by Heart: A Partnership to Improve Cardiovascular Outcomes in Type 2 Diabetes Mellitus. Circulation 140: 526-528.
18. American Diabetes Association (2019) Glycemic Targets: Standards of Medical Care in Diabetes-2019. Diabetes Care 42: S61-S70.
19. Bourne RR, Stevens GA, White RA, Smith JL, Flaxman SR, et al. (2013) Causes of vision loss worldwide, 1990-2010: a systematic analysis. Lancet Global Health 1: e339-e349.

20. Bradley C (2013) Handbook of psychology and diabetes: a guide to psychological measurement in diabetes research and practice. Routledge. Taylor & Francis eBooks.

21. Crosby RA, DiClemente RJ, Salazar LF (2013) The precede-proceed planning model. In: Health behavior theory for public health: Principles, foundations and applications. (13th Edition). (pp: 45-64). Burlington, MA: Jones & Bartlett.

22. Lin S, Naseri T, Linhart C, Morrell S, Taylor R, et al. (2017) Trends in diabetes and obesity in Samoa over 35 years, 1978-2013. Diabet Med 34: 654-661.

23. Messina R, Rucci P, Sturt J, Mancini T, Fantini MP (2018) Assessing self-efficacy in type 2 diabetes management: validation of the Italian version of the Diabetes Management Self-Efficacy Scale (IT-DMSES). Health Qual Life Outcomes 16: 71.

24. PAHO (2012) Bermuda. Health in the Americas, 2012 Edition: Country Volume.

25. Purnell L (2002) The Purnell model for cultural competence. Journal of Transcultural Nursing 13: 193-196.

26. Sarwar N, Gao P, Seshasai SRK, Gobin R, Kaptoge S, et al. (2010) Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. Lancet 375: 2215-2222.

27. Schmitt A, Gahr A, Hermanns N, Kulzer B, Huber J, et al. (2013) The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. Health Qual Life Outcomes 11: 138.

28. Sunaert P, Bastiaens H, Nobels F, Feyen L, Verbeke G, et al. (2010) Effectiveness of the introduction of a Chronic Care Model-based program for type 2 diabetes in Belgium. BMC Health Serv Res 10: 207.

29. Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM (2002) Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. Diabetes Care 25: 1159-1171.

30. Toobert DJ, Glasgow RE (1994) Assessing diabetes self-management: the summary of diabetes self-care activities questionnaire. Handbook of psychology and diabetes. Pp: 351-375.

31. Van Der Ven NCW, Weinger K, Yi J, Pouwer F, Adèr H, et al. (2003) The confidence in diabetes self-care scale: psychometric properties of a new measure of diabetes-specific self-efficacy in Dutch and US patients with type 1 diabetes. Diabetes Care 26: 713-718.