2017

Assessing for Awareness and Knowledge Regarding Diabetes in Pre-Diabetes Obese Patients

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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2017

Abstract

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by

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Over the past few decades, there has been an increase in prevalence of diabetes in the United States. Prevention of diabetes and improving patients' knowledge and awareness of diabetes are crucial for healthcare providers. Using the Health Belief Model (HBM) as a theoretical foundation, the student used the National Diabetes Prevention Program (NDPP) from the Centers for Disease Control and Prevention (CDC), to improve awareness and knowledge of diabetes among obese individuals with prediabetes. The key research question of this project was to determine whether the patients' diabetes knowledge and awareness improved after the NDPP program. A convenience sample of 30 participants was recruited from patients seeking care at a family practice clinic. Data collection was conducted using the Michigan Diabetes Research and Training Center's Diabetes Knowledge Test (DKT). Pretest and posttests were used to evaluate improvement in the participants' knowledge and awareness after administration of education sessions. The t-tests indicated a significant improvement in the patients' knowledge ($p < 0.000$) and awareness ($p < 0.000$) of diabetes after the NDPP program. Thus, the NDPP program was effective in improving the patients' diabetes knowledge and awareness. The nationwide adoption of the NDPP program was recommended to reduce the rate of diabetes among high risk individuals. The implication of this Doctor of Nursing Practice (DNP) project to social change was that improving knowledge and awareness of diabetes among obese patients with prediabetes would increase their participation in lifestyle and behavioral modification programs, thus, improving the control of blood sugar levels.

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Dedication

I dedicate this DNP project to very special people who have contributed to my development in various stages of my life: My Mother and Father, Jimmie and Mattie; my brother, Matthew; my amazing son, Dario; and in memory of my grandfathers, Albert Lee and Ben; my Grandmothers, Lillie Mae and Mary Dee; and my aunt Hattie Mae. Thank you for all your encouragement as I began my education in nursing. I will always be grateful for the impact you have made in my personal and professional life.

Acknowledgment

I would like to acknowledge Dr. Jennings and Dr. Wright for their exceptional efforts in helping nursing students achieve their educational aspirations. Their professional dedication to nursing has consistently inspired me to overcome any challenges encountered while undertaking this DNP project.

Table of Contents

List of Tables

List of Figures

Section 1: Overview of the Evidence-Based Project

Introduction

Pre-diabetes is a condition that occurs when concentrations of blood glucose are higher than usual, but lower than conventional onset of diabetes (Kowall et al., 2012). Pre-diabetes is characterized by impaired glucose tolerance (IGT), impaired fasting glucose (IFG), or a combination of IGT and IFG (Kowall et al., 2012). Because of IGT, IFG, or the combination of both, there is a reproduction of glucose dysregulation intermediary between normoglycemia and diabetes, particularly type 2 diabetes (T2D) (Tabák, Herder, Rathmann, Brunner, & Kivimäki, 2012). Approximately a third of adults in the United States (US) have pre-diabetes and are consequently predisposed to T2D and other co-morbidities, such as cardiovascular disease and obesity (Mainous, Tanner, Baker, Zayas, & Harle, 2014).

Diabetes has several effects which may include dysfunction and, in some cases, failure of body organs (Tabák et al., 2012). T2D also exposes individuals to various conditions such as cardiovascular disease, amputations, renal failure, visual loss, and obesity. Weight loss has been found to prevent actualization of T2D and obesity in persons with pre-diabetes (Brown & Kuk, 2015). Therefore, early detection and treatment of pre-diabetes can prevent its transition to full onset diabetes and consequently minimize the associated complications.

Though diabetes can be managed, there also exists several measures that can be employed to prevent the disease. In most cases, taking medication, adhering to healthy diet, losing weight, and exercising regularly are the main treatments accessible

(American Association of Diabetes Educators (AADE), 2010). While medication has proved to be efficient in most scenarios, non-pharmaceutical interventions to delay or prevent progression to T2D have shown to be more cost-effective and reliable (ADA, 2010). In this regard, diabetes self-management education (DSME) programs have been created to develop skills and behaviors essential to avoid and/or manage diabetes and its associated risks (Haas et al., 2013). The American Diabetes Association (ADA) (2010) affirmed in *The Principles of Medical Care in Diabetes* that psychotherapy for patients at risk for or with diabetes is imperative for the accomplishment of the delay or prevention of T2D. Moreover, the ADA (2010) outlined that individual programs should acknowledge DSME and continuous diabetes support as an important module in the treatment structure. The effectiveness of DSME is determined by whether standards have been attained and whether outcomes have been evaluated. These outcomes and standards have been outlined by the AADE and the ADA (AADE, 2010).

Problem Statement

Diabetes is arguably an emerging epidemic of the 21st century. The aim of this DNP project was to use an existing developed educational program based on the ADA guidelines on DSME for improving awareness and knowledge regarding diabetes among obese patients with pre-diabetes. After conducting pretests on obese patients with prediabetes, the DNP student identified gaps in awareness and knowledge of diabetes among the participants. The responses from the pretest were used to improve and modify the educational program to meet the individual needs of obese patients with prediabetes.

There is a growing need for interventions that improve patients' knowledge and awareness of diabetes (Islam et al., 2014). Diabetes management requires knowledge on daily self-management practices that must be followed to achieve the desired outcomes. Diabetes threatens to overcome the healthcare system in the near future (Tabak et al., 2012). Research has established a correlation between other health conditions, such as obesity, and diabetes which compound the health challenge associated with diabetes (Ellulu, Abed, Rahmat, Ranneh, & Ali, 2014). The significant population at risk for or with diabetes is within the age group of 35–64 years. Lack of measures to reduce occurrence of pre-diabetes would lead to a consequential increase in health spending, morbidity, and other related health conditions. To manage the scourge of diabetes, public health interventions are necessary to avert diabetes or delay its advancement (Islam et al., 2014). Such initiatives can include comprehensive lifestyle modification for those at risk of diabetes and timely treatment for those with the disease. An aggressive approach targeting persons at risk of diabetes is an essential public health approach aimed at decreasing the risk factors for diabetes in the community level.

In developing initiatives to curb diabetes, knowledge is an indispensable asset (Demaio et al., 2013). There is a correlation between persons with lower levels of health knowledge and higher burdens of diabetes (Maina, Ndegwa, Njenga, & Muchemi, 2011). Patients' knowledge of their health can be useful in the evaluation of risk for diabetes, treatment, and control of diabetes. Therefore, stakeholders in the healthcare sector should aim at designing and executing comprehensive health promotions and diabetes education programs to improve diabetes knowledge and awareness.

Purpose Statement and Project Objectives

The purpose of this DNP project was to assess awareness and knowledge regarding diabetes in pre-diabetes obese patients. To identify if the patients were prediabetic and obese, the project used patients' medical records to select patients with impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). Additionally, the patients were identified as obese if they have a body mass index (BMI) of over 30kg/m^2. The patients' level of awareness on the risk of developing T2D and knowledge regarding risk reduction behavior and interventions was assessed using the DKT questionnaire. The DNP student also determined how awareness and knowledge levels among patients vary based on age, gender, and level of education. This project used diabetes related questions from the DKT questionnaire to assess and categorize patients based on their knowledge and awareness of diabetes. The questionnaire contains 23 questions regarding diabetes and every patient was given a score for every correct answer recorded. Every correct answer to the questions in the DKT questionnaire was awarded one point. After completing the pretest, the questionnaires were coded for anonymity purposes. The questionnaires took approximately 30 minutes to complete. Participants were provided with identification numbers in case they wish to know their scores in the DKT. Scoring of the posttests was performed after completion of the questionnaires and participants provided with their scores. Determination of a patients' awareness and knowledge of diabetes and their risk of developing type 2 diabetes may motivate them to change their lifestyle and adopt new interventions to reduce the risk for diabetes. This project targeted adult obese patients of both genders; therefore, the findings may be useful in the

development of future interventions towards reducing diabetes risk in populations with high risk of developing type 2 diabetes. The project was guided by the following objectives:

i. Objective 1: To determine the level of knowledge and awareness regarding diabetes in pre-diabetic obese patients. This objective was achieved by scoring the DTK survey. The participants were deemed knowledgeable in the following categories: 0-11=poor knowledge, 11-17=average knowledge, and 17-23= high knowledge. Awareness scores were categorized using the following scores: 0-5= low awareness, 5-7= moderate awareness, 7-23= high awareness.

ii. Objective 2: To determine the association between knowledge and awareness of diabetes among obese patients with prediabetes based on gender, age, and level of education. The association was achieved by comparing DTK scores to gender, age, and educational level.

iii. Objective 3: To use the NDPP program from the CDC to improve knowledge and awareness of diabetes among obese patients with pre-diabetes. After identifying knowledge and awareness gaps regarding diabetes among obese patients with prediabetes, the DNP student would modify and improve the NDPP educational program. The individual educational sessions took place within 10 minutes after completion of the pretests. The effectiveness of the NDPP educational program was determined by conducting posttests after education of the patients on diabetes self-management practices using the

DTK. Pre-and post-test scores were compared to determine diabetes change in knowledge and awareness.

Research Questions

This DNP project aimed at addressing following research questions:

i. Is the awareness and knowledge levels of diabetes among pre-diabetic obese patients associated with gender?
ii. Does the relationship between patients' awareness and knowledge on diabetes vary based on age?
iii. Does the awareness and knowledge level of diabetes vary based on the patients' level of education?
iv. Does an educational program improve obese patients with prediabetes' knowledge and awareness of diabetes?

Significance of the Project

There has been a rise in prevalence of pre-diabetes and obesity in the U.S. In addition, there is a high possibility of progression to T2D for persons with pre-diabetes (Tabak et al., 2012). Diabetes increases the risk of developing other complications such as hypertension, kidney complications, and blindness in addition to increasing the cost of treatment and loss of productivity. Thus, there is need for an approach to increase the level of knowledge and awareness regarding pre-diabetes and obesity among the patients to ensure early detection of the disease. The findings of the project may help in recognizing populace knowledge gaps and behavior regarding pre-diabetes and obesity, which would facilitate the development of diabetes and obesity management initiatives.

Healthcare providers and practitioners may find the results of this project significant to use in handling people with pre-diabetes and obesity.

Implications for Social Change in Practice

It is estimated that almost 300 million people worldwide suffer from diabetes (C3 Collaborating for Health, 2011). Half a million of these patients include children under the age of 14 and the number is expected to rise by 50% by the year 2030 (C3 Collaborating for Health, 2011). Though provision of care to diabetic patients is expensive, healthcare institutions face a more challenging burden in treating complications arising from T2D such as stroke, heart attack, and kidney failure which also inhibit economic productivity and increase the cost of social care (C3 Collaborating for Health, 2011). Therefore, prevention, effective treatment, early diagnosis of T2D, and creation of awareness about diabetes among obese pre-diabetic patients are vital practices in reducing the negative impacts of the disease to individuals and the society.

This project assessed the awareness and knowledge regarding diabetes in pre-diabetic obese patients. The findings of this project would be incorporated into initiatives to tackle obesity and diabetes with the aim of creating a culture of learning/gaining knowledge about diabetes among obese individuals in the society. The efficacy of such an initiative would result in significant management of obesity and diabetes which would increase the quality of life of diabetic patients. Also, it would reduce health care costs.

By creating awareness and imparting knowledge, the project findings would impact the community positively. For instance, the findings would also be used to educate the community on the dangers of obesity and how the people can manage pre-

diabetes and T2D. To the public, the representative data on knowledge and awareness about diabetes would be used to plan public health policies aimed at preventing and controlling diabetes.

Definitions of Terms

Diabetes awareness: Refers to the understanding about diabetes based on information and experience (Fonseca, Kirk man, Darrow, & Ratner, 2012). In the case of this project, diabetes awareness comprised of the patient's basic knowledge of diabetes, the methods and importance of controlling blood glucose levels.

Knowledge of Diabetes: Refers to possession of skills, information, and facts regarding diabetes that is acquired through education or experience (Fonseca et al., 2012). For the purposes of this project, knowledge of diabetes referred to the practical and theoretical aspects of diabetes.

Pre-diabetes: This is a medical condition where the level of blood glucose is higher than the standard level, but not high enough to be categorized as diabetes (ADA, 2011).

Type 2 diabetes: This is a condition where the body does not make use of the insulin secreted by the pancreas, leading to high blood glucose levels than normal (ADA, 2011).

Obesity: This is a medical condition where there is excess body fat which is determined when body mass index, measured by dividing an individual's weight by the square of the height, exceeds 30 kg/m^2 (Haas et al., 2013).

Normoglycemia: This is the presence of the recommended concentration of glucose in the blood (Phung, Baker, Vanita, Bhardwaj, & Coleman, 2012).

Hypertriglyceridemia: This is a medical condition resulting when the triglyceride levels become elevated as a result of obesity, sedentary habits, and uncontrolled diabetes mellitus (Berglund et al., 2012).

Pharmacotherapy: This is a term used to explore the medications which can be used in the management of diseases and health conditions like hypertriglyceridemia (Korytkowski, 2013).

Insulin: This is a hormone produced by the pancreas and is responsible for regulation of blood sugar to prevent hyperglycemia or hypoglycemia (American Diabetes Association, 2013).

Hyperglycemia or hypoglycemia: Hyperglycemia is used to describe the condition when an individual has high glucose in their blood, and hypoglycemia implies low levels of glucose in the blood (Korytkowski, 2013).

Assumptions, Limitations and Delimitations

This project was based on the assumption that obese patients with prediabetes may have less knowledge and awareness of diabetes, therefore, the NDPP educational program would improve the patients' knowledge of diabetes. It was also assumed that increasing awareness regarding diabetes and its associated risks would result in improved outcomes when managing the health condition. The sample population for this project was limited to obese patients in a family practice clinic. Therefore, the ability to apply the findings to the entire population of patients at risk of developing diabetes is limited.

However, the sample patients were faced with the same diabetes risk factors, therefore, the results can be reliable. The sample was determined using convenience sampling technique which has been criticized because it may lead to systematic bias and skewed findings due to interference by the student (Stommel & Wills, 2004).

Summary

Diabetes is increasingly becoming a health care burden that is likely to strain the current healthcare system. In addition, diabetes is associated with other health conditions that make it more challenging. There is need for effective efforts to tackle the health condition to delay its effects. The success of a health initiative is partly influenced by the public's level of knowledge regarding the health condition. Knowledge and information play a role in diabetes and obesity cognizance, and consequently, the seeking of treatment and management of the disease. This project sought to evaluate the public's awareness and knowledge regarding diabetes in pre-diabetic obese patients. The findings of this project would be useful to policy makers and health care providers who can incorporate them in designing and implementing diabetes and obesity programs. Chapter two of this project provides general and specific literature on diabetes, the association between obesity and diabetes, and interventions aimed at reducing risk of T2D.

Section 2: Review of Scholarly Evidence

This section presents general and specific literature on diabetes control and management. The literature is organized into: (1) Literature search (2) Specific Literature (3) General Literature, (4) Theoretical Framework, and (3) Summary. The main themes evident in the specific literature section include: (1) Assessing Awareness and Knowledge about Diabetes (2) Impact of Obesity on Type 2 Diabetes, (3) Insulin Resistance in Pre-diabetes and Obesity, (4) The Relationship between Visceral Adiposity, Insulin Resistance, and Obesity, (5) Weight Loss Benefits in Obese and Pre-Diabetic Persons, and (6) DSME. The general literature is mainly themed on: (1) National Standards for DSME, (2) Standards for Outcomes Measurement of DSME, (3) Efficiency of DSME, and (4) Cost Effectiveness of DSME.

Literature Search

To obtain sources for the literature review, the following electronic databases were searched: Medline, PubMed, Bioline International, Embase, Cochrane Central Register of Controlled Trials (CCTR), the Cochrane Database of Systematic Reviews (CDSR), Database of Abstracts of Reviews of Effectiveness (DARE), and Google Scholar. Other than using online libraries, journal articles which were related to the topic under study were also searched from the Walden University Library.

The following search terms were used in this project: *diabetes*, *Type 1 Diabetes*, *Type 2 Diabetes,* and *obesity and pre-diabetic*. After relevant studies were identified, hand-searching was done where all the bibliographies and reference lists of included

studies were reviewed for relevant studies that may not have been picked up through the electronic search. As part of the inclusion criteria, only latest journal articles published between 2009 and 2015 were reviewed. The literature search lasted one week starting from 1st to 30th April 2015. The inclusion criteria included: Articles written in the English language, qualitative and quantitative studies, and articles published from 2009 to 2015. The exclusion criteria included: Non-English articles, dissertations/theses, published abstracts, and articles published later than 2000. A total of 100 articles were retrieved; however, only 79 were retained for this project. Ten articles were rejected because they did not have any sampling procedure while 11 articles were reviews.

Specific Literature

Assessing Awareness and Knowledge about Diabetes

Deepa et al. (2014) conducted a cross-sectional study in both rural and urban India with the aim of assessing awareness and knowledge about diabetes in the general population among patients with diabetes in selected regions in India. In this study, Deepa et al. (2014) used subjects drawn from four geographical regions of India. A sample of 6,607 individuals was employed. In the study, Deepa et al. (2014) assessed awareness of diabetes and knowledge of causative factors and complications of diabetes through the use of an interviewer administered structured questionnaire. The response rate was 86%. In their conclusion, Deepa et al. (2014) established that the level of knowledge and awareness about diabetes in India was poor in rural areas in comparison to urban areas because only 43.2% of the populations used were aware of the conditions of diabetes. However, urban residents presented higher awareness rates of 58.4% compared to 36.8%

of rural residents. Deepa et al. (2014) emphasized for the need for improvement in knowledge and awareness in the diabetic subjects and the general population with the aim of achieving better control and prevention of diabetes and its problems.

The Finnish Diabetes Prevention Study Group found that persons with impaired glucose tolerance can considerably decrease the possibility of developing diabetes by affecting the adjustable risk factors of sedentary lifestyle and obesity (Woodbury, Botros, Kuhnke, & Greene, 2013). In the study, 522 participants with impaired glucose tolerance were arbitrarily assigned to a control group or an intervention group. The main objective of the intervention group was to achieve a decrease in weight of at least 5% and to exercise for a minimum of half an hour per day. Upon comparison of the general occurrence of diabetes in the intervention group to that of the control group, it was found that there was a reduced chance of 58% of having diabetes. The results varied among gender with a 54% reduction in women and 63% reduction in men (Woodbury et al., 2013). This study demonstrated how considerably lifestyle changes can diminish the risk of developing T2D.

A study by Evert et al. (2013) also established that lifestyle changes can reduce the risk of developing T2D. The study involved 84,941 female nurses who were followed for 16 years. In the period of the study 3,300new occurrences of T2D were identified. The findings of the study indicated that obesity and overweight, which were measured by use of body mass index (BMI), to be the most significant predictors of developing diabetes (Evert et al., 2013). However, after adjusting for BMI, other factors such as poor diet, sedentary lifestyle, smoking status, and the levels alcohol were all linked with a

considerably higher possibility of developing diabetes. Obtaining and preserving the right weight, regular exercising, drinking limited amounts of alcohol, and having a healthy diet, were commendations consequential from the study to reduce the possibility of developing T2D (Evert et al., 2013).

The Diabetes Prevention Program Research Group related occurrence of diabetes in individuals who changed their lifestyle and those who used metformin as their medication (Knauper et al., 2014). Metformin is a medicine normally used to augment the sensitivity of cells to insulin actions consequently decreasing insulin resistance (Roumie et al., 2014). The 3,234 non-diabetic persons were allotted into three clusters; metformin group, control group, and intensive lifestyle-modification category. The intensive lifestyle modification cluster had an objective to attain at least a 7% of weight loss and amass a minimum of 150 minutes of physical activity on weekly basis. The metformin cluster took the medication two times a day besides receiving standard lifestyle commendations. The control group used a placebo two times a day besides receiving standard lifestyle commendations. The results showed that both metformin and lifestyle-modification reduced a person's risk of developing T2D. However, the lifestyle intervention showed a 58% reduction whereas the metformin showed a 31% reduction (Knauper et al., 2014).

A follow-up study was undertaken by the Finnish Diabetes Prevention Group to establish the effect of lifestyle intervention (Saaristo et al., 2010). Dietary intake, physical activity, and a number of other metabolic and clinical measures were evaluated in a period of one to three years. The results showed that the intervention group had

significantly greater advances than the control group. The participants achieved enduring benefits in dietary changes, levels of physical activity, a number of metabolic and clinical indices, besides diabetes risk (Lindstrom et al., 2008). Similarly, Lindstrom et al. (2008) undertook a follow-up to the Finnish Diabetes Prevention Study. In the study, participants were followed for a median aggregate in a period of seven years. The results showed a 43% reduction in relative risk for the development of T2D compared to the initial study findings of 58%. These findings revealed that a rigorous lifestyle intervention over a limited time can result in long lasting effects in diminishing the possibility of T2D in high-risk persons (Lindstrom et al., 2008). The above-mentioned studies show the extent of attaining and upholding a small amount of weight loss besides consistent physical activity to decrease the risk of having T2D. As such, these are part of the approaches for the management and treatment of diabetes.

A number of interventional studies have found that a considerable reduction in weight can lead to a reduced incidence of progressing from pre-diabetes to T2D (Liu, 2010; Qiao, 2010; Roumie et al., 2014; Woodbury et al., 2013). Appuhamy, Kebreab, Simon, Yada, Milligan, and France (2014) conducted a study involving middle-aged obese participants with IGT who received intensive personalized instruction on food intake, weight reduction, and supervision on physical activity. After 3 years, there was a 57% relative decrease in the occurrence of diabetes in the research participants who received personalized intervention as opposed to those who received standard treatment.

The AADE has acknowledged seven self-care behaviors that are essential for management and treatment of diabetes. The self-care behaviors outlined are: Being

active, healthy eating, monitoring, problem solving, healthy coping, reducing risks, and taking medication (AADE, 2010). Studies have been conducted to explore the effect of the behaviors and offer evidence regarding their effectiveness (Liu, 2010; Qiao, 2010; Roumie et al., 2014; Woodbury et al., 2013).

Effective diabetes management requires a certain degree of knowledge and awareness of diabetes among the patients (Lindstrom et al., 2008). However, education of diabetic patients and individuals at risk of developing T2D requires calculated instructions in order to ensure successful diabetes control. Evidence from past literature suggests that increasing knowledge on diabetes and related complications can improve the patients' compliance to treatment and exercise plans (Deepa et al., 2014). Therefore, healthcare institutions should encourage diabetes education and adopt effective educational interventions in order to support and improve diabetes prevention and management.

Impact of Obesity on Type 2 Diabetes

The possibility of having T2D increases with an increase in BMI. This relationship is stronger in younger persons than it is in older people (Malik, Popkin, Bray, Despres, & Hu, 2010). In addition, weight gain between 15 and 35 years is associated with a higher possibility and an earlier inception of T2D than is weight gain between 41 and 60 years. This weight gain relationship shows that the possibility of diabetes increases linearly with BMI (Wilding, 2014).

Though there has been an increase in the occurrence of diagnosed diabetes cases in the last 10 years, the occurrence of IFG and undiagnosed diabetes has remained

moderately stable (Cowie, 2010). The possibility of central obesity increases with increase in, waist-to-hip ratio, waist circumference, and visceral adiposity. In an evaluation of 35 cross-sectional and 17 prospective studies in persons of 18 - 74 years, either waist circumference or BMI were associated or predicted T2D independently (Qiao, & Nyamdorj, 2010).

Research shows that for non-diabetics who are overweight, there is an increase of 49% in the occurrence of diabetes, over a decade, for each 1kg/year weight gain (Wilding, 2014). Similarly, every kg of weight lost yearly over a decade is associated with a 33% lesser possibility of diabetes in the succeeding 10 years. Similar studies found that weight gain was considerably associated to diabetes occurrence but only in persons who were not primarily overweight (Alcott, 2010). Liu (2010) established that each 1kg increase in weight was correlated with a 9% increase in the occurrence of diabetes. In addition, visceral fat is strongly associated with an increase in abnormal metabolism rather than upper body dermatological fat. However, both dermatological fat and visceral adiposity are associated with negative cardio metabolic risk factors (Liu, 2010).

Prevention of obesity is a major contributor in the management and prevention of T2D (Liu, 2010). As evident from past literature, decrease in the number of obese people may not provide the solution to reduction of diabetes risk among obese patients. However, due to the alarming rate of obesity, addressing the major causes of obesity will reduce the prevalence of obesity and thus reduce the risk of T2D (Wilcox, 2005). Therefore, care providers should encourage healthy eating behavior and exercising among patients at risk of T2D in order to improve the patients' health outcomes.

Insulin Resistance in Pre-diabetes and Obesity

Insulin resistance is the failure of responsible organs to have a normal response to the action of insulin. This results in an insulin resistance syndrome (IRS) which outlines the collection of abnormalities that happen more regularly in insulin resistant persons. In some cases, it results in metabolic syndrome (MS) which is a collection of metabolic anomalies where insulin resistance is the main trait. The constituents of metabolic syndrome are abdominal obesity which is a waist circumference more than 102 cm and 88 cm in men and women respectively, hypertriglyceridemia, low HDL-C, high blood pressure, and high fasting glucose.

Standard glucose homeostasis is preserved by a subtle equilibrium between secretion of insulin and the level of insulin sensitivity by peripheral tissues such as the adipose tissue muscle, and the liver. Reduced insulin sensitivity and impaired function of β-cells are the two main constituents in T2D pathogenesis that are found in adults (Kaiser & Leibowitz, 2009). The main link between T2D and obesity is insulin resistance. Normally, insulin resistance and obesity come before abnormal glucose which leads to T2D. Insulin resistance is demonstrated by reduced insulin-stimulated glucose conveyance and absorption in skeletal muscle and adipocytes by impaired dominance of hepatic glucose production (Ali, 2011).

Previous literature suggests that obesity is one of the primary causes of insulin resistance. In addition, studies have shown that adipose tissue in certain areas of the human body produce hormones that can form the basis of insulin resistance and other disorders (Wilcox 2005). Therefore, there is need for effective educational programs for

patients at risk of T2D on the importance of weight loss and reduction of body fat in diabetes management and control.

The Relationship between Visceral Adiposity, Insulin Resistance, and Obesity

In obesity, the first deposition of triglycerides happens in dermatological adipose tissue and as it surges insulin resistance will likely rise and restrict further dermatological lipid accretion. This will result in diversion of triglycerides ectopic sites and to the visceral fats. Consequently, it results in a considerable increase in insulin resistance and the occurrence of its related disorders. In lean persons, BMI is the prime cause of insulin resistance. It has also been found that metabolic syndrome abruptly increases in occurrence at high intensities of insulin resistance. This might be caused by the diversion of lipids from the dermatological to the visceral depot (Ali, 2011). Accretion of fat in the abdomen area has key effects for absorption and principally for insulin sensitivity (Brown & Kuk, 2015). This high occurrence of co-morbidities associates more to waist circumference than BMI.

A number of studies have established association between visceral obesity and insulin resistance (Brown et al., 2014). The Action for Health in Diabetes study on patients with T2D established that distribution of adipose tissue was considerably changed with more inter-muscular adipose tissues and visceral adipose tissues which are known to aggravate insulin resistance, and less dermatological adipose tissues in persons with diabetes than in those without diabetes (Gallagher, 2009). A high occurrence of abdominal obesity and obesity is linked with a significant increase in occurrence of hypertension and diabetes (Castro, Kolka, Kim, & Bergman, 2014). Visceral adiposity is

a cause for metabolic syndrome, insulin resistance, and T2D in grownups and in first degree relations of persons with T2D but have normal glucose levels (Castro et al., 2014; Patel & Abate, 2013). Visceral adipocytes secrete adipocytokines, hormones which cause chronic inflammatory profile and insulin resistance associated with visceral obesity (Hayashi, 2010).

Therefore, there is need for a better understanding of the link between insulin resistance, obesity, and T2D in order to facilitate effective control and management of T2D (Wilcox, 2005). Current literature on diabetes contains insufficient analysis of the determinants of T2D. However, conducting large-scale studies on the major determinants of T2D can improve diabetes knowledge and awareness among diabetes patients and individuals at risk of developing T2D (Mumu, Saleh, Ara, Haque, & Ali, 2014).

Weight Loss Benefits in Obese and Pre-Diabetic Persons

Research shows that there are benefits of losing weight for persons with pre-diabetes and obesity. Weight loss of 5% to 15% can considerably reduce the risk factors for obesity and its related diseases (Kim et al., 2013). This is because weight loss improves cardio-vascular and glycemic control risk factors in obese persons who have T2D. Clinical studies have established that there is an increase in therapeutic benefit with weight loss of 0.45 - 4 kg has positive impacts on metabolic control, mortality rates, and cardiovascular risk factors. The influence of weight loss on prevalence of diabetes and its related conditions serves to shows that the most efficient interventions should include all-inclusive behavioral management, modification in dietary habits, bariatric surgery exercise, and pharmacotherapy (Unwin & Unwin, 2014). Common medication such as

orlistat and sibutramine result in moderate loss of weight with noticeable improvements in co-morbidities, in persons with T2D.

Interventional and observational studies have found thatT2D can be prevented or delayed by lifestyle actions, such as reduction in energy consumption to encourage a moderate but consistent reduction in weight as well as necessary modification diet composition (Fujioka, 2010). Even in aged persons, diet-prompted weight loss leads to improvement in sensitivity of insulin and improvement in function of β-cells in the short-term as well as in the long-term (Roumie et al., 2014; Unwin & Unwin, 2014). The consumption of diets low in carbohydrates for obese persons with pre-diabetes improves insulin sensitivity, glucose profiles, and reduces plasma triglyceride as well as levels of cholesterol both in the short-term and in the long-term (Unwin & Unwin, 2014).

Weight loss is an important factor in diabetes control and management (Wilding, 2014). Due to the high likelihood of developing obesity, over weight individuals also suffer the high risk of developing T2D (Liu, 2010). Therefore, there is need for incorporation of lifestyle interventions that are effective in facilitating weight loss among populations at risk of developing T2D in diabetes prevention and management plans.

Diabetes Self-Management Education

In the past scholars, have developed diabetes self-management programs (DSME) meant to aid patients in making informed choices and expedite self-care behavior (Mulcahy et al., 2003). Change in lifestyle behaviors such as increasing physical activity and decreasing risks, is of ultimate significance in DSME programs. The AADE commends behaviors that can be learned to accomplish self-management. DSME

programs are developed to instill the most effectual skills and behaviors to manage diabetes and its associated risks. In order for DSME plans to effectively educate patients in self-management, they have to be effective in aiding patients modify their behavior (Woodbury et al., 2013).

A number of documents have been advanced to direct DSME program overseers to accomplish intended effectiveness of the DSME programs. The documents are: *AADE Standards for Outcomes Measurement of Diabetes Self-Management Education, National Standards for Diabetes Self-Management Education,* and National *Standards, Essential Elements and Interpretive Guidance*. The National Standards for DSME were developed to outline eminence diabetes self-management education and to help diabetes instructors in a number of settings to offer education that is evidence-based (Funnell et al., 2010). The National Standards, Essential Elements and Interpretive Guidance guideline is an instrument developed by the AADE to be utilized by overseers seeking approval for their program. The instrument is founded on the National Standards essential within a program to attain every element outlined in the national standards (AADE, 2010). The AADE Standards for Outcomes Measurement of Diabetes Self-Management Education were created as a supplement to the National Standards for Diabetes Self-Management Education (AADE, 2010). The objective of the AADE Standards for Outcomes Measurement of Diabetes Self-Management Education was to back the revised version of National Standards for Diabetes Self-Management Education (AADE, 2010).

A documented curriculum with the current practice and evidence procedures, with standards for assessing results, serves as the outline for the DSME program. Evaluated

needs of the person with diabetes and pre-diabetes define which content will be offered (Funnell et al., 2010). Standard 10 of the National Standards for Diabetes Self-Management Education outlines that the DSME program will evaluate the efficiency of the education process and define prospects for development by utilizing a documented constant quality enhancement strategy that designates and documents a methodical evaluation of the entities' progression and resulting data (Funnell et al., 2010). In order to establish efficacy, results must be evaluated. Diabetes mentors can utilize the core metrics to establish their efficiency with populations and individuals, relate their performance with proven standards, and determine the distinctive impact of DSME in the general framework of diabetes care (Woodbury et al., 2013).

As a result of the current dynamism of the healthcare industry and diabetes research, diabetes education programs should be adaptable to changes in diabetes knowledge, treatment strategies, new interventions in the management and control of T2D (Funnel et al., 2010). Therefore, there is need for identification and implementation of knowledge and awareness improvement programs for patients at risk of developing T2D and diabetic patients in order to ensure effective management of diabetes (Mulcahy et al., 2003). Additionally, after implementation, the programs should be incorporated into the patients' treatment timelines, collection of data, and evaluation of outcomes.

General Literature

National Standards for Diabetes Self-Management Education

The National Standards for Diabetes Self-Management Education was developed to offer evidence-based practices for educators in diabetes self-care to enable them provide superior diabetes education curriculums (Funnell et al., 2010). These standards came from the 1983 National Standards for Diabetes Patient Education Programs. In 1993, a task force made of representatives from nine key agencies such as the Centers for Disease Control and Prevention, American Diabetes Association, and the AADE were charged with appraising and reviewing the National Standards for Diabetes Patient Education Programs. Founded on research findings and health practices at that time, the task force reviewed the standards and called the new guidelines the National Standards for Diabetes Self-Management Education (Woodbury et al., 2013). Ever since then, the National Standards for Diabetes Self-Management Education have been revised a number of times.

Excellent diabetes self-management education curriculums can be evaluated in terms of process, structure, and results (Roumie et al., 2014). The present National Standards for Diabetes Self-Management Education are founded on these three key modules. Within each of the three modules there are definite standards which encompass quality of DSME programs. The first four standards address the DSME structure, standards 5 to 8 address the procedure of a DSME program, and standards 9 and 10 address results or outcomes (Funnell et al., 2010).

Standards for Outcomes Measurement of Diabetes Self-Management Education

The AADE (2010) delineates DSME as a cooperative process through which individuals at risk of, or with diabetes, acquire the skills and knowledge required to change behavior and effectively self-manage the disease and its associated conditions. To support measuring of results and guarantee the efficiency of DSME programs, the AADE outlined the standards that any program must attain to evaluate what the program has delivered as well as what it has achieved (Roumie et al., 2014). In this regard, behavior change is a distinctive result metric for diabetes self-management education, and the diabetes self-care behavior procedures should establish the efficiency of diabetes self-management education at participant, population, and individual levels. In addition, the diabetes self-care activities should be appraised at the baseline and then at systematic interludes after the education program. The AADE also outlines that a range of consequences, such as learning, clinical, health status, and behavioral consequences should be evaluated to validate the inter-relationship between behavior change and DSME in the care of persons with diabetes. Moreover, personal patient results are utilized to direct the mediation and enhance care for that patient. Cumulative population results are used to direct programmatic results and for unceasing quality enhancement activities for the program and the people it serves (AADE, 2010). Evaluating the results enables diabetes instructors to establish the efficiency of the program, to define the effect of the program on the partakers, and to determine spheres that need enhancement (Evert& Boucher, 2014). The process of frequently and consistently evaluating results at several intervals is important as is using the data to make clinical and educational decisions.

Efficiency of Diabetes Self-Management Education

Even with its demonstrated success, only approximately half of Americans with diabetes take part in formal diabetes education. There is a goal to increase this number to more than 70% by 2018 (Duncan et al., 2009). However, for people to take part, a DSME program should be executed in the community. Moreover, a DSME program should be designed to be efficient at either preventing those with pre-diabetes progressing to diabetes and reducing the risk of other complications for people already with diabetes.

There have been past studies that demonstrate the efficiency of community-based programs (Kulzer, Hermanns, Gorges, Schwarz, & Haak, 2009; Makrilakis, Liatis, Grammatikou, Perrea, & Katsilambros, 2010). Using Athens, Greece as a case study, Makrilakis et al. (2010) evaluated diabetes prevention in Europe using Diabetes Lifestyle Physical Activity and Nutritional Intervention (DE-PLAN). The DE-PLAN evaluation was instigated with an objective to develop a DSME model program in Europe. Moreover, Makrilakis et al. (2010) sought to guarantee that the DSME being recommended would be cost-effective and feasible. Given that it was the first program of its type in Greece, the original goal was to categorize persons at risk for T2D by using the Finnish Type 2 Diabetes Risk Score Questionnaire (Makrilakis et al., 2010). The questionnaire was circulated to twelve locations; six occupational settings and six primary-care settings. In the study 3240 filled questionnaires, where 620 persons were recognized to be of high-risk for developing T2D. The high-risk persons were requested to undertake a verbal glucose tolerance examination to identify persons with unknown diabetes. Subsequently 318 persons agreed to take part of which 67 were discovered as

having T2D. In addition, the remaining persons were requested to take part in the lifestyle intervention where 191 consented. The intervention comprised of six group meetings spread across 1 year. The objective of the intervention was to educate partakers concerning the risk of having diabetes and to offer motivation to initiate lifestyle changes, predominantly in the areas of physical activity and nutrition. One hundred and twenty-five partakers finished the intervention and the subsequent oral glucose tolerance examination. The results showed that for those who took part in 4-6 intervention meetings, weight loss was substantial. Moreover, glycemic status improved in all participants (Makrilakis et al., 2010).

A research undertaken by Kulzer et al. (2009) created a Prevention of Diabetes Self-Management Program (PREDIAS) founded on the DSME. The program comprised of 12 lessons spread across one year. After completion of the intervention, a follow-up was undertaken using a similar evaluation at baseline, comprising of a test in oral glucose tolerance, lipid, A1C and glucose levels, height, weight, waist circumference, physical activity evaluation, blood pressure, nutrition evaluation, and psychological and anxiety well-being assessments (Kulzer et al., 2009). Participants in the intervention group exhibited positive results compared to those in the control group. Noteworthy weight loss, improved nutrition, increased physical activity, enhanced fasting glucose, reduced total triglycerides and cholesterol, reduced diastolic and systolic blood pressure, better psychological well-being, and decreased depressive and anxiety indications were all exhibited in the intervention cluster and were significant compared to the control group (Kulzer et al., 2009).

Cost Effectiveness of Diabetes Self-Management Education

Given the limited resources to undertake certain initiatives, it has become gradually significant to evaluate health results as well as economic results of the services offered. The information acquired from a population-based assessment aids to establish interventions that are most cost effective and appropriate for a particular population (Evert & Boucher, 2014). Educating persons at risk of diabetes and those with diabetes is effective in enhancing their quality of life. Haas et al. (2014) reviewed a number of studies on the efficiency of self-management training in T2D. This study reported on self-care, knowledge, risk factors, lifestyle behaviors, quality of life and psychological outcomes, cardiovascular disease, glycemic control, and health-care and economic utilization outcomes from the studies they appraised. Haas et al. (2014) concluded that there was adequate evidence to support the efficiency of self-management training for persons with T2D. Boren and colleagues (2009) established that DSME programs are cost effective. Their study was an evaluation of studies published from 1991-2006 retrieved from EBSCOhost and Medline databases. After reviewing 26 papers, Boren et al. (2009) concluded that the benefits of a DSME program offsets the costs related with the program

It is apparent that any medical intervention has a cost. Duncan et al. (2009) evaluated the effect of DSME programs on patient care cost. Data on administrative claims from members of Medicare Advantage and commercial health plans was evaluated. There were 8.7 million claims compiled from the two Health plan programs. Duncan et al. (2009) outlined process codes that were particular to diabetes prevention

and care besides making a concerted effort to diminish any possible bias that could arise from the sample. The results of the study showed demonstrated that members of the plans with diabetes who took part in diabetes education incurred lower general health costs than those who did not take part in diabetes education. The commercially covered member cost reduced by 5.8% and the cost for Medicare members reduced by 15% in the members with diabetes who took part in DSME programs (Duncan et al., 2009). This further accentuates the findings that DSME programs are cost effective, hence, an important addition to the health care system in managing diabetes and its allied conditions such as obesity and cardiovascular diseases. Based on this literature review, I identified a gap in literature relating to assessment of the effectiveness of diabetes prevention interventions and the role of race and ethnicity on diabetes risk. Therefore, further improvements of community-based diabetes prevention programs are required in order to improve knowledge and awareness on diabetes.

Theoretical Framework and Conceptual Framework

Theoretical Framework

Health beliefs, knowledge, and attitudes are major concepts of health behavior models. Particularly, perceptions of disease danger, control, and effects are comprised in social cognitive models given that they underline health behaviors, intervene in the effects of other risk facets, are responsive to changes, and are objectives for disease interventions. In this regard, this project was based on the Health Belief Model (HBM). The HBM is an intrapersonal model that is within the individuals' beliefs and knowledge theory used in health promotion (Jones, Smith, & Llewellyn, 2014). The application of

the HBM was to assess health behavior of persons through examination of awareness, perceptions, and attitudes someone might have towards a disease and the consequences of particular actions.

In the HBM, the likelihood that an individual will adhere to preventive behavior is influenced by three aspects: (a) Perceived susceptibility and severity where one identifies that there is sufficient rationale to make a health concern important; (b) perceived threat where a person comprehends that they might be susceptible to a disease or negative health consequence; and (c) perceived benefits and barriers where an individual realizes that behavior change can be constructive and the benefits of that change will overshadow any expenditures of doing so (Bayat et al., 2013).

Within the healthcare sphere, susceptibility delineates the risk an individual has to a particular health outcome or disease. However, within the framework of the HBM, perceived susceptibility refers to an individual's beliefs about how possible the behaviors they participate in are going to lead to a negative health consequence (Orji, Vassileva, & Mandryk, 2012). Perceived threat evaluates how possible it is that the disease can be developed. The threat of a disease can be influenced by environmental factors, demographic background such ethnicity and race as well as socioeconomic status.

The HBM indicates that a trigger or a cue is essential for encouraging engagement in health positive behaviors. Cues to feat can be external or internal. Internal cues include physiological cues such as pain symptoms while external cues comprise events or information from the media, family and friends, and healthcare practitioners taking part in health-related behaviors (Zareban et al., 2013). The cues to action include reminders

from medical practitioners, the experiences from family and friends, and labels from health products. The strength of the cues is necessary to influence speedy action that varies between persons by perceived susceptibility, significance, benefits, and obstacles. The model also includes self-efficacy that refers to a person's perception of their competence to effectively perform a behavior. Self-efficacy explains individual variations in health behaviors.

The knowledge about a disease and attitude towards the disease affect the likelihood of action. After being cognizant of the possibility of developing a disease, if there is no change in behavior, it is significant to consider both the barriers and benefits of taking action and establish which have more effects in one's life (Julinawati, Cawley, Domegan, Brenner, & Rowan, 2013). The likelihood of action is also influenced by perceived benefits such as quality of life and other associated benefits. In any behavior change initiatives, there are barriers to change which play a role in the outcome.

The HBM model has been applied to diabetes to elucidate the awareness and behavior of the health condition. It revealed that the model supports the elementary knowledge about the operational, psychological, and environmental mechanisms of the patients for approval and adhering of suitable behaviors. Such knowledge may reduce the short-term and long-term diabetes effects and offer instructions for investigators to create suitable training approaches (Bayat et al., 2013). These instructions significantly improve acceptance and adherence of applicable behaviors like nutrition regimes and ultimately result in the long-term management of levels of blood sugar in persons with diabetes.

Conceptual Framework

Figure 1 below is a conceptual framework showing the relationship between the HBM and this project.

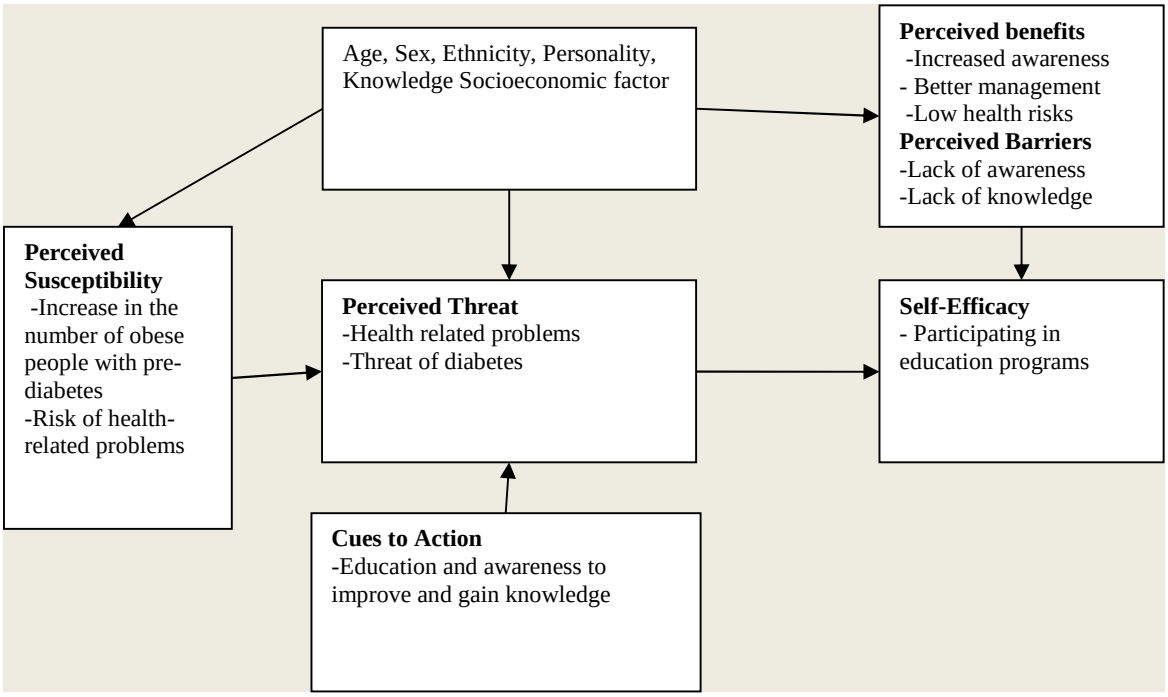

Figure 1: Modified Conceptual Framework.

Summary

This chapter focused on the review of available literature relating to the topic of the project. The reviewed literature indicates that self-management education is important in acquiring the skills and knowledge required to change behavior and effectively self-manage diabetes. The literature also indicates that self-management education is effective in managing diabetes. Additionally, the reviewed literature indicates that diabetes self-management education helps in reducing the cost of managing diabetes. The literature reviewed has gaps in the effectiveness of diabetes prevention interventions and the role of

race and ethnicity on the risk of getting diabetes. This project was based on the Health Belief Model which indicates that the probability of patients to adhere to preventive measures depends on perceived susceptibility, perceived threat, and perceived benefits.

Section 3: Approach

Research Design/Methods

The purpose of this project was to assess the awareness and knowledge of diabetes among obese individuals with prediabetes who are patients in a family practice clinic. The project used a descriptive research design to measure participants' knowledge and awareness of T2D. The measurement of findings, along with national guidelines, informed the improvement of the NDPP educational program. A descriptive research design is a method that provides a description of the people taking part in a project. The major ways of carrying out a project using a descriptive research design are: Survey, case study, and observational studies (Shawyer et al., 2014). This section is divided into seven major subsections: Pretests and Posttests, Improvement of the NDPP Educational Program, Population and Sampling, Data Collection, Data Analysis, Project Evaluation Plan, and Summary.

Pretests and Posttests

In this project, the DKT questionnaire was used to conduct pretests and posttests on obese patients with pre-diabetes. The participants were invited to participate in the pre-and posttests using the DKT questionnaire. The questions were written in such a way the respondents can understand and comprehend (Shawyer et al., 2014). The survey was used to assess the level of awareness and knowledge regarding diabetes from the sampled persons. Levels of awareness and knowledge may differ depending on various factors. Using results from the pretests, the DNP student modified the NDPP educational program

to meet the needs of obese patients with pre-diabetes. After education of the participants as a group, a posttest was conducted using the DKT questionnaire to determine the effectiveness of the educational program. The NDPP educational program would be implemented on a large scale after evaluation and approval from the Family Practice Clinic.

This DNP project employed the use of a descriptive quantitative design. A quantitative design was chosen because of its ability to give numerical data which can be used for statistical analysis (Creswell, 2014). In a quantitative research design, the aim is to determine the link between an independent variable and the dependent variable (s) in a population (Creswell, 2014). In this project, the relationship was between awareness regarding diabetes in pre-diabetic obese patients and how it affects the management of diabetes. After assessment of the level of awareness and knowledge of diabetes among the participants using quantitative methods, the student used national guidelines by the ADA on DSME to inform the improvement of the NDPP educational program for obese patients with prediabetes. The national guidelines by the ADA advocates for: Use of diabetes education to improve clinical outcomes among patients, development of more effective models of DSME, implementation of programs that incorporate behavioral and psychosocial approaches to improve patient outcomes, and development of effective support strategies to DSME (Funnel et al., 2010).

Improvement of the NDPP Educational Program

The purpose of this DNP project was to assess the level of awareness and knowledge of diabetes among obese patients with prediabetes. Before the implementation

of any educational program, it is important to assess the existing level of knowledge and awareness of among the participants in order to allow for modification of the program to suit the needs of the population under study (Malathy et al., 2011). Concerning this project, a pretest was conducted before administration of the NDPP educational sessions. The responses to the DKT questionnaire enabled the DNP student to identify gaps in knowledge and awareness of diabetes among the participants.

The NDPP educational program was developed for the purpose of reducing the growing incidences of prediabetes and T2D by improving knowledge and awareness of diabetes among obese patients with prediabetes. After administration of the educational sessions, the DNP student would modify the NDPP educational program using gaps in knowledge and awareness found in the pretests and posttests. Diabetes self-management practices, blood glucose testing, and diabetes risk factors were considered for improving the NDPP educational program. The DNP student aimed to describe the benefits of improving knowledge and awareness of diabetes among obese patients with pre-diabetes. This step was important because equipping obese patients with prediabetes with knowledge and awareness of diabetes would improve diabetes control and reduce the likelihood of developing diabetes-related complications. Implementation of the NDPP would then be conducted after evaluation and approval by the Family Practice Clinic.

Population and Sampling

This project was conducted in a family practice clinic where the obese patients had been diagnosed with pre-diabetes. A convenience sample of 30 pre-diabetic adult obese patients was used. The clinic has 3 doctors, an internal medicine doctor who has 40

years' experience in diabetes management, one obstetrician/gynecologist, and a family practice physician, and 3 Registered Nurses (RNs). The project took 4 weeks to complete.

Convenience sampling was selected because the clinic is accessible to the DNP student and obese patients with pre-diabetes who were willing to participate in the project could easily be recruited. Therefore, the respondents were selected because of their accessibility. The primary advantage of convenience sampling technique is that it is simple, cost effective, and less demanding in terms of time spent in selecting and recruiting the participants. In order to participate in the project, the patients had to: (a) be at least 18 years; (b) be conversant in spoken and written English; (c) be free of complications like chronic kidney disease, severe stroke, significant hearing, or visual impairment; and (d) have pre-diabetes.

The participants were categorized as being aware of having pre-diabetes after indicating that: (1) They had been pronounced by a medical practitioner to be in the borderline for diabetes or had diabetes, (2) they had been informed that they had pre-diabetes or borderline diabetes, or (3) their level of blood sugar is higher than standard but not adequate to be termed as diabetes. Participation in the educational sessions was voluntary. Posters inviting obese patients with diabetes to participate in the educational sessions were placed at strategic locations in the Family Practice Clinic. After signing the consent form, the participants were provided with the pretest before receiving the educational sessions. A posttest was then conducted using the DKT questionnaire.

Data Collection

Instrument

A questionnaire was used to collect data from obese diabetic patients in a Family Practice Clinic. The Diabetes Knowledge Test (DKT) questionnaire was employed. The DKT questionnaire (Appendix C) was developed by the Michigan Diabetes Research Training Center (MDRTC) for the purpose of testing general knowledge of diabetes. The questionnaire contained questions on: (a) description of the diabetes diet, (b) measure of glucose levels in blood, (c) methods for home glucose testing, (d) signs associated with diabetes, (e) reactions based on insulin intake, and (f) causes of blood glucose reactions. The DKT questionnaire is open for public use, therefore, no permission is required before using it.

The questionnaire contained only closed-ended questions. The questions were simple and to the point to ensure that the subjects do not take a lot of time answering the questions. The questionnaires were administered by an administrative assistant. Each participant was provided with a unique identification code for anonymity purposes. The participants were given provided with 30 minutes to complete the questionnaire. After completion of the questionnaires, the administrative assistant collected and stored the questionnaires for data analysis. The questionnaires were double-locked and stored in a private room. Using the unique identification codes that were earlier provided to each participant, the student was able to compare the pre-and posttest scores of each individual participant.

Protection of Human Subjects

Research ethics were observed throughout this project. In this regard, the student sought consent of potential research participants before recruiting them to take part (Felzmann, Sixsmith, O'Higgins, Ni Chonnactaigh, & NicGabhainn, 2010). The consent form included the objective of the project and the role of the project participants. The consent forms also highlighted what the participants were expected to do and the risks and benefits of taking part. Only participants who sign the consent form were recruited to take part (Hammersley & Traianou, 2012). Anonymity of the participants was maintained throughout the project. No personal detail of participants was shared with other participants. The student recorded the patients' gender, Date of Birth (DOB), and medical record number in order to allow for evaluation of differences in diabetes knowledge and awareness between the age and gender of the patients. The student also observed professional guidelines of physician-client privacy. In addition, in the data collection process, analysis, and publication, no personal identification details were publicized. After data collection, the data was kept in the student's password-protected computer to guarantee anonymity. Only the student had access to the computer. The hard copies of the questionnaires were kept in a private room that is only accessible to the student. In addition, the data stored in the computer was stored on the students' email account in case of loss or damage to the computer. The student also sought Walden Institutional Review Board (IRB) approval before contacting participants and collecting data.

Data Analysis

Reliability

Despite its usefulness, the DKT is not recommended for testing self-management education programs because the questions do not match the educational contents of the programs. The DKT questionnaire takes approximately 20-30 minutes to complete. To test the reliability of the DKT questionnaire, Fitzgerald (1998) conducted a study which found out that both the 14-question general test and the 9-question insulin use sub-scale had a Cronbach's coefficient $\alpha \geq 0.70$ indicating that the questionnaire is reliable.

Validity

The Diabetes Knowledge Test (DKT) is made up of 23 rigid questions. Out of the 23 questions, 14 are general test questions, and 9 are meant for insulin users. However, all the 23 items can also be administered to all patients irrespective of insulin use. The test for validity indicated that patients with type 1 diabetes scored higher than patients with T2D, but the difference was not statistically significant, implying that the test is valid and suitable for a variety of settings and patient populations.

Analytical Techniques to Answer Guiding/Research Questions

Microsoft Excel was used to compute descriptive statistics such as percentages and frequencies. Frequencies and percentages were used to analyze demographic data from the participants. Knowledge and awareness scores were analyzed by computing frequencies and percentages. The knowledge scores ranged from 0-23 and were categorized as follows: 0-10= poor knowledge, 11-17=average knowledge, and 18-23= high knowledge. Awareness scores were determined as follows: 0-4= low awareness, 5-

7= moderate awareness, 8-23= high awareness. In order to determine knowledge gaps among the patients, the student recorded the questions that more than half of the patients answered incorrectly. T-tests were also conducted to compare pre-and posttest scores. The results were being presented in tables, charts, and graphs.

Project Evaluation Plan

Formative evaluation was carried out throughout the project to ensure that the project activities were conducted efficiently and effectively. Formative evaluation is a technique which aims to improve a project by assessing the delivery of the project and the quality of its implementation (Geonnotti, Peikes, Wang, & Smith, 2013). After securing permission from the IRB and the Family Practice Clinic, the student invited patients from the Family Practice Clinic to participate in the educational sessions using posters. The data was collected by an administrative assistant through physical administration of the DKT questionnaire to patients. The administrative assistant assisted the patients with filling the questionnaires in case the patients needed clarification. Additionally, the administrative assistant assisted in the collection of the questionnaires, and checking the completeness of the questionnaires. Incomplete questionnaires were not included in the project to avoid biased results. The questionnaires were double-locked and stored in a secured private room. The questionnaires were retrieved only for confirmation of any anomalies in the posttest scores.

Summary

A descriptive quantitative research design was used in this project. Data was collected using the DKT questionnaire. Samples of 30 pre-diabetic obese patients were

selected from a Family Practice Clinical Setting. Convenience sampling was used, meaning that only participants meeting the inclusion criteria were selected. Descriptive statistics such as percentages and frequencies were calculated to establish the variation in the level of knowledge and awareness about diabetes in the sample. In addition, formative evaluation was conducted throughout the project to ensure that the project activities were performed efficiently, effectively, and according to the approved methodology.

Section 4: Discussion and Implications

Summary of Findings

The purpose of this project was to evaluate diabetes knowledge and awareness among individuals with prediabetes in family practice clinic settings. The DKT questionnaire consisted of 23 items which tested the participants' knowledge and awareness of the diabetes diet, a measure of blood glucose levels, home glucose testing, diabetes signs, insulin-related reactions, and causes of blood glucose reactions (Fitzgerald et al., 1998). Paired sample t-tests were conducted using Excel to test improvement in diabetes awareness and knowledge among the respondents. The statistical tests were performed at 0.05 level of significance. A total of 30 respondents took part in the pretests, NDPP educational sessions, and posttests. The participants' average age was 41.33 years with a standard deviation of 3.71. The youngest participant was aged 18 years while the oldest participant was 81 years old. The respondents comprised of 53.3% females (n = 16) and 46.7% males (n = 14). Figure 2 shows the distribution of participants based on gender.

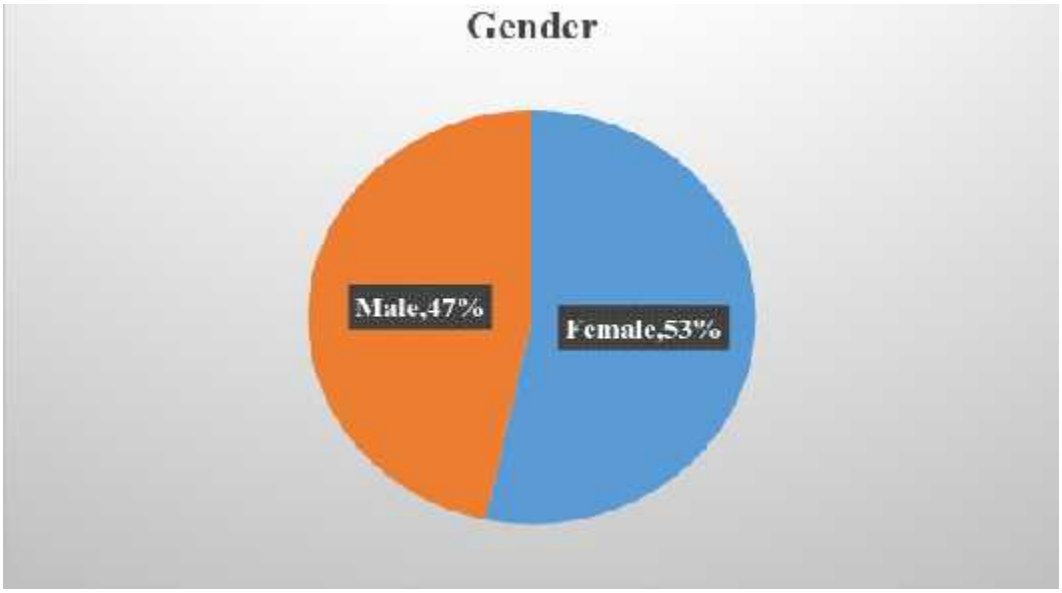

Figure 2. Gender.

Out of 23 points, the mean scores for the male and female participants in the pretest were 6.71 (29.2 %) and 5.81 (25.3 %) respectively. Regarding the level of education attained by the participants, 20% (*n* = 6) of the respondents had not achieved a high school education, while 10% (*n* = 3), 30% (*n* = 9), 23.3% (*n* = 7), and 16.7% (*n* = 5) of the patients had attained doctoral-level, high school, some, and university education respectively. Figure 3 shows the distribution of participants based on the level of education.

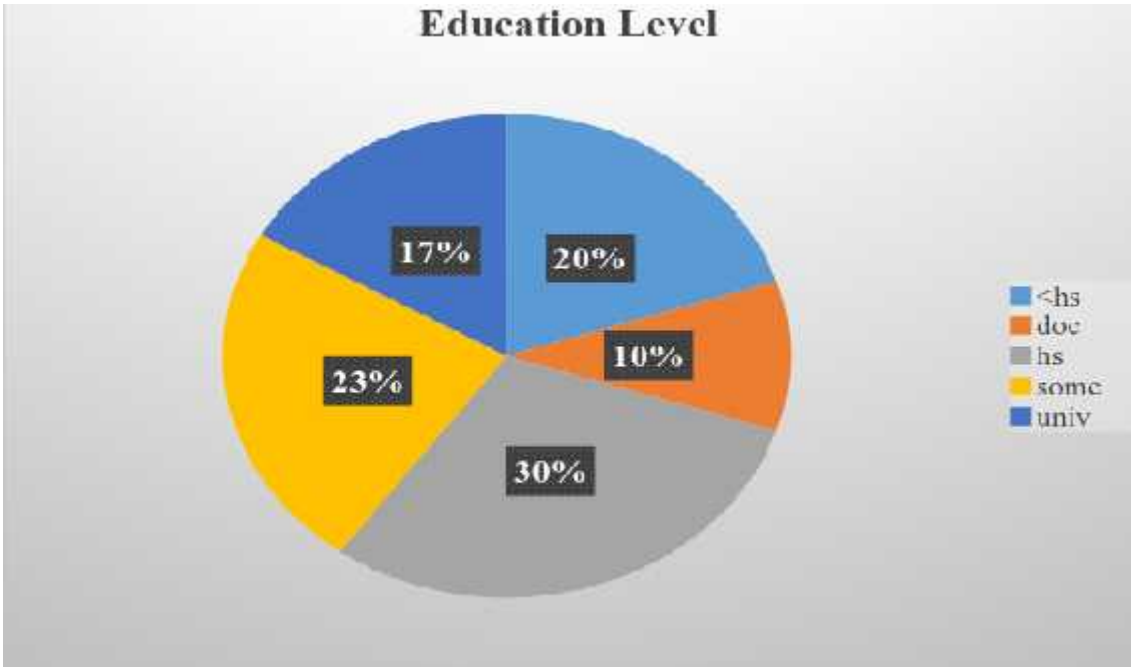

Figure 3. Level of Education.

After the implementation of the NDPP educational program, the DKT scores for the male and female participants improved to 16.29 and 15.75 respectively. The overall mean scores for the pre-and posttests were 6.23 and 16 points respectively. Based on the paired samples t-test, there was a significant statistical difference between the pretests and posttests ($p < 0.000$), thus, indicating an improvement in knowledge and awareness of diabetes. Table 1 shows the paired sample statistics for the pre-and posttest scores.

Table 1

Paired Samples Statistics

T-Test: Paired Two Sample for Means		
	Pretests	*Posttests*
Mean	6.23	16.00
Variance	2.94	6.28
Observations	30.00	30.00
P(T<=t) two-tail	0.00	

Pretest and Posttests Results

Based on the pretests, the majority of the patients (43.3%, *n* = 13) perceived a diabetic diet as the way most Americans eat. Only 30% (*n* = 9) of the patients correctly answered item 1 by indicating that the diabetes diet is a healthy diet for most people. After the NDPP educational program, 70 % (*n* = 21) of the patients were able to correctly defined diabetes as a healthy diet for most people. Regarding item 2, 43.3% (*n* = 13) of the participants correctly indicated that baked potato had the highest amount of carbohydrate compared to baked chicken, Swiss cheese, and peanut butter. After the NDPP program, 86.7 % (*n* = 26) of the participants answered item 2 correctly.

In the pretests, only 13.3 % (*n* = 4) of the patients correctly identified that low fat (2%) milk had higher fat content compared to corn, honey, and orange juice. After the NDPP program, 63.3 % (*n* = 19) of the participants correctly identified that low fat (2%) milk was richer in fat compared corn, honey, and orange juice. Regarding the pretest scores for item 4, 30 % (*n* = 9) of the participants correctly identified that “free food” was any food that contained less few than 20 calories per serving. After the NDPP program, 66.7 % (*n* = 20) of the patients were able to correctly define “free food” as any food that has less than 20 calories per serving.

Based on the pretests for item 5, only 20 % (*n* = 6) of the participants knew that A1C is a measure of blood glucose which is based on the past 6-12 weeks. After the NDPP program, 73.3 % (*n* = 22) of the participants correctly responded to item 5. Only 43.3 % (*n* = 13) of the participants correctly answered item 6 in the pretests. However,

the posttest scores indicated an improvement in the patient's knowledge with 53.3% (*n* = 16) of the participants correctly responding to item 6.

A knowledge deficit was also indicated by the participants' responses to item 7. Based on the responses, only 23.3 % (*n* = 7) of the patients knew that unsweetened fruit juice raised blood glucose. However, after the NDPP program, half of the patients (*n* = 15) were aware that unsweetened fruit juice raised the levels of blood glucose. Regarding item 8, only 30 % (*n* = 9) of the patients knew that diet soft drinks could not be used to treat blood glucose before the NDPP program. However, the posttest indicated an improved knowledge among the patients with 86.7 % (*n* = 26) of the patients correctly answering item 8. The pretest scores for item 9 indicated that majority of the participants were not aware that exercise lowers blood glucose for individuals in good control (73.3%, *n* = 22), while only 26.7 % (*n* = 8) were knowledgeable about this impact. After the NDPP program, the number of patients who were aware of the impact of exercise on blood glucose increased to 63.3 % (*n* = 19). Also, the number of patients who believed that exercise has no effect on blood sugar among individuals in good control reduced from 43.3% (*n* = 13) to 23.3%(*n* = 7). The pretest scores for item 10 indicated a deficit in knowledge regarding the impact of infections on blood sugar levels. Based on the pretest scores, only 30 % (*n* = 9) of the patients were aware that infections can raise the amount of blood glucose, while 43.3% (*n* = 13) believed that infections had no effect on blood glucose. However, after the educational program, 63.3 % (*n* = 19) correctly indicated that infections can raise blood glucose levels.

Regarding item 11, the pretest scores indicated that only 26.7% (*n* = 8) of the participants were aware that the best way to take care of feet was to wash them every day. However, after the NDPP program, 80 % (*n* = 24) of the patients correctly responded to item 11. Based on pretest scores for item 12, only 20 % (*n* = 6) of the patients knew that eating foods with low fat content decreased the risk of heart disease. After the NDPP program, majority of patients (83.3%, *n* = 25) were aware that foods that are rich in fats increased the risk of heart disease. Item 13 indicated a large gap in knowledge regarding to numbness and tingling as possible symptoms of nerve disease. The pretest scores on item 13 indicated that 33.3% (*n* = 10) of the participants knew that numbness and tingling were possible symptoms of nerve disease. The posttest scores indicated an improvement in the patient's knowledge with 86.7 % (*n* = 26) correctly responding to item 13.

Based on item 14, 40% of the participants correctly indicated that lung problems were not linked to diabetes before the implementation of the NDPP program. However, the posttest scores indicated an improvement in the patients' knowledge with 66.7% (*n* = 20) correctly responding to item 14. Regarding item 15, only 43.3% (*n* = 13) of the patients correctly indicated that vomiting was a sign of ketoacidosis (DKA) in the pretests. After the NDPP program, 86.7% (*n* = 26) of the participants correctly responded to item 15. Based on the pretests scores for item 16, only 23.3% (*n* = 7) of the participants were aware that they should frequently test their blood glucose whenever they had flu. After the NDPP program, 86.7% (*n* = 26) of the participants correctly responded to item 16, thus, indicating an improvement in knowledge. Regarding item 17, the pretest scores indicated that only 20% (*n* = 6) of the patients correctly indicated that

blood glucose reaction was most likely to occur in less than two hours when rapid-acting insulin is taken. After the NDPP program, 73.3% (*n* = 22) of the patients correctly responded to item 17.

Regarding the pretest scores for item 18, only 36.7% (*n* = 11) of the participants correctly indicated that diabetic patients should check their blood glucose to determine how much insulin they should take during lunch whenever they forget take insulin during breakfast. After, the NDPP program, 76.7% (*n* = 23) of the patients correctly responded to item 18. Based on pretest scores for item 19, 30% (*n* = 9) of the patients correctly indicated that drinking juice was a possible remedy to the initial stages low blood glucose reaction. After the NDPP program, 70% (*n* = 21) of the patients correctly responded to item 19. Regarding the pretests scores for item 20, only 20% (*n* = 6) of the patients were aware that a low blood glucose reaction may result from too much insulin. Based on the posttests, 93.3% (*n* = 28) correctly responded to item 20.

Regarding the pretest scores for item 21, 40% (*n* = 12) of the patients correctly indicated that the blood glucose normally decreases when diabetes patients take their morning insulin but skip breakfast. However, after the NDPP program, 80% (*n* = 24) of the participants correctly responded to item 21. Based on the pretest scores for item 22, only 26.7% (*n* = 8) of the patients correctly indicated that high blood glucose was likely to be caused by inadequate insulin. However, the posttest scores indicated improved knowledge among the participants with 60% (*n* = 18) correctly responding to item 22. The final item also indicated a deficit in knowledge regarding to the causes of low blood glucose reaction. Based on the pretest scores, only 30% (*n* = 9) of the patients correctly

indicated that heavy exercise was likely to cause low blood glucose reaction. After the NDPP program, 63.3% (*n* = 19) correctly responded to item 23. All the percentages and frequencies for correct responses to each question and the pretest and posttest scores of the DKT questionnaire are provided in Appendix B.

General Levels of Knowledge and Awareness

The participants' knowledge and awareness scores were divided into three categories: Poor (0-10), average (11-17), and high (18-23) knowledge of diabetes. Based on the pretests, 96.7 % (*n* = 29) of the participants demonstrated poor knowledge on diabetes, while only 3.3 % (*n* =1) exhibited average knowledge on diabetes. None of the participants showed a high level of knowledge on diabetes. After the NDPP educational sessions, none of the participants had poor knowledge on diabetes. The posttests indicated that 63.3 % (*n* = 19) of the participants had average knowledge regarding diabetes, while 36.7 % (*n* = 11) had high diabetes knowledge. Table 2 shows the distribution of frequencies before and after the NDPP educational sessions.

Table 2

Knowledge Scores

	Frequency	
Knowledge Score	Pretest	Posttest
0-10 (Poor Knowledge)	29	0
11-17 (Average Knowledge)	1	19
18-23(High knowledge)	0	11
P(T< = t) two-tail	0.00	

Regarding the awareness levels among the participants, the pretests indicated that 36.7 % (*n* = 11) of the respondents had low awareness of diabetes, while 40 % (*n* = 12)

and 23.3 % (n = 7) of the participants showed moderate and high levels of awareness on diabetes respectively. After the NDPP educational sessions, all the participants (N = 30) exhibited high diabetes awareness levels. Table 3 shows the awareness scores before and after the NDPP educational sessions.

Table 3

Awareness Scores

	Frequency	
Awareness Score	Pretest	Posttest
0-4 (Low awareness)	11	0
5-7(Moderate awareness)	12	0
8-23(High awareness)	7	30
P(T<=t) two-tail	0.00	

Overall, the pre-and posttests indicated significant increases in knowledge and awareness of diabetes among the participants after the NDPP educational sessions. Though the respondents still missed some of the questions in the DKT after the NDPP educational sessions, there was a consistent improvement in scores. Base on the t-test, there was a statistically significant improvement in the participants' knowledge (p < 0/00) and awareness (p < 0.00) after the implementation of the NDPP program.

Discussion of Findings in the Context of Literature and Frameworks

The results of this DNP project indicate a significant improvement in awareness and knowledge of diabetes among the respondents. This project confirmed the effectiveness of the NDPP educational program in enhancing diabetes knowledge and awareness among obese patients with prediabetes. The results of this DNP project are congruent with research evidence from the literature review that support the use of

educational interventions to improve the level of knowledge and awareness about diabetes (Deepa et al., 2014; Evert et al., 2013; Kulzer et al., 2009; Lindstrom et al., 2008; Makrilakis et al., 2010; Woodbury et al., 2013). The NDPP educational sessions indicated the importance of implementing educational interventions in the management of diabetes among high-risk patients such as those with obesity. Deepa et al. (2014) evaluated the awareness and knowledge of diabetes among 16, 607 individuals from both urban and rural settings in India who were aged 20 years and above. Based on the findings of this project, the level of diabetes knowledge and awareness was poor among the general population in India, especially in the rural areas. According to Deepa et al. (2014), there is the need for education of patients to improve awareness and knowledge of diabetes and promote effective control and prevention of diabetes. In addition, Linstrom et al. (2008) and Mulcahy et al. (2003) also argued that adequate knowledge and awareness of diabetes is essential for the effective management of diabetes. Linstrom et al. (2008) conducted a study to determine the extent to which diabetes risk factors influenced the effectiveness of intensive lifestyle interventions among a sample of 422 participants. Linstrom et al. (2008) used the Finnish Diabetes Risk Score (FINDRISC) to evaluate the participants' characteristics. Based on the findings of this project, the effects of the intensive lifestyle intervention were not affected by other risk factors or baseline characteristics. Linstrom et al. (2008) concluded that lifestyle intervention programs can be useful in identifying high-risk populations that are most likely to benefit from diabetes prevention lifestyle interventions.

The findings of this project are also similar to Zhuang, Wu, Lu, Du, and Guo (2015) who examined the prevalence and awareness of prediabetes among 881 diabetes-free adults in Suzhou, China between 2012 and 2013. Zhuang et al. (2015) found that the risk of developing diabetes was significantly low among patients who had increased knowledge of the disease. Based on the findings of this study, approximately half of the individuals who had prediabetes were not willing to seek lifestyle changes for the prevention of diabetes, while less than a third did not know that prediabetes was risk factor for T2D (Zhuang et al., 2015). Based on Zhuang et al. (2015), there is a need for diabetes education among patients with prediabetes. Thus, it is important to adopt diabetes awareness programs and interventions to reduce the diabetes risk among individuals with prediabetes.

The need for effective awareness programs for patients who are a high risk of diabetes was also corroborated by Mumu, Saleh, Ara, Haque, and Ali (2014). In a cross-sectional study involving 400 non-diabetic individuals aged over 30 years, Mumu et al. (2014) found a low level of awareness of diabetes risk factors among the general population in Bangladesh. Mumu et al. (2014) recommended the adoption of innovative interventions that target specific patients including those at a high risk of diabetes.

The promotion of diabetes awareness found among elderly patients who have prediabetes was also reiterated by Qin and Xu (2016). Using a cross-sectional study involving 434 participants from 42 locations in Yiyang, China, Qin, and Xu (2016) examined the influence of health literacy on diabetes control and prevention, and the diabetes risk factors among older patients with prediabetes. The findings of this study

showed that diabetes health literacy was lower among participants who had 1-6 years' education compared to those who had at least 6 years of education (Qin & Xu, 2016). Also, men had lower diabetes health literacy compared to women (Qin & Xu, 2016). Therefore, educational and awareness promotion interventions should include appropriate health education materials for older adults who are a high risk of diabetes.

The findings of this project are also consistent with Jalilian, Motlagh, Solhi, and Gharibnavaz (2014) who found that developing diabetes educational programs based on the HBM are effective in improving diabetes self-management and prevention programs. This longitudinal study involved 120 T2D patients from Gachsaran, Iran. The findings of Jalilian et al. (2014) indicated improved response for benefit, severity, susceptibility, and self-management group among diabetic patients who participated in the HBM-based self-management educational program (Jalilian et al., 2014). Therefore, researchers should also consider other change models in designing future interventions for promoting diabetes awareness and knowledge.

Most of the existing diabetes control and prevention programs focus on improving the patients' self-management practices and adherence to strict diet and insulin schedules. Research has indicated that diabetes educational interventions are effective in improving diabetes knowledge and awareness among patients from different healthcare settings (Deepa et al., 2014; Jalilian et al., 2014; Mumu et al., 2014). Some of the diabetes control and prevention programs are used for specific populations, while others can be used for all chronic conditions. For example, the NDPP program is used specifically for individuals with prediabetes or those who are at an increased risk of T2D (National

Association of County and City Health Officials [NACCHO], 2013). Conversely, the Diabetes Self-Management Education/Training (DSME/T) is specifically used for diabetes patients (NACCHO, 2013). However, some programs like the Stanford Chronic Disease Self-Management Program/Education can be used to address all chronic conditions (NACCHO, 2013).

In this project, the HBM model was used to evaluate how patients' health and lifestyle behaviors can be modified to improve health outcomes. Using the HBM model, the DNP student examined the respondents' awareness and knowledge regarding diabetes based on the DKT scores. Based on the HBM, individuals' health behaviors are influenced by various factors including perceived susceptibility, severity, threats, benefits, and barriers (Jones et al., 2014). Based on the HBM, patients' knowledge of diabetes and related complications can influence their beliefs about severity and vulnerability. Perceived susceptibility involves the belief that an individual has on the probability of contracting a disease or harmful condition as a result of a given behavior (Orji, Vassileva, & Mandryk, 2012). According to Orji et al. (2012), perceived susceptibility indicates that individuals are inclined to indulge in healthy behaviors if they believe that they are at a high risk of a specific negative health outcomes. Conversely, perceived severity refers to a person's belief of the extent of the consequences of a particular health condition or disease (Orji et al., 2012). Specifically, perceived severity is based on the individual's subjective belief of the degree of harm that a disease or health condition can cause.

Implications

Implications on Practice/Action

The findings of this DNP project support the use of educational programs in diabetes control and management. Evidently, obese patients have a higher risk of developing diabetes compared to patients with normal weight status. Therefore, obese patients need assistance and support from healthcare providers on the proper diet, amount of physical exercise, medications, and diabetes self-management skills. Based on the findings of this project, healthcare providers should aim to improve patients' knowledge and awareness of diabetes to allow for effective lifestyle modification and behavioral changes that can reduce the risk of diabetes. This project found that educational programs significantly improve patients' knowledge and awareness of diabetes. Therefore, a good understanding of diabetes is necessary for the development of diabetes prevention and control interventions that aid patients at a higher risk of diabetes. This DNP project was aimed at assessing the knowledge and awareness of diabetes among patients with obesity based on their gender, age, and level of education. Based on this DNP project, the student has identified the importance of testing baseline knowledge before implementing evidence-based diabetes educational interventions in care practice in the United States. Therefore, the findings of this project can be used as a source of evidence by researchers in future projects, especially among patients with obesity.

Implications for Social Change

The findings of this study also have significant implications for social change in practice. The findings of this DNP project will improve awareness and understanding of

diabetes among patients who are obese or overweight. As a result, such patients can enroll in behavioral/lifestyle modification programs to manage their blood sugar levels, thus, controlling diabetes. Based on the findings of this project, the NDPP educational program significantly ($p<0.00$) increased diabetes knowledge and awareness among the participants. This finding indicates the need for adoption of diabetes educational programs to strengthen the knowledge and awareness of diabetes in order to impact on societal change. Another implication for positive social change of this project is that the quality of life of obese patients who have prediabetes will be significantly enhanced due to improved knowledge and awareness of diabetes risk factors. This project was also effective in promoting patients' knowledge and awareness of glycemic control through self-management practices. Therefore, this project could improve glycemic control among high risk patients and reduce the prevalence of diabetes among obese patients. In the long-term, this project could possibly reduce mortality and morbidity that result from diabetes-related complications.

This project also indicated the need of baseline knowledge of diabetes among populations in order to be able to design effective education and awareness programs that are aimed at preventing or controlling diabetes in the United States. The improvement of diabetes knowledge and awareness can significantly reduce the risk and prevalence of diabetes among obese individuals with prediabetes (Mumu et al., 2014). Also, diabetes education and awareness programs could be vital in strengthening diabetes awareness and knowledge in the society (Zhuang et al., 2015). Developing diabetes educational programs for the community can assist in reaching those individuals who cannot access

hospital-based diabetes risk-reduction programs. The findings of this project can also aid in policy development which can, in turn, improve care for obese patients with prediabetes.

Implications for Future Research

The purpose of this project was to improve diabetes awareness and knowledge among obese individuals with prediabetes who are patients in family practice clinics. The NDPP program facilitated the improvement in participants' knowledge and awareness among the 30 participants who took part in the project. However, the NDPP program should be studied in a larger sample size to increase generalizability. This project also identified gaps in health behaviors among obese patients with prediabetes. Based on the improvement of participants' knowledge and awareness regarding diabetes after the NDPP program, there is the need for more research on more effective educational interventions to improve diabetes care in susceptible patients. Existing diabetes awareness and control programs in the United States are mainly based on ethnicity, age, prevalence of diabetes among different populations in the country (ADA, 2016). For example, the American Indian/Alaska Native Programs are focused on Alaska Natives and American Indians who have the highest age-adjusted diabetes prevalence compared to other ethnic and racial groups in the United States (ADA, 2016). Also, the Older Adult Outreach Program is directed towards addressing the needs for older adult patients (ADA, 2016). The findings of this project can be used in the development of comprehensive diabetes awareness for patients with different ages, backgrounds, and risks of T2D.

Strengths and Limitations of the Project

Strengths

Previous research indicates the effectiveness of educational interventions in improving care and reducing the cost of diabetes (Aghili et al., 2013). Using the HBM as a conceptual framework, the NDPP educational program was effectively used to achieve behavioral change in this project. This project improved the participants' knowledge and awareness regarding diabetes, thus, reducing their likelihood of developing diabetes. The DNP student was also able to learn about diabetes, its effects, and possible prevention measures.

Limitations

The first limitation in this study was the small sample size which increased the likelihood of bias. The use of a larger sample size would have improved the accuracy of the results. Another limitation of this DNP project was the extremely low levels of knowledge of the participants. Most of the participants did not comprehend the items in the questionnaire, thus, requiring the student to explain the meaning of the items. As a result, the participants' responses may have been influenced. In addition, the use of small convenient samples limited the generalizability of the project findings (Peterson & Merunka, 2014). Another disadvantage of using a convenient sample is that the participants who are available may not be a representative of the population of interest.

Recommendations for Remediation of Limitations

This DNP project involved 30 obese individuals with pre-diabetes who were patients in a Family Practice Clinical. Utilization of a larger sample size would have

provided more accurate results. Therefore, there is the need for replicating the project using a larger sample size to ensure a clearer representation of the population under study. In addition, the project needs to address how specific populations such as African American and Hispanic patients and educational programs can be used to improve diabetes knowledge and awareness among such populations. Another possible area of study should be the examination of how educational programs can be used to improve nursing staff's knowledge on diabetes and its risk factors. The focus of such a study should be to assess how educating nursing staff can improve patient outcomes among diabetes patients with weight problems. In addition, healthcare institutions should develop educational programs to improve diabetes knowledge and awareness among nursing staff. By improving nursing staff's knowledge and awareness of diabetes, healthcare institutions can improve patient outcomes among individuals with prediabetes.

In this DNP project, the student employed a quantitative research design to assess the participants' awareness and knowledge regarding diabetes. However, future studies should attempt to examine the participants' perceptions of diabetes using a qualitative research design. The patients successfully indicated improvement in knowledge and awareness of diabetes. Therefore, healthcare institutions should adopt the educational program for all obese patients who have increased risk of diabetes. Incorporation of the information gathered in this DNP project is also useful in the development of behavioral programs that are designed to promote diabetes control and management in the community. Offering such programs to patients at a higher risk of diabetes can be

beneficial in changing health behaviors, thus, reducing the likelihood of developing diabetes.

Section 5: Scholarly Product

After the implementation of this DNP project, the student developed a scholarly manuscript that was used for dissemination purposes (See Appendix A). The manuscript would be used in a nursing publication and presented in conferences.

Analysis of Self

According to Zaccagnini and White (2015), the DNP is meant to improves nurses' knowledge and increase their potential to become better scholars and leaders. Personally, my experience from the practicum and the DNP project has nurtured me into a leader and project developer who can contribute towards improving people lives and influence other people to make changes. Through the DNP program, I have developed the ability to identify problems in healthcare and act as a change agent in trying to solve these issues.

As a scholar

Throughout the DNP program, I have learned how development and utilize diabetes knowledge for different populations. The NDPP program has greatly improved my understanding of diabetes and the resources that are available for diabetes patients in the country. However, the effectiveness of these resources is not regularly accessed. Through the DNP project, I was able to use my scholarly knowledge to evaluate the effectiveness of the NDPP program in improving obese patients' knowledge and awareness of diabetes. In addition, I have improved my critical thinking skills through extensive appraisal of past literature and application of knowledge to provide solutions to health problems in society. During the development of this project, I improved my writing, proofreading, analysis, and literature searching skills that have improved my

confidence as a scholar. In addition, the DNP program has equipped me with the necessary requirements to effect change in society through translation of research evidence into clinical practice. The most important step in the transfer of research evidence into practice is the dissemination stage. By sharing the findings of the DNP project to the stakeholders in various healthcare settings, I will contribute to increasing knowledge and awareness of diabetes in the healthcare sector.

As a Practitioner

As a DNP student, I have learned that the application of evidence-based nursing in most healthcare settings improves health outcomes, patient safety, and satisfaction. In addition to developing my skills and knowledge on diabetes management in this project, I am now motivated to bring more evidence-based interventions into clinical practice. In addition, I have witnessed an overall growth as a professional during the development and implementation of this project. According to Zaccagnini and White (2015), advanced nurse practitioners are expected to provide effective, safe, timely, equitable, efficient, safe, and patient centered care. Throughout the development of this project, I have developed effective leadership skills that can be used in cooperation with healthcare institutions and organizations to improve and restructure diabetes care for the purposes of improving health outcomes and quality of care.

As a Project Developer

This DNP project has demonstrated my ability to act as a project developer. My experience in designing and developing this DNP project provided me with the opportunity to contribute in the fight against diabetes. During the design phase of this

DNP project, I developed an improved knowledge of the cultural and community needs at the location of the project. The improved knowledge of the community needs improved my ability to identify the requisites of the educational program. As a project developer, the project enhanced my ability to conduct needs assessment and translate the findings of the project into clinical practice. In addition, activities such as evaluation of current guidelines on diabetes management and implementation of the project improved my knowledge and confidence to develop similar evidence-based interventions in future.

Under the guidance of my instructors, I was able to design, implement, and disseminate the evidence-based project. Through my experience in the development of this project, I was able to identify and reflect on my strengths and limitations as a DNP students and nurse practitioner. Overall, my experience during the development of the project significantly enhanced my growth as a professional, especially my teamwork, communication, and leadership skills. Therefore, I will continue to improve my skills and knowledge as a nurse practitioner to introduce changes in healthcare that will assist vulnerable populations.

What Does this Project Mean for Future Professional Development?

During the implementation of this project, I developed tremendous professional growth that will lead to my transformation as a nurse practitioner and leader. As a nurse leader, my professional transformation will occur through interaction with other healthcare professionals, patient, community members, and my organization's administration. In addition, collaborating with other healthcare professionals to develop similar health promotion interventions will enhance my professional experience and

growth. According to Zaccagnini and White (2015), nurses have the responsibility of using collective creativity to facilitate the adoption of research evidence into practice. The continuous improvements of patient outcomes using evidence-based interventions that can reduce the risk of diabetes require a comprehensive dissemination of the project findings. Participation in the NDPP program has increased my awareness of the need for teamwork when implementing evidence-based projects. The aspects of the project involving diabetes self-management, risk factors, and blood glucose testing were used to improve the NDPP educational program. As a nurse leader, I foresee that my participation in future policy processes to redesign diabetes care and improve diabetes self-management education for the purpose of improving the quality of health outcomes among diabetes patients.

Summary

Reduction of the number of diabetes-related complications is the main and long-term goal of diabetes management. Previous research has indicated that effective diabetes self-management practices can be acquired through educational programs. Education of patients on diabetes is an evidence-based approach that can result in improvement in the quality of care to patients and their families. In addition, the immediate community can also benefit from the implementation of an evidence-based diabetes self-management educational program. The purpose of this project was to assess the knowledge and awareness of diabetes among obese individuals with prediabetes who are patients in a family practice clinic. Based on reviewed literature, education of patients on diabetes significantly reduces the risk of diabetes among high risk populations. In addition,

continuous education of patients on diabetes self-management practices is important in instilling the knowledge that is required to change behavior and lifestyles for effective management of diabetes. Based on the findings of this project, there was a significant improvement in the patients' knowledge and awareness after the implementation of the NDPP program. The implications of the project to social change in practice include the incorporation of the NDPP in diabetes prevention programs to develop a culture of educating patients on diabetes management. The implementation of the DNP project industry-wide is expected to improve obese patients' knowledge and awareness of diabetes and reduce the risk of diabetes among high risk populations. Further, the use of self-management approach to educate patients could be a key factor in reducing the prevalence of diabetes in the United States.

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Appendix A: Scholarly Manuscript for Publication

Assessing the Impact of the National Diabetes Prevention Program (NDPP) on the Knowledge and Awareness of Diabetes in Prediabetes Obese Patients

Introduction

Diabetes is still a major public health concern in the United States. Over the past few decades, there has been a growing need for interventions to help reduce the prevalence of diabetes among high risk populations (Islam et al., 2014). Researchers argue that effective management of diabetes requires adequate knowledge and awareness of self-management practices among the patients (Tabak et al., 2012). Therefore, there is a need for effective education of patients who are at a high risk of diabetes on self-management practices to reduce the likelihood of transition from pre-diabetes to T2D. Pre-diabetes occurs when the blood glucose level is higher than usual, but lower than normal onset of diabetes (Kowall et al., 2012). Individuals with pre-diabetes normally suffer from impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or a combination of IGT and IFG (Kowall et al., 2012). According to Mainous, Tanner, Baker, Zayas, & Harle (2014), approximately 33% of Americans have pre-diabetes. Pre-diabetic individuals have a higher risk of developing T2D and other comorbid diseases including obesity and cardiovascular diseases. Diabetes may sometimes be accompanied by failure or dysfunction of body organs (Tabák et al., 2012). In addition, diabetic individuals also have a higher likelihood of amputations, kidney failure, obesity, loss of eyesight, and cardiovascular diseases.

Despite proof of the effectiveness of educational programs in promoting healthy lifestyles and behaviors, only 50% of Americans take participate in formal diabetes education. According to Duncan et al. (2009), the number of Americans who take part in DSME programs is expected to increase by over 70% by 2018. However, there is need for introducing the DSME programs closer to high risk individuals to increase their participation. In addition, the DSME should be designed to either prevent the progression of pre-diabetes into T2D or minimize the risk of complications arising from diabetes-related comorbidities.

Significance of the Project

The high prevalence of prediabetes in the Unites States has necessitated the development of evidence-based interventions to help in the control of diabetes. According to Tabak et al. (2012), individuals who have prediabetes are at an increased risk of progressing into T2D. Obese patients with prediabetes are also at an increased risk of developing T2D (Tabák et al., 2012). In addition, diabetes increases the cost of healthcare and the likelihood of kidney failure, loss of sight, hypertension, and obesity. Therefore, there is a need for education of patients to improve their knowledge and awareness of obesity to reduce the likelihood of progression into T2D. Improved knowledge and awareness of diabetes would ensure patients perform daily self-management practices effectively, thus, improving reducing the risk of diabetes. The project's theoretical foundation was based on the Health Belief Model (HBM). Based on the HBM model, perceived susceptibility involves an individual's beliefs about certain activities and behaviors/lifestyles influence their health outcomes (Orji, Vassileva, &

Mandryk, 2012). The application of the HMB model facilitated the assessment of individuals' behaviors based on their awareness, attitudes, and perceptions towards diabetes.

Methods

The quality improvement initiative employed a pre-and posttest design to assess the levels of knowledge and awareness of T2D among obese patients with pre-diabetes. Pre-and Posttests were conducted before and after the implementation of the NDPP educational program to assess the patients' knowledge and awareness of diabetes. The findings of the project were used together with national guidelines to improve the NDPP program. The HBM model was used to assess how patients' lifestyle and behaviors could be modified to reduce obesity and the risk of diabetes.

Setting

The project was implemented in a family practice clinic. The clinic has 3 doctors, 3 RNs, one family practice clinician, one obstetrician/gynecologist, and an internal medicine doctor.

Population and Sampling

This project involved obese and pre-diabetic participants from a Family Practice Clinical Setting. A convenience sample was used to recruit 30 obese patients who had prediabetes to participate in the NDPP program. A convenient sample was used because the DNP student can easily access the clinic and there is a high population of obese patients who visit the clinic. In addition, convenience sampling is cost effective, simple, and time saving compared to random or probability sampling (Peterson & Merunka,

2014). The participants who took part in this project had to be (a) aged 18 years and above; (b) understand English; (c) be free of complications such as visual impairment, stroke, chronic kidney disease, and significant hearing; and (d) have pre-diabetes. Posters in strategic locations at the family practice clinic were used to invite prospective participants to participate in the educational sessions.

Data Collection

Data collection was conducted using the DKT questionnaire before and after the implementation of the NDPP program. The DKT questionnaire was used to collect data from the participants during the pretests and posttests. The DKT questionnaire is available for use by researchers without any approval as long as the researcher acknowledges the Michigan Diabetes Research Center as the author. The DKT questionnaire contains 23 closed-ended questions that are categorized into two: 14 general test questions, and 9 questions for insulin users. The DKT questionnaire has a high reliability with a Cronbach's alpha coefficient (α) ≥ 0.70 (Fitzgerald, 1998). After signing the consent form, participants completed the pretests before receiving the educational sessions. The results of the pretests were used to improve the NDPP program to effectively address the needs of obese patients with prediabetes. The participants also completed the posttests immediately after the educational program. The responses from the participants were used to evaluate their level of knowledge and awareness of diabetes. The questionnaires took approximately 30 minutes to complete and were administered with the help of an administrative assistant. All the questionnaires were then coded to maintain anonymity and stored in a secure room awaiting analysis.

Ethical Considerations

Throughout the DNP project, all the research ethics were observed. First, the student sought approval from the Walden Institutional Review Board (IRB) before starting the project. All the participants were required to sign a consent form before taking part in the project. The consent form ensured that the participants were aware of the purposes and importance of the project. To maintain confidentiality, the questionnaires were coded and stored in a secure room where only the student could access.

Data Analysis

Data analysis was performed using Microsoft Excel where percentages and frequencies were calculated. Knowledge and awareness scores were analyzed using frequencies and percentages. Participants were categorized as having knowledge of diabetes using the scale: 0-10= poor knowledge, 11-17= average knowledge, and 18-23= high knowledge. Awareness was measured as follows: 0-4= low awareness, 5-7= moderate awareness, 8-23= high awareness. Paired samples t-tests were used to determine significant changes in knowledge and awareness among the participants. The findings of the project were presented in the form of tables and graphs.

Findings and Implications

The 23 items in the DKT questionnaire are categorized into 6 categories: Blood glucose levels, causes of blood glucose reactions, symptoms of diabetes, insulin-related reactions, home glucose testing, and knowledge and awareness of the diabetes diet (Fitzgerald et al., 1998). Paired samples t-tests were computed using excel to test for

changes in knowledge and awareness after the NDPP program. Statistical significance was confirmed at $p = 0.05$. The total sample size was 30 comprising of 46.7% males ($n = 14$) and 53.3% females ($n = 16$). The average age of the participants was 41.33 years with minimum and maximum ages of the participants of 18 and 81 years respectively.

Based on the pretests, the male participants scored higher average scores (6.71) compared to the female participants (5.81). After the educational sessions, the male participants' mean scores were 16.29 while the female participants scored 15.75 points as indicated in the posttests.

Based on the demographic statistics, 20 % ($n = 6$) of the participants did not have high school education, while 16.7% ($n = 5$) had university education. In addition, 23.3% ($n = 7$), 30% ($n = 9$), and 10 % ($n = 3$) of the participants had some education, high school education, and doctoral level education respectively. The mean score for the pretest was 6.23 points, while the posttests yielded an average of 16 points. The paired samples t-tests indicated significant statistical differences between the pre-and posttest scores ($p < 0.000$). Therefore, there was an improvement in the patients' knowledge and awareness of diabetes after the NDPP program. Shown in Table are the paired sample statistics for the pre-and posttests.

Table 1

Paired Samples Statistics

t-Test: Paired Two Sample for Means		
	Pretests	*Posttests*
Mean	6.23	16.00
Variance	2.94	6.28
Observations	30.00	30.00

P(T<=t) two-tail	0.00	

Pretest and Posttests Results

Based on the pretests, and posttests scores, the number of patients who correctly scored item 1 increased from 30 % (*n* = 9) to70 % (*n* = 21) after the NDPP educational program. Forty-three percent (*n* = 13) of the patients scored item 2 correctly in the pretests while 86.7 % (*n* = 26) responded correctly after the NDPP program. The number of participants who correctly responded to item 3 in the pretests and posttests was 13.3 % (*n* = 4) and 63.3 % (*n* = 19) respectively. Before the NDPP program, only 30 % (*n* = 9) of the participants correctly responded to item 4. Sixty-six percent (*n* = 20) of the patients correctly responded to item 4 after the NDPP program. Regarding item 5, the frequency of correct responses increased from 20 % (*n* = 6) in the pretests to 73.3 % (*n* = 22) after the NDPP program. The number of participants who correctly responded to question 6 in the pretest and posttest was 43.3 % (*n* = 13) and 53.3% (*n* = 16) respectively. Twenty-three percent (*n* = 7) of the participants correctly responded to item 7, while 50 % *(n* =15) correctly scored item 7 after the NDPP program. Item 8 was correctly scored by 30 % (*n* = 9) of the patients in the pretests, but 86.7 % (*n* = 26) correctly responded to the item after the NDPP program. There was also an improvement in knowledge based on item 9 where the 26.7% (*n* = 8) and 63.3% (*n* = 19) of the participants correctly responded to the item in the pretests and posttests respectively. The percentage of patients who correctly responded to item 10 in the pretests and posttests was 30 % (*n* = 9) and 63.3 % (*n* = 19) respectively. Twenty-six percent (*n* = 8) of the participants correctly responded to item 11 in the pretests, while 80 % (*n* = 24) correctly responded to the item after the NDPP

program. The frequency of correct scores for item 12 increased from 20 % (*n* = 6) in the pretests to 83.3% (*n* = 25) in the posttests. While 33.3% (*n* = 10) of the participants correctly responded to item 13 in the pretests, 86.7 % (*n* = 26) correctly responded to the item after the NDPP program. Forty percent (*n* = 12) and 66.7% (*n* = 20) correctly responding to item 14 in the pretests and posttests respectively. Regarding item 15, the frequency of correct responses increased from 43.3% (*n* = 13) in the pretests to 86.7% (*n* = 26) after the NDPP program. Item 16 was correctly scored by 23.3% (*n* = 7) of the participants in the pretests, while 86.7% (*n* = 26) correctly responded the item after the NDPP program. Based on item 17, the frequency of correct responses increased from 20% (*n* = 6) in the pretests to 73.3% (*n* = 22) in the posttests. Also, item 18 was correctly scored by 36.7% (*n* = 11) of the participants in the pretests. However, after the NDPP program, item 18 was correctly scored by 76.7% (*n* = 23) of the patients. Thirty percent (*n* = 9) and 70% (*n* = 21) of the participants correctly responded item 19 in the pretests and posttests respectively. Item 20 was correctly scored by 20% (*n* = 6) of the patients during the pretests and 93.3% (*n* = 28) after the NDPP program. Also, 40% (*n* = 12) and 80% (*n* = 24) of the patients correctly responded to item 21 in the pretests and posttests respectively. Item 22 was correctly scored by 26.7% (*n* = 8) and 60% (*n* = 18) of the patients in the pretests and posttests respectively. Based on item 23, the frequency of correct responses increased from 30% (*n* = 9) in the pretests to 63.3% (*n* = 19) in the posttests.

General Levels of Knowledge and Awareness

The results of the pretests indicated that 96.7 % (n = 29) of the participants had poor knowledge of diabetes, while 3.3 % (n =1) had average knowledge of diabetes. However, none of the respondents had high levels of knowledge on diabetes. After the NDPP educational program, none of the respondents indicated poor knowledge of diabetes. Based on the posttests, 63.3 % (n =19) participants demonstrated average knowledge of diabetes, while 36.7 % (n = 11) respondents had high knowledge of diabetes. There was a significant statistical difference ($p < 0.000$) between the patients' pretest and posttest knowledge scores. Therefore, the NDPP program was effective in improving the patients' knowledge of diabetes. The distribution of the pretests and posttests are provided in Table 2.

Table 2

Knowledge Scores

	Frequency	
Knowledge Score	Pretest	Posttest
0-11(Poor Knowledge)	29	0
11-17(Average Knowledge)	1	19
17-23(High knowledge)	0	11
P(T<=t) two-tail	0.00	

Concerning the awareness of diabetes among the participants, 36.7 % (n =11) of the respondents showed low awareness of diabetes, while 40 % (n = 12) showed moderate awareness. Lastly, 23.3 % (n = 7) of the participants demonstrated high awareness of diabetes. Based on the posttests, all the participants (N =30) showed high awareness of diabetes. The t-test results ($p < 0.000$) indicated a significant statistical difference between the patients' pretest and posttest awareness scores. Thus, the patients'

awareness of diabetes was improved after the NDPP program. Shown in Table 3, are the pre-and posttest scores based on awareness.

Table 3

Awareness Scores

	Frequency	
Awareness Score	Pretest	Posttest
0-5 (Low awareness)	11	0
5-7(Moderate awareness)	12	0
7-23(High awareness)	7	30
P(T<=t) two-tail	0.00	

Generally, there was a significant improvement in knowledge and awareness of diabetes after the NDPP educational sessions. Despite the participants failing to correctly score some of the items, the overall improvement in knowledge and awareness was consistent.

Discussion

The results of this project indicated a significant improvement in the patients' knowledge and awareness of diabetes. Therefore, the effectiveness of the NDPP program in improving knowledge and awareness of diabetes among obese patients with prediabetes was confirmed. The findings of this project are consistent Deepa et al. (2014) who found that educational programs are effective in improving diabetes knowledge and awareness. Other researchers have also found that education of patients on diabetes improves their knowledge and awareness, thus, reducing their likelihood of developing T2D (Lindstrom et al., 2008; Woodbury et al., 2013). Based on the findings of this project, it is important to adopt educational programs among high risk patients such as

those with obesity. For effective diabetes control and management, healthcare institutions should adopt comprehensive evidence-based diabetes educational interventions (Deepa et al., 2014; Linstrom et al., 2008; Mulcahy et al., 2003). In a study involving 16, 607 participants, Deepa et al. (2014) found that there was poor knowledge and awareness of diabetes among the Indian population. Linstrom et al. (2008) and Mulcahy et al. (2003) also found that adequate diabetes knowledge and awareness is vital for effective control and prevention of diabetes. According to Linstrom et al. (2008), intensive lifestyle does not have any effect on baseline characteristics and diabetes risk factors. The findings of this project are consistent with Zhuang, Wu, Lu, Du, and Guo (2015) found that the risk of T2D is lower among individuals who have knowledge and awareness of diabetes.

Mumu, Saleh, Ara, Haque, and Ali (2014) also support the need for effective diabetes educational programs for high risk patients. Also, Qin and Xu (2016) found that diabetes health literacy was affected by age, level of knowledge and awareness, and gender. Thus, diabetes educational programs should contain relevant materials for elderly individuals who are at a risk of diabetes. Jalilian, Motlagh, Solhi, and Gharibnavaz (2014) also found that using the HBM as a framework for diabetes education and prevention programs was effective. Therefore, future studies should be designed using different change models to promote diversity in the fight against diabetes.

Most of the diabetes control and prevention programs have been found to be effective in improving individuals' self-management practices and adherence to diabetes treatment regimens and diets. Based on research evidence, diabetes educational interventions can be sued to improve diabetes knowledge and awareness among

individuals (Deepa et al., 2014; Jalilian et al., 2014; Mumu et al., 2014). Some of the diabetes control and prevention programs are used for specific populations, while others can be used for all chronic conditions.

Implications on Practice/Action

The results of project indicated that educational programs are effective in the control and management of diabetes among obese patients with prediabetes. Compared to individuals with normal weight status, obese patients have a higher risk of developing T2D. Therefore, there is need for adequate support and assistance to obese patients with prediabetes on the appropriate diet, medications, physical exercise, and diabetes self-management skills. As indicated in the findings of this project, improvement in patients' knowledge and awareness of diabetes leads to effective behavioral and lifestyle modifications that reduce the risk of diabetes. Adequate knowledge of diabetes is vital in the establishment of diabetes control and prevention strategies. Thus, the findings of this project can be an important source of evidence for future studies on diabetes management and control.

Conclusion

The NDPP program significantly improved the participants' knowledge and awareness of diabetes and self-management practices. Therefore, the introduction of educational program for continuous education of patients with prediabetes was recommended. It was also recommended that nurses should take the initiative to provide support and educate obese patients with prediabetes on the importance of maintaining healthy behaviors and lifestyles. The DNP project also provided proof of the

effectiveness of the NDPP educational program. Therefore, an industry-wide adoption of the NDPP program can significantly reduce the risk of diabetes among high risk populations, thus, reducing the prevalence of diabetes. An increase in the patients' knowledge and awareness of diabetes will significantly reduce the risk of progression of prediabetes into T2D. Though the NDPP program effectively increased the participants' knowledge and awareness of obesity, the project was somehow limited by the small sample size which limits the generalizability of the project. However, there is need for further research on more effective educational interventions among high risk populations.

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Appendix B: Pretest and Posttest Scores

			Pretests		Posttests	
1	The diabetes diet is:		n	%	n	%
	a.	the way most American people eat	13	43.3%	5	16.7%
	b.	a healthy diet for most people	9	30.0%	21	70.0%
	c.	too high in carbohydrate for most people	7	23.3%	1	3.3%
	d.	too high in protein for most people	1	3.3%	3	10.0%
2	Which of the following is highest in carbohydrate?					
	a.	Baked chicken	6	20.0%	3	10.0%
	b.	Swiss cheese	10	33.3%	1	3.3%
	c.	Baked potato	13	43.3%	26	86.7%
	d.	Peanut butter	1	3.3%	0	0.0%
3	Which of the following is highest in fat?					
	a.	Low fat (2%) milk	4	13.3%	19	63.3%
	b.	Orange juice	10	33.3%	6	20.0%
	c.	Corn	8	26.7%	2	6.7%
	d.	Honey	8	26.7%	3	10.0%
4	Which of the following is a “free food”?					
	a.	Any unsweetened food	6	20.0%	2	6.7%
	b.	Any food that has “fat free” on the label	4	13.3%	1	3.3%
	c.	Any food that has “sugar free” on the label	11	36.7%	7	23.3%
	d.	Any food that has less than 20 calories per serving	9	30.0%	20	66.7%
5	A1C is a measure of your average blood glucose level for the past:					
	a.	day	12	40.0%	4	13.3%
	b.	week	5	16.7%	3	10.0%
	c.	6-12 weeks	6	20.0%	22	73.3%
	d.	6 months	7	23.3%	1	3.3%
6	Which is the best method for home glucose testing?					
	a.	Urine testing	6	20.0%	4	13.3%
	b.	Blood testing	13	43.3%	16	53.3%
	c.	Both are equally good	11	36.7%	10	33.3%
7	What effect does unsweetened fruit juice have on blood glucose?					
	a.	Lowers it	10	33.3%	9	30.0%
	b.	Raises it	7	23.3%	15	50.0%
	c.	Has no effect	13	43.3%	6	20.0%
8	Which should not be used to treat low blood glucose?					
	a.	3 hard candies	8	26.7%	3	10.0%

	b.	1/2 cup orange juice	2	6.7%	0	0.0%
	c.	1 cup diet soft drink	9	30.0%	26	86.7%
	d.	1 cup skim milk	11	36.7%	1	3.3%
9	For a person in good control, what effect does exercise have on blood glucose?					
	a.	Lowers it	9	30.0%	19	63.3%
	b.	Raises it	8	26.7%	4	13.3%
	c.	Has no effect	13	43.3%	7	23.3%
10	What effect will an infection most likely have on blood glucose?					
	a.	Lowers it	8	26.7%	2	6.7%
	b.	Raises it	9	30.0%	19	63.3%
	c.	Has no effect	13	43.3%	9	30.0%
11	The best way to take care of your feet is to:					
	a.	look at and wash them each day	8	26.7%	24	80.0%
	b.	massage them with alcohol each day	11	36.7%	4	13.3%
	c.	soak them for one hour each day	7	23.3%	1	3.3%
	d.	buy shoes a size larger than usual	4	13.3%	1	3.3%
12	Eating foods lower in fat decreases your risk for:					
	a.	nerve disease	8	26.7%	1	3.3%
	b.	kidney disease	7	23.3%	2	6.7%
	c.	heart disease	6	20.0%	25	83.3%
	d.	eye disease	9	30.0%	2	6.7%
13	Numbness and tingling may be symptoms of:					
	a.	kidney disease	4	13.3%	1	3.3%
	b.	nerve disease	6	20.0%	2	6.7%
	c.	eye disease	10	33.3%	1	3.3%
	d.	liver disease	10	33.3%	26	86.7%
14	Which of the following is usually not associated with diabetes?					
	a.	vision problems	9	30.0%	2	6.7%
	b.	kidney problems	6	20.0%	3	10.0%
	c.	nerve problems	3	10.0%	5	16.7%
	d.	lung problems	12	40.0%	20	66.7%
15	Signs of ketoacidosis (DKA) include:					
	a.	shakiness	9	30.0%	2	6.7%
	b.	sweating	4	13.3%	2	6.7%
	c.	vomiting	13	43.3%	26	86.7%
	d.	low blood glucose	4	13.3%	0	0.0%
16	If you are sick with the flu, you should:					
	a.	Take less insulin	6	20.0%	1	3.3%
	b.	Drink less liquid	9	30.0%	0	0.0%
	c.	Eat more proteins	8	26.7%	3	10.0%
	d.	Test blood glucose more often	7	23.3%	26	86.7%

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	6	20.0%	22	73.3%
	b.	3-5 hours	7	23.3%	2	6.7%
	c.	6-12 hours	9	30.0%	2	6.7%
	d.	More than 13 hours	8	26.7%	4	13.3%
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	7	23.3%	0	0.0%
	b.	Take the insulin that you usually take at breakfast	7	23.3%	5	16.7%
	c.	Take twice as much insulin as you usually take at breakfast	5	16.7%	2	6.7%
	d.	Check your blood glucose level to decide how much insulin to take	11	36.7%	23	76.7%
19	If you are beginning to have a low blood glucose reaction, you should:					
	a.	exercise	6	20.0%	3	10.0%
	b.	lie down and rest	8	26.7%	2	6.7%
	c.	drink some juice	9	30.0%	21	70.0%
	d.	take rapid-acting insulin	7	23.3%	4	13.3%
20	A low blood glucose reaction may be caused by:					
	a.	too much insulin	6	20.0%	28	93.3%
	b.	too little insulin	4	13.3%	0	0.0%
	c.	too much food	13	43.3%	1	3.3%
	d.	too little exercise	7	23.3%	1	3.3%
21	If you take your morning insulin but skip breakfast, your blood glucose level will usually:					
	a.	increase	8	26.7%	2	6.7%
	b.	decrease	12	40.0%	24	80.0%
	c.	remain the same	10	33.3%	4	13.3%
22	High blood glucose may be caused by:					
	a.	not enough insulin	8	26.7%	18	60.0%
	b.	skipping meals	8	26.7%	0	0.0%
	c.	delaying your snack	7	23.3%	10	33.3%
	d.	skipping your exercise	7	23.3%	2	6.7%
23	A low blood glucose reaction may be caused by:					
	a.	heavy exercise	9	30.0%	19	63.3%
	b.	infection	8	26.7%	1	3.3%
	c.	overeating	5	16.7%	6	20.0%
	d.	not taking your insulin	8	26.7%	4	13.3%
				100.0%		100.0%

Appendix C: Questionnaire

Section 1: Demographic Information

1. What is your age group?

18 - 27 years
28 – 37 years
38 – 47 years
28 - 57 years
58 years and over

2. Which one of the following best identifies you?

Male
Female
Prefer not to answer
Other

3. What is the highest level of education that you have completed?

Some high school or less
High school diploma
Some college or university
University or college degree
Professional or doctoral degree

Section 2: The Michigan Diabetes Research and Training Center's Revised Diabetes Knowledge Test Questionnaire

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 <u>not</u> be used to treat 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 liquid
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