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Improving Glycemic Control in Adult with Type 2 Diabetes

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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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Abstract

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MSN, Maryville University, 2014

BSN, Governor State University, 2007

Project Submitted in Partial Fulfillment

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Abstract

Ninety percent of people with diabetes have Type 2 diabetes mellitus (T2DM). T2DM is a complex disease that affects every organ in the body, which makes effective management of the disease imperative. The American Association of Clinical Endocrinologist (AACE) and American College of Endocrinology (ACE) strongly recommended early treatment initiation among the target population to delay disease progression and complications. The purpose of this evidence-based project was to examine the impact of using the T2DM management algorithm for effective management of adults with T2DM over a 3-month period. The shared experience decision-making model and chronic care model were used as a guide to implement the approach to practice. Implementation of the diabetes algorithm revealed a significant decrease in diabetes-related complications from 61.8% before implementation to 34.06% after the implementation. A pre- and post-design was used to evaluate the impact of the interventional diabetes education among the 14 participants in the educational session. Diabetes education showed an increase in the participants' knowledge of the disease with a prescore average of 56.91% compared to 90.72% post score. Early identification of individuals at risk of developing T2DM, an adaptation of the algorithm into practice, effective patient education, and efficient use of community-based resources, might decrease the incidence, prevalence, physical and financial burden, and psychosocial impact of T2DM, and help to bring about positive change by decreasing T2DM treatment failure.

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Dedication

This project is dedicated to God, who has given me the grace and the strength to continue till this day. Because it is not by my power or by my strength but by His spirit and grace. Also to my sister, Late Atinuke Olaiya.

Acknowledgments

I'm grateful for the wonderful people God has used to help me in achieving my goal. Most especially my family, my preceptor, Mr. Tim Robert, my advisor, Dr. Pohlman Lynn, and my mentor, Dr. Mary Verklan. Thank you all for your relentless efforts.

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Section1: Nature of the Project

Introduction

Type 2 diabetes mellitus (T2DM) is attributed to numerous risk factors such as genetic disposition, age, socioeconomic factor, and obesity. The ability to identify individuals with family history of T2DM, and obesity would enable the care provider to initiate appropriate interventions promptly and delay the progression of the disease. It is estimated that the onset of T2DM occurs an average of 4 to 7 years before clinical diagnosis. A high proportion of individuals exhibit evidence of end-organ damage by the time they are diagnosed (Forouhi & Wareham, 2014). The American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE) strongly recommend early treatment initiation in this population to delay disease progression and complications (Garber et al., 2017). A step by step management algorithm by the AACE and ACE could be used by clinicians to initiate treatment in patients with substancial risk of T2DM promptly. The purpose of this evidence-based project is to evaluate the impact of early treatment of individual who have substantial risk of T2DM in delaying the progression of the disease. The goal is early prevention to prevent or delay the progression to advance diabetic status among the target population. Prevention is the key to reducing the incidence and prevalence of diseases such as diabetes by up to 50% (Backholer et al., 2013; Boyle et al., 2010; CDC, 2014). Section 1 of this project proposal will discuss the background, problem statement, purpose, practice-focus question and project objectives, theoretical frame works, nature of the

doctoral project, significance of the project, gaps in literature, implications for social change, and a summary.

Background

The project site is a non-profit primary care setting, in Destin, Florida that serves undocumented immigrants, homeless, and working Americans who are not able to afford medical insurance. The patient population at the clinic are predominantly individuals ages 25 and above with low socioeconomic status and at least two chronic diseases such as hypertension, hyperlipidemia, diabetes, and coronary arterial disease (CAD). In comparison to patients with other chronic diseases, patients with T2DM are experiencing an increased rate of treatment failure due to a phenomenon called glycemic burden. Glycemic burden is a condition in which the patient's cumulative glycated hemoglobin (HbA1c) exceeds the specified treatment goal regardless of therapy (Brown, Nichols, & Perry, 2004).

The organization is currently using traditional guidelines for management of T2DM. The traditional guidelines do not require treatment initiation unless the patient is significantly symptomatic which is defined as having a non-healing wound, frequent infections, sudden weight gain or weight loss, HbA1c value greater than 10% in a routine blood test, diabetic neuropathy, and elevated urine protein. With the current guidelines, effective management of T2DM becomes complex because most of the patients have already developed diabetes-related complications before treatment is initiated.

A retrospective review of patients' medical records at the clinic over the last 5 years demonstrated that more than 85% of the patients with T2DM were diagnosed late.

A late diagnosis results in treatment delay and related complications such as diabetic retinopathy, peripheral diabetic neuropathy, and cardiovascular problems. An established protocol and guidelines for early diagnosis and prompt management of T2DM are imperative to the successful management and prevention of complications in adults with T2DM. Early treatment initiation is necessary to delay the progression and prevent disease-related complications, in patients with T2DM. The AACE and ACE strongly recommend early treatment initiation in this population to delay disease progression and complications (Pfeiffer, 2014; Brown et al., 2004; Garber et al., 2017).

Problem Statement

Aside from numerous physical, psychological, and financial consequences faced by individuals affected by DM and their families, a long-standing uncontrolled hyperglycemia places the patient at higher risk for additional microvascular and macrovascular complications (Herman, 2011; McCulloch, 2014). The project site is a small non-profit primary care setting serving about 3,200 patients a year. The organization relies on community-based clinical providers who volunteer at the clinic to provide medical services to their patients. Currently, the organization has no specific treatment protocol for patients with T2DM such that the treatment plan and management is basically at the providers' discretion. Treatment is not initiated until the patients become symptomatic as manifested by elevated HbA1c, a non-healing wound, frequent infections, and sudden weight gain or weight loss. Approximately 85% of the patients diagnosed with T2DM have one or more diabetes related complications.

Most of the patients have other comorbidities such as hypertension and hyperlipidemia that make the management of DM more complex. Based on the T2DM management algorithm, metformin should be initiated not only as a first line of therapy for the patient diagnosed with DM but also as a prophylaxis measure for the individual who has high risk of developing T2DM (Garber et al., 2017). Glucophage (metformin hydrochloride) is an oral antihyperglycemic agent that improves glucose tolerance in patients with T2DM by lowering both basal and postprandial plasma glucose (Bristol-Meyers Squibb, 2017). Metformin is an appropriate drug for the target population because it does not affect insulin secretion while fasting (Bristol-Meyers Squibb, 2017) and is available to the patients from the project site at no cost from most of the neighborhood pharmaceutical companies.

The impact of metformin in prevention of overt diabetes in individuals with high risk and prevention of complications in individuals diagnosed is well supported by numerous studies (see Crandall et al, 2008; DeFronzo & Abdul-Ghani, 2011; De Kruetzenberg et al., 2015; Diabetes Prevention Program Research Group (DPPRG), 2012; Goldberg et al., 2017; Herman, 2011; Herman, 2015; Kelly et al., 2012; Malin, Gerber, Chipkin, & Braun, 2012; Marutur et al., 2013; Maji, Roy, & Das, 2005; Perreault et al., 2012). Standardization of care based on the T2DM algorithm would enable the providers to initiate treatment promptly in individuals with high risk of developing DM.

Purpose Statement

The primary purpose of this evidence-based project was to implement the diabetes management algorithm as the standard of care for patients with T2DM at the project site

and establish the benefits of metformin to individuals at risk of developing the disease based on the diabetes algorithm. The secondary purpose was to increase patients' and providers' awareness of the complexity of T2DM and emphasize the need for early treatment in individuals with high risk of developing T2DM to delay the progression of the disease and prevent complications in individuals diagnosed. Adequate understanding of the disease process for patients and providers would increase the patients' compliance to treatment therapy and it would enable the providers to initiate treatment promptly in patients at risk of developing T2DM. An effective collaboration between patients and providers is crucial to optimal health care outcomes in the target population.

Practice-Focused Question and Project Objectives

The practice focused question was: Would early initiation of treatment with metformin based on the AACE and ACE diabetes management algorithms delay the progression of T2DM in individuals with high risk of developing the disease and prevent complications in individuals diagnosed with the disease? The first project objective was to implement the diabetes algorithm as the standardized management guidelines of care for patients at high risk of developing T2DM as well as patients diagnosed with the disease to increase providers' initiation of early treatment. To achieve the objective, a Power Point presentation on the significance of using the algorithm as the standard of care for diabetic management to help alleviate the issue of treatment failure was sent to all care providers via group email. It was also delivered to the providers at the providers' quarterly meeting. The CDC prediabetes screening test from the National Diabetes Prevention Program (NDPP) (see Appendix A) and the patient risk assessment tool from

the ADA (see Appendix B) to help identify individuals at risk of developing T2DM and initiate immediate treatment dialogue with the patients were provided to care providers. The number of patients at risk of developing T2DM who were treated based on the traditional guidelines was collected over a 3-month period prior to the implementation of the algorithm and compared to the number of patients who were started on metformin and or referred to the community-based diabetes prevention program based on the algorithm for a 3-month period after implementation of the algorithm. Provider competency in the disease process and management of patients diagnosed with T2DM is imperative to actively engage patients in the context of patient-centered care and achieve optimal outcomes (Bernabeo & Holmboe, 2013).

The second project objective was to increase the awareness of patients at risk of developing T2DM about the disease process and its management. Health literacy is the key to achieving effective chronic disease management and preventive health management and it strongly depends on patients and providers improved information and communication practices (Cavanaugh, 2012). The ability of patients to be aware of risks and potential complications would enable them to make better-informed decisions and increase compliance with the treatment modality as initiated by their providers based on the algorithm.

To attain the second objective, a Power Point presentation discussing T2DM, the disease process, its management, and complications was presented to patients at risk of developing T2DM. The patients who have a high risk of developing T2DM or were diagnosed with T2DM in the last 6 to 24 months were selected via the electronic medical

record (EMR) based on family history of diabetes, age (40 years and above) body max index (BMI), and existing medical comorbidities, such as hypertension and hyperlipidemia. They were sent a follow-up letter (see Appendix C) to notify them of risks and the various treatments available to them at no cost to ask for their participation in diabetic education that would take place at the project site to improve their knowledge of the disease and enhance their self-care management. A pre-and post-intervention test was conducted to evaluate the patients' level of understanding of T2DM and its management. A pamphlet version of the power point presentation was also provided to each participant and it was available in each examination room in both English and Spanish languages.

The ability of providers and patients to adequately understand the disease process would increase the patients' adherence to the treatment modality and promote positive patients' outcomes (Cavanaugh, 2012; Adams, 2010). Mutual collaboration between patients and providers is essential for total glycemic control, effective management of the disease, complications prevention, medication compliance, and successful patient health outcomes (McCulloch, 2014; Shrivastava, Shrivastava, & Ramasamy, 2013). In primary care, patients' adequate knowledge of the disease process and active participation in their care is crucial to efficient transition of care from the clinical setting to home environment (Shrivastava & Ramasamy, 2013; Sayah et al., 2012).

Gap in Practice

Prior to the evidence-based proposal, there was no specific standard of care or treatment guidelines in place for the management of T2DM at the project site. Disease

management was basically at the providers' discretion. Patients were screened for diabetes when presenting with conditions such as a non-healing wound, frequent infection, sudden weight gain or weight loss, or an HbA1c value greater than 10% in a routine blood test. Treatment is then initiated after the result of screening confirmed the presence of the disease. The length of time from the point at which the patient experienced the first symptom to the diagnosis and initiation of treatment can be as long as 9 to 12 months.

An individual could be developing T2DM for as long as 7 years before he or she presents with the first symptom (Forouhi & Wareham, 2014). However, by the time the patient is diagnosed, one or more organs may already be affected. With progression of T2DM, the treatment plan becomes more complex and the prognosis becomes poorer. Therefore, adaptation of the diabetes management algorithm for the management of patients with T2DM from the AACE and ACE would enable providers to promptly initiate treatment based on the algorithm. With early intervention, the progression of T2DM may be delayed using cost-effective monotherapy such as metformin to achieve overall positive health care outcomes (Garber et al., 2017). Establishment of a standardized evidence-based practice (EBP) would bridge the gap in inequality of patient care and disparities in health care. By using the diabetes mangement algorithm to manage T2DM at the project site, the patients are able to receive the same quality evidence-based care just as their counterparts with medical insurance.

Nature of the Doctoral Project

The nature of the project was to determine the impact of providers' adequate use of the diabetes management algorithm to initiate early treatment in patients with high risk of developing T2DM at the project site. To evaluate the providers' utilization of the algorithm, a comparison of the number of patients at risk of developing type 2 DM who were started on early treatment collected over a 3-month period prior to the implementation of the algorithm, to the number of patients who were started on metformin and referred to the community-based diabetes prevention program based on the algorithm after a three-month period was completed. The comparison shows a clear measure of effects of the intervention.

The project also evaluated the knowledge of patients at risk of developing T2DM its disease process, management, and complications. A quasi-experimental design of one-group pretest-posttest approach was used to evaluate the increase in patients' knowledge regarding their management of T2DM. The presentation took place in the conference room at the project site. The presentation discussed T2DM, it etiology, contributing factors to the progression and complications of the disease, the importance of adequate knowledge and self-care management. The information was presented at a fifth grade level with limited medical verbiage for patients' comprehension (Badarudeen & Sabharwal, 2010). The approach enabled the establishment of baseline knowledge regarding patients' understanding of the complexity and multi-faceted nature of T2DM. At the end of the Power Point presentation, the patients were given the posttest. Result of the pre and post-test were compared to evaluate the change in knowledge of the patients regarding T2DM. Statistical Package for the Social Science (SPSS) version 24.0 was

used to compute a paired sample *t*-test to accurately analyze patients' knowledge of T2DM, its disease process, management, and complications.

Significance of the Project

About 29.1 million American are currently diagnosed with diabetes, and the number could be doubled if total control of T2DM cannot be achieved by the year 2020 (Healthy People 2020, 2011). Prevention is the key to reduce the incidence and prevalence of diseases such as diabetes by up to 50% (Backholer et al., 2013; Boyle et al., 2010; CDC, 2014). Healthy People 2020 (2011) said "Through prevention programs, reduce the disease and economic burden of diabetes, and improve the quality of life for all persons who have or are at risk for diabetes".

Use of the diabetes algorithm affords providers the clear evidence from well-conducted studies to deliver an evidence-based quality of care. The guidelines as a standard of care serve for providers to develop a customized patient plan of care based on the algorithm and initiate treatment promptly as deemed. Prompt intervention decreases the burden of poor glycemic control as well as long-term complications of metabolic syndrome (Backholer et al., 2013). Standardization of care based on the algorithm would provide consistency in practice and promote effective continuity of care.

Effective patient-provider collaboration of care would not only improve patients' compliance with the treatment regimen, but also promotes patients' sense of involvement in care that leads to the achievement of healthcare goals and positive clinical outcome (Cavanaugh et al., 2009). By increasing patients' awareness of the complexity of T2DM, there should be an increase in positive self-care behaviors, such as dietary modifications

and routine exercise. Above all, the use of the algorithm will enhance the cost-effectiveness of providing care, increase access to care and decrease health disparities among the target population.

Implications for Social Change

Standardization of diabetes care based on the diabetes management algorithm for providers, identification of the individuals at risk of developing T2DM, and prompt initiation of treatment are imperative to decrease treatment failure in the target population. The providers' knowledge of the complexity of the disease process would enable them to screen individuals at risk of developing T2DM, initiate treatment modalities earlier, and use other community-based resources such as the diabetes prevention program and medication assistance program to attain the best patient care outcomes. The success of early treatment and elimination of treatment failure will improve both short-and long-term outcomes in patients at risk for and currently diagnosed with T2DM.

Increasing patients' knowledge and awareness of T2DM is essential to the achievement of optimal health care outcome. Patients' adequate understanding of the disease process will heighten their commitment to treatment modalities and self-care management. Active patients' involvement and participation in care would not only optimize their compliance with care, but also promote their sense of involvement and ownership of care. Above all, to hinder the progression of T2DM and prevent complications related to the disease, a robust evidence-based practice such as the diabetes algorithm must be adopted into practice. Adaptation of the algorithm into practice,

effective patient-provider collaboration of care and efficient use of community-based resources are necessary to decrease the incidence, prevalence, physical burden, psychological impact, financial constraints, and other complications o T2DM.

Summary

The rate of treatment failure of patients diagnosed with T2DM at the project site is incredibly high because treatment is based on providers' discretion. The goal was to change the management of patients diagnosed with T2DM from a treatment-based to a prevention-based focus. Therefore, standardized and evidence-based guidelines need to be adapted by providers to ensure a consistent approach to management of T2DM and earlier initiation of treatment strategies for patients at risk. Adaptation of the diabetes management algorithm will enable providers to effectively screen patients at risk of developing T2DM based on their risk factors, initiate treatment early, and make appropriate referrals to community-based diabetes prevention programs. The nature of the project was to determine the impact of the providers' use of the algorithm to initiate early treatment in patients at risk of developing T2DM and to evaluate the knowledge of the patients at risk of developing T2DM, its disease process, management, and complications. The significance of the project to clinical practice is that it provides the providers a concise and step-by-step evidence-based guideline to develop a customized patients' plan of care. The implication of the project to social change is that it increases the knowledge of both the providers and patients about the complexity of the disease and the need for early treatment. Mutual understanding of the disease process promotes

treatment compliance among patients and attainment of optimal healthcare outcomes a reality in the target population.

Section 2: Background and Context

Introduction

T2DM is a very complex disease and its management is cumbersome in addition. The complexity of the disease process could easily become overwhelming to both patients and providers. Adequate awareness of the disease process for patients, use of a standardized treatment guidelines such as the diabetes management algorithm by the AACE and ACE, early identification of patients at risk of developing T2DM, and effective use of community-based resources such as the Florida diabetes preventive program are crucial to effective and efficient management of chronic disease such as T2DM, thereby eliminating treatment failure. In this section, the shared experience decision-making model and the chronic care model (CCM) are the two theoretical frameworks that will be used to systematically integrate the new approach to practice. The background and content of the EBP, its relevance to nursing practice, the role of the DNP student, the role of the project team, and the definitions of terms used will be discussed.

Concepts, Models and Theories

To systematically integrate the new approach to practice, and improve patients' and providers' awareness of T2DM and promote patient self-care management and empowerment, the shared experience decision-making model and CCM were used to orchestrate the process. The shared decision-making process promotes a collaborative and joint effort between the health care provider and the patient to arrive at the best health care choice that is suitable for the individual patient based on the best available

research evidence, and the patient's own values. The shared decision-making model consists of three key concepts which are evidence in clinical practice, incorporation of the evidence into clinical practice, and emphasis on the individual patient's value in the decision-making process (Friesen-Storms et al., 2015).

With about 85% of patients diagnosed with T2DM having at least one diabetes related complication, the need for EBP and standardized clinical practice for the management of patients with T2DM is necessary at the project site. The T2DM management algorithm is essential to meet the need for a robust EBP for effective management of the target population. Adaptation of the algorithm into clinical practice would enable providers to identify individuals at risk of developing T2DM and initiate treatment promptly. Adequate patient education about T2DM becomes the driving force for patients to be more involved in their plan of care. Patients' health literacy is vital for effective contributions to their health care decision-making process. The shared decision-making model helped provide a mutual effort between providers and patients to develop a consensus on screening for T2DM, its diagnosis, and effective interventions based on the algorithm for best health outcomes. A robust evidence-based practice decision-making environment must intergrate evidence into the intervention, clinical expertise, and must incorporate the patient's value at all levels (see Figure 1).

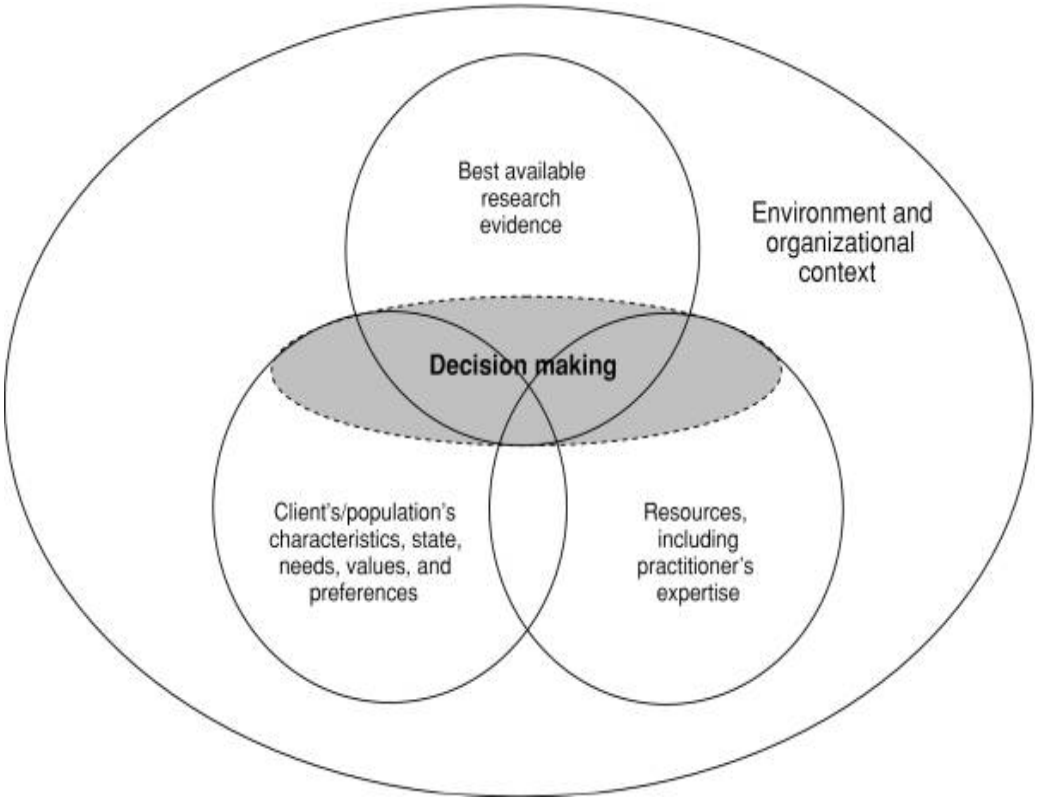

Figure 1. EBP Decision-Making Environment Model. From "Shared Decision Making in Chronic Care in the context of Evidence-Based Practice in Nursing," by J. H.H.M. Friesen-Storms, G.J.J.W. Bours, T. V. D. Weijden, and A.J.H.M. Beurskens, 2015, *International Journal of Nursing Studies,* 52(1), 393–402.

The CCM is another theoretical framework suitable to promote patients' personal empowerment related to self-care and collaboration of care between provider and patient; and enhance continuity of care in patients with T2DM. The focus of CCM is to enhance use of available resources, promote patients' comprehension of disease processes and promote an upbeat health care team. Its features are establishment of a health system and organization of health care to provide leadership for securing resources and removing barriers to care, creation of self-management support to facilitate skills-based learning

and patient empowerment for patients, promotion of decision support that guides implementing evidence-based care, development of delivery system designed to coordinate care processes, provision of clinical information systems to track progress through reporting outcomes to patients and providers, and enhancement of community resources and policies that sustains care by using community-based resources and public health policy (Baptista et al., 2016).

Establishment of a health system and organization of health care to provide leadership for securing resources and removing barriers to care is the first feature of the CCM. Lack of standardization of care is one of the contributing factors to treatment failure in patients with T2DM at the project site. Establishment of standardized treatment guidelines such as the algorithm for management of T2DM is a change that must be adopted into practice by the care providers in the organization to alleviate treatment failure. The organization's ability to embrace the guidelines would promote safe and high quality care and management of errors remove barriers to care, and advance quality control (Baptista et al., 2016).

The second feature of the CCM is the creation of self-management support to facilitate skills-based learning and patient empowerment. Lack of patient awareness of T2DM, its disease process, management, and complication are major contributing factors to poor patient health care outcomes in the target population. Creation of self-management support that facilitate skills-based learning and patient empowerment is imperative. Adequate patient education that empowers the patients and emphasizes their

role in effective self-management is necessary for successful achievement of desired patient health care goals.

Promotion of decision support that guides implementing evidence-based care is the third feature of the CCM. Inconsistency in management of patients diagnosed with T2DM and late initiation of treatment in patients with high risk of developing T2DM at the project site are due to lack of clear evidence-based clinical guidelines such as the algorithm. Availability of evidence-based clinical guidelines to support clinical decision promotes consistency in delivery of care. Use of the guidelines will enable the providers to screen individuals at risk and initiate treatment promptly.

Development of a delivery system designed to coordinate the care processes is the fourth feature of the CCM. Effective management of T2DM is very complex and a multidisciplinary team that focuses on individual structured care must be developed. Development of a delivery system designed to coordinate care process is necessary to achieve health care goal for patients with T2DM.

The fifth feature of the CCM is the provision of clinical information systems to track progress through reporting outcomes to patients and providers. Individual patients' customized plans of care and desired clinical health care goals must be developed. Provision of clinical information systems that track the progression of patient outcomes is imperative for efficient and effective management of the diseases.

The sixth and the last feature of the CCM is an enhancement of community resources and policies that sustains care by using community-based resources and public health policy. Efficient transition of care from the clinical setting to home environment is

the ultimate goal in management of patients with chronic disease such as T2DM in primary care system (Shrivastava & Ramasamy, 2013). Use of community-based resources such as the state diabetes preventive program, medication assistance program by the neighborhood pharmaceutical companies, and provision of diagnostic tests by the community philanthropies are imperative not only to meet the patients' need but to attain the best patient care outcomes and sustenance of care. Enhancement of community resources and policies that sustain care by using community-based resources and public health policy is essential to efficient and effective management of chronic disease such as T2DM. Establishment of partnerships between healthcare systems, organization, patients, families, and the communities are adamant to the successful patient health care outcome and effective disease management in chronic disease management (see Figure 2).

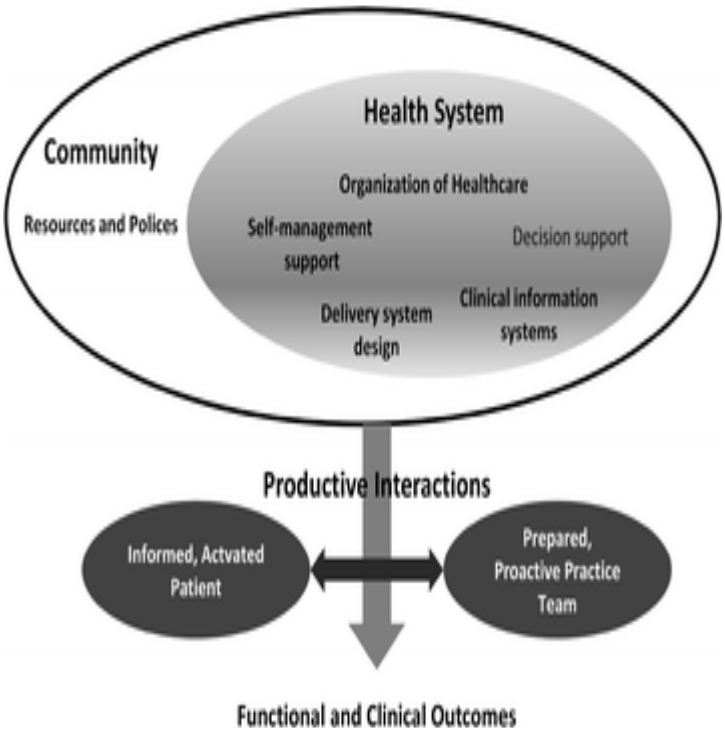

Figure 2. Chronic care model from "The Chronic Care Model for Type 2 Diabetes: A Systematic Review" by D. R. Baptista, A. Wiens, R. Pontarolo, L.Regis, W. C. Torelli Reis, and C. J. Correr, 2016. *Diabetology* and *Metabolic Syndrome*, (8)7, 1-7.

Relevance to Nursing Practice

T2DM is a very complex, and multifaceted disease. The disease process and its progression are very complicated such that an individual could have the disease for as long as seven years before the first symptom emerged. By the time the patient is diagnosed, he or she typically already has developed complications related to the disease (Forouhi & Wareham, 2014). Due to the depth-of the disease progression before diagnosis, the disease management become cumbersome and treatment failure ensue. Clinicians, providers, stakeholders, patients, and families are greatly affected by the burden of the treatment failure. It is projected that the number of Americans diagnosed

with diabetes and the government expenditure related to the disease will double by the year 2020, if no drastic measure is taking to curtail the disease progression (Healthy People 2020, 2011).

While it is impossible to eliminate the hereditary risk factor of T2DM, risk factors such as diet and weight can be managed effectively and thereby delay the progression of the disease and prevent complications related to the disease. Primary prevention is the key to efficient and effective management of T2DM to prevent individuals at risk of developing T2DM to overt diabetes. Early treatment would reduce the incidence, prevalence, economic burden, and improve the quality of life individuals diagnosed or are at risk of developing T2DM (Healthy People 2020, 2011).

The cost of diabetes and diabetes related complication are another fact that makes early treatment imperative among the target population. Most of the patients cannot afford their medications, and they rely on the medication assistance program. The providers, care managers, and social workers work relentlessly to explore various pharmaceutical companies for medication assistance and other needs from the community resources for these patients. Early treatment initiation in individuals with substantial risk of diabetes with metformin (Garber et al., 2017) noted in the algorithm, is a win-win for this population. There are few community-based pharmaceutical companies such as Publix and Winnie Dixie that provide metformin at no cost to patients at the project site. However, when the disease is advance to class A2 as described by Klemetti et al. (2016) in which insulin therapy is required to manage the disease, the treatment modality becomes cumbersome in the target population. Because attainment of insulin from the

medication assistance program is not guaranteed, which could place the patients at a disadvantage and the health outcomes become threatened.

T2DM is a composite disease, and individualized patient treatment plan and ongoing clinical support are essential to attain positive patient health care outcome (Robertson, 2012). The success of early treatment initiation strongly depends on the cooperation among clinicians, the organization, and providers. It is imperative that providers be aware of patients at risk and initiate the dialogue for early intervention promptly. Adequate and efficient patient education would enable patients to make an informed decision towards their health. The development of a collaborative care approach between patients and their providers along with, customized patient-centered plan of care are the recipes to a successful clinical outcome and attainment of patients' health care outcome in the target population.

Local Background and Context

The project site is a clinic operated by a non-profit organization, and providers are volunteers. The Hope committee does not interfere with the clinical aspect of the clinic activities. Their focus is to provide the providers with resources to perform the job. The committee consists of 10 retired nonmedical personnel and two retired public health personnel. The medical director is a volunteered retired cardiologist. Unlike the Medicare and Medicaid funded organizations that are required to develop patients' treatment plan based on a specific guideline, the providers at the project site are not under a specific guideline and no quality control based on evidence-based practice is in existence. The treatment plan for patients with T2DM is not begun unless patients

become symptomatic or the HbA1c is 10% or above. Currently, there are no specific guidelines or protocols in place for the management of T2DM. The treatment plan and management is basically at the providers' discretion. A standard of care for every disease process must be established, like the diabetes management algorithm and it must be part of quality core measures for the clinic's quality of care.

Despite the ongoing global propaganda regarding the impact of T2DM, its management, and the effect of early treatment in delaying the progression of the disease; the Florida state legislature has no legislation in place to help speed up the adaptation of the evidence-based practice into practice by every provider. According to Krieger (2008), the practice of government and political priorities are the proximal determinants that govern the distal determinants which are the society's economy, social patterns, physical, behavioral, psychosocial, and biological exposures that trigger pathogenic, processes thereby causing disease. A political ideology that undermines the significance of health and healthy living is a catalyst for the public's adverse health care outcome.

The proximal-distal phenomenon creates a class and racial inequality that differentially affect the living standards, working conditions, and environmental exposures of the dominant and subordinated classes and racial/ethnic groups (Krieger, 2008). The phenomenon leads to social class inequality and racial/ethnic health disparities. The only way the proximal-distal phenomenon leading to health disparities can be eliminated is to have legislation that mandates a standardized, evidence-based quality of care to all patients regardless of socioeconomic status and racial/ethnic groups.

Definition of Terms

The following are the definitions of relevant terms used in this paper:

Adenosine Monophosphate-activated Protein Kinase (AMPK): An enzyme that speed up metabolism and burn fat when activated (De Kreutzenberg et al., 2015).

Athena: A computer system use by the clinic site for clinical decision support (CDS).

Body Mass Index (BMI): A person's weight in kilograms divided by the square of height in meters. It is moderately correlated with more direct measures of body fat (CDC, 2016).

Diabetes management algorithm: The standard and recommendations guidelines established by endocrine governing bodies based on the most current clinical evidence for efficient and effective of diabetes (Garber et al., 2017).

Diabetic nephropathy: Damage to small blood vessels in the kidneys (WHO, 2017)

Peripheral diabetic neuropathy: A dysfunction of cardiac autonomic activity (Bansal, 2015).

Diabetic retinopathy: Small blood vessel damage to the back layer of the eye, the retina, leading to progressive loss of vision, even blindness (WHO, 2017).

Euglycemic: Normal blood glucose (or, blood sugar). It is also referred to as normoglycemia (Bansal, 2015).

Glycemic burden: A condition in which the patient's cumulative glycated hemoglobin (HbA1c) exceeds the specified treatment goal regardless of therapy (Brown, Nichols, & Perry, 2004).

Glycated hemoglobin (HbA1c): A biochemical marker that is used to monitor the long-term glycemic control and assess the risk of developing complications (Yedla, Kuchay, & Mithal, 2015).

Hyperglycemia: When the blood glucose level is too high because the body isn't properly using or doesn't make the hormone insulin (Hess-Fischl, 2015).

Hypoglycemia: A condition characterized by abnormally low blood glucose (blood sugar) levels, usually less than 70 mg/dl (McCulloch, & Mulder, 2016).

Overt diabetes: Progression of pre-diabetes condition to full clinical diabetes stage (Maruthur et al., 2013).

Pre-diabetes: An intermediate state of hyperglycemia with glycemic parameters above normal but below the diabetes threshold (Bansal, 2015).

Treatment failure: Inability to achieve clinical treatment goal (Brown et al., 2004).

Type I diabetes: A congenital defect that results in decrease insulin production by the pancreatic beta cells (Punjab, 2016).

Type II diabetes: Resistance to the action of insulin of different target tissues such as muscle, liver, and adipose, which ultimately leads to an impaired glucose uptake for these organs (Punjab, 2016).

Therapeutic Lifestyle Changes (TLC): Lifestyle component that focuses on healthy eating pattern, weight management, and increased physical activity (CDC, 2016).

Role of the DNP Student

Clinical prevention and population health for improving the nation's health is one of the academic requirements for the Doctor of Nursing Practice (DNP) curriculums essential for all DNP graduates (AACN, 2006). It is vital for a DNP as an agent of change and empowerment to develop and promote, health promotion and disease prevention activities for individuals, aggregates, and population (AACN, 2006). According to Center for Disease Control and Prevention (CDC) (2015), about half of preventable deaths in the United States (U.S) are related to unhealthy lifestyle, lack of adequate screening for diseases, and obesity. The DNP graduate's ability to engage in leadership that integrate and institutionalize evidence-based clinical prevention and disease management is indispensable (AACN, 2006). As a DNP student, I feel compelled and obligated that the population served at the project site should receive the same quality care and most current evidence-based standard of care for everybody else in the community regardless of their socioeconomic status and or racial/ethnic background.

After the approval of the Walden's Internal Review Board (IRB) to implement the project and the execution of the project is also approved by the sponsor at the project site, I met with the team to discuss about the project. Then I developed the schedule and the activities of the project based on the organization's hours of operation. I was the project manager for the project team. As described by Thomas, Jacques, Adams, & Kihneman-Wooten, (2008) my responsibility as the project manager, includes successful initiation,

planning, design, execution, monitoring, and evaluation of the project. My goal was to complete the project in twelve weeks and on time as scheduled without delay or hindrances. Although the process of a project implementation could be very cumbersome and challenging, but with these team members on my side, the project it was a success.

Role of the Project Team

Project planning and team development are integral parts and process of a project. They must be developed and initiated simultaneously with the project (Thomas et al., 2008). The role of each project team members and effective management of such role is critical to the successful outcome of the project. The success of any project strongly depends on well-considered, well-developed, and outstanding, committed team members (Thomas et al., 2008). I was the project manager, my preceptor was the sponsor as the director of the organization, and the other team members are the Spanish interpreter, who is a volunteer at the clinic and the project site care coordinator, who is an employee of the organization. The role of the Spanish interpreter is very crucial to the project as 50% of the population served at the project site is Spanish speaking only. The project site care coordinator coordinates the EMR review and served as the liaison between the project team, project manager, the patients, providers, and other stakeholders. A well strategic plan and committed team members are the precursors to a successful project outcome.

Summary

T2DM is identified as one of the complex chronic diseases to manage in primary care. Its multi faceted disease characteristics required a multidisciplinary team management to be managed efficiently and effectively. Use of a standardized treatment

guideline such as the diabetes management algorithm serves as a blue print for a provider in the identification of patients at risk of developing T2DM. The ability of the providers to identify individuals at risk would result in prompt treatment initiation. Adequate patient knowledge of the disease process and judicial use of community-based resources such as the diabetes preventive program are essential to the effective and efficient management of T2DM, thereby alleviating treatment failure in the target population. The shared experience decision-making model demonstrates that a robust EBP decision environment must integrate evidence of the clinical intervention, clinical expertise, and incorporation of patient's value at all level to achieve the utmost clinical outcome. The CCM framework promotes patients' empowerment related to self-care management, a collaboration of care between providers, patients, organization, and continuity of care in patients with T2DM. The background and content of the EBP were identified as lack of standard of care for the management of T2DM by the providers and the need to adapt the algorithm to decrease treatment failure. The relevance of the project to the nursing practice is a reduction the incidence; prevalence, economic burden, and improvement of the quality of life of individuals diagnosed or that are at risk of developing T2DM. My role as an agent of change and empowerment was to develop and promote health promotion and disease prevention activities for individuals, aggregates, and target population. The role of every project team members and effective management of such role was critical to the successful outcome of the project.

Section 3: Collection and Analysis of Evidence

Introduction

The purpose of this evidence-based project are to implement the diabetes algorithm as the standard of care for the management of T2DM at the project site, increase patients' and providers' awareness of the complexity of the disease, the need for early treatment of individuals at high risk of developing T2DM to delay the progression of the disease in individuals at risk of developing the disease, and prevention of complications related to the disease in diagnosed individuals. The clinic has experienced significant level of treatment failure with about 85% of patients diagnosed with T2DM having one or more additional microvascular and macrovascular complications due to a lack of standardized treatment protocol. A robust and standardized evidence-based practice is needed to alleviate the gap in treatment failure in the target population. Numerous studies support early treatment of individuals with a high risk of developing T2DM with metformin based on the algorithm (see Herman, 2015; Kreutzzenberg et al., 2015; Malin et al., 2012; Maruthur et al., 2013). An extensive review of literature is discussed in this section, in addition to sources of evidence, the practice-focused question, evidence generated for the doctoral project, and analysis and synthesis of the project.

Practice-Focused Question

Currently, there is no specific guideline or protocol for the management of T2DM at the project site. Management of the target population is basically at the individual provider's discretion. The lack of standardization of treatment results in treatment failure and glycemic burden. An established standard of care is imperative to address these issues. The purpose of this project was to implement an evidence-based standard of care such as the algorithm for patients T2DM, to prevent patients at risk of developing T2DM from developing overt diabetes and diabetes-related complications in individuals diagnosed with the disease. Hence, the practice-focused question was: Would early initiation of treatment with metformin based on the AACE and the ACE diabetes management algorithm delay the progression of T2DM in individuals with a high risk of developing the disease and prevent complications in individuals diagnosed with the disease?

Sources of Evidence

The review of literature for evidence was conducted using the databases PubMed, MEDLINE, CINHAL, National Institutes of Health (NIH), CDC, and the Cochrane Library via Walden University to identify studies that focused on the effects of early intervention in patients with T2DM and used metformin as a prophylaxis in patients with potential risks of developing diabetes and pre-diabetes based on the diabetes management algorithm. Studies that examine the cost-effectiveness of metformin were also identified. The key terms and combination of words used were: *diabetes, type II diabetes, complications, risk factors, and cost of care*. Searched articles were published between 2006 and 2017 to obtain the most current evidence-based and peer-reviewed articles. The

studies were selected based on the aim of the study, outcome of the study, population sample size, research design, and levels of evidence, strengths and weaknesses of each study. The initial results of the search generated 2,800 articles related to prevention and early treatment of diabetes. The number of the article was narrowed down to 500 after adding metformin as the intervention for prevention and early treatment of T2DM. The articles were further narrowed down to 10 by selecting articles in which metformin was used as either the primary preventive intervention for T2DM or as an adjunct with another intervention such as lifestyle changes based on the diabetes algorithm.

Literature Review

Maruthur et al. (2013) examined the relationship between early measures of weight and glucose control in patients with a high risk of developing T2DM who used metformin and lifestyle modification in a diabetes prevention program and found there was a 58% decreased risk of overt diabetes in the metformin group as compared to the lifestyle and placebo groups. It was also shown that a significant (p=0.038) interaction between weight loss and glucose does exist (Maruthur et al., 2013). The study demonstrates the effectiveness of metformin alone in overt diabetes prevention and its ability to potentiate the effectiveness of lifestyle modification when added to a treatment plan. The implication of the study to practice is that metformin can be used independently as a monotherapy or in conjunction with another intervention to prevent overt diabetes in individuals at risk.

The DPPRG (2012) revealed a reduced body weight by 7%, weight circumference, and waist circumference in the metformin group compared to the placebo

(DPPRG, 2012). Gastrointestinal symptoms were seen among the metformin group at the beginning of the intervention but subsided over time. The metformin group maintained weight loss when evaluated during follow-up (DPPRG, 2012). The incidence of diabetes was reduced by 34 % in the metformin and 18 % in the lifestyle group as compared to the placebo (DPPRG, 2012). The study supports the project by showing that early treatment initiation with metformin as recommended by the diabetes management algorithm for individuals at risk helps gain efficient glucose control and weight management.

Herman (2015) compared the cost efficiency of lifestyle changes, metformin, and placebo in a diabetes progression prevention program. There was a reduction in prevalence of diabetes rate by 34% in the lifestyle group and 18% in the metformin group as compared to the placebo group (Herman, 2015). It was also discovered that the lifestyle modification and metformin interventions were more expensive than the placebo intervention, but their costs were offset by reductions in the costs of nonintervention-related medical care. Metformin alone as an intervention has the potential to delay the progression of T2DM to u pto 10 years and the progression can be further extended up to 18 years when combined with diet and exercise (Herman, 2015). The implication of the study to clinical practice is imperative because patients can be managed with metformin in spite of their ability to comply with lifestyle modifications and delay the progression of the disease.

De Kreutzzenberg et al (2015) assessed the impact of metformin in modifying the alleged effectors of longevity in peripheral mononuclear cells of patients with prediabetes. Pre-intervention and post- treatment anthropometric and metabolic

parameters were collected for comparison (De Kreutzenberg et al., 2015). Metformin effectively prevented the progression of prediabetes to overt diabetes among the subjects and also significantly blunted inflammation, improved cell survival, and exerted anticancer effects by suppressing the mammalian target of rapamycin (mTOR)/S6K1 axis (De Kreutzenberg et al., 2015). Metformin targets AMP-activated dependent kinase (AMPK) (see definition of terms) and thereby increases cellular resistance to stress, inflammation, and aging (De Kreutzenberg et al., 2015). De Kreutzenberg et al. (2015) said that metformin delays progression of T2DM; it also suppresses the aging process at the same time. Increase in age is one risk factor for developing T2DM. The older an individual, the higher the risk of developing T2DM (De Kreutzenberg et al., 2015).

Perreault et al. (2012) conducted a randomized clinical trial to compare the impact of lifestyle changes with metformin, lifestyle only, and placebo in the progression of pre-diabetes to overt diabetes. The outcome revealed that the lifestyle and metformin group had a higher number of participants that returned to normal glucose regulation (NGR) as compared to lifestyle alone and placebo groups (Perreault et al., 2012). The conclusion of the study also supports the effectiveness of metformin when combined with other interventions such as lifestyle modification. The study implies that adding metformin to the treatment plan of patients with difficulty managing lifestyle modification is an imperative implication for clinical practice to attain the best clinical outcome in the targeted population.

Malin et al. (2012) evaluated the combination of exercise with metformin (EM), to exercise (E) and metformin (M) independently, placebo (P), and placebo with exercise

(PE) in delaying the progression of pre-diabetes to overt T2DM. The result showed an overall increase in insulin sensitivity ($p < 0.05$) relative to the control group and average rise of 25-30% higher in insulin sensitivity among the PE group as compared to EM or with metformin alone (Malin et al., 2012). The researchers observed that adding metformin heightened the full effect of exercise in the metformin and exercise group (Malin et al., 2012). The study affirms the efficiency of metformin in delaying progression of T2DM as a monotherapy or as an adjunct to other intervention such as increase physical activities.

Rhee et al (2010) examined the percentage of individuals that could benefit from metformin treatment based on the recommendation of the ADA consensus panel in delaying type 2 DM or preventing its occurrence. The ADA recommends that individuals with both impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), along with one additional risk factor such as age 60 years, BMI greater than 35 , family history of diabetes in first-degree relative, elevated triglycerides, reduced HDL cholesterol, or A1C 6.0% should be considered for treatment with metformin, lifestyle modification, weight loss and physical activity (Rhee et al., 2010). It was found 1 in 12 individuals in the target populations met the criteria for consideration of metformin (Rhee et al., 2010). The findings of the study outcomes for clinical practice supports the project that early identification of individuals at risk of developing T2DM and the need to initiate treatment promptly to delay the progression of the disease is significant. An effective primary prevention of T2DM would reduce morbidity, mortality, and financial constraint related to its complications (Rhee et al., 2010). The outcome of the investigation supports the use

of metformin treatment for diabetes prevention or delay of its progression as an imperative clinical implication for practice (Rhee et al., 2010).

Viskochil, Malin, Blankenship, and Braun (2017) conducted a 12 weeks study to determine the effect of metformin alone (M), metformin combined with exercise (ME), placebo alone (P), and exercise with placebo (EP) on peripheral insulin sensitivity. A pre- and post-intervention fasting plasma proinsulin, C-peptide, insulin, and glucose were collected. Hepatic insulin extraction, insulin clearance, body weight, and cardio respiratory fitness were also measured. The result shows fasting proinsulin was unchanged following P and EP. However, a significant increase insulin clearance and a decrease fasting proinsulin were seen with M and even greater after EM. Insulin clearance was significantly greater following M and EM but was unchanged in P or EP (Viskochil et al., 2017). The study indicates that metformin combined with exercise training reduced circulating proinsulin, and increased insulin clearance. The outcome not only supported the hypothesis that adding metformin to exercise may attenuate the training effects of exercise but also a clear indication for clinical use of metformin in the management of T2DM to achieve desired outcome (Viskochil et al., 2017).

Mangahas, Huang, Neher, & Safranek, (2013) performed a systematic analysis of three meta-analyses to determine the effectiveness of metformin in preventing diabetes in adults at risk of developing diabetes. The analysis demonstrated that metformin significantly reduced the risk of the at-risk patient from developing overt diabetes as compared to the placebo group. A long-term follow-up of the patients in the Diabetes Prevention Program (DPP) also indicates that metformin could delay the progression of

T2DM to overt diabetes for as long as 10 years (Mangahas et al., 2011). The study also showed that young adults ages 25-44 could benefit more from lifestyle modification when combine with metformin than exercise alone. It was also concluded that patients ages 65 years and above could benefit more from diet and exercise that could young adult. Hence, the ADA strongly recommends utilization of metformin to prevent T2DM in patients at risk despite lifestyle modification (Mangahas et al., 2011). The evidence strongly supports and reinforces the impact of incorporating metformin for effective and efficient management of T2DM based on the algorithm. The outcome of the study also showed that combination of metformin and exercise is more beneficial to deter the progression of T2DM in adult with high risk of developing T2DM from overt diabetes. Metformin as a monotherapy or in conjunction with other therapy to delay the occurrence or progression of T2DM is well researched and presented a clear implication for clinical practice that could result in effective management of T2DM in primary settings (Mangahas et al., 2011; Viskochil et al., 2017; Rhee et al., 2010).

Evidence Generated for the Doctoral Project

Participants

The target population for the project was adults, male and females ages 40 and above, who have a BMI of greater than or equal to 25, family history of diabetes, with or without existing medical history of hypertension, hyperlipidemia, prediabetes, and recently diagnosed in the last 6 to 24 months as T2DM non-insulin dependent. A randomized review of the EMR was performed at the project site to identify individuals that meet the inclusion criteria. Exclusion criteria include individuals diagnosed with

T2DM for more than 24 months and on insulin therapy for diabetes management, pregnant, and history of mental health. The ability to intervene at the preventive stage of the disease process could prevent overt diabetes in individuals at high risk of developing the disease and prevent the individuals recently diagnosed from developing further complications related to the disease.

Procedures

The execution of the project cannot take place without the approval of the Walden IRB. After the approval of the Walden IRB (Approval #: 03-23-18-0653019) the identified potential participants who met the inclusion criteria were contacted for their consent and participation in the diabetes education. The diabetes education was conducted on Monday and Tuesday of the month that the organization was screening for admission of new patients to the clinic. The clinical director suggested those days to be the best period for the diabetes education, because there would less clinical activities on those days and the staff would be available to help organize the sessions. The educational sessions were held in the organization's conference room in the morning before lunch time.

On the first day of the educational session, the participants were seated in the conference room as they arrive at the clinic. A pen and a paper copy of the consent were presented to each participant. It was collected and kept in a folder labeled "consent" and kept on the table. After the participants signed the consent, they were given the pre-test questionnaire (see Appendix E) and a pen to complete it. Because the pre-test and the post-test (see Appendix E) were the same sets of questionnaires, the word pre-test was

circled, and the participants filled out the questionnaire with a pen. I was available in the conference room for any questions by the participants as they fill out the questionnaires. The result of the pre-test was used to establish their baseline knowledge of diabetes. The questionnaires were kept anonymous and participants' identification was not required. The participants placed their completed pre-test questionnaire in the folder labeled "Pre-Test Questionnaire".

The diabetes education was presented in a power point via the organization's projector in both English (see Appendix F) and Spanish (see Appendix P). I presented the English version of the teaching session and Marlin, who is a member of the project team and the Spanish interpreter for the organization, presented the Spanish version while I stood by for questions. At the end of day one of the program, participants were given a copy of the diabetes pamphlet (see Appendix F; Appendix P) with the same content delivered based on their language preference. Participants were encouraged to return on the second day of the program with any questions or concerns they may have regarding the subject discussed or about diabetes in general.

On the second day of the educational session, the first few hours were used to address any questions or concerns participants had regarding diabetes. The information presented the previous day was reinforced to the participants in English by me and in Spanish by Marlin. Then the post-test (see Appendix E) with the word posttest circled, was distributed to the participants. The participants completed the posttest with a pen. Both Marlin and I remained in the room in case there were any questions. The questionnaires were kept anonymous and participant identification was not required. The

participants placed the completed posttest questionnaire in the folder labeled “Posttest Questionnaire”. The consent, the pre-test, and the posttest folders were taken to the director’s office where they were locked inside a locked cabinet.

The results of the pre-test and post-education were compared by the director and me. The total number of correct answers before the diabetes education session was compared to total number of the correct answers after the educational session to ascertain the changes in the participants’ knowledge of the subject matter. The expected successful outcome of the diabetes education was a score of 90% or greater on the answered posttest questionnaire. A result below 90% would have called for a repeat of the diabetes education which would have been scheduled for the next organization’s screening period. However, participants were also encouraged to follow up with their primary care provider for screening and management as soon as possible. The patients’ knowledge deficit related to diabetes was identified as a major contributing factor to the late diagnosis and lack of effective management of T2DM in the target population. The lack of literacy related to the disease becomes the driving force to heighten the patients’ knowledge and awareness of the disease.

Instrument

The pre- and post-test (see Appendix E) was developed by myself from the NDEI based on the diabetes teaching recommendation by the ADA, to evaluate whether the diabetes educational session will improve the participants’ knowledge of diabetes, the risk factors, and the complications related to the disease. The questionnaire was developed to meet the educational need of the target population in accordance with the

ADA teaching guidelines to support its validity and reliability. The learning tool described diabetes in simple English and Spanish languages at a fifth-grade level for maximum understanding by the participants and other readers.

Protections

The principle of Health Insurance Portability and Accountability Act (HIPAA) was strictly adhered to, to safeguard the participants' privacy. All the documents were maintained in a locked cabinet inside the director's private office at all times. The data transcribed from the raw data collection was stored in a Microsoft word folder named "Pre-and Posttest Results" in the organization's computer system. Access to the documents and data were limited to the project team members only. These authorized individuals were assigned a password for accountability and security.

Analysis and Synthesis

The first objective of the project was to establish use of the diabetes algorithm as the standard of care for the management of patients diagnosed with T2DM and patients at high risk of developing T2DM at the project site. To effectively analyze the providers' compliance with the guidelines, the number of patients with diabetes related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy receiving treatment based on the traditional guidelines was collecetd over a period of three months before the implementation of the algorithm. Then the number was compared to the number of patients with diabetes related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy treated based on the algorithm for a three-month period after implementation of the algorithm. The impact of

the guideline in the effective management of T2DM in the target population was determined by comparing a 3-month period prior to implementation of the algorithm to 3-month period after implementation of the algorithm.

The second objective was to increase the awareness of patients at risk of developing T2DM about the disease process and its management. A power point presentation was delivered to the identified participants to enhance their knowledge of the disease and its complications. A one group pre-and post-test was used to analyze the influence of the teaching on patients' knowledge of the subject discussed. The SPSS version 24.0 was used to analyze the paired t-test to evaluate the differences between the pre- and post-tests.

Summary

The project site has experienced a substantial level of treatment failure of patients with T2DM due to lack of standardized clinical guidelines for the treatment of the target population. The ongoing treatment failure and its impact cannot be over emphasized. Hence, the need for a robust and standardized evidence-based practice to lessen the severity of the problem and its impact on clinical outcome is highly imperative. The focus of the project was to explore the hypothesis whether early initiation of treatment with metformin based on the AACE and the ACE diabetes management algorithms delay the progression of T2DM in individuals with high risk of developing the disease and prevents complications in individuals diagnosed with the disease. An extensive literature review was completed to validate its reliability and validity, and to ensure the effectiveness of the type 2 DM algorithm in the management of patients with T2DM.

Databases PubMed, MEDLINE, CINHAL, National Institutes of Health (NIH), CDC, and the Cochrane Library via Walden University were used to conduct the review of literature. The analysis and synthesis of the project was performed in two parts. First, to compare the number of patients started on metformin based on the algorithm for three months prior to the intervention and compared the number with post intervention result. Second, a one group pre-and post-test would be utilized to analyze the learning outcome of the diabetes teaching among the participants. The enormous impact of early identification of individuals at risk of developing type 2 DM and initiation of preventive measure with metformin based on the diabetes algorithm is indisputable to the prevention of the progression of the disease and its complications.

Section 4: Findings and Recommendations

Introduction

The primary purpose of the DNP project was to implement the diabetes management algorithm as the standard of care for patients with T2DM at the project site based on AACE and ACE guidelines, and increase patients' knowledge of the disease, its process, and complications. A Power Point presentation including the clinical recommendations developed based on the AACE and ACE guidelines was sent to all the care providers at clinic via the clinic group email address. Patients with diabetes-related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy who received treatment based on the traditional guidelines for the period between January and March was collected and compared to the number of patients with diabetes-related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy based on the new guidelines for the period between April and June. Also, an extensive 2-day diabetes education program delivered in both English and Spanish languages was provided to patients older than 40 who had a high risk of developing T2DM and were newly diagnosed within the last 6 months. To assess the participants' baseline knowledge of the subject, a pre-test was given before the diabetes educational sessions on day one and a posttest was provided on day two to determine the change in the participants' level of understanding of T2DM. In this section, the findings, implications, recommendations, contributions of the doctoral project team, strengths, and limitations of the project will be discussed.

Findings and Implications

The practice focused question was: Would early initiation of treatment with metformin based on the AACE and the ACE diabetes management algorithms delay the progression of T2DM in individuals with high risk of developing the disease and prevents complications in individuals diagnosed with the disease? There were two objectives for the project. The first objective was to implement the diabetes algorithm as the standardized management guidelines to promote initiation of early treatment in individuals at risk of developing T2DM and prevent complications in the individuals diagnosed. The second project objective was to increase the awareness of patients at risk of developing T2DM regarding the disease process and its management.

A Power Point presentation including the clinical recommendations developed based on the AACE and ACE guidelines was sent to all the care providers at the clinic via the clinic group email address on March 27, 2018. Two weeks later, 70% (13 of the 18 volunteer providers) of the clinicians responded. During the providers' quarterly meeting in April, the AACE and ACE guidelines was formally introduced by the director to the providers as the clinic's clinical guidelines to be used by providers for management of patients with T2DM or at risk of developing the disease based on the algorithm. The clinic's computer system Athena (see definition of terms) is now equipped with screening features that would prompt providers to explore more from patients with a family history of T2DM during the initial encounter. Providers were also provided with the CDC prediabetes screening test by the NDPP (see Appendix A) and the patient risk assessment tool by the ADA (see Appendix B). All these resources were made available to providers

at the project site to promote early identification of individuals at risk, prompt treatment initiation to curb treatment failure, and ease the transition from the traditional guidelines to the evidence-based diabetes algorithm.

To analyze the providers' compliance new guidelines for the management of patients with T2DM, the number of patients with diabetes-related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy receiving treatment based on the traditional guidelines from the months of January through March prior to the implementation of the algorithm was compared to the number of patients with diabetes-related complications such as cardiovascular disease, hyperlipidemia, and peripheral neuropathy treated based on the algorithm for the months of April through June after implementation of the algorithm. The result of the review from January through March yielded 36 patients diagnosed with T2DM who also had hypertension, hyperlipidemia, and/-or peripheral neuropathy. Of the 36 participants, 21 (58.3%) were females and 15 (41.7%) were males. Ages ranged from 37 through 62, with an average age of 48.3 years. It was found that the majority had hypertension, neuropathy, hyperlipidemia, and just less than half of the group had a combination of hypertension, hyperlipidemia, and neuropathy. An average of 61.8% of the participants has one or more diabetes-related complications (see Table 1).

Table 1

Descriptive Statistics for Age of the Study Participants Pre- intervention/Implementation (n = 36)

	Frequency	Percentage
Age		
≤ 45 years	12	33.3
46 to 50 years	13	36.1
≥ 51 years	11	30.6
Gender		
Female	21	58.3
Male	15	41.7
Hypertension		
Yes	31	86.1
No	5	13.9
Neuropathy		
Yes	18	50
No	18	50
Hyperlipidemia		
Yes	24	66.7
No	12	33.3

The post intervention review of EMR was performed for the months of April through June. The result yielded 46 participants. The age of the participants ranged from 35 to 66 with an average of 45.5. Among them were 28 (60.9%) females and 18 (39.1%) males. The participants were evaluated for diabetes related complications that include hypertension, hyperlipidemia, and neuropathy. These diabetes-related complications were averaged at 34.06 among the participants (see table 2).

Table 2

Descriptive Statistics for Age of the Study Participants Post Intervention/Implementation (n = 46)

	Frequency	Percentage
Age		
≤ 45 years	20	43.5
46 to 50 years	10	21.7
≥ 51 years	16	34.8
Gender		
Female	28	60.9
Male	18	39.1
Hypertension		
Yes	11	23.9
No	35	76.1
Neuropathy		
Yes	13	28.3

No	33	71.7
Hyperlipidemia		
Yes	23	50.0
No	23	50.0

The comparison of the pre-and post-intervention of diabetes related complication was performed to evaluate the effective utilization of the diabetes management algorithm by the providers. During the pre-intervention EMR review, 31 (86.1%) of the participants were diagnosed with hypertension, 18(50.0%) with neuropathy, and 24 (66.7) were diagnosed with hyperlipidemia while the post-intervention shows 11(23.9%), 13 (28.3%), and 23 (50.0%) respectively (see Figure 3).

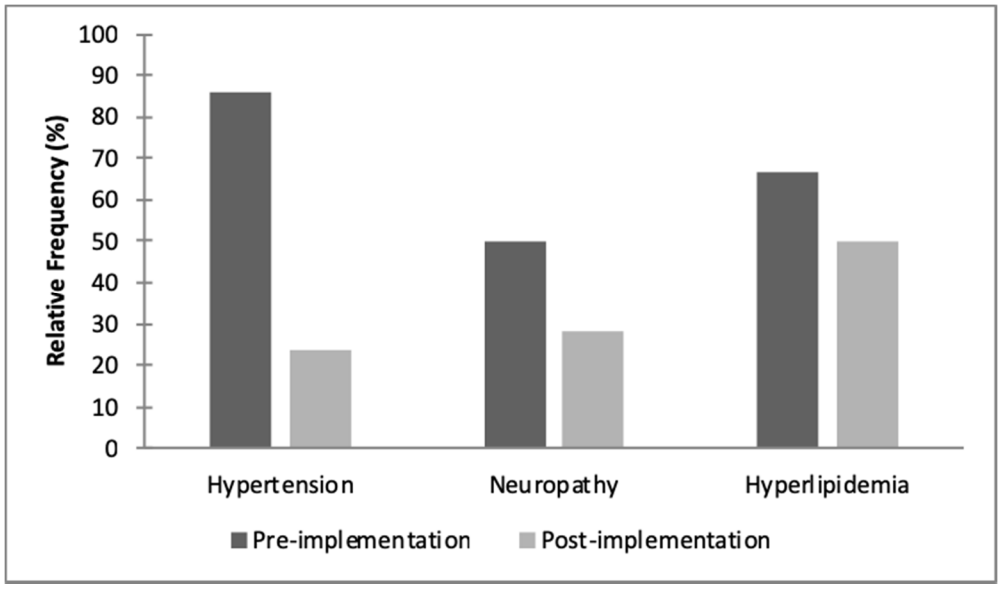

Figure 3. Pre and post implemetation of diabetes algorithm.

A comprehensive diabetes management educational session was held at the project's site. After an extensive randomized review of the EMR, 37 individuals were found who met the inclusion criteria. Of these 37 individuals, only 16 responded to the

invitation to participate in the diabetes education. It's not surprising for one to wonder why the participation rate was less than 50% of the individuals who met the inclusion criteria. One of the reasons is lack of transportation. The clinic is situated in the downtown of the city where public transport is not available in the area, and individuals are dependent on their own private vehicle, which may be difficult for them to fuel. The target population has a very low socioeconomic status such that not all basic needs are available to them. Most of the patients depend on families and friends to bring them to the clinic for their scheduled appointment. It is not uncommon for patients to cancel appointments in successions due to lack of transportation to the clinic. For the female patients, the lack of childcare is another common reason for them to miss their appointment. These are some of the reasons why it is difficult for some of these qualified participants to make a commitment for the diabetes education.

The educational session was conducted for two days. On day one of the session, 10 female and six male participants were present for the pre-test and the diabetes education (see Table 2). However, only 14 participants partook in the posttest on the second day of the educational session. The analysis and computation of the paired t-test for the pre-test was computed based on the number of participants who completed both the pre-test (*n = 14*) and the posttest only. The average age of the participants based on the number of participants that completed the two sessions was 48.5 years (*SD = 13.02, n = 14*; *SD* = 4.9, *n* = 14) ranging in age 40 to 57. SPSS version 24.0 was used to analyze the paired t-test and to evaluate the differences between the pre and posttests. Analysis of the diabetes education program is provided (see Table 3). The mean score on the pre-test

was 56.91 while the score on the posttest was 90.72. The participants' average pre-test and post-test score respectively was 56.91% and 90.72%, an increase of 34.14%, leading to 90.72% average score.

Table 3

Paired Samples Statistics Diabetes Education Pre and Post test Scores

	N	Mean	Standard Deviation
Pre-Intervention Score	14	56.91	13.02
Post-Intervention Score	14	90.72	6.46

There was a mean difference of 34.14 between the participants' pre-test diabetes knowledge as compared to their knowledge on the post-test (see Table 4). Conduction of the paired difference of the pre-and posttest diabetes education yielded a $p < 0.05$, demonstrating that the outcome of knowledge was not impacted by the number of the absentees. The remarkable increase in the posttest average diabetes education score indicates a need for diabetes education in the target population. T2DM is very complex and the results support that ongoing, adequate, and efficient diabetes education is necessary for the patient's effective self-care management.

Table 4

Paired Samples Statistics for Diabetes Education Pre/Post-Intervention Test Scores (n = 14)

				95% Confidence Interval				
Score	N	Mean	Std. Dev.	Lower	Upper	t	df	p
Pre Intervention	14	56.91	13.02	49.84	63.35			
Post Intervention	14	90.72	6.46	87.35	94.11			
Post compared to Pre	14	34.14	13.99	26.06	42.21	9.13	13	<0.001

Implications

The target population is faced with a significant knowledge deficit related to their T2DM, its disease process, and complications. The wide gap in knowledge indicates a need for ongoing assessment of patients' knowledge of the disease and corresponding teaching sessions by clinicians. The goal is identification of individuals at risk of developing T2DM with prompt intervention ensuing. However, in most cases these individuals are not identified until the overt disease phase is manifested (Forouhi & Wareham, 2014). In this case the goal is to delay the progression of the disease and thereby prevent complications. T2DM is a multifaceted, chronic, and complex disease such that patients' adequate understanding of the disease is imperative for effective management of the disease. The patients' ability to understand the disease will not only support their skills-based learning but it will enhance their sense of empowerment to self-care management (Baptista et al., 2016).

Lack of patients' awareness of T2DM has been identified as one of the major contributing factors to poor patients' health care outcome in the target population. Thus, to achieve efficient transition of care from the clinical setting to the home environment, adequate patient education that empowers the patients and emphasizes their role in effective self-management is necessary for successful achievement of the individual patient's desired clinical outcome.

Recommendations

Early identification of individuals at risk of developing T2DM based on their family history, BMI, and age is key to delaying the disease progression and prevention of complications. One of my recommendations is for the providers to adopt a culture of standardization of care based on the clinical guidelines that support prophylaxis and early treatment of the target population. Healthcare insurance organizations such as Medicare and Medicaid recommend standardized clinical guidelines as a benchmark for provision of care and development patients' plan of care by providers. According to Krieger (2008) standardization of care at all levels is indisputable to eliminate the proximal-distal phenomenon. The phenomenon not only creates a class and racial inequality that differentially affects the living standards, working conditions, and environmental exposures of the dominant and subordinated classes and racial/ethnic groups, but also promotes health care disparities (Krieger, 2008). Standardization of care for the target population is imperative as the clinic is staffed by volunteer providers which mean that the probability of the patients seeing the same provider at each clinic visit is less than 50%. The use of the diabetes management guidelines as a standard of care for the target

population will not only eliminate inconsistency of care among providers, it will also promote continuity of care among the target population despite the instability of providers' availability at the project site.

Early screening of individuals at risk is another key recommendation. Individuals with a strong family history of T2DM, age 40 and above, even without elevated BMI should be screened for the disease. It was established that an individual could have the disease for as long as seven years before the first symptom emerged (Forouhi & Wareham, 2014). The new insight gained about T2DM that one can have the disease for about 7 years before the onset of the initial symptoms, explains the reason why most patients already have complications related to the disease at the time of initial diagnosis. From an epidemiological stand point, primary prevention is the goal of effective disease management.

Adequate and efficient patient education must be ongoing. The existence of such an educative forum will enable patients to make an informed decision towards their health and develop a sense of involvement. Development of a collaborative care approach between patients and their providers, along with a customized patient-centered plan of care, are imperative to a successful clinical outcome and attainment of a positive health care outcome in the target population.

Contribution of the Doctoral Project Team

The contribution of the doctoral project team cannot be over emphasized. According to Thomas et al. (2008), project planning and team development are integral parts and processes of a project and must be developed and initiated simultaneously with

the project. After the approval of the project by IRB, I as the project manager met with the project team members who consisted of my preceptor who is also the sponsor, the site care coordinator and the Spanish interpreter to decide when the diabetes education could take place. During the meeting, it was agreed upon to have the teaching done on the 2nd and 3rd of April, and every team members' role was reinforced for clarity.

The project site care coordinator coordinates the EMR review and serves as the liaison between the project team, project manager and the patients. As the project manager, I also worked closely with the care coordinator during the EMR review as well as reaching out to potential participants via telephone. The Spanish interpreter was the one that helped interpret in Spanish. My sponsor, who is the director of the organization was responsible for safety of all the correspondence. The consent, the pre-test, and the posttest folders were kept in a locked cabinet in his office. The project was a success because of the committed team members.

Strengths and Limitations of the Project

One of the strengths of the project was that it gave the target population the opportunity to reassess their knowledge of T2DM. It allows the participants to have clarity about the disease process and the potential complications. The diabetes education was an eye opener to the participants as majority of them was not aware of the fact that T2DM is a medical condition that affects the diagnosed systemically. The project was held over a two-day period which allowed the participants ample time to digest the information presented and not be over saturated with information in just few minutes. The format allowed for more questions from the participants and provided enough time to

allow every participant's questions to be answered. Also, the Power Point presentation I developed based on the -AACE and ACE-guidelines shared with the providers did not only enhance their knowledge of the disease process but also provided them with the standard of care evidence-based practice guidelines related to T2DM. The project enabled the providers to embrace prophylaxis measures towards the disease and not just focus on treatment modalities only (Crandall et al., 2008; Boyle et al., 2010).

The only limitation of the project is that the outcome of the project cannot be generalized to another hospital, unit, or different patient population. The project site is a small community-based clinic with an annual patient population of about 3200 and majority are Spanish speaking. The sample size and the combination of the participants may not have truly represented the general population for the outcome of the project to be generalized. Hence, use of the project outcome at a similar organization is suggested. A replication of the project can be conducted in an environment with a more diverse and larger population sample to enhance the generalizability of the project (Mishra, Lalumière, & Williams, 2017).

Section 5: Dissemination Plan

Introduction

The purpose of this DNP project was to alleviate treatment failure in patients diagnosed with type 2 DM at the project site. Prior to the project, the clinic was using traditional guidelines for the management of patients with type 2 DM. Based on the traditional guidelines, patients were not screened nor treated prophylactically unless they were symptomatic, which is defined as having a non-healing wound, frequent infections, sudden weight gain or loss, a HbA1c value greater than 10% in a routine blood test, diabetic neuropathy, and elevated urine protein. A retrospective review of patients' medical records over the last 5 years demonstrated that more than 85% of the patients with type 2 DM were diagnosed late and analysis of data from the months of January through March showed 61.8% of patients had diabetes related complications.

During my investigation, I discovered that to alleviate the problem of treatment failure in the target population two things must be done. First, was the establishment of standards of care based on the AACE and the ACE diabetes management algorithm. Secondly, an educational intervention to educate patients about T2DM, its disease process, and complications needed to be developed. The results of the pre-and posttest diabetes education program showed an increase of 34.14%. The project will be disseminated via electronic media to similar community-based clinics, pharmaceutical stores, the Florida diabetes prevention center, and Florida public health center in Destin.

The manuscript will be developed for consideration for publication in the *American Journal of Diabetes (AJD).*

Analysis of Self

Scholar

According to the AANC (2006) development and evaluation of new practice approaches based on nursing theories and theories from other disciplines are some of the core elements of a DNP-prepared nurse. As a DNP-prepared nurse scholar, I am equipped to assess an organization or a system for potential improvements or changes that could enhance the productivity of the organization and the population served. It is also vital for me as an agent of change and empowerment to develop and implement health promotion and disease prevention activities for individuals, aggregates, and population. Health promotion and population health are imperative for positive global wellbeing and health outcomes (Kumar & Preetha, 2012).

Practitioner

Organizational and systems leadership for quality improvement and systems thinking is another key component of a DNP prepared practitioner (AANC, 2006). I firmly believe that standardization of practice based on accredited guidelines is imperative to achieve universal population positive health outcomes.

Long-Term Goal

My long-term goal as a DNP-prepared nurse is to be actively involved in health care politics and policies. My goal is to start with my local constituency and then continue to Congress. Health care policy for advocacy in health care is another essential

requirement of a DNP-prepared nurse (AACN, 2006). The ability to facilitate health care services delivery and engagement in practice to address health care needs is imperative (McWilliams, 2009).

My exposure to the population served at the project site had a significant impact on me related to health care policy. The majorities of the patients were of low socioeconomic status and had limited access to health care due to lack of health care insurance. In Destin, Florida where the clinic is located, most of the available employment is either part-time or seasonal. Employees may work as though they are full-time but without full-time benefits because their employment status is part-time. In this case, employers have no obligation to provide those employees with medical insurance because they are considered part-time. Non-profit clinics such as my project site are left to bridge the gap. This experience has inspired to encourage other scholars to get involved in politics that could influence change in healthcare legislation.

Lack of health insurance has been identified as the major reason preventing adults from seeking health care in a timely manner. They have less access to recommended care, receive poorer quality of care, and experience worse health outcomes than insured adults (McWilliams, 2009). According to the AACN (2006), political activism and commitment to policy development are central elements of professional nursing practice. As a DNP graduate I am equipped with the ability to assume a broad leadership role on behalf of the population served as well as the nursing profession to influence change in terms of health disparities, cultural sensitivity, ethics, the internationalization of health care concerns,

access to care, quality of care, health care financing, and issues of equity and social justice in the delivery of health care.

My ability to engage in leadership that integrates and institutionalizes evidence-based clinical prevention and disease management is indispensable. As a captain and element leader in the United States Air Force (USAF) and a clinical primary care provider, my leadership skills have prepared me to be one of the best in the nursing profession. These experiences have also paved the way for my ongoing professional, leadership, and scholarly growth.

Project Manager

Even though the process of project implementation could be very challenging, it is vital to successful implementation of a change into practice. According to the AACN (2006), clinical prevention and population health for improving the nation's health is one of the academic requirements for the DNP. Acquired clinical knowledge became the driver for me to assess the clinic's needs related to treatment failure in patients with T2DM at the project site. Identification of the clinical problem and the stakeholders were critical elements of the project. Involvement of the representatives from the target population is not only essential to create a sense of connection and ownership of the program among the target population, but also promote support for the implementation, acceptance, and sustainability of the programs (Hodges & Videto, 2011). Having a strategic plan is a critical part of project development and implementation (ASCO, 2009). The process may become cumbersome along the way and one may not be able to absolutely control the future of the program at that point but having a strategic plan could

help establish a sense of re-direction and the ability to maximize the available options to influence the environment and attain the project outcome (ASCO, 2009).

Completion of the Project

Challenges and Solutions

Like any other project, the completion of the DNP project was not without challenges. One of the challenges faced during the execution of the project was choosing the right topic. As a provider, I knew I wanted to develop a project related to health promotion and disease prevention because most of the chronic diseases that I deal with at the clinic can be prevented with effective and efficient intervention. I had numerous ideas, but the prevention of T2DM in individuals at risk became clear to me due to my personal life experience with diabetes. The need to focus on the target population became stronger when I got to my clinical site. I have experienced cases of treatment failure in my own practice, but it was nothing compared to what I saw at the clinical site. I started exploring the literature to enquire more about the clinical problem and about what can be done to alleviate it.

The review of the literature was another challenge that I faced during the project. I used the databases PubMed, MEDLINE, CINHAL, NIH, CDC, and the Cochrane Library via Walden University. It took me about one week to sort through about 2800 articles generated by my initial search to obtain the specific literatures that support my topic. At the end the result of the literature review gave me more confidence that I was in the right direction because of the numerous existing studies that supported the topic.

Choosing the right methodology and theoretical framework was another challenge. Although, I had an insight of what my project would be, I was unsure of my method of data collection, how to evaluate the data, and how to theoretically present the information. Materials from my research class such as McEwin and Wills (2014) and others were used to overcome the barrier. Another challenge that I faced during the DNP project was finding participants and avenues to perform the diabetes education. Contacting the potential participants to participate in the project was harder than I anticipated. The organization's director and the entire staff were very supportive, and they helped me throughout the process.

Insight Gained on the Scholarly Journey

Perseverance and dedication are the most important insight that I gained from my scholarly journey. During my journey, I work as a full-time parent, active military personnel, and as a clinical provider. Work and family life together can be very challenging and become much more challenging when combined with full-time academic work. They could be very overwhelming but having a very dedicated mentor is what made the difference. Like a marathon runner, sometimes I felt like giving up, but I always found the courage to continue until I reached the finish line.

Summary

The first purpose of the project was utilization of the diabetes algorithm as the standardized guidelines of care for patients at high risk of developing T2DM to increase the provider's initiation of early treatment in the target population. A review of the EMR over 3-month period revealed an average of 61.8% in diabetes-related complications

among the patients diagnosed with T2DM in the last 24 months. These are conditions that could have been prevented if treatment was initiated earlier. It was discovered that most providers were not aware that T2DM could be existing in an individual for up to 7 years before the presentation of the first sign and symptom. The lack of awareness of the disease process by clinicians leads to delay in diagnosis and eventually resulted in treatment failure in the target population.

The second purpose was to increase the awareness of patients at risk of developing T2DM about the disease process and its management. The analysis of the diabetes education showed a significant means difference of 34.14 from the pre-education and paired difference yielded a statistically significant $p < 0.05$. An ongoing diabetes education program is imperative in the target population to eliminate the knowledge deficit related to the disease process and its complications. The ability of the target population to understand that T2DM is a very complex disease that does not affect only one area of the body, but every part of the body, will heighten their self-care management treatment regimen. Most patients are gripped with fear of the unknown upon diagnosis and are not able to comprehend the potential impacts of the disease onset in their lives. Genetic awareness of the disease by individuals with strong family history and early intervention to prevent overt diabetes cannot be overemphasized. The goals of the DNP project were attained at the end of the project. The patients' knowledge of T2DM was enhanced and the providers' use of the diabetes management algorithm as standard of care has led to increase in early diagnosis and prompt intervention, thereby alleviating treatment failure in the target population.

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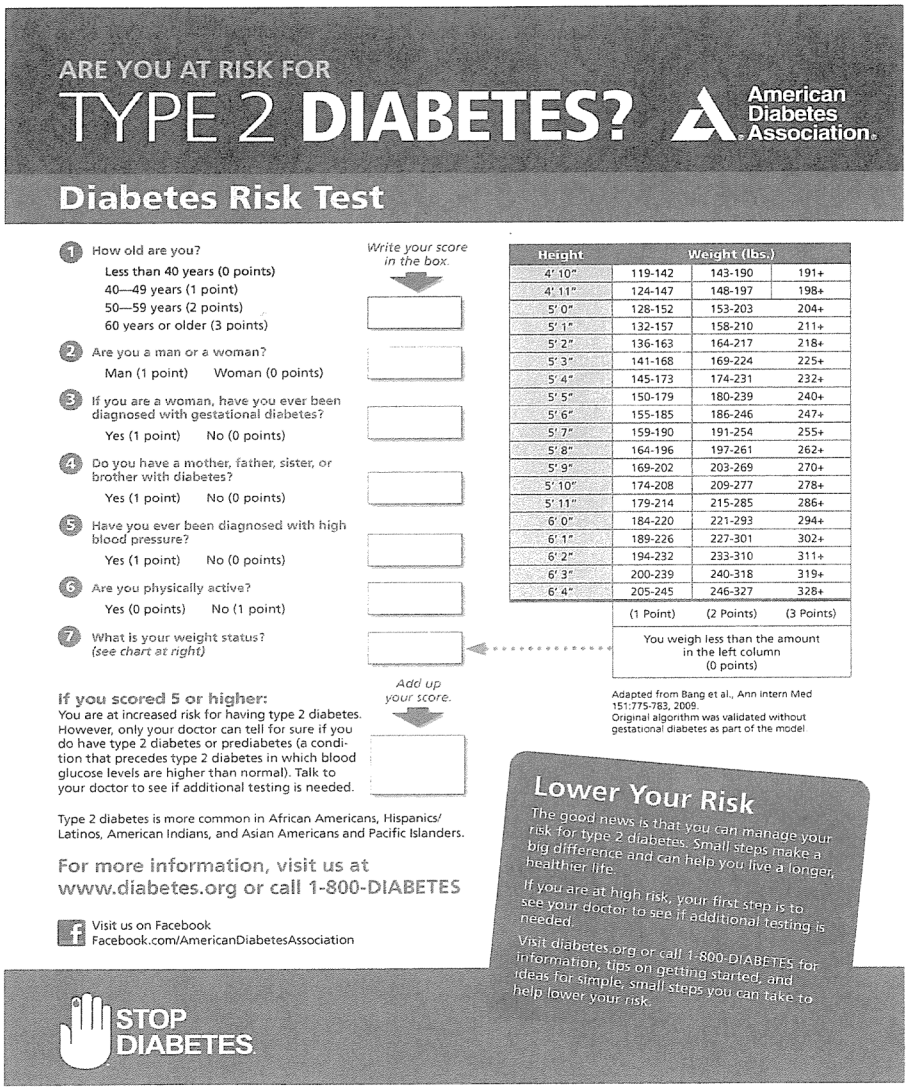
Appendix A

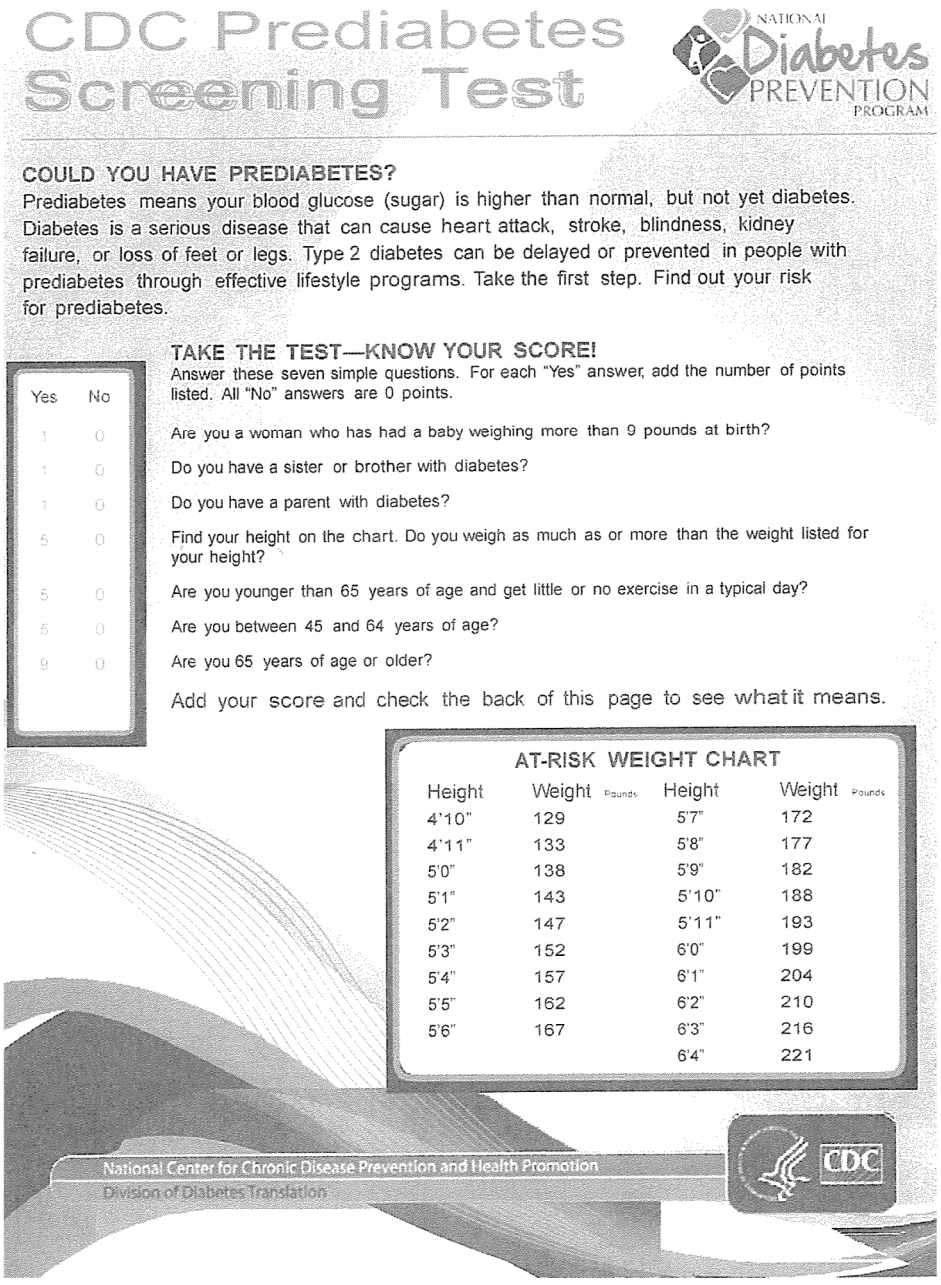
Patient Risk Assessment

Patient risk assessment



Appendix B

Prediabetes Screening Test



CDC Prediabetes Screening Test

NATIONAL Diabetes PREVENTION PROGRAM

COULD YOU HAVE PREDIABETES?

Prediabetes means your blood glucose (sugar) is higher than normal, but not yet diabetes. Diabetes is a serious disease that can cause heart attack, stroke, blindness, kidney failure, or loss of feet or legs. Type 2 diabetes can be delayed or prevented in people with prediabetes through effective lifestyle programs. Take the first step. Find out your risk for prediabetes.

TAKE THE TEST—KNOW YOUR SCORE!

Answer these seven simple questions. For each "Yes" answer, add the number of points listed. All "No" answers are 0 points.

Yes	No	
1	0	Are you a woman who has had a baby weighing more than 9 pounds at birth?
1	0	Do you have a sister or brother with diabetes?
1	0	Do you have a parent with diabetes?
5	0	Find your height on the chart. Do you weigh as much as or more than the weight listed for your height?
5	0	Are you younger than 65 years of age and get little or no exercise in a typical day?
5	0	Are you between 45 and 64 years of age?
9	0	Are you 65 years of age or older?

Add your score and check the back of this page to see what it means.

AT-RISK WEIGHT CHART

Height	Weight Pounds	Height	Weight Pounds
4'10"	129	5'7"	172
4'11"	133	5'8"	177
5'0"	138	5'9"	182
5'1"	143	5'10"	188
5'2"	147	5'11"	193
5'3"	152	6'0"	199
5'4"	157	6'1"	204
5'5"	162	6'2"	210
5'6"	167	6'3"	216
		6'4"	221

National Center for Chronic Disease Prevention and Health Promotion
Division of Diabetes Translation

CDC

Appendix C

Follow Up Letter Template

Letter template

Use/adapt these templates to conduct efficient follow-up and referral with patients who have been identified as having prediabetes

<<YOUR LETTERHEAD>>
<<ADDRESS>>
<<PHONE NUMBER>>

<<DATE>>

<<PATIENT NAME>>
<<PATIENT ADDRESS>>

Dr. Mr./Mrs. <<PATIENT LAST NAME>>,

Thank you for being a patient of the <<PRACTICE NAME HERE>>. We are writing to tell you about a service to help make your health better.

Based on our review of your medical chart, you have a condition known as prediabetes. This means your blood sugar is higher than normal, which increases your risk of developing serious health problems including type 2 diabetes, as well as heart disease and stroke.

We have some good news. Our office wants you to know that you may be eligible for a diabetes prevention program run by our partners, <<NAME OF PROGRAM PROVIDER>>. This program is proven to reduce your risk of developing diabetes and other health problems.

We have sent a referral to <<NAME OF PROGRAM PROVIDER>> and someone will call you to discuss the program, answer any questions you may have and, if you are interested, enroll you in the program.

Please feel free to give <<NAME OF PROGRAM PROVIDER>> a call at <<PHONE NUMBER>>.

–OR–

We have sent a referral to <<NAME OF PROGRAM PROVIDER>> and we urge you to call <<PHONE NUMBER>> to learn more about the program and enroll.

We hope you will take advantage of this program, which can help prevent you from developing serious health problems.

Sincerely,

Dr. <<PHYSICIAN LAST NAME>>

Appendix D

Pre Test/Post Test questions

The purpose of this pre-test/post-test is to evaluate whether this diabetes education program improved the participants' knowledge of diabetes, its risk factors, and complications related to the disease.

1. What do you understand by diabetes?
   a. Too much sugar in the body
   b. Too much sugar in the blood
   c. None of the above
   d. I do not know
2. How many types of diabetes do exist?
   a. 2.
   b. 1.
   c. I do not know
3. What conditions put one at risk for diabetes?
   a. Age
   b. Obesity
   c. Family history of diabetes
   d. All the above
   e. None of the above
4. Identify other medical conditions that can be developed due to diabetes.
   a. Blindness
   b. Heart disease
   c. Loss of extremities
   d. Kidney failure
   e. All the above
   f. None of the above
5. What can you do when you think you are at risk
   a. Do nothing
   b. Talk to your doctor
   c. Call your pastor
6. Can diabetes be prevented before it starts in people at high risk?
   Yes □ No □
7. How can it be prevented?
   a. Eat little or no food
   b. Exercise every day

c. Make healthy choice of food and increase physical activities
d. Follow your doctor's treatment plan
e. c & d

8. How often does your doctor need to check your A1C when you are on medication?
   a. Not at all
   b. Every six months
   c. Every three months.
9. How do you know when your blood sugar is too high?

   a. Drinking a lot
   b. Urinating a lot
   c. Mouth feels like cotton
   d. Losing weight for no reason
   e. Feeling tired all the time
   f. All the above
   g. None of the above
10. What will you do when you feel that your blood sugar is high?

    a. Call your doctor
    b. Do nothing
    c. Call your pastor
11. What will you do when you feel that your blood sugar is too low?

    a. Do nothing
    b. Drink juice like orange juice
    c. call your doctor
    d. b & c

(NDEI.org, n.d)

Appendix E

Diabetes Education: English Version

Appendix F

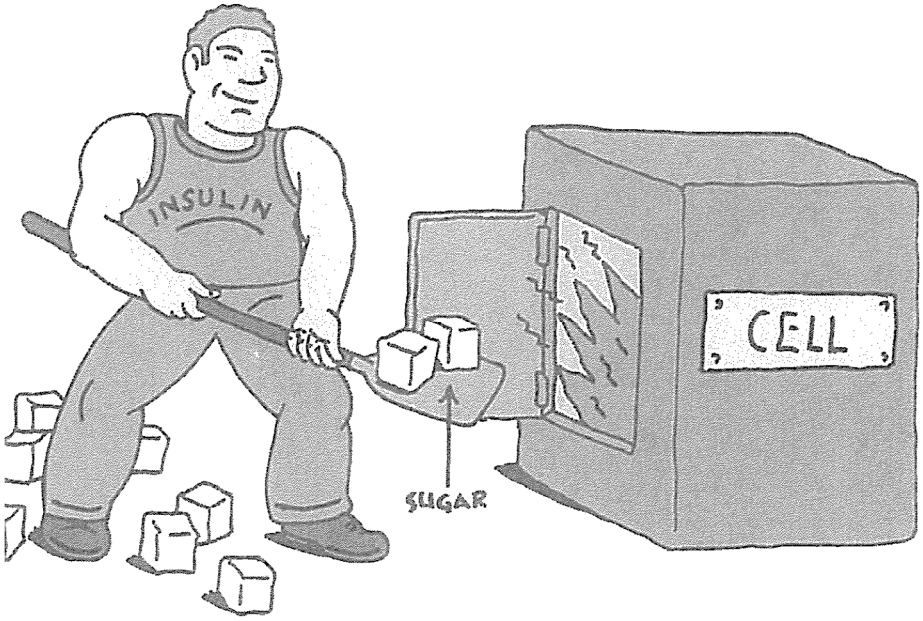
Definition of Diabetes

Diabetes means you have too much sugar in your blood. The medical word for sugar in the blood or blood sugar is *glucose*, but most people just say sugar.

Your body changes most of the food you eat into sugar (glucose). Sugar travels in your blood to all the cells in your body. Your body makes a chemical called *insulin* to help sugar move from your blood into your cells. Your cells need sugar to give you energy and keep you healthy.

When you have diabetes:

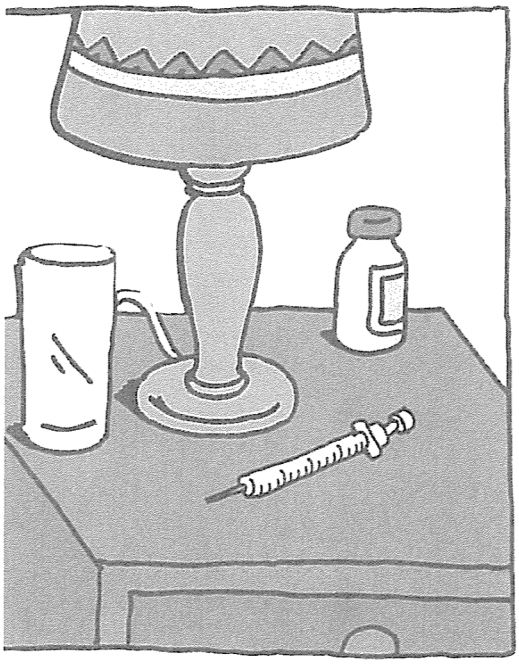
- your body does not make insulin
- your body does not make enough insulin, or
- the insulin you make doesn't work right



Appendix G

Types of Diabetes

Blood sugar levels stay high if you don't have enough insulin to move sugar from your blood into your cells. Over time, high blood sugar levels that are not lowered cause diabetes.



The most common types of diabetes are type 1 and type 2.

Type 1 diabetes

In type 1 diabetes, the body cannot make insulin. Type 1 diabetes occurs more often in children and young adults than in older adults. People with type 1 diabetes must inject insulin to control their blood sugar.

Appendix H

Type 2 Diabetes

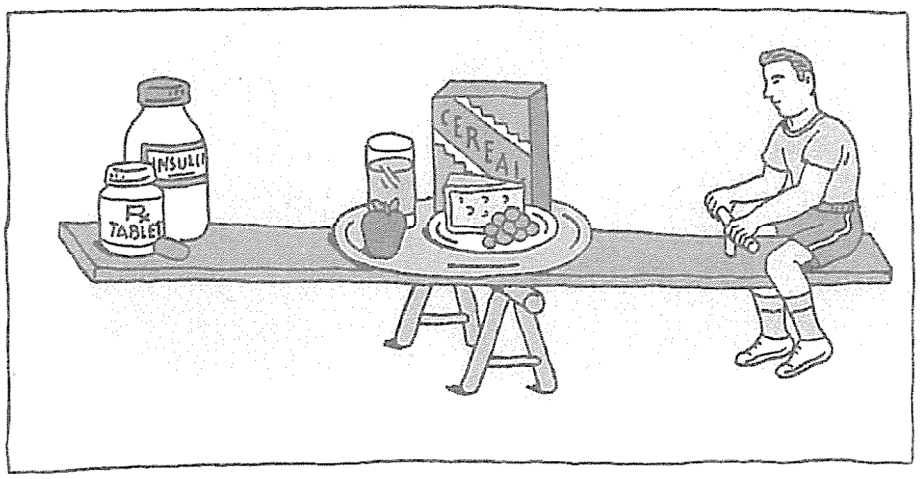
Type 2 diabetes

In type 2 diabetes, the body can make some insulin, but not enough. Or, the insulin the body makes does not work right.

Type 2 diabetes often starts in adults, but children can have it too. It is more common in overweight people or if someone in the family has diabetes.

Type 2 diabetes is controlled by balancing when and how much you eat with:

- how active you are
- your weight, and
- the diabetes medicine you take



Appendix H

High Blood Glucose

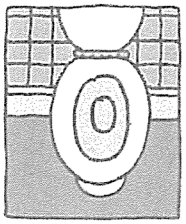
High blood sugar

Because insulin isn't working right, sugar in your blood may spill into your urine. High blood sugar and sugar in the urine may cause problems, such as:

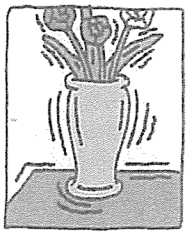
feeling tired

weight loss

feeling thirsty

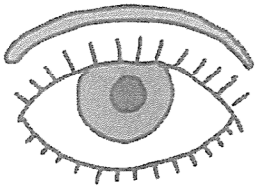


a need to urinate often



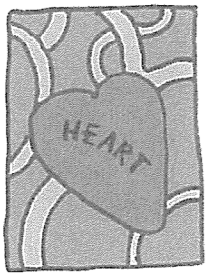
blurry vision

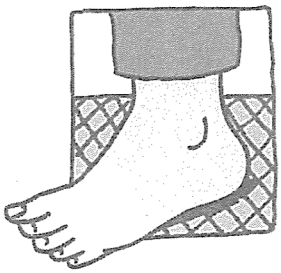
Controlling diabetes is important. You can have serious health problems when your blood sugar is out of control, such as:



eye problems – even blindness

heart disease





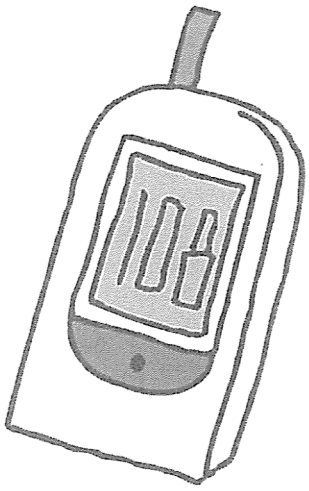
foot problems – even losing a foot or leg

Appendix J

Blood Glucose and Ketone Tests

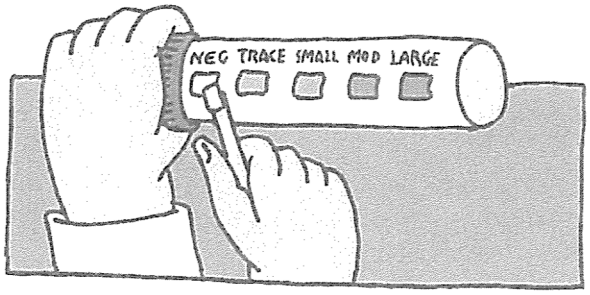
Blood sugar and ketone tests

You can have a high blood sugar problem but not know it. That's why it is important to check your blood sugar often.



Most people check their blood sugar by testing a drop of their blood in a special meter.

Another important blood test is the A1C. This test shows your average blood sugar level over the past 2 to 3 months.



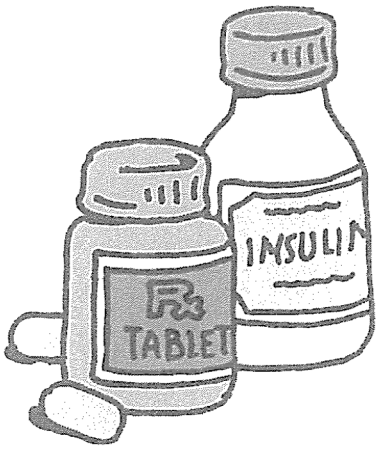
A urine test is used most often to tell if you have ketones in your urine. Ketones mean your blood sugar level is very high. Call your doctor right away if you have ketones. You may be having a medical emergency.

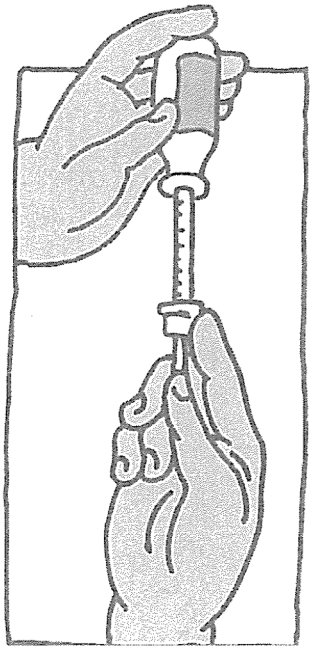
Appendix K

Diabetes Medications

Medicine for diabetes

Most people with diabetes take medicine to control their blood sugar. Diabetes pills work in different ways to help lower blood sugar. If you take a pill for diabetes, take it at the same time every day. And learn what to do if you forget to take your pill. You don't want to take a missed pill with your next pill.





If you take insulin, you will learn how, where, and when to inject it. Many people use a needle and syringe to inject insulin. Insulin pens and insulin pumps are also used. It is important to know where to keep your insulin and how long you can use it. Call your doctor or health clinic right away if you have questions about using insulin.

Appendix L

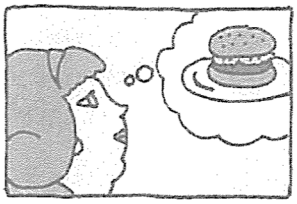
Changes in Blood Glucose Level

Low blood sugar

Insulin or pills help control diabetes but can sometimes cause low blood sugar. This can happen if you:

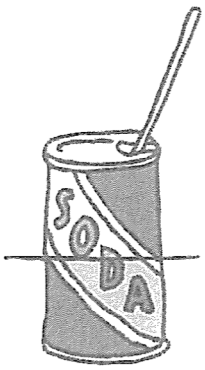
- ☐ are too active
- ☐ skip a meal
- ☐ don't eat enough
- ☐ take too much medicine

The signs or symptoms of low blood sugar include

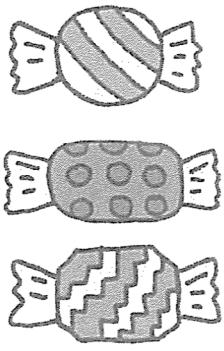




feeling shaky, dizzy, sweaty, upset, hungry, or tired.

If you have a low blood sugar problem, it's important to eat or drink 15 grams of a fast-acting food high in sugar right away, such as:



- ☐ 1/2 can of regular (not diet!) soda
- ☐ 1 tablespoon (or two packets) of real sugar
- ☐ 3 hard candies you can eat quickly



Appendix M

Blood Glucose Maintenance Goals

Blood sugar goals

Your doctor will help you decide the blood sugar goals that are best for you. Write your goals in the table below.

Blood Sugar (Glucose) Goals*

Time	Adults With Diabetes	Your Goal
Before Meals	80 to 130 mg/dL	
2 Hours After Meals (postprandial)	Less than 180 mg/dL	
A1C	7% or less	

*American Diabetes Association guidelines (plasma values)

Before you leave the doctor's office or clinic, be sure you understand:

- ☐ how to use your meter
- ☐ what your blood test results mean, and
- ☐ what your blood sugar goals are

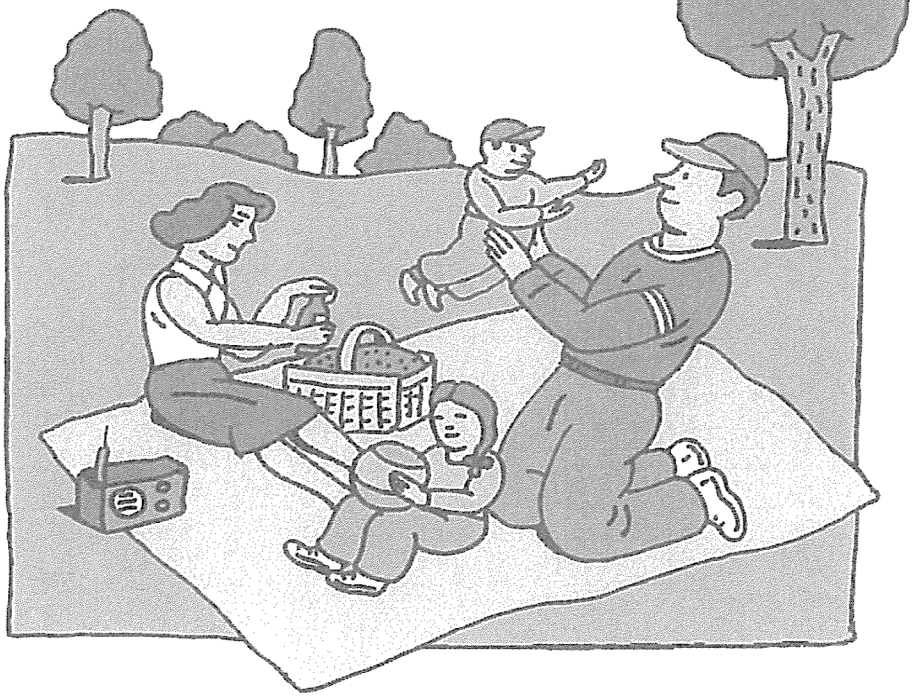
Call your doctor's office anytime you have questions about how to control your diabetes.

Appendix N

Support System

It can be hard at times to do the things you need to do to control diabetes. Join a support group. Tell your family and friends what they can do to help.

Diabetes cannot be cured, but it can be controlled. Eat healthy foods every day, be active often, and take your medicine – if you need to. You can lead a healthy life with diabetes!



Always talk to your doctor before making any changes in your diabetes treatment plan.

Appendix O

Diabetes Education: Spanish Version

Appendix P

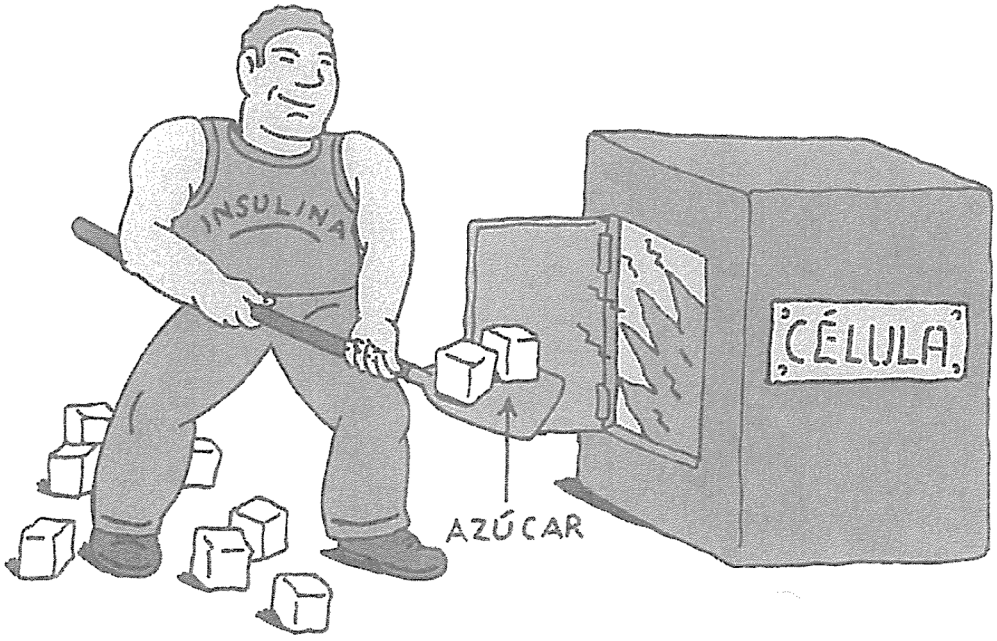
Definicion De La Diabetes

La diabetes quiere decir que usted tiene demasiada azúcar en la sangre. La palabra médica para azúcar en la sangre es *glucosa*, pero la mayoría de las personas dicen simplemente azúcar.

Su cuerpo convierte en azúcar (glucosa) la mayor parte de los alimentos que usted come. El azúcar viaja en su sangre a todas las células de su cuerpo. Su cuerpo produce una sustancia química llamada *insulina* para ayudar a que el azúcar se mueva de su sangre a sus células. Sus células necesitan azúcar para darle energía y mantenerlo saludable.

Si usted tiene diabetes:

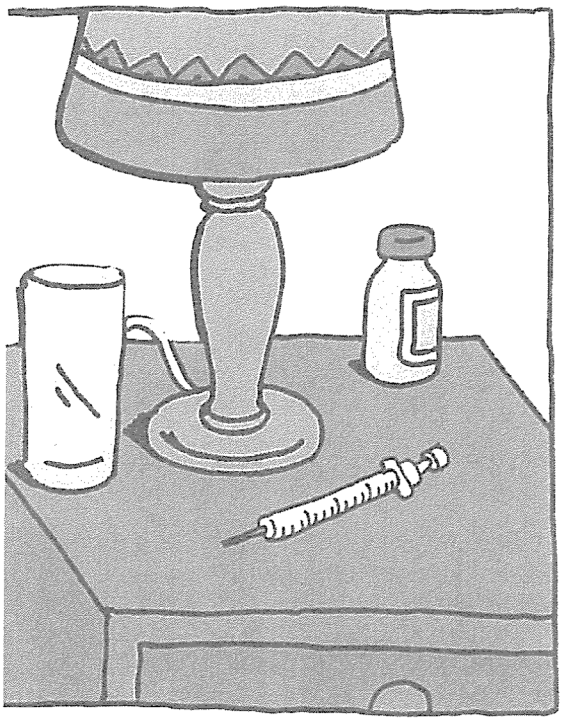
- su cuerpo no produce insulina
- su cuerpo no produce suficiente insulina, o
- la insulina que produce no funciona correctamente



Appendix Q

Tipo De Diabetes

Los niveles de azúcar en la sangre se mantienen altos si usted no tiene suficiente insulina para mover el azúcar de su sangre a sus células. Con el tiempo, si los niveles altos de azúcar en la sangre no bajan, causan diabetes.



Los tipos más comunes de diabetes son tipo 1 y tipo 2.

Diabetes tipo 1

En la diabetes tipo 1, el cuerpo no puede producir insulina. La diabetes tipo 1 ocurre más a menudo en niños y adultos jóvenes que en adultos mayores. Las personas con diabetes tipo 1 tienen que inyectarse insulina para controlar su azúcar en la sangre.

Appendix R

Type 2 Diabetes

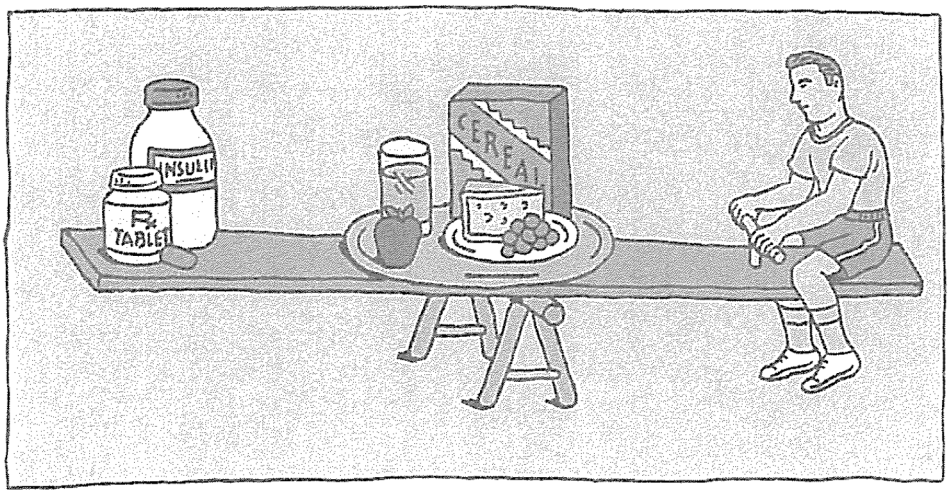
Diabetes tipo 2

En la diabetes tipo 2, puede que el cuerpo produzca algo de insulina, pero no lo suficiente, o la insulina que el cuerpo produce no funciona bien.

La diabetes tipo 2 a menudo comienza en adultos, pero los niños también pueden tenerla. Es más común en las personas con sobrepeso o si alguien de la familia tiene diabetes.

La diabetes tipo 2 se controla balanceando cuándo y cuánto usted come con:

- cuánta actividad hace
- su peso, y
- la medicina para la diabetes que toma



Appendix S

Alto Nivel De Glucose En Sangre

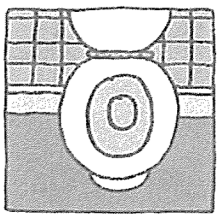
Nivel alto de azúcar en la sangre

Como la insulina no funciona bien, el azúcar en su sangre puede llegar hasta la orina. Un nivel alto de azúcar en la sangre y azúcar en la orina pueden causar problemas, como:

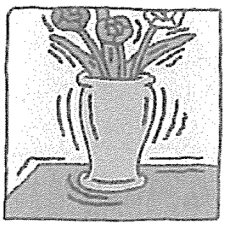
sentirse cansado

pérdida de peso

tener sed

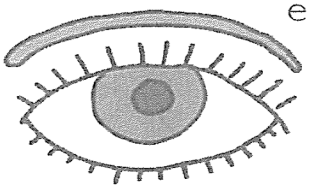


necesidad de orinar con frecuencia



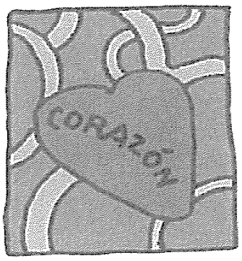
visión borrosa

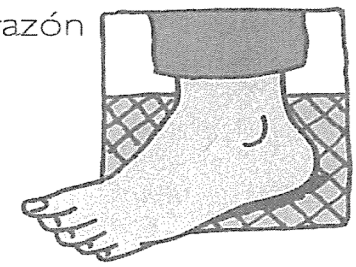
Controlar la diabetes es importante. Usted puede tener serios problemas de salud si su azúcar en la sangre está fuera de control, como:



problemas de los ojos – hasta ceguera

enfermedad del corazón





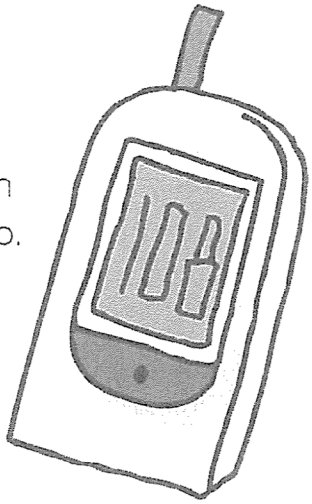
problemas de los pies – hasta perder un pie o una pierna

Appendix T

Pruebas De Glucosa En Sangre y Cetonas

Pruebas de cetonas y azúcar en la sangre

Usted puede tener un problema de nivel alto de azúcar en la sangre y no saberlo. Por eso es importante revisar a menudo su azúcar en la sangre.



La mayoría de las personas revisan su azúcar en la sangre haciendo una prueba con una gota de sangre en un medidor especial llamado glucómetro.

Otra prueba de sangre importante es la A1C. Esta prueba muestra su nivel promedio de azúcar en la sangre durante los pasados 2 a 3 meses.

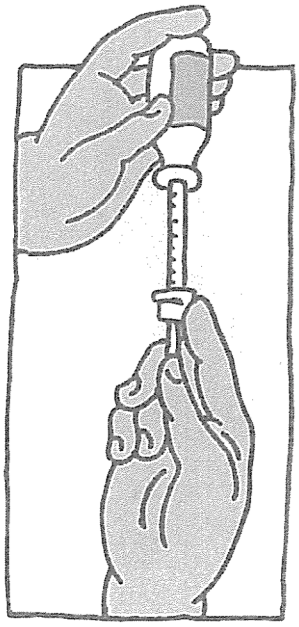
Una prueba de orina se usa con más frecuencia para saber si tiene cetonas en la orina. Las cetonas indican que su nivel de azúcar en la sangre está demasiado alto. Llame de inmediato a su médico si tiene cetonas. Puede que tenga una emergencia médica.

Appendix U

Medicamentos Para La Diabetes

Medicina para la diabetes

La mayoría de las personas con diabetes toman medicamentos para controlar su azúcar en la sangre. Las píldoras para la diabetes funcionan de distintas maneras para ayudar a bajar el azúcar en la sangre. Si usted toma píldoras para la diabetes, tómelas todos los días a la misma hora y sepa qué hacer si olvida tomársela. No debe juntar la dosis olvidada con la próxima dosis.



Si usa insulina, aprenderá cómo, dónde y cuándo inyectarla. Muchas personas usan una jeringa con una aguja para inyectarse la insulina. También se pueden usar plumas de insulina y bombas de insulina. Es importante saber dónde debe guardar su insulina y por cuánto tiempo puede usarla. Llame a su médico o clínica de salud de inmediato si tiene preguntas o dudas acerca de cómo usar la insulina.

Appendix V

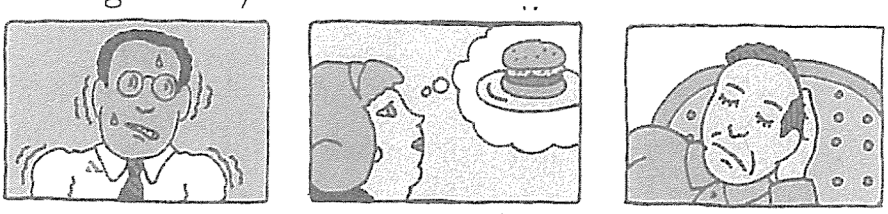
Cambios En La Glucosa En La Sangre

Nivel bajo de azúcar en la sangre

La insulina o las píldoras ayudan a controlar la diabetes, pero a veces pueden causar que baje mucho el nivel de azúcar en la sangre. Esto puede ocurrir si usted:

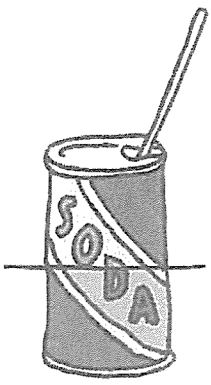
- ☐ está muy activo
- ☐ salta una comida
- ☐ no come lo suficiente
- ☐ toma demasiada medicina

Las señales o síntomas de un nivel bajo de azúcar en la sangre incluyen

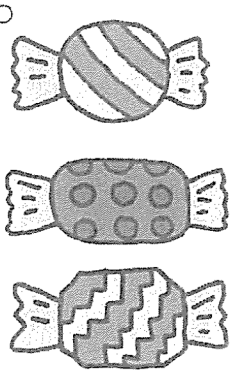


sentirse tembloroso, mareado, sudoroso, molesto, hambriento o cansado.

Si tiene un problema de nivel bajo de azúcar en la sangre, es importante que coma o beba enseguida 15 gramos de un alimento alto en azúcar de acción rápida, como:



- ☐ 1/2 lata de refresco de soda regular (¡no de dieta!)
- ☐ 1 cucharada (o dos sobresitos) de azúcar regular
- ☐ 3 caramelos duros que pueda comer rápido



Appendix W

Objetivos De Mantenimiento De La Glucosa En Sangre

Metas de azúcar en la sangre

Su médico le ayudará a decidir las metas de azúcar en la sangre más adecuadas para usted. Escriba sus metas en la tabla a continuación.

Metas de azúcar (glucosa) en la sangre*

Hora	Para personas con diabetes	Su meta
Antes de las comidas	80 a 130 mg/dL	
2 horas después de comer (posprandial)	Menos de 180 mg/dL	
A1C	7% o menos	

*Guías de la American Diabetes Association (valores en plasma)

Antes de salir de la oficina del médico o la clínica, asegúrese de saber:

- ☐ cómo usar su glucómetro
- ☐ qué significan los resultados de su prueba de sangre, y
- ☐ cuáles son sus metas de azúcar en la sangre

Llame a la oficina de su médico siempre que tenga preguntas acerca de cómo controlar su diabetes.

Appendix X

Sistema De Apoyo

Puede ser difícil hacer todas las cosas necesarias para controlar la diabetes. Únase a un grupo de apoyo. Enseñe a sus familiares y amigos qué pueden hacer para ayudarle.

La diabetes no puede curarse, pero sí puede controlarse. Coma alimentos saludables todos los días, manténgase activo a menudo y tome sus medicamentos, si los necesita. ¡Puede vivir una vida saludable con diabetes!

Hable siempre con su médico antes de efectuar cualquier cambio en su plan para el tratamiento de la diabetes.