Happy Feet in a Rural Clinic: A Diabetic Foot Education Intervention

by

Carmencita Abood

American Sentinel University

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Carmencita S. Abood

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Capstone Chair: Barbara Pate, Ph.D., MPH, R.N.
Member: Sandra Cleveland, Ph.D., MSN, R.N.

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Abstract

Rural Healthy People 2010 report indicated that diabetes was more pervasive in non-metropolitan areas than in central cities and more commonplace in the Southeast and the Southwest regions of the United States due to complex set of factors such as low socioeconomic status among many rural residents, a high proportion of racial or ethnic minorities, and aging populations that were predominant in rural areas. The need for innovative, low literacy education material that type 2 diabetes mellitus (T2DM) patients in a rural clinic is imperative. The purpose of the capstone project was to determine the effectiveness of a patient-centered diabetes foot education intervention designed to improve patients’ knowledge, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention. A quasi-experimental design was used. This design avoided the additional steps required with random assignment to study arms, as well as the potential ethical concerns involved in substituting a less effective nursing intervention for one group of study participants. The Statistical Package for the Social Sciences (SPSS) 20.0 was used to analyze the data. The variables of interest included a two-level categorical independent variable, “Education Intervention” (Pre/Post) and a continuous dependent variable “PIN Total Scores”. Findings from this project proved the effectiveness of a patient-centered diabetes foot ulcer prevention education intervention as a pedagogical method of increasing patients’ knowledge of preventing foot ulcer formation.

Keywords: Type 2 Diabetes Mellitus, Peripheral Neuropathy, Diabetic Foot Ulcer
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## Table of Contents

Abstract ........................................................................................................................................... 2  
Acknowledgments........................................................................................................................... 3  
List of Tables .................................................................................................................................. 7  
List of Figures .............................................................................................................................. viii  

CHAPTEIR 1: INTRODUCTION ................................................................................................... 9  
  Problem Statement ...................................................................................................................... Error! Bookmark not defined.2  
  Background ................................................................................................................................. Error! Bookmark not defined.3  
  Purpose ....................................................................................................................................... Error! Bookmark not defined.9  
  Significance of the Study ............................................................................................................. Error! Bookmark not defined.0  
  The Nature of the Project ............................................................................................................ Error! Bookmark not defined.2  
  Hypothesis or Research Question(s) ....................................................................................... Error! Bookmark not defined.4  
  Theoretical Framework ............................................................................................................. 24  
  Definitions ................................................................................................................................. 26  
  Scope and Limitations................................................................................................................ 27  
  Summary ................................................................................................................................... 29  

CHAPTEIR 2: LITERATURE REVIEW ...................................................................................... 30  
  Introduction ................................................................................................................................. 30  
  Conclusion ................................................................................................................................ 44  
  Summary ................................................................................................................................... 45  

CHAPTEIR 3: METHODS ............................................................................................................ 47  
  Introduction ................................................................................................................................. 446  
  Project Design ............................................................................................................................. Error! Bookmark not defined.4  
  Instruments ................................................................................................................................ 49  
  Data Collection, Management and Analysis Plan ..................................................................... 52
List of Tables

Table 1. Participants’ Demographics ................................................................. 62
Table 2. Pre-Test PIN Subscales ................................................................. 64
Table 3. Post-Test PIN Subscales ................................................................. 65
Table 4. Paired Samples Test ................................................................. 67
Table 5. Paired Samples Statistics ............................................................. 68
Table 6. Correlation .................................................................................. 69
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Pender's Health Promotion Model</td>
<td>26</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Histogram of Pre PIN Total Score</td>
<td>69</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Histogram of Post PIN Total Score</td>
<td>70</td>
</tr>
</tbody>
</table>
CHAPTER 1: INTRODUCTION

Introduction

Diabetes is a chronic and incurable medical condition that can affect multiple organ systems when not properly managed. It is marked with high levels of blood glucose that create a cluster of symptoms otherwise known as diabetes mellitus (DM). Diabetes is a medical condition that causes blood glucose (sugar) levels to be elevated due to a deficiency in insulin production, insulin action, or a combination of both (World Health Organization, 2015). Diabetes has become a menacing and growing global health challenge, costing an estimated US$548 billion worldwide on approximately 382 million people who are diagnosed with the disease in 2013 (Yuncken, 2014). In the U.S., 25.8 million Americans are diagnosed with diabetes, 79 million are with pre-diabetes and are at high probability of acquiring the disease in the next decade; and one in three American children born in 2000 are likely to acquire diabetes in their lifetimes (Fradkin, 2012).

Diabetes is a chronic disease that necessitates self-management and ongoing medical care to prevent, delay, and manage debilitating complications. Early onset of diabetes complications such as diabetic neuropathy can be identified by assessing markers which if implemented early could potentially delay onset of diabetic foot disease (ADA, 2010). The development of foot ulcer and/or amputation is described as “trilogy” of risk factors which are neuropathy, peripheral arterial disease (PAD), and increased susceptibility to infection (Wilson & Lawrence, 2013). The quality of diabetes care in the rural communities remain less propitious and many diabetic patients do not receive the established standards of care such as foot screenings and diabetic foot prevention education which contribute to incidence in foot ulcer formation and amputations (Agency for Healthcare Research and Quality [AHRQ], 2008). Many diabetic patients do not
receive the established standards of care such as foot screenings which contribute to foot ulcer and further foot complications including amputations.

People with diabetes are at risk of developing complications that contribute to substantial morbidity and mortality. In 2011, the American Association of Diabetes Educators (AADE) convened in Reducing Risks Symposium to develop practical advice for diabetes educators and other members of the diabetes care team regarding the reduction of diabetes-related risks. Optimum diabetes management necessitates patients to be proactive in their care with a multidisciplinary team. Diabetes education provides understanding of the disease, its progression and potential complications, direction and encouragement to engage in risk-reduction decisions and self-care. Prevention of diabetes complications is fundamental in the reduction of morbidity and mortality among patients with diabetes hence diabetic education through tight glucose control, dietary changes, lifestyle modifications such as exercise; adherence to medical appointments; compliance to medication regimen, foot care and monitoring are part of the standards of care in managing the disease (Yuncken, 2014).

As a chronic medical condition, diabetes necessitates self-management and ongoing medical care to prevent, delay, and manage debilitating complications. Early onset of diabetes complications such as diabetic neuropathy can be identified by assessing markers which if implemented early could potentially delay onset of diabetic foot disease (American Diabetes Association [ADA], 2010). Neuropathy and ischemia are conditions that can lead to slow healing foot ulcers which if not properly monitored and managed can get infected and result in amputations. Diabetic neuropathy affects the lower extremities in three pathways: sensory, motor, and autonomic. The most common form of neuropathy is sensorimotor which affects
motor and sensory nerves and presents as pain in the toes with proximal progression and subsequent loss of sensation (Wilson & Lawrence, 2013).

The CDC projected comprehensive foot care programs inclusive of annual exams and self-care stratagems can reduce incidence of foot ulcers and amputations by 48%-85% (CDC, 2008). Development of diabetic foot prevention programs reduce incidence of diabetic foot amputations hence it is imperative that individuals with diabetes should receive standard diabetic education and patient education regarding foot hygiene, nail care and proper footwear to reduce the risk of an injury that can lead to ulcer formation. Disparities make diabetes management complex and challenging. Diabetes prevalence is higher among those living in the rural areas than those living in the urban centers of the United States. Ethnic minorities such as the Hispanic population have rates twice than the non-Hispanic population group (Utz, 2008). The 2014 National Diabetes Statistics Report indicated that diabetes is a public health crisis with 29.1 million people or 9.3% of the U.S. population have diabetes with adjusted rate of 8.5% diagnosed Central and South Americans, 9.3% for Cubans, 13.9% for Mexican Americans, and 14.8% for Puerto Ricans (Center for Disease Control [CDC], n.d.). This epidemic is attributed to factors such as longer life span, rising obesity, inactivity, and other factors. In addition to those already diagnosed with diabetes, CDC reported 27.8% of people with diabetes are undiagnosed, on top of this are people with pre-diabetes who have impaired glucose tolerance and are at risk for developing type 2 diabetes mellitus (T2DM).

Rural Healthy People 2010 report indicated that the prevalence of diabetes is higher in non-metropolitan statistical areas (non-MSAs) than in central cities and is even more common in the Southeast and the Southwest regions of the United States (Utz, 2008). The higher prevalence of diabetes among rural residents is attributed to low socioeconomic status, higher percentage of
racial or ethnic minorities, and a higher number of elderly in the rural areas. People in the rural areas have more barriers to health care and this makes it even more challenging to manage an already complex illness such as diabetes. Barriers to health care include cultural beliefs, costs of care, distance and transportation, and limited available specialists and certified diabetes educators. Given the prevalence of diabetes and the barriers to health care among rural populations, it is imperative to identify and provide evidenced based practices and standards of care to health care providers so rural residents receive quality care and the necessary guidance in managing the disease and prevent complications (Utz, 2008).

**Problem Statement**

The CDC reported that comprehensive foot care programs inclusive of annual exams and self-care stratagems can reduce incidence of foot ulcers and amputations by 45%-85% (CDC, 2008) yet the quality of diabetes care remains less than propitious hence many diabetic patients in disparate populations in rural communities do not receive the established standards of care such as foot screenings which contribute to development of complications such as foot ulcer formation and amputations (Agency for Healthcare Research and Quality [AHRQ], 2008).

Lower limb morbidity reduction necessitates improved foot care education which entails earlier detection of patients at risk through screening; patient education based on recommended foot self-care practices, and access to care. Assessment of foot care quality is necessary to identify improvement opportunities that foster maintenance of healthy feet for patients with diabetes among the rural populations. Inconsistent diabetic patient education regarding foot health in a rural population substantiates the need to empower patients with the knowledge necessary to prevent diabetic foot ulceration to the disparate population. Fragmented diabetic
patient education leads to non-compliance, diabetic foot ulcer development and subsequent rise in lower limb amputations.

Patient participation in healthcare process has been established as a significant element for successful disease management (Ishikawa, Takeuchi, & Yano, 2008). Disease management necessitates an all-encompassing, ongoing patient self-care. Health education and information is an important means to assist diabetic patients’ understanding and participation in the management of their disease condition; however, research indicates that many nurses do not have the knowledge to provide evidence-based, patient-centered education on diabetic foot care in rural healthcare settings. Therefore, there is a need to develop and test a diabetes educational program designed to improve patient knowledge and competencies based on the national standards of diabetes foot care and prevention among T2DM patients in a rural health care setting. Developing an educational program based on the established diabetes standards of care in diabetic foot prevention and care is imperative.

**Background**

Based on the 2014 International Diabetes Federation report, there are 387 million people with diabetes and is projected to be 592 million by 2035; 4.9 million deaths in 2014 (one death every seven seconds), $612 billion dollars in health expenditure (IDF, 2014). Diabetes is considered the fourth leading cause of mortality; one of the leading causes of end stage renal failure (ESRF) globally; most common cause of hospitalizations; diabetic peripheral neuropathy (DPN) being the most common predisposing factor leading to foot ulceration (International Working Group on the Diabetic Foot [IWGDF], 2007). Based on the 2014 National Diabetes Statistics Report (NDSR), Diabetes is the 7th leading cause of death in the United States, with 29.1 million Americans diagnosed in 2012. Out of the 29.1 million, 8.1 million were
undiagnosed and 86 million who are age 20 and older had prediabetes, 73,000 diabetes related non-traumatic lower-limb amputations were performed in adults aged 20 years or older who were diagnosed with diabetes (American Diabetes Association [ADA], 2015). The cost of diabetes-related amputations is approximately $3 billion per year or $38,077 per amputation procedure (Amputee Coalition of America [ACA], 2012). In 2012, the United States spent approximately $245 billion total costs of diagnosed diabetes, $176 billion for direct medical costs, and $69 billion in reduced productivity (American Diabetes Association [ADA], 2015).

Type 2 diabetes mellitus (T2DM) is a chronic disease in which the symptoms and complications can progress throughout the course of the disease. One of the complications of T2DM is diabetic neuropathy which results from damage to the peripheral neurons resulting to loss of sensation. The most common component in the pathway to diabetic foot ulceration is peripheral neuropathy (Perry, 2013). This condition coupled with poor blood supply secondary to vascular disease in T2DM makes lower extremities more predisposed to damage with subsequent ulceration. Foot ulcers can become non-healing wounds which if not properly managed can lead to infection followed by gangrene and eventual hospitalization and amputation of the affected limb. Manifestations of peripheral neuropathy in T2DM are discomfort, pain and loss of sensation in the extremities and assessment in primary care settings is usually performed using a 10g monofilament, palpation of distal pulses of the foot and by testing vibration with use of a tuning fork (Perry, 2013).

Diabetic foot complications increase morbidity and mortality of patient with diabetes and the quality of life is greatly impacted through impaired physical functioning, increased health care costs and additional burden on the caregivers (Peterson & Virden, 2013). Based on the Amputee Coalition of America (2009), diabetes-related amputations cost approximately $3
billion per year or $38,077 per amputation procedure (Peterson & Virden, 2013). The price tag cannot be ignored but more importantly, the cost in terms of quality of life of a diabetic amputee is a significant reason to do prevention and early detection of signs of tissue damage, identify risk factors and implement preventive strategies through a routine monthly comprehensive foot examination (ADA, 2010). Prevention of diabetes complications such as diabetic foot ulcer is fundamental in the reduction of morbidity and mortality in patients with diabetes hence diabetic foot education is one of the standards of care in managing the disease (Yuncken, 2014). The Center for Disease Control (2008) reported that diabetes affects nearly 23.6 million Americans. It is a leading cause of adult blindness, lower-limb amputation, kidney disease and nerve damage with two-thirds of people with diabetes die from a heart attack or stroke and is more prevalent among American Indians and Alaska Natives, non-Hispanic blacks, Hispanic/Latino Americans, and Asian Americans (McCleary-Jones, 2011).

The people in rural communities are twice more likely to bear the burden of diabetes as those residing in urban areas (17% versus 7.8%) (CDC, 2008); likewise, this population have poorer access to medical care and lower quality of care compared to urban residents (Disparities in Health Care Quality among Racial and Ethnic Minority Groups, 2008). Improving diabetes care through access to medical care and self-management has become one of the priorities of Rural Healthy People (2010). Peterson and Virden (2013) explained that free clinics and rural health centers become safety nets for this population hence providers of care need to be primed to overcome the challenges of providing care services to diverse and disparate patient populations. Given the devastating impact diabetic ulcers pose on the quality of life of patients and the health care costs of a country, it is crucial for health care providers to identify the at risk
group and to be perceptive to the needs of disparate populations in order to provide effective self-management education.

The prevalence of T2DM is higher in rural communities particularly in the Southeast and the Southwest regions of the United States. With increasing number of people diagnosed with the disease among rural residents, reduction of morbidity and mortality in a more socioeconomically and culturally diverse population is a challenge (CDC, 2010). The insured population and racial and ethnic minority groups is projected to increase with the passage of the Affordable Care Act of 2010 (Institute of Medicine [IOM], 2011). In conjunction with this projection, the Agency for Healthcare Research and Quality (AHRQ) 2010 National Healthcare Disparities Report established that disparities (race, ethnicity, and socioeconomic status) still permeate the American health care system in relation to preventive care, treatment of acute conditions, and management of chronic diseases. These disparate populations are susceptible to adverse health outcomes, health complications, untimely death, diminished quality of life and poor quality of care (AHRQ, 2010). Nurse-managed clinics and rural health centers become safety nets for these populations (Peterson & Virden, 2013).

In establishing the potential effectiveness of prevention, White (2014) indicated that people diagnosed with diabetes who received early intervention have demonstrated a 67 % reduction in lower-limb amputations. Part of the national campaign in prevention and reduction of diabetes related amputations is education and early detection of complications such as peripheral neuropathy. The Center for Disease Control (CDC, 2011) reported approximately 9 million people age 65 or older had diabetes, 30% had Medicare Advantage plans, 70% or 7.6 million of people age 65 and over are in the traditional Medicare programs and out of the 7.6 million only half or 2.8 million see a podiatrist. Conventionally, three quarters of the 7.6 million
with diabetes and on Medicare (5.7 million) have risk factors for diabetic foot ulcer (DFU) making them qualified for therapeutic footwear under the Medicare plan (White, 2014).

Awareness of evidence-based practice models sustains efforts to develop, evaluate, and disseminate paradigms and practices that advance the care of patients with diabetes, reducing the incidence of ulceration and amputations (White, 2014). Prevention and reduction of diabetes-related complications including amputations were agreed in the 1989 European meeting in Italy sponsored by the World Health Organization (WHO) and the International Diabetes Federation (IDF). This was set at 50% for diabetes-related lower limb amputations. A similar declaration was announced for the Americas six years later (Abu Qamar, 2006). Prevention is considered as a strategy that can reduce diabetes-related lower limb amputations hence foot care preventive programs have been introduced both in developed and developing countries however, continued prevalence of diabetic foot ulcers at the global level remains high. The American Diabetes Association (ADA) declares that 15% of the diabetes population will experience foot ulcers during their lifetime. Despite early recognition of the seriousness of this problem and the implementation of a wide range of foot care preventive programs, diabetic foot ulcers (DFU’s) are still a significant problem due to patient noncompliance; the complexity of the disease which requires a multidisciplinary approach which in most cases may not be available in many rural health care settings (Abu Qamar, 2006).

The occurrence of diabetic foot ulcer (DFU) is insidious in nature where in its early stages individuals with T2DM may not practice preventive measures or seek early health advice and may only obtain treatment in the late stages when healing can be challenging or infection has already set in. In the late stages of DFU’s, there is bone and tendon involvement and multidisciplinary health care management will be required. This type of coordination of care may not
be existent in many rural health centers where disparate populations come for health care. The need for preventive measures and integration of diabetic foot education and screening to be implemented at different stages by healthcare providers is imperative. Foot screening is a preliminary examination of the foot using inspection and palpation to identify neuropathic, structural foot deformity and circulatory effects of early stages of diabetes where prevention of occurrence foot ulceration is still feasible.

Diabetic foot complications increase morbidity and mortality of patient with diabetes and the quality of life is greatly impacted through impaired physical functioning, increased health care costs and additional burden on the caregivers (Peterson & Virden, 2013). Based on the Amputee Coalition of America (2009), diabetes-related amputations cost approximately $3 billion per year or $38,077 per amputation procedure (Peterson & Virden, 2013). The price tag cannot be ignored but more importantly, the cost in terms of quality of life of a diabetic amputee is a significant reason to do prevention and early detection of signs of tissue damage, identify risk factors and implement preventive strategies through foot screenings (ADA, 2010). Loss of protective sensation is considered the primary contributing factor in the occurrence of diabetic foot ulceration. The most widespread triad of causes that result in foot ulceration is neuropathy, deformity, and trauma; hence the identification of patients who are at risk is the first step in diabetic foot ulcers prevention (Boulton, Armstrong, Albert, Frykberg, Hellman, Kirkman, & Wukich, 2008).

The primary step towards prevention of DFU is annual foot screening as this can spot individuals who are at risk. Foot screening also provides a baseline in prioritization of care so appropriate care can then be implemented based on the primacies established. If combined with other preventive measures, foot screening can reduce diabetic-foot-related problems however,
despite the awareness of the effects of diabetic foot ulceration and the dissemination of national standards of diabetes care that stress foot screening importance, and it remains underutilized (Abu Qamar, 2006). The underutilization of diabetic foot screening is a health care service delivery challenge. More importantly, people with T2DM and health care professionals need to be cognizant of the importance of foot screening and diabetic foot prevention education.

**Purpose**

The purpose of this study was to determine the effectiveness of a patient-centered diabetes foot education intervention designed to improve patients’ knowledge, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention.

According to the Texas Health and Human Services Commission (THHSC, 2012), diabetes is ranked number one in the number of visits by primary diagnosis and number two in the number of patients with a primary diagnosis and the number of patient diagnosed with the disease is increasing with estimated $18.5 billion in costs during CY2011: $12.3 billion in direct medical costs and $6.2 billion in indirect costs. The significant rise in the number of people affected by diabetes and insufficient healthcare resources makes it increasingly crucial to improve education on the prevention of diabetic foot complications.

The goal of this capstone project was to test the effectiveness of a diabetes educational program, designed to help nurses develop the competencies to provide evidence-based education to increase knowledge for self-management of diabetic foot care inT2DM patients in a rural clinic. A preventive educational component was included to teach diabetic patients the importance of assessing and prompt reporting of warning signs prior to the development of a diabetic foot ulcer. Diabetes complication such as diabetic foot ulceration was a shared challenge
to health care professionals in a rural clinic due to fragmented patient education which resulted in ineffective self-management and potential increase in incidence of diabetic foot disease and subsequent lower limb amputation. The need for a standardized and consistent patient education regarding diabetic foot health substantiated the need to empower patients with the knowledge essential in health promotion and diabetic foot ulcer prevention. Through increased education of diabetic foot care, this intervention met the IOM’s mandate for safe, timely, effective, efficient, equitable, and patient centered care.

**Significance of the Study**

Texas ranks 44th nationally on population health status and health outcomes and this attributed to factors such as high rate of uninsured residents (25 percent), high rate of children living in poverty (26.5 percent), low public health funding ($56 per person), high incidence of infectious diseases (18.4 cases per 100,000 population) and limited availability of primary care physicians (95 primary care physicians per 100,000 population) (Texas Department of State Health Services, 2013). Presently, one in eight adult Texans (approximately 2.2 million people) is diagnosed with diabetes and by 2040 this is expected to go up to 8 million with the elderly and Hispanics as the fastest growing population in the state and most likely to be obese and have diabetes. Diabetes, currently costs the state more than $12.5 billion and one in 10 health care dollars is attributed to the disease (Healthcare Provider Advocacy Hospital Fact, n.d.). The prevalence of diabetes substantially increased with age with 1 in 20 adults in age group 30-44 years compared to 4 in 20 adults in age group 65 years and older. Adults with college or higher level education showed significantly lower prevalence (7.1%) as compared to adults with high school diploma (10.2%) or without high school diploma (11.2%). Among forty-five to sixty-four year olds, the prevalence of diabetes was higher among Hispanic and black (non-Hispanic)
populations than among white (non-Hispanic) population. This difference was increasingly evident as persons aged, with the greatest disparity seen in older Texans (65+) (Texas Department of State Health Services, 2013). These statistical data pointed to the vulnerability of the disparate populations in Texas who are older, poorer and less educated.

Poor socio-economic condition, lack of proper diabetic foot care education, and incorrect footwear were factors associated with the development of diabetic foot ulcers (Jeffcoate et al. 2011). Most foot care education aimed at patients with pre-existing complications of the foot and lower extremities with little or no patient education provided on basic foot care or the prevention of foot ulcerations. Despite awareness that diabetic foot complications could quickly deteriorate, provision of foot health education was not consistent. Effective and consistent provision of preventative foot care education reduced patient morbidity and mortality, utilization of expensive resources, and the risk for amputation (Wu, Driver, James, & Armstrong, 2007). Abu-Qamar (2006) explained that many providers of diabetes did not often perform foot screening for people with diabetes and the lack of adherence to the standards of diabetic care and absence of clear referral pathways for foot care services in rural clinics attributed to the incidence of diabetic foot ulcer.

The capstone project implemented an evidence based education intervention on T2DM patients at the Tomball, Magnolia, Waller (Tomagwa) Healthcare Ministries which serves the rural communities of Tomball, Magnolia and Waller Counties in Texas (Tomagwa Healthcare Ministry, n.d.). Tomagwa is a Christian ministry, funded mainly by donations with 60 percent of patient care provided by volunteers. Tomagwa Ministry does not accept government funding and is not a United Way agency. The ministry impacts different cultures and provides comprehensive family healthcare to a predominantly Hispanic population (Tomagwa Healthcare Ministry, n.d.).
The National Advisory Committee on Rural Health & Human Services (NACRHHS) reported that families in rural communities are poorer and are associated to poorer health (National Advisory Council on Nurse Education and Practice [NACNEP], 2013).

The capstone project provided an educational intervention to patients with type 2 diabetes mellitus (T2DM) patients in Tomagwa clinic. Tomogwa signifies the rural counties of Tomball, Magnolia and Waller (Tomagwa) in Texas. It has a population of 44,367 and meets the current definition of a rural area of less than 50,000 (United States Census Bureau, 2015). Tomagwa clinic foresaw 14,500 uninsured patient visits in 2014. Assuming that these visits would have otherwise resulted in emergency room visits, Tomagwa would have saved service area hospitals an estimated $22.8 million for the fiscal year 2014 (Tomagwa Healthcare Ministry, 2014).

Given the rise in patient population in this clinic, particularly incidence of diabetes, a diabetic clinic was added to the services provided in this facility. Hence, the implementation of an educational intervention on diabetic foot care was timely. The lack of standard diabetic foot assessment and education among diabetic patients in this rural clinic validated the need to embolden these patients with the knowledge essential in prevention and reduction of the incidence of diabetic foot ulcer.

**The Nature of the Project**

The project design served as a road map of how to answer the question or test the hypothesis of the proposed study. The research purpose of this project defined what the appropriate type of design that was used: to determine the effectiveness of a patient-centered diabetes and diabetic foot education intervention designed to improve patients’ knowledge of
peripheral neuropathy, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) score from pre-intervention to post-intervention.

To establish evidence of effectiveness, a quantitative quasi-experimental, equivalent sample design was used to evaluate diabetes peripheral neuropathy knowledge before and after the patients received the diabetes foot care educational intervention. The data generated from quantitative statistics were numbers, developing meaning from the statistical analysis of numerical data obtained from samples and populations with the intent to apply or generalize knowledge from a smaller sample of subjects to a larger target population (Tappen, 2011). Quantitative research method started with a specific theory, either proposed or previously developed, which lead to specific hypotheses that were then quantitatively measured, rigorously analyzed and evaluated according to established research procedures (Keele, 2011).

A formal introduction prior to the education session was established. All participants received a diabetic foot screen for loss of protective sensation and standard information provided by the facilitator. The information provided consisted of oral and written instructions on foot care and the prevention of foot complications associated with diabetes foot care. The module’s oral and written instructions were based on standards from the American Diabetes Association, the American Association of Diabetes Educators, and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Educational materials such as 13 Tips to Happy Feet and the Save the Feet for a Lifetime booklet were the teaching material used during the intervention which aligned with the Institute of Medicine’s definition of integrating the best research, clinical expertise, and patient values in making decisions on diabetic foot prevention and education. These modules were selected for its evidence-based content and relevance to the
purpose of this project. Likewise, it met the target population’s need for ease in readability, age appropriateness, cultural, socio-economic status, and the time constraints of the rural clinic.

**Question and Hypothesis**

Question: Was a patient-focused diabetic foot care education program more effective than standard care in improving knowledge of foot self-care among T2DM patients in a rural clinic?

Hypothesis: There would be a statistically significant improvement in diabetic patients’ PIN scores from pre to post implementation of a nurse-focused diabetic foot care educational intervention.

**Theoretical Framework**

Choosing a conceptual method assisted the researcher in project development as this provided an emphasis, the rationale and a tool for the integration and interpretation of the information (Moran, Burson, & Conrad, 2014). The theoretical framework most relevant for the capstone project was Pender’s health promotion model (HPM). This theoretical framework highlighted the role of expectation in affecting behavior based on the tenet that the greater a person’s self-efficacy or perceived competent behavior, the more likely the person became committed and actually carried out a positive behavior (Peterson & Bredow, 2008). The HPM model conceded to the exploration of the biopsychosocial processes that influenced engagement in behaviors that promoted health with three areas of focus: the individual characteristics and experiences, behavior-specific cognition and affect and the behavioral outcomes (Pender, 2006).

The capstone project proposal postulated to integrate HPM to improve the knowledge of peripheral neuropathy in T2DM patients in a rural clinic. HPM identified the background factors that influenced health behavior and provided the means to understand how individuals conducted
themselves in relation to their health and how they conformed to health therapies. Fundamentally, HPM had six beliefs that can be assessed by the nurse that are critical in nursing intervention. The behavior-specific variables which determined an intervention were: perceived benefits of action, perceived barriers to action, perceived self-efficacy, activity related affect, interpersonal influences, and situational influences (Pender, 2006). Assessment of the changes in these variables was crucial in ascertaining if changes resulted from the intervention and subsequently influenced changes in commitment of health-promoting behaviors. Essentially the nurse played a pivotal role in affecting a positive behavior by focusing on the benefits of a behavior, imparting information in overcoming barriers in carrying out healthy behavior, and inducing high levels of efficacy through positive feedback (Pender, 2006).

Education and behavioral strategies were the standards of care in facilitating lifestyle changes in the management of patients with T2DM. Pender’s theoretical framework demonstrated the nurse’s influence in a diabetic patient’s behaviors and attitudes toward self-care through diet control, exercise, medication compliance, regular foot assessment and utilization of available resources. Patients are more likely to engage in health-promoting behaviors when afforded with assistance to enable healthy behaviors (McGuire & Anderson, 2012).
Definitions

*Type 2 diabetes mellitus* (T2DM) also formerly known as adult-onset or noninsulin-dependent diabetes, is a chronic disease condition that affects how the body breaks down blood glucose due to either body’s resistance to insulin which is a hormone that regulates the blood sugar level or inability of the body to produce insulin to maintain a normal blood glucose (Mayo Clinic, 2014).

*Blood glucose* is also known as blood sugar which is the body's principal source of energy (ADA, 2013).

*Hispanic* is an ethnic description used by the United States government when reporting
population and health statistics which refers to persons of Mexican (59%), Puerto Rican (10%), Cuban (4%), Central and South American, or other Spanish ethnic origin residing in the United States (Hatcher & Whittemore, 2007).

*Peripheral neuropathy* is one of the diseases of the nervous system which affects mainly the lower extremities with symptoms of discomfort, pain and loss of sensation in the lower extremities and assessed by using 10g monofilament, by palpation of foot pulses and by testing vibration (Perry, 2013).

*Neuropathic foot ulcer* is an ulceration of the foot related to peripheral neuropathy which is a complication of diabetes (ADA, 2013).

*Foot infection* is a serious problem in people with diabetes which is defined by presence of inflammation and/or purulence. Polymicrobial foot infection means presence of aerobic Gram-positive cocci particularly staphylococci, the most common causative organisms (Turns, 2013).

*Diabetic foot ulcer* (DFU) is defined as any skin breakdown on the foot, inclusive of minor skin breakdown on the toes, heel, and the dorsal and plantar foot caused by trauma including use of ill-fitting footwear (Holt, 2009).

*Amputation* is defined as minor if one or more toes, or some part of the foot at or below the ankle were amputated and major if the amputation was above the ankle (Gershater, Pilhammar, Apelqvist, & Alm-Roijer, 2011).

**Scope and Limitations**

The capstone project was implemented in a one site rural clinic that served a predominantly disparate population in a three-county area. The accessible population consisted of diabetic patients that presented to this clinic. The goal was to increase knowledge by educating T2DM patients enrolled in a diabetic clinic in Tomagwa Health Ministries through an
educational intervention using evidence-based information incorporating guided reading of educational materials such as 13 tips to Happy Feet and the Save the Feet for a Lifetime booklet from the ADA and NDEP websites respectively. This capstone project’s theoretical framework for evaluation was Pender’s health promotion model (HPM) which supported the importance of educating disparate population healthy behaviors such as compliance of health therapies and daily foot examination to prevent ulcer development. There was minimal financial cost involved. The organization supported this project, as it provided an opportunity to promote healthy foot care behaviors in an at-risk population.

One of the limitations foreseen in the implementation of the capstone project was evaluation of education effectiveness. The project was generalized to one geographical area and targeted only type 2 diabetic patients with time allotment of 1.5 hours. The post-questionnaire was administered three weeks after the education activity. Funded mainly by donations with 60 percent of patient care provided by volunteers, Tomagwa clinic does not have funding for education material. Lack of funding placed limitations on time and intervention. The learning activity was implemented solely by this author and the educational material was personally funded and was left in the clinic for future use. Another limitation was generalizability given that the project was implemented in just one rural clinic.

**Summary**

Diabetic foot disease was expected to intensify further in the future given that the contributory factors such as peripheral neuropathy and vascular disease appear in more than 10% of people at the time of diagnosis of type 2 diabetes. The greatest rise in the prevalence of type 2 diabetes was likely to be among disparate populations of which foot ulcers were more likely to be of neuropathic origin hence highly preventable. Accelerating implementation of evidence
based practice cannot be underestimated given that the driving force is public health and safety. A substantial body of researched information was available documenting different approaches to improve outcomes for people with diabetes, yet implementation of these approaches was challenging given the complexity of the disease, the number of people affected, and the disparity among the diabetic patient populations. Culturally adapted diabetic education interventions such as daily self-foot inspection contributed in the reduction of the gap between most favorable therapy and what is undertaken in the real-world settings. With the expansive number of researched information available, health care providers have the tools to address this challenge, and it should be utilized.

It was important to develop programs for patients who were disproportionately affected by T2DM. The disparate population in a rural clinic was at risk for developing neuropathic foot ulcers and should receive the best care using the best available evidence, including education and regular clinic follow-up to prevent neuropathic limb amputation. The overarching goal of this capstone project was to improve, maintain and sustain quality of life among diabetic patients in the local community through education, lifestyle modification, and promote healthy behaviors.
CHAPTER 2: LITERATURE REVIEW

Introduction

Chapter Two provides review of literature which guided and supported the development of a diabetic foot education program for patients with T2DM in a rural clinic. For the purpose of this project and consistency with agency standards, Pender’s Health Promotion Model (HPM) and constructs from the Diabetes Self-Management Education (DSME) will be used as guiding principles in the development and implementation of an evidence-based basic foot care education that was informative and consistent in rural healthcare settings. To place this problem within the context of scientific inquiry, a comprehensive search of relevant literature was done on peer reviewed studies from several databases such as Cumulative Index of Nursing and Allied Health Literature (CINAHL), Agency of Healthcare and Quality (AHRQ), Google Scholar, and MEDLINE through PubMed using search terms such as diabetes, diabetic foot ulcer prevention, diabetes knowledge and control, diabetes education, self-care and diabetes peripheral neuropathy. Inclusion criteria were studies focusing on diabetic foot care. Exclusion criteria were articles published in non-peer review journals, published prior to 2008 or in a language other than English. In addition to a synthesis of current and relevant literature on this topic, this chapter will also present a historical overview of the significance of promoting best practices for diabetic foot care.

Historical Overview

The prevalence of diabetic foot ulcer in the past decades led to a host of research studies. One strategy in reducing diabetes-related lower limb amputations was prevention. Prevention and reduction of diabetes-related amputations by 50% were agreed in the 1989 European meeting in Italy sponsored by the World Health Organization (WHO) and the International
Diabetes Federation (IDF). Six years later, the same declaration was announced for the Americas. Consequently, foot care preventive programs had been introduced both in developed and developing countries nevertheless, despite the initiatives set forth; prevalence of diabetic foot ulcers remained high globally. In the U.S., 15% of the diabetes population will experience foot ulcers during their lifetime (American Diabetes Association [ADA] as cited by Abu Qamar, 2006).

The CDC reported United States as one of the countries hit hardest by the diabetes epidemic and the Mexican Americans, the largest Latino subgroup, to have one of the highest rates of diabetes (23.9%) (CDC, 2005). The report cited contributing factors to this prevalence: access to care, cultural beliefs, lifestyle and socio-economic status. To achieve and sustain sufficient self-management of the disease for Mexican Americans can be exigent due to factors such as literacy, low health literacy, language barriers, poverty and barriers to culturally relevant care (Vincent, 2009).

Despite early recognition of the seriousness of this problem and the implementation of a wide range of foot care preventive programs, diabetic foot ulcers (DFU’s) are still a significant problem due to patient noncompliance and the need for a multidisciplinary approach which in most cases may not be feasible in many rural health care settings.

**Current Findings**

An extensive examination of eligible peer-reviewed literature identified the standards for developing the nurse-focused educational intervention and for promoting evidence-based foot care education. There were three themes that were consistent in the researched articles regarding diabetic foot education: self-management and prevention through early detection of patients who were at risk of developing diabetic foot ulcers.
The research studies that were reviewed and synthesized for this educational intervention project focused on determining the best method for reduction and/or prevention of the incidence of diabetic foot ulcer in T2DM patients. Many research studies recommended periodic foot assessment for the prevention of diabetes-related foot complications. The use of standardized protocol comprising three aspects of foot examination such as dermatological inspection, vascular and neurological assessment with inclusion of demographic data and information on diabetic foot care, height, weight, blood pressure and blood glucose levels are recommended. The existing guidelines of diabetes care and management indicated that patient education along with other preventive measures such as regular podiatry; adjusted shoes and insoles; regular foot examination by health care professionals were pre-requisites to diabetic foot ulcer prevention (Gershater, Pilhammar, Apelqvist, & Alm-Roijer, 2011).

A single crucial element in prevention of diabetic foot complications was screening, identifying and classifying diabetic patients for risks based on a foot risk classification (Peters & Lavery 2001) as cited by Schmidt, Mayer and Panfil (2008). Based on patient foot risk classification, clinicians could use a standardized tool to establish the frequency of follow-up visits for foot examination. Article search findings supported the significance of identifying patients with self-care deficits, consequently improving patients’ daily foot self-care knowledge hence reducing the incidence of foot ulcer development. Use of questionnaire was the recommended tool to identify self-care deficits of the patients (Schmidt, Mayer, & Panfil, 2008).

Majority of foot care education focused on patients with pre-existing complications of the foot and lower extremities with very limited EBP obtainable on basic foot care or diabetic foot ulcer prevention. Despite proven knowledge that people with diabetic foot complications can deteriorate precipitously, many primary care providers viewed foot health education as costly
hence foot care education was excluded in the general care (Wu, Tung, Liang, Lee, M., & Yu, 2014). This problematic trend possibly could even be much more heightened in primary safety net clinics and rural clinics given that most if not all lack the infrastructure in sustaining the processes needed to advance diabetic care and improve outcomes. If provided effectively and consistently, diabetic education intervention such as diabetic foot care and ulcer prevention can reduce patient morbidity, health care costs and improve quality of life on this population.

Recent studies in the US, Europe and Latin America have indicated that quality improvement (QI) interventions on diabetes care in rural settings remains substandard leaving considerable gaps in the quality of care for diabetes patients in these areas (Ricci-Cabello, Ruiz-Perez, Rojas-García, Pastor & Gonçalves, 2013). This underscores the existence of significant disparities in diabetes care. With limited time and resources to educate and treat patients, poor clinical information systems and lack of access with diabetes education programs, little to non-existent access to diabetes specialists and multidisciplinary team, practitioners and clinicians in rural centers were more likely to ignore the standards of care for this population group (Ricci-Cabello et al., 2013).

Diabetic foot complications increase morbidity and mortality of patient with diabetes and the quality of life is greatly impacted through impaired physical functioning, increased health care costs and additional burden on the caregivers (Peterson & Virden, 2013). Based on the Amputee Coalition of America (2009), diabetes-related amputations cost approximately $3 billion per year or $38,077 per amputation procedure (Peterson & Virden, 2013). The price tag cannot be ignored but more importantly, the decline in the quality of life of a diabetic amputee is a significant reason to do prevention and early detection of signs of tissue damage, identify risk factors and implement preventive strategies through routine monthly comprehensive foot
examination (ADA, 2010). Prevention of diabetes complications such as diabetic foot ulcer is fundamental in the reduction of morbidity and mortality in patients with diabetes hence diabetic foot education is one of the standards of care in managing the disease (Yuncken, 2014). Diabetes affected nearly 23.6 million Americans and is the leading cause of adult blindness; lower-limb amputation; kidney disease and nerve damage and this is more prevalent in disparate population (Center for Disease Control [CDC], 2008; McCleary-Jones, 2011).

Improving diabetes care through self-care management and access to medical care is one of the priorities of Rural Healthy People (2010). Peterson and Virden (2013) explained that free clinics and rural health centers become safety nets for this population hence providers of care need to be primed to overcome the challenges of providing care services to diverse and disparate patient populations. Given the devastating impact diabetic ulcers pose in the quality of life of patients and the burden of financial health care costs, it is crucial for health care providers to identify the people who are at risk and to be perceptive to the needs of disparate populations in order to provide effective self-care management.

**Prevention**

Diabetic foot patient education program that provides screening protocols demonstrated hospitalizations and amputation reduction in a managed care organization. Patients were stratified into high and low risk groups and preventive and acute diabetic foot protocols were implemented based on the presence or absence of diabetic neuropathy, peripheral vascular disease, foot pressures and history of foot pathology. Study results demonstrated 47.4% reduction in amputation occurrence; 37.8% reduction in diabetic foot related hospital admissions; 21.7% reduction in average patient length of stay (LOS); 69.8% decrease in the skilled nursing facility (SNF) admissions (Lavery et al., 2005; Wu, et al., 2007).
Another study with participants aged between 41 and 60 years who had T2DM of more than five years were categorized into four risk groups of foot ulceration. The study recognized that poor protective sensation in the feet was one-fifth of the study population, with similar proportion with foot deformities. The study concluded that patients with several risk factors in conjunction with lack of adherence to regular foot screening develop foot ulcer hence incorporation of regular foot screening within the context of standard care provided to individuals with diabetes is imperative (Abu-Qamar, 2012). Despite confounding evidence in support of screening measures and patient risk classification, diabetic foot screenings have not been fully utilized particularly among disparate populations. Early identification of patients at the initial stage of diabetic neuropathy and subsequent regular foot examination of people with T2DM is crucial thus prompt treatment can be provided before excessive tissue damage occurs. The question however remains how best to implement these screening programs to reduce the incidence of lower extremity ulceration and subsequent amputations. To be effective, screening measures and intervention systems and processes must be accessible to the different patient populations (Abu-Qamar, 2012).

A single crucial element in prevention of diabetic foot complications is screening and classifying diabetic patients for risks based on a foot risk classification standard (Schmidt, Mayer & Panfil, 2008). Based on patient foot risk classification, clinicians could use a standardized tool to establish the frequency of follow-up visits for foot examination. Article search findings support the significance of identifying patients with self-care deficits and consequently improving patients’ daily foot self-care knowledge hence reducing incidence of foot ulcer development (Schmidt, Mayer, & Panfil, 2008).
Research findings demonstrated that diabetic patients with several risk factors in conjunction with lack of adherence to regular foot inspection and screening developed foot ulcers hence regular foot screening efforts had to be incorporated within the context of standard care to individuals with diabetes (Abu-Qamar, 2012). Presently, majority of foot care education focused on patients with pre-existing complications of the foot and lower extremities with very limited EBP obtainable on basic foot care or diabetic foot ulcer prevention. Despite proven knowledge that people with diabetic foot complications can deteriorate precipitously, many primary care providers viewed foot health education as costly hence foot care education was excluded in the general care (Wu, Tung, Liang, Lee, M., & Yu, 2014). This problematic trend was heightened in primary safety net clinics and rural clinics given that most if not all lacked the infrastructure in sustaining the processes needed to advance diabetic care and improve outcomes. If provided effectively and consistently, diabetic education intervention such as diabetic foot care and ulcer prevention reduced patient morbidity, health care costs and improved quality of life in this population.

The literature review on diabetic foot screening established the potential mortality associated with the development of DFU. Despite having a higher mortality rate, DFU as a pathologic process was no more deadly than breast cancer or prostate cancer. However, there were protocols followed in the management of these cancers that led to mortality reduction. DFUs on the other hand did not have uniform management protocol, consequently mortality continued to rise (Fitzgerald, 2012). The five-step lower extremity amputation prevention (LEAP) program was developed by the U.S. Department of Health and Human Services (USDHHS) for the clinicians to utilize in the evaluation of the diabetic patient. The LEAP program was primarily aimed at detection of loss of protective sensation (LOPS) among diabetic
patients using several interventions such as annual screening, education, daily self-inspection, appropriate footwear selection, and early management of simple foot problems. The LEAP program recommended the use of 5.07 monofilament; annual foot screening on all patients with diabetes; foot and shoe screening four times a year for patients who were identified as high risk (Fitzgerald, 2012).

**Diabetes Self-Management Education**

The fundamental focus of diabetes self-management was to assist patients make well-informed healthcare decisions and to outline their self-care activities. The diabetes education paradigm had shifted from content-driven practice to outcome-driven practice hence the need for disease management program evaluation based on the federal and accreditation agencies standards and mandates (Beebe & Schmitt, 2011). Federal and accreditation agencies referred Diabetes Self-Management Education (DSME) programs as a process measure with the goal to advance the standards practice and care and the quality of the overall improvement of patient health outcomes. Education was the core of DSME program and it emboldened people with diabetes to lead healthy lifestyle in conformity with the recommended diabetes health therapies.

A study investigating the extent of participation of African American women with type 2 diabetes on diabetic self-management education (DSME) based on the behavioral risk factor surveillance survey (BRFSS) had indicated 53.6% of participants had DSME which was less than the 62.5% participation rate suggested by Healthy People 2020. The study concluded that DSME participants were more likely to engage in self-care behaviors compared to those who did not participate in DSME (45.0%) which also indicated that target set for Healthy People 2010 related to diabetes self-management education has yet to be met (Gumps, 2012). Despite being recognized as essential in the management of diabetes, the number of patients with diabetes who
receive DSME was disproportionately small. Barriers to receiving diabetes education included access and DSME delivery approaches. Hence, it is crucial that healthcare providers develop strategies to improve participation and promote self-care behaviors among Type 2 diabetes patients in disparate population.

Findings of another study that examined DSME delivery in primary care and the effect of DSME on glycosylated hemoglobin (HbA1c) and low-density lipoprotein-cholesterol (LDL-C) levels had indicated that out of the 5,344 diabetes patients encompassing four primary care practices, 784 patients received point of service (POSE) diabetes education. The HbA1c mean values were higher among patients who received POSE than those who received the usual care and substantial decrease in HbA1c and LDL-C levels in both groups. Despite insignificant findings between-group difference in HbA1c, participants who received POSE had shown improvement in LDL-C levels than participants in the usual care group. These results pointed to the conclusion that DSME was feasible in primary care settings (Siminerio, Ruppert, Emerson, Solano & Piatt, 2008). Implementation of DSME programs to low-income population who may also had lower health literacy had the potential to eliminate barriers to effective diabetes self-management and could be a considerable investment in improving global health and well-being and healthcare cost reduction (Abu-Qamar, 2006).

**Diabetes Education**

The American Association of Diabetes Educators (AADE) convened in a symposium in 2011, which aimed at developing guidelines and standards for diabetes educators and diabetes care team in reduction of diabetes-related risks. In order to improve diabetes outcomes, the symposium report recommended patients to be active participants in their care within a multidisciplinary team setting. Diabetes education had to be a fundamental component in a
multidisciplinary team approach because it assisted the patients understand the disease, its progression and potential complications. Likewise, diabetes education provided direction and reinforcement to engage patients proactively in risk-reduction decisions. Access to a wide range of education resources to assist diabetes educators develop individualized, patient-centered plan for risk reduction is crucial to the success in implementation of diabetes education initiatives. Diabetes educators were encouraged to stay up-to-date with the changing models of care and to establish relationships from within and beyond the diabetes health care team (Kent, et al., 2013).

The effectiveness of a diabetes education was measured in patient’s attitude, knowledge and self-practices. Knowledge entailed the over-all understanding of the disease, self-care, foot care and the application of health therapies learned. Health literacy influenced knowledge and skill attainment and impacted self-efficacy in diabetes self-management. Research findings indicated that diabetes knowledge and self-efficacy were factors that influence patient’s diabetes self-care activities likewise poor health outcomes was associated to low health literacy. This also supported Morris et al. (2006) findings that diabetes management was not dependent mainly on the ability to read the health information.

The relationships between health literacy and diabetes knowledge, and the correlation between diabetes knowledge and self-efficacy brought to light crucial influences in an individual's involvement in diabetes self-management activities. Cognizance of the impact of health literacy on the implementation of diabetic foot education to patients in a rural health setting was essential. Addressing the appropriate strategies to improve the patient’s knowledge on diabetes foot care and self-efficacy was fundamental in the implementation of diabetes foot education. Health literacy initiatives and development of diabetes education programs took into account the literacy level of target population. Study findings showed that participants without a
high school diploma or GED received less formal diabetes self-management education compared to those with high school diploma or GED. This information is critical if diabetic foot education program is going to be effective. Learning needs assessment and provision of education should be based at a level that maximizes their comprehension. The success in the implementation of the diabetic foot education intervention relies on the ability of the educator to anticipate learning needs of clients.

**Diabetic Foot Self Care**

Article search related to diabetic foot self-care among patients with T2DM were reviewed to gain better understanding and provide guidance in the implementation of diabetic foot education project. A cross-sectional study and development of the Frankfurter Catalogue of Foot Self- Care -Prevention of Diabetic Foot Syndrome reported that patients who had participated in more than three education programs had considerable improvement in self-care practices than those who had not attended or attended only one diabetes education (Schmidt, Mayer & Panfil, 2008). Hence, for individuals who attended regular educational programs particularly individuals with a risk of developing diabetic foot had better knowledge and understanding of T2DM and were unlikely to develop diabetic foot ulcers.

Chin, Huang & Hsu (2013) investigated adaptable social-psychological factors related to daily self-foot examinations on patients with diabetes and peripheral neuropathy that measured family support and health belief factors (HBF). This study complemented to the work of Sarkar et al. (2006) and Perrin et al. (2009) by substantiating self-efficacy on daily foot inspection practices of patients with diabetes. Several studies revealed that the most powerful predictors among health behaviors are perceived barriers (Champion & Skinner, 2008). Chin, Huang and Hsu (2013) corroborated perceived barriers to daily foot-exam practices. Obesity, reduced visual
acuity, and poor joint flexibility are significant barriers to foot-care practices of diabetic patients (Neil 2002, Pollock et al. 2004, Johnston et al. 2006, Chin et al., 2013). Hence, it was highly recommended that clinicians need to assess each patient’s physical ability, including visual acuity and joint flexibility before teaching foot-care skills.

Chin, Huang and Hsu (2013) found that HBF such as perceived benefits, perceived barriers, perceived threats, self-efficacy and select action cues are associated with daily foot practices in this population. Perceived self-efficacy and perceived barriers to foot care were found to be major predictors of daily foot-examination practices and older people with DFU have higher amputation rate hence, daily foot-examination practices of older people should be addressed. Improving daily foot inspection practices in this population is important in the prevention of DFU (Martinez & Tripp-Reimer 2005). Given this knowledge, promotion of daily foot-examination practices among older patients with neuropathy is crucial. Using the findings of this study assisted health professionals in the development of education interventions that addressed barriers to daily foot-examination.

**Diabetic Peripheral Neuropathy**

Boulton (2005) defined diabetic peripheral neuropathy (DPN) as the manifestation of peripheral nerve dysfunction in people with diabetes after the exclusion of other causes. There are several forms of DPN however; chronic sensorimotor neuropathy is by far the most common form which is of insidious onset and present in 10% of patients at the outset of diagnosis of T2DM. The prevalence of DPN increases with age and the duration of the diagnosis of the disease (Turns, 2012). There are very few data available related to the influence of DPN on mortality. Yagihashi et al. (2011) explained that estimation of the prevalence, incidence, and risk of DPN are contingent on the criteria employed to identify the syndrome. The definition of DPN
included a symptom score, a focused neurological examination and nerve conduction studies. Irrespective of the diagnostic measures, three facts about DPN were: it was highly prevalent, it increases with age and the duration of the diabetes disease and strict glycemic control reduced the incidence and progression of diabetic neuropathy. DPN was the most common and intractable complication of T2DM and the prevalence ranges from 7% within 1 year of diagnosis to 50% for those with diabetes for ≥25 years and could be 90% if patients with subclinical levels of neuropathic disturbances are included (Yagihashi et al., 2011).

The current recommendation from the National Institute of Health and Clinical Excellence (NICE) to individuals identified as low-risk in developing diabetes complications is a management plan that incorporates foot care education to increase awareness and understanding of the importance of foot health, reduce incidence of accidental injury and promote self-care (McInnes et al., 2011). Individuals identified as low risk based on NICE standards were those with normal foot sensation and palpable pedal and tibial pulses. At present, diabetic foot education is predominantly aimed at patients with pre-existing complications, elevated HbA1c levels and individuals who have been diagnosed with diabetes for more than five years. In the absence of stringent glycemic control, foot self-care practices and timely detection of foot sensory changes, occurrence of foot complications for this group could develop relatively quickly.

There are two specific evidence-based guidelines regarding provision of foot care for patients without overt symptoms of diabetes peripheral neuropathy (DPN). The guidelines were published by the American Diabetes Association (ADA) and the International Working Group on the Diabetic Foot in 2004 and 2007. To effectively educate those who are identified as at low risk of developing complications, it is essential that clinicians understand patient’s perspective
on the importance of foot care. Research demonstrated 23 to 63% of low risk diabetes patients rarely perform foot inspection or not at all, which reinforced other study findings indicating patients’ lack of knowledge on the seriousness of diabetes and its complications and the necessity to compliance and preventive measures relating to foot complications (McInnes et al., 2011).

Educating diabetes patients identified at low risk for complications were condensed in the mnemonic CARE: control blood glucose levels; annual foot screening; report foot changes promptly; engage in a simple daily foot care routine. This recommended basic foot care regimen for diabetes patients at low risk of foot complications is simple and should be fostered. It empowers the patient to be proactive in diabetes foot care thus reducing the likelihood of complications. The fundamental component in the CARE framework is individualized fit and tailored to take into account patient’s health beliefs and motivation to change. To reduce the likelihood of developing complications, low risk diabetes patients should be encouraged to undertake basic foot care regimen (McInnes et al., 2011).

Conclusion

The magnitude of the challenges in the management of T2DM and its complications particularly diabetic foot ulcer formation and subsequent amputations among disparate populations must be addressed. Article review on related topics such as diabetic self-management education (DSME), diabetic foot education, diabetic foot self-care, diabetic foot screening and diabetic peripheral neuropathy (DPN) solidified the need to disseminate evidence based knowledge and established standards and protocols in diabetic foot prevention. Increasing diabetes peripheral neuropathy knowledge among T2DM disparate patients in a rural clinic is imperative. Diabetic peripheral neuropathy and other diabetes-related foot complications are
high risk factors for foot ulceration and lower extremity amputation. Diabetic foot screening, foot self-care education, cognizance of the disease and its complications prevent foot ulceration hence improving prognosis and outcomes. Nurses need to develop and implement effective foot care programs to provide foot care education. Implementation of a nurse based diabetic foot education project promoted diabetes peripheral neuropathy knowledge, self-care practices and non-ulceration of a diabetic foot. Improved participants’ knowledge of basic foot care increases the probability of healthcare cost reduction and improved overall health outcomes.

**Summary**

Diabetes is a multi-factorial disease and the success in patient management derives from the collaboration of providers to provide comprehensive care (Fitzgerald, 2012). Evidence demonstrated the efficacy of community-based programs that promoted partnership of patient and health care provider empowered the patient to lead a more proactive role in the management of their disease, consequently improving patient health outcomes. This collaboration provides opportunity for clinicians to perform patient screening and triaging hence, provision of appropriate and timely intervention can be initiated consequently reducing diabetic foot complications such as amputations.

Literature review focused on factors that can be significant in the reduction of the incidence and prevalence of foot complications such as engagement in simple daily foot care routine, diabetic foot screening, diabetic self-management education (DSME), diabetic foot education, and diabetic peripheral neuropathy (DPN). There was inconsistency in provision of foot self-care education among patients who are identified at low risk of developing foot complications. These patients may receive insufficient information on the prevention and avoidance of diabetic foot complication such as DPN. Diabetes as a disease is silent and the
onset of complications is insidious hence, there is no symptom-driven impetus to change behavior up until the manifestations of complications are evident. The patient’s behavior changes in relation to perceptions on the impact of the disease on everyday life, the ability to exercise control over their medical condition and the effectiveness of preventive strategies are crucial in diabetic foot prevention (Turns, 2012). Research had demonstrated that greater self-efficacy such as confidence in performing health-related behavior is associated with greater probability of foot self-care practices. In lieu of these considerations, diabetes education should therefore incorporate assessment of health beliefs and motivation to engage in foot self-care practices.

Recommendations from literature review substantiated the significance of education and prevention of diabetic peripheral neuropathy. Literature review supported the role of diabetes peripheral neuropathy, diabetic self-management, diabetic education, diabetic foot education, screening and daily foot inspection and prompt reporting in the prevention of foot ulceration. The information obtained from the synthesis of literature review strengthened the intentions of this project. The strength of the literature reviewed emphasized the positive impact of educating patients with T2DM, the importance of daily foot inspection and prompt reporting of abnormalities based on the set guidelines and standards.
CHAPTER 3: METHODS

Introduction

The need for innovative, low literacy education material that type 2 diabetes mellitus (T2DM) patients in a rural clinic can access is imperative. Illiteracy or the inability to read and write at a competent level is commonplace in many patients with type 2 diabetes mellitus (T2DM), hence it is essential to remove educational barriers regarding foot health (McCleary-Jones, 2011). The Rural Healthy People 2010 report indicated that diabetes is more pervasive in non-metropolitan areas than in central cities and even much more widespread in the Southeast and the Southwest regions of the United States due to complex set of factors such as low socioeconomic status among many rural residents, a high proportion of racial or ethnic minorities, and aging populations that are predominant in rural areas. The aim of this capstone project was to increase knowledge of T2DM patients enrolled in a rural health clinic by providing educational intervention using evidence-based information obtained from the American Diabetes Association (ADA). The utilization of education materials from the ADA provided an evidence-based framework in education intervention. Chapter 3 will discuss the project design and its measurement tools, data collection and management and the analysis plans used in the project.

Project Design

This project used a single group pretest-posttest quasi-experimental design. Tappen (2011) explained that quasi-experimental design is frequently the most practical and ethical option for conducting research where the study population consists of existing patients. This design avoided the additional steps required with random assignment to study arms, as well as the potential ethical concerns involved in substituting a less effective nursing care for one group
of study participants. The strength of this single group quasi-experimental design was the use of an equivalent control group, using a paired samples t-test which compared the mean scores for the same group of participants on two different occasions. The paired samples design reduced the threat of selection bias, as the participants acted as their own controls. This design avoided the additional steps required with random assignment to study arms, as well as the potential ethical concerns involved in substituting a less effective intervention for one group of study participants.

**Threats to Internal and External Validity**

True experiments have a high degree of internal validity because of the controlling properties or randomization and control groups. While this study was not a true experimental design, the paired samples design reduced the threat of selection bias, as the participants acted as their own controls. Common internal threats to the validity of this study design included: Testing which could cause sensitization to post-test due to effect of having taken a pre-test where study participants could potentially change their responses on post-test after discussion with their spouses; mortality or sickness; regression towards the mean which could be associated with reliability of the test. External threats impact the ability of the study to generalize the results. External threats to the validity of this study included the Hawthorne Effect, where subjects performed differently because they knew they were being studied.

The patient-focused educational intervention was based on standards and recommendations from National Standards for Diabetes Self-Management Education (AADE, 2012). This module was selected for its evidence-based content and relevance to the purpose of this project. Likewise, it also met the target population’s need for ease in readability, age appropriateness, cultural, socio-economic status, and the time constraints of the rural clinic.

**Project Variables**
The variables of interest in this project included a two-level categorical independent variable, “Education Intervention” (Pre/Post) and a continuous dependent variable “PIN Total Scores”. Independent variables were also known as treatment, manipulated, antecedent, or predictor variables which could influence outcomes. Dependent variables were the results of the influence of the independent variables which can be an outcome, an effect or a response. Variables measured at the nominal, dichotomous, and ordinal levels of measurements were discrete or categorical and those being measured at interval and ratio levels of measurements were continuous variables. Level of measurement was essential because it guided what statistical tests used in analyzing the data sets collected by the researcher. Knowing the relationship between the level of measurement and the choice of statistical test, the clinical researcher was able to gauge the strength of the study (Kim and Mallory, 2013).

The presence of extraneous variables presented threats to the internal validity of the study because it presented competing explanations for the observed relationship between the independent and dependent variables which could interfere with the cause-and-effect inferences. These confounding variables included sample characteristics, such as gender, age groups, race/ethnicity, or socioeconomic conditions. To neutralize the effects of one or more sample characteristics, analysis of covariance was utilized.

**Sample Selection**

Effectiveness of the patient-focused education intervention on improving cognitive and emotional cognitive and emotional factors associated with foot self-care in diabetic patients can only be determined if the sample size was sufficient to detect a difference when a difference really existed between the pre and post study groups. Performing power analysis and sample size estimation was an important aspect of this design, because without these calculations, sample
size may be too high or too low. If sample size was too low, the experiment would lack the precision to provide reliable answers to the questions it was investigating. If sample size was too large, time and resources would be wasted, often for minimal gain. To estimate the sample size a priori, G*Power was used to determine the appropriate number of subjects needed to detect a difference between pre and posttest PIN total scores for this study with 95% confidence that the difference was real. Power refers to the probability that the test would find a statistically significant difference when such a difference actually existed. In other words, power is the probability that one would reject the null hypothesis when one should (thus avoiding a Type II error). It is generally accepted that power should be .8 or greater; which means there is an 80% or greater chance of finding a statistically significant difference when there is one. The G*Power results of an a priori sample size estimation using a confidence level of 95%, a power of 80%, and a medium effect are shown below:

<table>
<thead>
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<th>Analysis:</th>
<th>A priori: Compute required sample size</th>
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<td>α err prob</td>
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<td>Total sample size</td>
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</tr>
<tr>
<td>Actual power</td>
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</tr>
</tbody>
</table>

The inclusion criteria for this project were patients clinically diagnosed at least for six months with T2DM based on the Mayo Clinic (2013) defined diagnoses of type 2 diabetes mellitus. The exclusion criteria were patients >70 years of age, with significant neurological diseases (except for those related to diabetic neuropathy). The neuropathic patients were
excluded if they had active foot ulcers, previous minor or major foot amputations, or Charcot's joints. Patients who met the criteria and were willing to participate in the education activity, signed the consent and completed the survey forms.

**Instruments**

The Patient Interpretation of Neuropathy questionnaire was used for this project which is a 73 item questionnaire that measured type 2 diabetic patients’ level of understanding of the link between foot ulceration and self-care deficit and evaluated their cognitive and emotional understanding of peripheral neuropathy. Validity requires that an instrument is reliable (Kim & Mallory, 2013). Reliability denotes whether the instrument measured what it was intended to measure and whether or not the findings were reproducible and consistent. Several research studies using the PIN questionnaire (McInnes et al., 2011; Perrin & Swerrisen, 2008) proved the tool as a reliable and a valid measurement specific to diabetic foot self-care and suitable for the adult learner in the clinic setting. An internal threat identified in this project was consistency between administration times (stability) particularly Test-Retest where one sample of individuals was subjected to the same test/questionnaire on two separate occasions, keeping all testing conditions as constant as possible. If the test was reliable, the subject’s score should be similar on multiple trials. The Test-Retest Intervals were far apart enough to avoid fatigue, learning or memory effects, likewise close enough to avoid genuine changes in the measured variable. Test-Retest Reliability was analyzed using the Intraclass correlation coefficient (ICC) and the percent agreement was determined and the kappa statistic was applied for nominal data.

Diabetic foot knowledge and self-foot practices were the identified variables for this study. The Patient Interpretation of Neuropathy (PIN) questionnaire was the tool that was selected to collect pre- and post- intervention data. The PIN questionnaire measured the level of
understanding of the link between foot ulceration and self-care deficit, evaluated cognitive and emotional understanding of diabetic peripheral neuropathy (Vileikyte et al., 2006). Several research studies using the PIN questionnaire (McInnes et al., 2011; Perrin & Swerrisen, 2008) proved the tool as a reliable and a valid measurement specific to diabetic foot care knowledge with a Cronbach’s alpha that equaled to 0.62-0.90 and test-retest reliability or Pearson’s r that equaled 0.51-0.64 (Vileikyte et al., 2006). The PIN questionnaire was primarily focused on foot care and was suitable for the adult learner in the clinic setting and it assessed patient cognitive and emotional representation of diabetic peripheral neuropathy, which could influence the adherence to foot care standards. For details, refer to Appendix A: Peripheral Interpretation of Neuropathy Questionnaire.

Data Collection, Management and Analysis Plans

Data management is the process of controlling the information generated during a research project to ensure honesty and truthfulness of the project findings. Collecting, analyzing, and managing data were an integral part of the project implementation process. How data was managed depended on the types of data involved, how data was collected and stored, and how it was used during implementation and after the project had ended.

Data Collection

Data collection was the process of gathering and measuring information on variables of interest, in an established systematic fashion that enabled one to answer stated research question, test hypotheses, and evaluate outcomes. The emphasis for data collection was to maintain data integrity during the consenting process, collection of sample characteristics and administration of the pre and posttests.
Prior to the implementation of the nurse-focused educational intervention, diabetes patients were approached to extend the offer to participate in the project. Each consenting participant was asked to complete an informed consent and demographic sheet. The questionnaires were given out to the participants using pen and paper; the patients' medical charts were reviewed and the participants’ demographic characteristics and diabetic foot knowledge were collected.

Validity in a data collection instrument referred to the extent to which an instrument measured what it was intended to measure and it required that an instrument was reliable. Once the selection of participants were completed, each participant was asked to complete the Patient Interpretation of Neuropathy (PIN) Questionnaire using pen and paper and were secured in a locked filing system, the proposed educational intervention was initiated. A formal introduction prior to the education session was established. All participants received a diabetic foot screen for loss of protective sensation and standard information provided by the facilitator. The information provided consisted of oral and written instructions on foot care and the prevention of foot complications associated with diabetes foot care. The module’s oral and written instructions were based on standards from the American Diabetes Association, the American Association of Diabetes Educators, and the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The Thirteen Tips to Happy Feet and the NIDDK’s Take Care of Your Feet for a Lifetime booklet was utilized as a visual aid and teaching guide during the intervention. For purposes of consistency for evaluation, the facilitator provided all verbal and written information. During the intervention, the participants participated in the discussions and provided return demonstrations of the skills that were taught. Active participation was encouraged to facilitate self-care, and empowered participants in handling different care
situations. There were three education sessions within the duration of clinic visits, maintaining the same content on each session. An introduction and overview of the diabetic foot instructions and demonstrations on daily foot checks were done on the first session. The second session was demonstration of foot hygiene, skin and toenail care, shoe and sock selection, and instructions on refrain from extreme temperatures. The third session was instructions on diabetic foot complications that needed to be reported to the healthcare provider. Each session was approximately 30 minutes of the time scheduled for each clinic visit and was conducted in the designated conference room on a one-on-one interaction between the facilitator and the participants. Upon completion of the didactic portion of educational intervention, the participants were asked to complete the second PIN questionnaire using pen and paper. The responses were recorded and transcribed verbatim to identify common themes. The data was analyzed and will be presented to the facility’s stakeholders in a scheduled roundtable discussion.

**Data Analysis**

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making for the purpose of answering the project question. The variables of interest in this project included two-level categorical independent variables, “Education Intervention” (Pre/Post) and a continuous dependent variable “PIN Total Scores”. Kim and Mallory (2013) explained that parametric tests require that certain assumptions are met, however if these assumptions were not met, the statistical results wouldn’t be accurate. Therefore, it was important to prove whether the required assumptions were met before conducting the proposed analysis. The preliminary analyses to test for normality and homogeneity of the variance were performed to determine the appropriateness of using a parametric Paired Samples T-test. The
Statistical Package for the Social Sciences (SPSS) 20.0 was used to perform various statistical tests to test assumptions, describe sample characteristics and determine the magnitude of effect of the educational program on the PIN scores.

Clinical researchers needed to ensure that assumptions of normal distribution were met before the statistical analysis in order to obtain the best statistical results. The use of parametric statistical test was a good choice even when one or more violations of the assumptions were present and were not serious. When data were not normally distributed, a serious violation of these assumptions occurred and a nonparametric test (tests that do not rely on a probability distribution) would have been used. In general, parametric tests tend to be a little more powerful than nonparametric tests when the assumptions were met. However, nonparametric tests become more powerful in detecting significant results when distributional assumptions were violated (Kim and Mallory, 2013). In this project, the assumption of normality was met; hence, the use of the nonparametric alternative, Wilcoxin Signed Rank Test, was not applicable.

Performing power analysis and sample size estimation is an important aspect of experimental design, because without these calculations, sample size may be too high or too low. If sample size is too low, the study will lack the precision to provide reliable answers to the questions it is investigating. If sample size is too large, time and resources will be wasted, often for minimal gain. Power refers to the probability that the test will find a statistically significant difference when such a difference actually exists. In other words, power is the probability that one will reject the null hypothesis when one should (and thus avoid a Type II error). It is generally accepted that power should be .8 or greater, which means there is an 80% or greater chance of finding a statistically significant difference when there is one. To determine if the difference was significant, an ‘effect size’ was calculated to relative magnitude of the differences
between groups. This effect size would tell the amount of the total variance in the dependent variable PIN Total Scores that was explained by knowledge gained from the independent variable, Education Intervention. Cohen’s d was used for the effect size for this study and interpreted as small effect = .2, medium effect=.5 and large effect=.8 (Pallant, 2013). Descriptive statistics using the mean, standard deviation, frequencies and proportions were used to analyze the sample characteristics. Graphs and tables were utilized to further elucidate the results of the project. Quantitative data were used to evaluate the amount of knowledge gained. The analysis of quantitative data provided a representation of the effects of basic foot education on patient’s knowledge of cognitive and emotional factors associated with foot self-care.

Data Management

Data management deals with the process in what a researcher do with data once it was collected, how it was stored and analyzed. Prior to data collection, an introduction that explained the purpose and importance of the study, assurance and maintenance of confidentiality and justification of the study were provided to the participants and to the participating unit staff and manager. Data collection focused only on data that was deemed essential in answering the study questions. It was also important to separate the identification and research data by providing participant ID code on every page, instructions and self-coding forms. The participants of the study were made aware that they were participating in a research study likewise information were provided that indicated the purpose of the study they were participating. Maintaining data confidentiality was done by assuring that the information collected were used only for the intended study and no personal identifying information from questionnaires and computer files, no links on study ID codes with individuals and no identifiable participant data would be published. Collected data were entered electronically in a database which was exported to an
Excel file that were stored on a personal computer that was password protected and locked in a file cabinet in the author’s place of residence. The electronic data will be kept for a period of five years after which all electronic data will be deleted from the personal computer.

The American Sentinel University (ASU) Institutional Review Board (IRB) policy and guide was reviewed and specified items such as site approval, completion of CITI training modules as well as permission to use the selected measurement tools were obtained. The American Sentinel University (ASU) Collaborative Institutional Training Initiative (CITI) is a web based module related to social and behavioral research ethics was completed prior to submission of IRB proposal. The selected setting for the project was a rural clinic serving the rural communities of Tomball, Magnolia and Waller in Texas and did not have IRB requirements, however approval to do the project had been granted by the Chief Operations Officer (COO). Permission to use the PIN questionnaire for this project was obtained after its appropriateness, reliability and validity were ascertained.

The study data management deals with the process in what a researcher do with data once collected, how it is stored and analyzed. Research data storage need to be left undisturbed after a research study (Tappen, 2010). Creswell (2013) explained that the ethical code for researchers was to safeguard the privacy of the participants and to communicate this protection to everyone involved in the study. There was no participant identifier used to collect or analyze data. All information was handled with strict confidentiality and dispersed as an aggregate data. Access to raw data was limited to the author and capstone committee members. Disruptions of the physical setting during surveys were minimized by using a private conference room.

**Methodology Appropriateness**
The appropriateness of the research methodology was defined by the research question and the type of design to be used. “The importance of a tight project that aligns the scientific approach with the appropriate design, methodology and evaluation cannot be understated” (Moran, Burson & Conrad, p. 331). The purpose of the capstone project was to determine the effectiveness of a patient-centered diabetes and diabetic foot education intervention designed to improve patients’ knowledge of peripheral neuropathy, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention. Based on the question, a quantitative quasi-experimental, equivalent sample design was appropriate for this project. Moran et al. (2014) explained that when a project aimed to initiate change through an intervention or innovation, the choice of design would be experimental which could be randomized controlled trial or a quasi-experimental study. In this project a quantitative quasi experimental design was appropriate because the project did not require a control group or randomization. The design was capable of measuring change in a health related outcome after the intervention when it was not feasible to use a true experiment (Polit & Beck, 2012).

The data generated from the quantitative design were numbers, developing meaning from the statistical analysis of numerical data obtained from samples and populations with the intent to apply or generalize knowledge from a smaller sample of subjects to a larger population (Keele, 2011). It was crucial for a nurse researcher to make sure that the sample was representative of the target population. A sample size was determined before the start of the project to ensure there were enough subjects in a sample to make appropriate inferences to the population (Kim & Mallory, 2013). A large sample could be costly and time consuming hence in this project a sample size of 34 pairs of participants was determined by power analysis using the G*Power.
The use of Statistical Package for the Social Sciences (SPSS) 20.0 for data analysis was appropriate and supported. SPSS is a statistical software package that assisted in efficiently analyzing data to answer evidence-based practice and research questions, and one of the most widely used statistical software packages available (Kim & Mallory, 2013). Data analysis translated the numbers that signified the outcome data of the project into a deduced meaningful evidence interpreted (Moran, Burson & Conrad, 2014). Quantitative analysis was used to evaluate the amount of knowledge gained. The analysis of quantitative data provided representation of the effects of basic foot education on a patient’s knowledge level.

**Feasibility and Appropriateness**

The successful implementation of the capstone project depended on the commitment on each key player of the project. The key players were the diabetic patients and families, nursing staff, the Chief Operating Officer, and the ancillary staff of the rural clinic. The implementation of the project depended on the approval and buy-in of each stake holders. Given the rise in patient population in this clinic, particularly incidence of diabetes, a diabetic clinic was added to the services provided in this facility. Hence, implementation of an educational intervention on diabetic foot care was timely. The lack of standard diabetic foot assessment and education to diabetic patients in this rural clinic validated the need to implement the capstone project that would provide the knowledge essential in prevention and reduction of the incidence of diabetic foot ulcer in this population. The capstone project introduced a basic framework from which a program development in the area of disease-specific care benefited the organization’s movement towards a provider of care for diabetic patients in this rural community.

**Summary**
The capstone project implemented and evaluated an evidenced based patient educational intervention to increase diabetes basic foot care knowledge in a rural clinic which served the communities of Tomball, Magnolia and Waller Counties in Texas. The purpose of this project was to determine the effectiveness of a patient-centered diabetic foot education intervention designed to improve patients’ knowledge of peripheral neuropathy, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention. The Patient Interpretation of Neuropathy (PIN) questionnaire was the chosen data collection tool for this project which collected pre- and post-education intervention data. The PIN questionnaire measured the level of understanding of the link between foot ulceration and self-care deficit, assessed cognitive and emotional interpretation of diabetic peripheral neuropathy, which impacted adherence to foot care (Vileikyte et al., 2006). Several research studies that used the PIN questionnaire proved it as a reliable and valid measurement tool specific to diabetic foot care knowledge (Perrin & Swerrisen, 2008). The theoretical framework most relevant for this project was Pender’s health promotion model (HPM). This theoretical framework highlighted the role of expectation in affecting behavior based on the tenet that the greater a person’s self-efficacy or perceived competent behavior, the more likely the person would commit and actually carry out a positive behavior (Peterson & Bredow, 2008).
CHAPTER 4: FINDINGS

Introduction

To obtain the best statistical result for this capstone project, the clinical researcher needed to ensure that assumptions of normal distribution were met prior to data analysis and interpretation of the findings. The use of parametric statistical tests was considered a good choice even when one or more violations of the assumptions were present but not necessarily serious. When data were not normally distributed, a serious violation of these assumptions could occur and a nonparametric test (tests that do not rely on a probability distribution) would have been used. In general, parametric tests tend to be a little more powerful than nonparametric tests when the assumptions were met. After all the variables were identified and totaled including total scores from variables for each subscale of the PIN tool, preliminary statistics were done for the Paired Samples t-test for all total scores of dependent variables then a Paired Samples t-test for all the total scores by pre-post group. The advantage of using a parametric test such as a t-test is that t-tests are more sensitive to finding a difference between groups when one really exists and are considered robust to violations of normality if the sample size is larger than 20 (Pallant, 2013, p. 216).

The capstone project measured the patients’ knowledge obtained from the education intervention, using a quasi-experimental design. The SPSS version 20.0 was used to analyze the quantitative data with the variables calculated using measures of central tendency including mean, median, and mode in order to measure frequency distributions and clarify patterns (Polit & Beck, 2008). Descriptive statistics was used also to analyze the demographic data as well as the level of knowledge retained. The details of data analysis will be demonstrated through graphs and tables to further elucidate statistical findings.
The Purpose of the Project

The purpose of this study was to determine the effectiveness of a patient-centered diabetes foot education intervention designed to improve patients’ knowledge, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention.

Inclusion criteria for this study were strictly followed. The participants were at least clinically diagnosed with T2DM for six months, less than 70 years of age, with significant neurological diseases (except for those related to diabetic neuropathy). The neuropathic patients were excluded if they had active foot ulcers, previous minor or major amputations, or Charcot's joints. Patients who met the criteria and were willing to participate in the education activity, signed consent and completed survey forms. At pre-testing, each participant completed the demographic sheet and the Patient Interpretation of Neuropathy (PIN) Questionnaire (N=25) using pen and paper. Upon completion of the didactic portion of educational intervention, the participants completed the second PIN questionnaire (N = 25) using pen and paper.

Sample Size and Characteristics

Inclusion criteria for this study were strictly followed. The participants were clinically diagnosed with type 2 diabetes for at least six months and were less than 70 years of age. Patients were excluded if they were more than 70 years of age, had active foot ulcers, with previous minor or major amputations, or presence of Charcot's joints. Effectiveness of the patient-focused education intervention on improving cognitive and emotional factors associated with foot self-care in diabetic patients can only be determined if the sample size was sufficient to detect a difference when a difference really exists between the pre and post study groups. So, to estimate the sample size, a priori, G*Power was used to determine the appropriate number of
participants needed to detect a difference between pre and post PIN total scores for this study, with 95% confidence that the difference is real. Estimated sample size needed for power in this study was N=34. According to Pallant (2013), the advantage of using parametric t-test, is that t-test is more sensitive to finding a difference between groups when one really exists and considered robust to violations of normality if the sample size is larger than 20. In this study, the sample size was = 25 pairs. The actual power for this study was = 0.8055675. A post hoc power analysis of sample size N=25, using G*Power, indicated there was 80.5% power to detect a difference when one really existed due to the large effect size in this study.

A total of 25 participants participated and completed the education intervention with (n=25) pre-test and (n=25) post-test. A post hoc power analysis of sample size N=25, using G*Power, indicated there was 80.5% power to detect a difference when one really existed due to the large effect size. A total of 25 participants completed the education intervention with 25 pre and 25 post-tests. The age range was 37 to 67, 72% were female (n =18, 72.0%) and 28% were male participants (n= 7, 28.0%). 64% were Hispanics (n = 16, 64.0%) and 36% belong under the category of others which means it composed of a mix of different ethnic groups (n = 9, 36.0%). 84% had less than high school education (n = 21, 84.0%) and 16% had high school education (n = 4, 16%). 56% were married (14), 16% were single, and 28% widowed (7). 68% were employed (n = 17, 68.0%), 32% were retired. 56% lived with their spouses and 44% lived with other family members. (See Table 1 for details).

Table 1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Proportion</th>
</tr>
</thead>
</table>

*Participant Demographics*
### Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7</td>
<td>28.0%</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>72.0%</td>
</tr>
</tbody>
</table>

### Ethnicity/Race

<table>
<thead>
<tr>
<th>Ethnicity/Race</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>16</td>
<td>64.0%</td>
</tr>
<tr>
<td>White</td>
<td>9</td>
<td>36.0%</td>
</tr>
</tbody>
</table>

### Education Attained

<table>
<thead>
<tr>
<th>Education Attained</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>21</td>
<td>84.0%</td>
</tr>
<tr>
<td>High School</td>
<td>4</td>
<td>16.0%</td>
</tr>
</tbody>
</table>

### Marital Status

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>14</td>
<td>56.0%</td>
</tr>
<tr>
<td>Single</td>
<td>4</td>
<td>16.0%</td>
</tr>
<tr>
<td>Widowed</td>
<td>7</td>
<td>28.0%</td>
</tr>
</tbody>
</table>

### Employment Status

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>17</td>
<td>68.0%</td>
</tr>
<tr>
<td>Retired</td>
<td>8</td>
<td>32.0%</td>
</tr>
</tbody>
</table>

### How many in the household?

<table>
<thead>
<tr>
<th>Household Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spouse</td>
<td>14</td>
<td>56.0%</td>
</tr>
<tr>
<td>Son, Daughter, Family</td>
<td>11</td>
<td>44.0%</td>
</tr>
</tbody>
</table>

---

**Data Analysis**

The data from total 50 PIN questionnaires (pre and post) were entered into SPSS Version 20. Each item on the questionnaire was defined as an individual variable. Subject ID numbers
were assigned and a pre and post-test variable was created to group cases by test time. All missing values were coded as 99. Frequency tables were run on all questions to make sure no values entered were out of range and that 50 values were entered for each variable. Descriptive statistics was used to analyze the demographic data as well as the PIN level responses. After all the variables were identified and totaled including total scores from variables for each subscale of the PIN questionnaire, preliminary statistics was done using Paired Samples t-test for all total scores of dependent variables and all the total scores of pre and posttests. To determine the magnitude of the intervention’s effect, an effect size was calculated and interpreted as eta squared. Eta-squared describes the ratio of variance explained in the dependent variable by a predictor while controlling for other predictors, making it analogous to the related effect size (r2).

The PIN questionnaire measured the level of understanding of the link between foot ulceration and self-care deficit, assessed cognitive and emotional interpretation of diabetic peripheral neuropathy, which could impact adherence to foot care with subscales that measures on the Nature (1-12), Cause (13-22), Duration and Course (23-30), Controllability (31-55), Physical Consequences (56-62), and Emotional Consequences (63-73) diabetic peripheral neuropathy and adherence to foot care (Vileikyte et al., 2006). The details of data analysis will be demonstrated to further elucidate statistical findings.

Table 2

<table>
<thead>
<tr>
<th>Total Scores on Pre-Test PIN Subscales and Overall PIN Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Nature &amp; Course</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Min</td>
</tr>
<tr>
<td>Max</td>
</tr>
</tbody>
</table>

**Independent and Dependent Variables for the Hypothesis**

The variables of interest in this analysis was independent variable of Education Intervention (1=Pre-Test and 2= Post-Test) and a continuous dependent variable called PIN Total Scores. The dependent variable of PIN Total scores was compiled by creating a composite mean for the 73 questions on the PIN questionnaire that were based on a Likert type scale with 1 = Strongly Disagree, 2= Disagree, 3= Uncertain, 4= Agree, and 5= Strongly Agree.

**Research Question**

*Question:* Was a patient-focused diabetic foot care education intervention more effective than standard care in improving knowledge of foot self-care among T2DM patients in a rural clinic?
Hypothesis: There will be a statistically significant difference in T2DM patients’ PIN scores from pre to post implementation of a patient-focused diabetic foot care educational intervention.

Paired Samples T-test Interpretation

This project was a one-group pretest/posttest quasi-experimental study. A paired samples t-test was conducted to evaluate the impact of a nurse-focused diabetic foot care educational intervention on patients’ knowledge of foot care self-management. There was a statistically significant increase in PIN scores from pre-test \((M = 261.64, SD = 30.00)\) to post-test \((M = 327.96, SD = 22.00)\), \(t(25) = 7.952, p = .000\) (two-tailed). In this study, the probability \((p)\) value on Pre and Post Pin total score was .000. The \((p)\) value was substantially smaller than the specified alpha value of .05 hence there was a significant difference in the PIN total scores at pre and post intervention. In comparing the mean values, the Mean score on the pre PIN total score was 261.64 and post PIN total score was 327.96; with a Mean Difference of -66.32, with 95 percent confidence interval which means that there was 95% confidence that the result was real and not due to chance.

The dependent variable of PIN Total scores were compiled by creating a composite mean for the 73 questions on the PIN questionnaire with subscales that measured on the Nature (1-12), Cause (13-22), Duration and Course (23-30), Controllability (31-55), Physical Consequences (56-62), and Emotional Consequences (63-73) on diabetic peripheral neuropathy and adherence to foot care. All subscales demonstrated a significant difference at the \(p=.05\) alpha, which means that the result had a 95% confidence that the results from these subscales were real and not due to chance. See Table 4 for details on paired differences between subscale differences and total scores differences.
Table 4

**Paired Samples Test Results**

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>95% Confidence Interval of the Difference</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Pair 3</td>
<td>-4.36000</td>
<td>6.51844</td>
</tr>
<tr>
<td>Pair 5</td>
<td>-5.56000</td>
<td>4.80521</td>
</tr>
</tbody>
</table>
### Table 5

**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Paired Samples Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Pair 6</td>
<td>Pre-test Emotional Consequences Subscale Total - Post-test Emotional Consequences Total</td>
</tr>
<tr>
<td>Pair 7</td>
<td>Pre-test Patient Interpretation of Neuropathy (PIN) Sum Total - Post-test Patient Interpretation of Neuropathy (PIN) Sum Total</td>
</tr>
</tbody>
</table>

### Table 6

**Correlations**

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Paired Samples Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Pair 7</td>
<td>Pre-test Patient Interpretation of Neuropathy (PIN) Sum Total &amp; Post-test Patient Interpretation of Neuropathy (PIN) Sum Total</td>
</tr>
</tbody>
</table>
Figure 2.

Pre PIN Total Score Histogram

![Pre PIN Total Score Histogram](image)

Figure 3.

Post PIN Total Score

![Post PIN Total Score](image)

Effect size of Paired Sample T-test
To determine the magnitude of the intervention’s effect, an effect size statistic was calculated and interpreted as Eta squared. Eta-squared describes the ratio of variance explained in the dependent variable by a predictor while controlling for other predictors, making it analogous to the related effect size ($r^2$).

In this study the calculated effect size is 0.7. Based on Cohen’s guidelines (1988), 0.01 = small effect size, 0.06 = medium effect, and 0.14 = large effect; therefore the effect size for this study was found to be extremely large. Eta-squared estimates only the effect size in the sample and measures the variance explained of the sample, not the population, meaning that it will always overestimate the effect size, although the bias grows smaller as the sample grows larger (Pallant, 2013).

**Conclusion**

The participants in this project were mostly female, Hispanic, had less than a high school education, were married, employed, and lived with their spouse. The variables of interest in this analysis were independent variable of Education Intervention (1=Pre-Test and 2= Post-Test) and a continuous dependent variable = PIN Total Scores. A paired samples t-test was conducted to evaluate the impact of the educational intervention among T2DM patients in a rural clinic based on PIN scores which measured the level of understanding of the link between foot ulceration and self-care deficit, assessed cognitive and emotional interpretation of diabetic peripheral neuropathy. There was a significant increase on T2DM patient’s knowledge scores from Pre educational intervention ($M = 261.64$, $SD = 30.0$) to Post educational intervention ($M = 327.96$, $SD = 22.0$), $t$ value $= 7.952$, $p = .000$ (two-tailed). The Mean difference of the two scores was -66.32, with a 95 percent confidence interval stretching from a lower bound of -83.53334 to an upper bound of -49.10666. The eta squared statistic (.72) indicated an extremely large effect size.
Diabetic foot education and prevention among diabetic patients in this rural clinic is essential because the knowledge and skills they have acquired as a result of the education intervention have a significant impact on their therapeutic outcomes. The findings in post education indicated increased knowledge, willingness and motivation, which are important elements that contribute to behavior change on this patient population.
CHAPTER 5: FINDINGS

**Introduction**

This capstone project implemented an evidence based education intervention on T2DM patients at the Tomball, Magnolia, and Waller (Tomagwa) Healthcare Ministries which serves the rural communities of Tomball, Magnolia and Waller Counties in Texas. Tomagwa is a Christian ministry, funded mainly by donations with 60 percent of patient care provided by volunteers. Poor socio-economic condition, lack of proper diabetic foot care education, and incorrect footwear are factors associated with the development of diabetic foot ulcers (Jeffcoate et al., 2011). Most foot care education aims at patients with pre-existing complications of the foot and lower extremities with little or no patient education provided on basic foot care or the prevention of foot ulcerations particularly in the rural communities. Based on this information, Chapter 5 will further elucidate the findings and recapitulate the information presented in Chapter 4 to form a broader meaning regarding the data analyses findings and present ensuing nursing leadership implications and recommendations for future research based on the result of the project.

**Interpretation of the Findings**

The capstone project aimed to establish the effectiveness of a patient-centered diabetes foot education intervention intended to improve diabetic patients’ knowledge, as evidenced by an increase in the Patient Interpretation of Neuropathy (PIN) scores from pre-intervention to post-intervention. The research question asked if among T2DM patients in a rural clinic, a nurse-focused diabetic foot care education program was more effective than the standard care in improving patients’ knowledge of foot self-care. There was a statistically significant
improvement in diabetic patients’ PIN scores from pre to post implementation of a nurse-focused diabetic foot care educational intervention; hence the null hypothesis was rejected.

Effect size was the measure of the strength of an effect or relationship between the variables and this assisted the researcher to measure the clinical significance of the study to make a more meaningful inference from a sample to a population (Kim & Mallory, 2013). Determining the effect size was crucial because it was a real measure of how great an effect an intervention had on the outcome of the study, which allowed the researcher to consider the clinical significance based on the extent of the effect in addition to the statistical significance. The effect size of the intervention for this study was found to be very large, which supported the clinical effect that this researcher hoped to achieve.

Inferences of Significant Findings

The hypothesis and question posed in this study were both answered yes. The theoretical framework of Pender’s health promotion model (HPM) emphasized the role of expectation in affecting behavior based on the tenet that the greater a person’s self-efficacy or perceived competent behavior, the more likely the person will commit and actually will carry out a positive behavior (Peterson & Bredow, 2008). The HPM model suggested that interventions on health promotion focused on three areas a) the individual characteristics and experiences, b) behavior-specific cognition and affect and c) the behavioral outcomes. Consistent with HPM model, the diabetic educational intervention focused on the participants’ engagement in the discussion and return demonstration of the skills that were taught (individual characteristics and experiences). Active participation encouraged to facilitate self-care, and empowered participants in handling different care situations (behavior-specific cognition and affect). The diabetic foot care education intervention for this project was based on the outcomes of numerous studies and evidence for
effective educational methods in increasing knowledge and changing behavior. The use of Pender’s health promotion model as a theoretical framework and the selected educational materials such as *13 tips to Happy Feet* and the *Take Care of your Feet for a Lifetime Booklet* demonstrated significant changes in the knowledge and behavior in this study as evidenced by the statistically significant improvement in diabetic patients’ PIN scores from pre to post implementation of a diabetic foot care prevention education. The effect size of the intervention was found to be very large. These findings were found in a sample that was mostly female, 37-68 years of age, Hispanic, had less than a high school education, were married, employed, and lived with their spouse. Majority of the patients in this clinic were women which may have increased the probability of female to male ratio in this study. In Perrin et al. (2009) study had indicated that males were less likely to seek medical advice during an illness or engage in health promoting activities which may also have influenced the female to male ratio in this study.

**Implications of the Analysis for Leaders**

The use of a scientific approach, such as evidence-based practice, plays a crucial role in the provision of appropriate care to patients. The move towards evidenced based practice paves the way for healthcare professionals to move away from long-established style of care delivery to the new paradigm where decisions are driven according to the best evidence available. Two notions central to the issue of evidence-based practice implementation are ownership of a problem and involvement with the process to solve the problem (Reavy & Tavernier, 2008). The role of nurse leaders in provision of organizational support, development of research practice and presentation of clinical solutions is critical in the dissemination of evidenced based practice (Limoges, Acorn & Osborne, 2015). Implementation and evaluation of evidence based practice allows for development of new knowledge. Providing educational intervention using evidence-
based information obtained from the American Diabetes Association (ADA) had afforded an evidence-based framework in education intervention for this capstone project. The new knowledge obtained from the project aligns with the scholarship of application where knowledge will be used in service activities within the community that will generate positive outcomes and will be beneficial to a larger population. The knowledge generated from this study will contribute to the scientific literature of nursing practice, particularly on diabetic foot prevention.

This project looked at common descriptive characteristics identified by previous studies on prevention of diabetic foot ulcers. The diabetic patients’ lack of knowledge on foot care was consistent with the findings of other studies. A systematic review on reducing risks in diabetes self-management reported a decrease in outcome improvement through the continuum, moving from 79% for immediate post intervention outcomes to 40% for long-term outcomes and this highlights the need to identify best approaches in risk reduction and ongoing interventions in diabetes self-management to prevent debilitating complications of diabetes (Kent et al., 2013). Majority of the patients in the diabetic clinic were women which may have increased the probability of female to male ratio in this study which is also supported by the Perrin et al. (2009) study which had indicated that males were less likely to seek medical advice during an illness or engage in fewer health promoting activities. As nurse leaders, these data should be articulated and disseminated to address rising concerns on debilitating complications of diabetes such as diabetic foot ulcers and subsequent amputation.

To enhance evidence-based practice and patient safety, the use of research findings need to be encouraged and promoted. The doctoral prepared nurse can take the lead in the dissemination of evidence based diabetic foot education to close the gap and improve health outcomes of diabetic patients in the rural clinics. Since early assessment and recognition of
diabetes complications is the key in prevention of diabetic foot ulceration, nurses need to be educated in early recognition of these complications. This can be accomplished by launching evidenced based education program for nurses to assist them in this undertaking.

Evidence based practice as a new paradigm is ongoing and the amount of research data has increased however, there remains a gap between the generation of new knowledge and widespread adoption and implementation to improve care and health outcomes (Pierson & Schuelke, 2009). To enhance evidence-based practice and patient safety, the use of research findings need to be encouraged and promoted. The capstone project brought to light gap in diabetic patient knowledge and practice. The doctoral prepared nurse can take the lead in the dissemination of evidence based diabetic foot patient education to improve health outcomes of diabetic patients in the rural clinics.

**Recommendations for Nursing Practice**

The lack of consistent diabetic foot education particularly among disparate populations in the rural communities heightens the necessity to provide a standardized diabetic foot education to promote prevention of complications among this population. Diabetic foot education is a crucial element in nursing intervention to improve diabetic patient outcomes and prevent diabetic foot amputations; therefore, health insurers need to recognize diabetic foot education as a significant intervention to promote positive behavior outcomes, which subsequently will result in saving health care costs.

Provision of preventive education highlights the doctoral prepared nurse’s role as the highest clinical degree to influence scholarship in education. Education outlines the role of the doctoral prepared nurse in the evaluation of clinical nurse continuing education as well as patient education to improve healthcare delivery. Implementation and evaluation the effectiveness of the
education delivery approach ensures that the current needs of the diabetic patients are met. It is imperative to develop patient educational activities that provide enhanced awareness of the complications that can affect lower limb and the actions that prevent these complications e.g. self-care practices such as drying between toes, avoiding walking barefoot, appropriate nail cutting technique, use of appropriate footwear are key to diabetic foot injury prevention. Adopting healthy foot habits require change of life routines for this population and the nurse is a crucial prime mover of this process through patient monitoring in order to create alternatives that facilitate diabetic patients’ adherence to prescribed management to achieve positive outcomes.

The implementation of the capstone project in a rural community clinic improved diabetic patients’ knowledge in self-management in diabetic foot ulcer prevention. This achievement will pave for the sharing of knowledge and skills among healthcare providers (doctors and nurses) in this clinic. The implementation of this project to larger population e.g. rural clinics around the state is feasible and could result in operational foot clinics that disparate population could access for this specific need.

Other than just focusing on the patient level, an education program aimed at healthcare professionals involved in the care and empowerment of diabetic patients will pave for a more congruent and robust educational program that will assist diabetic patients to be proactive and empowered in taking care of their feet, identify problems and seek timely help when problems arise. Early detection and prompt treatment of diabetic foot problems through sustained education and prevention such as screening will provide an operational model in reduction of morbidity and mortality and improve in diabetic patient outcomes in the rural communities where disparity is prevalent (Abbas, Lutale, Bakker, Baker & Archibald, 2011).
Recommendations for Future Research

The capstone project aimed to establish the effectiveness of a patient-centered diabetes foot education intended to improve diabetic patients’ knowledge on diabetic foot prevention. The diabetic foot care education intervention was based on the outcomes of numerous studies and evidence for effective educational methods in increasing knowledge and changing behavior. Consistent with Pender’s health promotion model, the diabetic foot education intervention focused on the participants’ engagement in the discussion and return demonstration of the skills that were taught. In this study, Pender’s theoretical framework demonstrated the nurse’s influence in a diabetic patient’s behaviors and attitudes toward self-care specifically on regular foot assessment and utilization of available resources. The use of this approach and chosen the educational material in this project demonstrated significant changes in knowledge and behavior in this study as evidenced by significant improvement in diabetic patients’ PIN scores from pre to post education implementation. Given this finding, basic foot care education should be offered to a larger population over a longer period of time. This will provide the opportunity to expand the project and serve a bigger number of diabetic patients that can be impacted likewise pave for further research to determine at which phase of basic foot care education should be implemented and re-enforced.

The capstone project proved that patient education on the prevention of foot ulceration is essential in the rural clinic serving the disparate population and should be incorporated into the routine care of patients with diabetes in this population. One to one patient contact and education has implications for future development of diabetes education program guidelines and reimbursement policies focused on individual diabetic foot prevention education.
Self-management education materials such as *13 tips to Happy Feet* and the *Take Care of Your Feet for a Lifetime* assisted diabetic patients develop self-management competencies to improve health among T2DM patients in Tomagwa clinic. Further research can be developed based on the competencies from this standardized education material such as development of evaluations related to the changes in behaviors and health outcomes on routine and emergency clinic visits, hospitalizations, development of foot ulcers, and amputations. A follow-up study using telephone interviews or surveys can also be developed to determine living conditions of participants. This study will provide further information if living condition is a determinant in acquiring self-management competencies of patients with diabetes.

The capstone project demonstrated that patient education on the prevention of foot ulceration is essential and should be incorporated into the routine care of patients with diabetes both in the acute and clinic settings. One of the roles of a doctoral prepared nurse is to disseminate research findings and evidence-based practice to improve outcomes and determine at which time in the plan of care the education needs to be implemented. This opens opportunity for future research on finding if there is a gap between patient knowledge and nursing practice. Clarity of education implementation could also elucidate the role of the nurse in reinforcement of diabetes education. Implementation of diabetic education programs tailored to the specific needs of the patients and nurses in a rural clinic will improve the quality of care, improve patients’ health outcomes and minimize the incidence of complications such as diabetic foot ulceration.

**Summary**

Accountability in health care is an emergent issue to consumers, policy makers, and health care professionals, hence the push for a responsible practice guided by the knowledge of the best intervention designed for a specific group of people in a particular health situation. The
development and expansion of nursing knowledge and the accessibility of clinical and other pertinent patient data place nurses at the fore to advance evidenced based and data driven approaches to health care delivery (Miller, Ward, & Young, 2010).

The result of the capstone project validated the effectiveness of a patient-centered diabetic foot education intervention. The knowledge generated from this study will provide more data to the literature of nursing practice particularly on diabetic foot prevention. To enhance evidence-based practice and patient safety, the use of research findings need to be encouraged and promoted. Evidence based practice as a new paradigm is ongoing hence; the amount of research data has also increased. However, there remains a gap between the generation of new knowledge and widespread adoption and implementation to improve care and health outcomes (Pierson & Schuelke, 2009). As nurse leaders, these findings should be articulated and disseminated to address rising concerns on debilitating complications of diabetes such as diabetic foot ulcers and subsequent amputations.

Provision of preventive education highlights the doctoral prepared nurse’s role as the highest clinical degree to influence scholarship in education. Education outlines the role of the doctoral prepared nurse in the evaluation of clinical nurse continuing education as well as patient education to improve healthcare delivery. Implementing and evaluating the effectiveness of the education delivery approaches ensure that the current needs of the diabetic patients in rural settings are met. The capstone project integrated the best evidence to improve patient outcomes and proved that patient education on the prevention of foot ulceration is essential in the rural clinics serving the disparate population hence it should be incorporated into the routine care of patients with diabetes in this population. Providing basic foot care education in a rural clinic will increase the patients’ knowledge of diabetic foot care, improve overall foot health, reduce direct
and indirect diabetic health costs, enhance the economic standing of patients and the health care facility, develop opportunities for shared learning experiences and bridge the gap between knowledge and practice.
References


George, H., Rakesh, P., Krishna, M., Alex, R., Abraham, V. J., George, K., & Prasad, J. H. (2013). Foot care knowledge and practices and the prevalence of peripheral neuropathy among people with diabetes attending a secondary care rural hospital in southern


Hollis, M., Glaister, K., & Lapsley, J. A. (2014). Do practice nurses have the knowledge to


reported self-care and a1c values among african americans with diabetes mellitus.


Appendix A

NPI

We are asking you to help us by completing the following questionnaire. We are trying to learn more about people like yourself, people with diabetes who have Lost Some or All Feeling in their Feet. We are interested in your own personal views about this medical condition.

Please do not ask a friend or relative to help you to answer the questions, as we are interested in your opinion alone.

The answers will be kept strictly confidential and only used for the purposes of this research.

THANK YOU VERY MUCH FOR YOUR HELP.

The first set of questions is about the NATURE of lost or reduced feeling. Please indicate how much you agree or disagree with each of the following statements by ticking the appropriate box.

<table>
<thead>
<tr>
<th>ID</th>
<th>Statement</th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>UNCERTAIN</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ID</td>
<td>Lost or reduced feeling means damage to the nerves in my feet</td>
<td></td>
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<tr>
<td>2ID</td>
<td>Lost or reduced feeling means poor circulation in my feet</td>
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<tr>
<td>3ID</td>
<td>Good circulation in the feet means that a person will not get serious problems such as ulcers (open sores) on their feet</td>
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<tr>
<td>4ID</td>
<td>Good circulation in the feet means healthy feet</td>
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<tr>
<td>5ID</td>
<td>It is possible to have lost or reduced feeling and at the same time have pain in the feet</td>
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<tr>
<td>6ID</td>
<td>It is possible to have lost or reduced feeling and at the same time have no symptoms in the feet</td>
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<tr>
<td>7ID</td>
<td>It is possible to have reduced feeling in the feet in spite of having sensitivity to touch</td>
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<tr>
<td>8ID</td>
<td>If the feet feel warm to the touch it means healthy feet</td>
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</tbody>
</table>
Lost or reduced feeling in the feet is only serious if it causes symptoms

If I had a foot ulcer (an open sore) I would get pain in my feet

When a foot ulcer (an open sore) gets worse it would be painful

I could develop a foot ulcer (an open sore) without feeling any pain

The next set of questions is about the likely CAUSE of lost or reduced feeling. Please indicate how much you agree or disagree with each of the following statements by ticking the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>UNCERTAIN</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>13C</td>
<td>Lost or reduced feeling is inevitable if one has diabetes</td>
<td></td>
<td></td>
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<tr>
<td>14C</td>
<td>Lost or reduced feeling in my feet was caused by poor medical care in the past</td>
<td></td>
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<tr>
<td>15C</td>
<td>Lost or reduced feeling in my feet was caused by not taking good care of my diabetes</td>
<td></td>
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<tr>
<td>16C</td>
<td>Foot ulcers (open sores) are caused by poor medical care</td>
<td></td>
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<tr>
<td>17C</td>
<td>Foot ulcers (open sores) are caused by not taking care of oneself</td>
<td></td>
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<tr>
<td>18C</td>
<td>Foot ulcers (open sores) are inevitable when one has diabetes</td>
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<tr>
<td>19C</td>
<td>Changes in foot shape can cause foot ulcers (open sores)</td>
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<tr>
<td>20C</td>
<td>Ill-fitting shoes can cause foot ulcers (open sores)</td>
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<tr>
<td>21C</td>
<td>Excessive hard skin formation (callus) can cause foot ulcers (open sores)</td>
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<tr>
<td>22C</td>
<td>Dry skin on the feet can cause foot ulcers (open sores)</td>
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</table>

The next set of questions is about the likely DURATION and the COURSE of lost or reduced feeling. Please indicate how much you agree or disagree with each of the following statements by ticking the appropriate box.
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Uncertain</th>
<th>Agree</th>
<th>Strongly Agree</th>
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</thead>
<tbody>
<tr>
<td>23TL</td>
<td>Lost or reduced feeling in my feet will be permanent</td>
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<tr>
<td>24TL</td>
<td>Lost or reduced feeling in my feet will last for a short time</td>
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<tr>
<td>25TL</td>
<td>Lost or reduced feeling in my feet will stay the same over time</td>
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<tr>
<td>26TL</td>
<td>Lost or reduced feeling in my feet will get worse over time</td>
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<tr>
<td>27TL</td>
<td>Lost or reduced feeling in my feet will get better over time</td>
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<tr>
<td>28TL</td>
<td>Foot ulcers (open sores) take a long time to develop</td>
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<tr>
<td>29TL</td>
<td>Foot ulcers (open sores) can develop very fast</td>
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<tr>
<td>30TL</td>
<td>I can develop a foot ulcer (an open sore) at any time</td>
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</table>

The next set of questions is about the likely CONTROLLABILITY of lost or reduced feeling. Please indicate how much you agree or disagree with **each** of the following statements by ticking the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Uncertain</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>31CC</td>
<td>I can examine my feet daily</td>
<td></td>
<td></td>
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<tr>
<td>32CC</td>
<td>I can engage in activities (such as walking or massaging my feet) that improve circulation in my feet</td>
<td></td>
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<tr>
<td>33CC</td>
<td>I can keep appointments with my foot care specialist such as a chiropodist/podiatrist</td>
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<tr>
<td>34CC</td>
<td>I can choose shoes that fit my feet</td>
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<tr>
<td>35CC</td>
<td>I can moisturise my feet regularly</td>
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<tr>
<td>36CC</td>
<td>I can have hard skin (callus) removed from my feet regularly</td>
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<tr>
<td>37CC</td>
<td>The diabetes doctor can prevent lost or reduced feeling in my feet from getting worse</td>
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<tr>
<td>38 CC</td>
<td>My GP / family doctor can prevent lost or reduced feeling in my feet from getting worse</td>
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<tr>
<td>39 CC</td>
<td>Nobody can prevent lost or reduced feeling in my feet from getting worse</td>
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<tr>
<td>40 CC</td>
<td>I can prevent lost or reduced feeling in my feet from getting worse</td>
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<tr>
<td>41 CC</td>
<td>I can keep appointments with my diabetes doctor</td>
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<tr>
<td>42 CC</td>
<td>Good diabetes control can prevent lost or reduced feeling in my feet from getting worse</td>
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<tr>
<td>43 CC</td>
<td>Improving circulation in my feet can prevent lost or reduced feeling from getting worse</td>
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<tr>
<td>44 CC</td>
<td>I can keep appointments with my GP / family doctor</td>
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<tr>
<td>45 CC</td>
<td>I can keep my blood sugars well controlled</td>
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<tr>
<td>46 CC</td>
<td>I can prevent foot ulcers (open sores) from occurring</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>47 CC</td>
<td>Diabetes doctors can prevent foot ulcers (open sores) from occurring</td>
<td></td>
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<tr>
<td>48 CC</td>
<td>GPs / family doctors can prevent foot ulcers (open sores) from occurring</td>
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<tr>
<td>49 CC</td>
<td>Foot care specialists such as podiatrists / chiropodists can prevent foot ulcers (open sores) from occurring</td>
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<tr>
<td>50 CC</td>
<td>Checking my feet every day can prevent foot ulcers (open sores) from occurring</td>
<td></td>
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</tr>
<tr>
<td>51 CC</td>
<td>Nobody can prevent foot ulcers (open sores) from occurring</td>
<td></td>
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</tr>
<tr>
<td>52 CC</td>
<td>Seeing my foot care specialist such as a podiatrist / chiropodist regularly can prevent foot ulcers (open sores) from occurring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53 CC</td>
<td>Wearing shoes that fit properly can prevent foot ulcers (open sores) from occurring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54 CC</td>
<td>Moisturising feet can prevent foot ulcers (open sores) from occurring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55 CC</td>
<td>Removing hard skin (callus) can prevent foot ulcers (open sores) from occurring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The next set of questions is about the **PHYSICAL CONSEQUENCES** of lost or reduced feeling. Please indicate how much you agree or disagree with **each** of the following statements by ticking the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>UNCERTAIN</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>56PC</td>
<td>Lost or reduced feeling in my feet could lead to difficulties with driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>57PC</td>
<td>Lost or reduced feeling in my feet could lead to difficulties with walking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58PC</td>
<td>Lost or reduced feeling in my feet could lead to injuries to my feet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59PC</td>
<td>Lost or reduced feeling in my feet could lead to foot gangrene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60PC</td>
<td>Lost or reduced feeling in my feet could lead to foot ulcers (open sores)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61PC</td>
<td>Lost or reduced feeling in my feet could lead to amputation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62PC</td>
<td>Lost or reduced feeling in my feet could lead to me becoming dependent on my family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The next set of questions is about **EMOTIONAL** consequences of lost or reduced feeling. Please indicate how much you agree or disagree with **each** of the following statements by ticking the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>UNCERTAIN</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>63EC</td>
<td>Having lost or reduced feeling in my feet makes me worry about what is going to happen next</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64EC</td>
<td>Having lost or reduced feeling in my feet makes me worry about a foot injury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65EC</td>
<td>Having lost or reduced feeling in my feet makes me worry about a foot ulcer (an open sore)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66EC</td>
<td>Having lost or reduced feeling in my feet makes me worry about losing a leg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67EC</td>
<td>Having lost or reduced feeling in my feet makes me angry about not being able to do things I want to do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
People with diabetes who have lost or reduced feeling may experience different problems with their feet. EVEN IF YOU DO NOT HAVE ANY OF THE FOOT PROBLEMS listed below, please tick the box to indicate the condition you think of as a likely CAUSE of each of the foot problem. If you think the foot problem has more than one cause, tick all that apply.

<table>
<thead>
<tr>
<th>68EC</th>
<th>Having lost or reduced feeling in my feet makes me angry about health care providers who don’t seem to care about me</th>
<th>Poor circulation</th>
<th>Nerve damage to feet</th>
<th>Age</th>
<th>None of these</th>
</tr>
</thead>
<tbody>
<tr>
<td>69EC</td>
<td>Having lost or reduced feeling in my feet makes me angry about health care providers not telling me what is really going on with my feet</td>
<td>Poor circulation</td>
<td>Nerve damage to feet</td>
<td>Age</td>
<td>None of these</td>
</tr>
<tr>
<td>70EC</td>
<td>Feeling worried makes me more determined to take good care of my feet</td>
<td>Poor circulation</td>
<td>Nerve damage to feet</td>
<td>Age</td>
<td>None of these</td>
</tr>
<tr>
<td>71EC</td>
<td>Feeling worried makes me feel helpless to do anything about my feet</td>
<td>Poor circulation</td>
<td>Nerve damage to feet</td>
<td>Age</td>
<td>None of these</td>
</tr>
<tr>
<td>72EC</td>
<td>Feeling angry makes me more determined to take good care of my feet</td>
<td>Poor circulation</td>
<td>Nerve damage to feet</td>
<td>Age</td>
<td>None of these</td>
</tr>
<tr>
<td>73EC</td>
<td>Feeling angry makes me resent all the foot care advice given</td>
<td>Poor circulation</td>
<td>Nerve damage to feet</td>
<td>Age</td>
<td>None of these</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THIS SYMPTOM</th>
<th>IS CAUSED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poor circulation</td>
</tr>
<tr>
<td>1 Burning in the legs or feet</td>
<td>Poor circulation</td>
</tr>
<tr>
<td>2 Excessive heat or cold in the legs or feet</td>
<td>Poor circulation</td>
</tr>
<tr>
<td>3 Pins and needles in the legs or feet</td>
<td>Poor circulation</td>
</tr>
<tr>
<td>4 Shooting or stabbing pain in the legs or feet</td>
<td>Poor circulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THIS SYMPTOM</th>
<th>IS CAUSED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poor circulation</td>
</tr>
<tr>
<td>5 Throbbing in the legs or feet</td>
<td>Poor circulation</td>
</tr>
<tr>
<td>6 Feelings in the legs or feet that make them jump</td>
<td>Poor circulation</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Irritation of the skin caused by something touching the feet, such as bed sheets or socks</td>
</tr>
<tr>
<td>8</td>
<td>Numbness in the feet</td>
</tr>
<tr>
<td>9</td>
<td>Inability to feel the difference between hot and cold with feet</td>
</tr>
<tr>
<td>10</td>
<td>Inability to feel objects with feet</td>
</tr>
<tr>
<td>11</td>
<td>Weakness in the hands</td>
</tr>
<tr>
<td>12</td>
<td>Problems with balance or unsteadiness while walking</td>
</tr>
<tr>
<td>13</td>
<td>Problems with balance or unsteadiness while standing</td>
</tr>
<tr>
<td>14</td>
<td>A foot ulcer (an open sore)</td>
</tr>
<tr>
<td>15</td>
<td>Changes in foot shape</td>
</tr>
<tr>
<td>16</td>
<td>Hard skin (callus) under the feet</td>
</tr>
<tr>
<td>17</td>
<td>Dry skin on the feet</td>
</tr>
<tr>
<td>18</td>
<td>Lost or reduced feeling in your feet</td>
</tr>
</tbody>
</table>

People with lost or reduced feeling can develop problems with their feet which may then go away. Again, EVEN IF YOU HAVE NOT EXPERIENCED ANY OF THE PROBLEMS LISTED BELOW, please tick a box next to each of them to indicate whether a change would mean that the lost or reduced feeling is cured, improving, not changing or getting worse.

<table>
<thead>
<tr>
<th>If this change in foot problems took place</th>
<th>Lost or reduced feeling in the feet would be:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cured</td>
</tr>
<tr>
<td>1 If burning in the legs or feet goes away</td>
<td></td>
</tr>
<tr>
<td>2 If excessive heat or cold in the legs or feet goes away</td>
<td></td>
</tr>
<tr>
<td>3 If pins and needles in the legs or feet go away</td>
<td></td>
</tr>
<tr>
<td>4 If shooting or stabbing pain in the legs or feet goes away</td>
<td></td>
</tr>
<tr>
<td>If this change in foot problems took place</td>
<td>Lost or reduced feeling in the feet would be:</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>If throbbing in the legs or feet goes away</td>
</tr>
<tr>
<td>6</td>
<td>If feelings in the legs or feet that make them jump go away</td>
</tr>
<tr>
<td>7</td>
<td>If irritation of the skin caused by something touching the feet, such as bed sheets or socks goes away</td>
</tr>
<tr>
<td>8</td>
<td>If numbness in the feet develops</td>
</tr>
<tr>
<td>9</td>
<td>If inability to feel the difference between hot and cold with the feet develops</td>
</tr>
<tr>
<td>10</td>
<td>If inability to feel objects with the feet develops</td>
</tr>
<tr>
<td>11</td>
<td>If the hands become weak</td>
</tr>
<tr>
<td>12</td>
<td>If unsteadiness while walking develops</td>
</tr>
<tr>
<td>13</td>
<td>If unsteadiness while standing develops</td>
</tr>
<tr>
<td>14</td>
<td>If a foot ulcer (an open sore) heals</td>
</tr>
<tr>
<td>15</td>
<td>If foot shape begins to change</td>
</tr>
<tr>
<td>16</td>
<td>If hard skin (callus) from under the feet is removed</td>
</tr>
</tbody>
</table>
Appendix B

CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Upon signing this document, I, ____________________________ am in agreement that my participation in this research project is strictly voluntary and my expectations within this project have been clearly stated within the content of this consent form. I fully understand that my participation in this project will not have in any way jeopardize or influence the medical treatment that I receive in Tomagwa Clinic, and I will not be exposed to any kind of physical, mental, or emotional harm as a result of my participation in this project.

I understand that I have the right to withdraw from this project at any point within the project. The purpose of this project has been fully explained to me such as effectiveness of self-management education session specific to care of the diabetic foot on the prevention of foot ulcerations in type 2 diabetes. I have been provided with an information sheet with the researcher’s contact information as well as a detailed description of the purpose and the expectation of this project. I understand that should I have any additional questions or concerns at any point during this project, I can contact the researcher with the information in which I have been provided. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project.

In signing this form, I agree to fully disclose all required information honestly and to the best of my knowledge. I agree to complete all required documentation, fill out questionnaires, surveys, or any other similar data collection tools. In addition, I understand that any information in regard to my participation in this project will be held strictly confidential and will only be shared between me and the researcher conducting this project. Likewise, I have been assured that no personal information will be shared with anyone else without my prior written consent. If sharing of information or recollection of events shared cause me emotional distress or anguish, I understand that resources are available upon request. Questions concerning the research, at any time during or after the project, should be directed to Carmencita Abood at [contact information].

The project and this consent form have been reviewed by the Institutional Review Board (IRB), which ensures that research projects involving human subjects follow federal regulations.
Any questions or concerns about rights as a research participant can be directed to the Chair of the Institutional Review Board of the American Sentinel University.

Date________________ Participant’s Signature _______________________________________________________________________

Date________________ Researcher’s Signature _______________________________________________________________________


Appendix C

PARTICIPANT’S INFORMATION SHEET

My name is Carmencita Abood. I am a registered nurse (RN), currently pursuing a Doctorate of Nursing Practice (DNP) degree at the American Sentinel University. Part of the degree requirement is to conduct an educational project. My project is to evaluate the effectiveness of self-management education specific to the care of the diabetic foot and the prevention of foot ulcerations in type 2 diabetes patients at the Tomagwa Health Clinic. I respectfully request your participation in this research project. Upon participation, you will be asked to complete a questionnaire prior to the start of the project, as well as a questionnaire after completion of the project.

Your participation is strictly voluntary. You are not obliged in any way to participate in the project and your participation or decline in participation will not, in any way, affect your current medical treatment or the type of care you receive from any of your healthcare providers. If you chose to participate, your identity will remain unknown to other participants or anyone outside of this project. Do not place your name or other identifying information on any documents that are to be turned in to the researcher. It is of vital importance that you to read this document in its entirety and then sign the consent form. If you choose to participate in this project it is very important that you answer questions openly and honestly at all times. Should you have any questions and concerns; my contact number is provided below. Please feel free to contact me. Thank you in advance for your consideration and participation in this research project.

CONTACT INFORMATION:

Carmencita Abood
Email: [REDACTED]
Cell: [REDACTED]