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# Development of Assessment and Screening Tool to Assist with Prevention and Identification of Charcot Foot in Type 2 Diabetics

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# Walden University

College of Health Sciences

This is to certify that the doctoral study by

Louise Wade

has been found to be complete and satisfactory in all respects,  
and that any and all revisions required by  
the review committee have been made.

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Walden University  
2016

Abstract

Development of Assessment and Screening Tool

to Assist with Prevention and Identification of Charcot Foot in Type 2 Diabetics

by

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MS, West Texas A&M University, 2010

BS, West Texas A&M University, 2010

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

August 2016

## Abstract

According to the World Health Organization, up to 50% of type 2 diabetic patients develop neuropathy, which may cause major infections, amputation, and Charcot foot due to impaired sensation. Early recognition and care is essential for treatment of Charcot foot and prevention of further injury. Due to the complexity of this potentially life-threatening complication, assessment is challenging, especially when practitioners who treat adult diabetic patients may not be familiar with Charcot foot. The purpose of this scholarly project was to develop an assessment, screening tool, and algorithm for detecting Charcot foot; an additional goal was to develop practice guidelines for practitioners to assist in the early recognition, treatment, and referral of adult diabetic patients at risk for Charcot foot. Lippitt's theory of change was used to guide the project. An interdisciplinary team of stakeholders was assembled to guide development of the tool, algorithm, and practice guidelines. Products were developed in accordance with evidence in current peer-reviewed literature and American Diabetes Association recommendations for Charcot foot diagnosis, treatment, and referral. Content was validated using a scale content validation instrument process to obtain input from experts in the care of Charcot foot. An implementation plan was developed to guide introduction of the products into practice, and an evaluation plan created to determine the extent to which intermediate term outcomes are met using these products. The project may contribute to social change by identifying patients at risk for Charcot foot prior to the onset of the complication, therefore preventing further injury, deformity, or amputation in populations that are often unable to afford quality healthcare.

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## Dedication

I dedicate this project to my husband Rex, who suffers from Charcot foot and remains one of the most positive and inspirational people I have ever met. Despite the multitude of complications from diabetes, he has continued to focus on my success rather than his own issues and supported me 100% every step of the way. He is an amazing man and I am truly blessed to have him in my life.

## Acknowledgments

First, I thank God for giving me such a wonderful family and the opportunity to embark on a journey that would have an impact on patients such as my husband. I also thank my husband Rex for the continued love and support he has given me throughout this journey and for always believing in me. He consistently makes me smile every day I am with him. In addition, I thank my children and grandchildren for their love, in spite of my shortcomings. They never seem to notice.

Secondly, my sincerest thanks to my mentor Dr. Angela Phillips who has given of her time, support, and patience. She has been not only an invaluable resource for me but a positive role model for many other nurses who have the pleasure of knowing her.

Finally, I would like to express my gratitude to the members of my committee; Dr. Stoerm Anderson for his constant support and encouragement throughout the project and for being a positive role model in my life; Dr. Deborah Lewis for her support and suggestions for a successful project completion and finally, Dr. Sandra Cadena as serving as the URR on this project and providing positive comments and encouragement. This entire journey would not have been possible without the encouragement and support of each of these people and I am eternally grateful.

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## Section 1: Overview of the Evidence-Based Project

### **Introduction**

According to the World Health Organization (WHO), approximately 347 million people worldwide have type 2 diabetes, and in 2004, it was estimated that 3.4 million people died as a result of complications from high fasting blood sugar (WHO, 2013). The WHO projects that the 7th leading cause of death in 2030 will be a direct result of diabetes (WHO, 2013). Maintaining a healthy diet, a normal body weight, avoiding tobacco use, and incorporating regular physical activity can prevent or delay the onset of type 2 diabetes. According to National Diabetes Information Clearinghouse (NDIC), diabetes is the seventh leading cause of death in the U.S. and affects millions of Americans (NDIC, 2011). The virulence of diabetes and its prevalence has steadily increased over the years and continues to rise. Fowler (2007) reports that diabetes has become a major cause of morbidity and mortality in the United States, which also continue to increase globally each year. “The magnitude of current statistics indicates that diabetes will continue to affect the United States population for the foreseeable future and is by no means limited to the United States” (Fowler, 2007, para. 5). Of the millions of Americans who are diagnosed every year, the number of those who go undiagnosed is even greater, meaning everyone should observe the warning signs and have routine screenings completed. Type 2 diabetes is a devastating chronic disease with the potential to have life-long effects to all major organs including kidneys, heart, eyes, and blood vessels. The American Diabetes Association (ADA) reports that type 2 diabetes produces

severe systemic complications such as nephropathy, neuropathy, retinopathy, foot complications, heart disease, stroke and many other devastating health problems, which occur due to uncontrolled elevated glycemic levels (ADA 2013). Maintaining controlled blood sugar levels can help prevent these complications.

### **Problem Statement**

Diabetic neuropathy is the most prevalent complication of type 2 diabetes, affecting up to 50% of all diabetic patients (WHO, 2016). Peripheral neuropathy, meaning peripheral nerve damage, causes significant issues such as nonhealing wounds, major infections, and amputations. Another consequence of peripheral neuropathy can be Charcot neuropathic osteoarthropathy (CN), commonly referred to as Charcot foot, which involves the soft tissue and bones of the foot and ankle and leads to permanent deformities. This condition may ensue if the bones in the feet suffer fractures and the foot becomes misaligned. Although experiencing a fracture would be extremely painful to most people, this particular condition can be painless to the diabetic patient due to nerve damage from diabetes prior to the fracture. The foot may eventually lose muscle support, leading to deformity. Diagnosis can sometimes be difficult due to the potential mimicking of other conditions such as deep venous thrombosis or cellulitis; therefore, diagnosis of a Charcot fracture cannot be made definitively until bone changes occur. The problem identified and addressed in the project is inconsistency by healthcare providers in the recognition and referral of patients with potential Charcot foot.

### **Purpose Statement**

According to Lin and Lorenzo (2013, para. 2), “in type 1 DM, distal polyneuropathy typically becomes symptomatic after many years of chronic prolonged hyperglycemia, whereas in type 2, it may be apparent after only a few years of known poor glycemic control or even at diagnosis.” Symptoms affect sensory, motor, and autonomic systems of the body. When neuropathy progresses to Charcot foot, it becomes a serious, potentially limb-threatening complication and during the acute phase, is considered to be an inflammatory syndrome. Due to the rarity of this condition, diagnosis and treatment pose a critical issue for healthcare practitioners including nurse practitioners (Rogers et al, 2011). The purpose of the project was the development of an assessment and screening tool for nurse practitioners providing care for type 2 diabetics at risk of Charcot foot, and integration of ADA Charcot diagnosis and treatment recommendations for nurse practitioners to assist in the early recognition and treatment of Charcot foot with the goal of preventing further complications and possible loss of the foot or more of the lower extremity.

### **Goals and Objectives**

The purpose of this project was to develop an assessment and screening tool and incorporate recommendations set forth by the ADA in an effort to assist healthcare practitioners in early recognition, diagnosis, and treatment of Charcot foot in the diabetic patient with peripheral neuropathy. In doing so, the goal was to improve consistency in

the diagnosis and treatment by healthcare providers of patients with or at risk of Charcot foot.

In this section, I outline the process by which an assessment tool was developed as well as discuss its implementation and evaluation. No data was collected nor were participants involved as the project involved the development of an assessment tool to further assist nurse practitioners (NPs) in the early detection, identification, and treatment of type 2 diabetic patients at risk of Charcot foot.

The outcomes that were used to determine goal attainment for the project included an evaluation planning step at the end of this DNP Project. The following outcomes were initially suggested as possible starting points for evaluation planning:

Outcome 1: Healthcare providers will identify, assess, and treat patients with Charcot foot.

Outcome 2: Healthcare providers will refer patients with Charcot foot to appropriate specialty for follow up care.

The detection of patient risks by nurses, which is “the ability of nurses to accurately identify signals can lead to early interventions so that harm to patients is minimized or circumvented” (Despins, Scott-Cawiezell, & Rouder, 2010, p. 465). Nurses and nurse practitioners are at the forefront of patient assessment, which is the first opportunity for detection and intervention of potentially life-threatening illness and injuries. They have a responsibility to patients to be skilled in their assessment abilities and intervene when necessary. Charcot foot, although complex and often difficult to



diagnose, is a major complication of diabetes that requires immediate treatment after a detailed and skilled assessment by competent healthcare professionals.

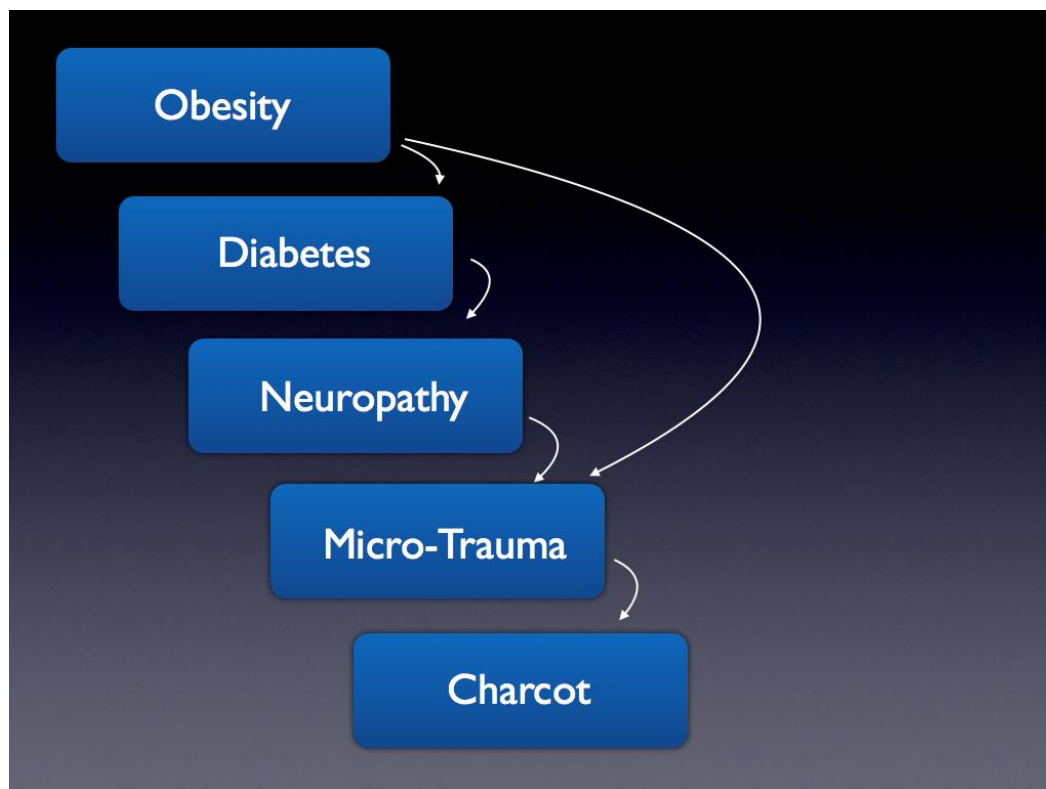
### **Significance of the Project**

The American Diabetes Association has developed guidelines for all healthcare practitioners to follow regarding the diagnosis, treatment, and surgical intervention of Charcot foot with the goal of rapid identification of signs and symptoms and appropriate treatment regimens as a means of preventing further complications. Currently, there are no exclusive assessment and screening tools and treatment algorithms specifically for NPs that address the patient at risk of Charcot foot. The project tools will meet the guidelines set forth by the ADA.

### **Implications for Social Change of Practice**

Accurate assessment of the diabetic foot is a complex process requiring skill, experience, and knowledge of not only the disease but also signs and symptoms of potential complications. The loss of sensation due to peripheral nerve damage makes it difficult for patients to help providers diagnose developing problems. They often present with vague symptoms or nonhealing wounds and often unaware of the nature of the initial injury. This is exacerbated by the unseen nature of problematic internal changes such as destruction of bone tissue and cartilage as a result of uncontrolled hyperglycemia. It is crucial that diabetic patients are consistently and closely monitored and made aware of the potential complications associated with the disease. According to Meyers (2013), by decreasing the incidence of amputations and improving quality of life through education

and close monitoring, the result will be a decrease in the amount of funds spent long-term for care of the patient with diabetes. However, many clinicians lack experience in the area of Charcot foot assessment and often consider it as simply “a diabetic foot.”



*Figure 1.* Why does Charcot deformity happen? (Perez, 2014)

According to Zgonis (2010), there is a limited amount of scientific literature in regard to treatment protocols and guidelines for management of Charcot foot and ankle deformities and may be in part due to the vague presentation of each individual case. Although many patients present with obvious deformities, there are a higher number of those who have few or vague complaints, which adds to the difficulty of accurate diagnosis for the practitioner.

## Definition of Terms

The principal terms used throughout this project will be:

*Type 2 Diabetes:* Type 2 is the most common type of diabetes and is defined as a condition in which the body does not properly utilize insulin. This is also referred to as insulin resistance. Typically, the pancreas produces an excess of insulin to accommodate elevated blood glucose levels; however, over time it is unable to adequately keep up with the body's demand of insulin to maintain normal blood glucose levels (ADA, n.d.). *Peripheral neuropathy:* Peripheral neuropathy refers to the destruction or dysfunction of peripheral nerves, which are damaged by uncontrolled elevated blood glucose levels, infection, trauma, metabolic disturbances, and exposure to toxins (Mayo Clinic, n.d.). *Charcot foot:* Charcot-Marie-Tooth (Charcot foot or CMT) was first defined in 1886 by three physicians, Jean-Martin Charcot, Pierre Marie, and Howard Henry Tooth (Charcot-Marie-Tooth Association [CMTA], 2010). It is a serious and potentially life-threatening complication of diabetes, which is characterized by various degrees of bone, joint, soft tissue, foot and often ankle involvement due to underlying neuropathy, trauma, and perturbations of bone metabolism, and it involves inflammation during the acute phase (Rogers et al, 2011).

*Podiatric:* Podiatric refers to the specialty of a physician who is a doctor of podiatric medicine (DPM), also known as a podiatric surgeon or physician who diagnoses and treats conditions of the foot, ankle, and related structures of the leg (American Podiatric Medical Association [APMA], 2014). *Acute:* Acute means a condition

characterized by sharpness or severity or having a sudden onset or short course or requiring short-term medical care for serious illness or traumatic injury (acute, 2014).

*Inflammatory:* Inflammatory refers to the body's response to either invading foreign substances (such as viruses or bacteria) or to direct injury of body tissue (inflammatory, 2014).

*Deformity:* Deformity is defined as the quality or state of being deformed, disfigured, or misshapen (deformity, 2014).

*Amputation:* Amputation is the accidental or intentional removal of a limb or body part (“amputation”, 2014).

### **Limitations**

A limitation of this project could be the willingness of all stakeholders to participate in the change. The effectiveness and success of a program relies heavily on the readiness of interested parties to be actively engaged and ready for change. Stakeholders can help (or hinder) an evaluation before it is conducted, while it is being conducted, and after the results are collected and ready for use. “Stakeholders are much more likely to support the evaluation and act on the results and recommendations if they are involved in the evaluation process” (George, Daniel, Frankish, Herbert & Bowie, n.d., p. 14). The identified stakeholders for this project included health practitioners who are completing the diabetic foot assessment.

### **Relevance to Nursing Practice**

Due to the fact that type 2 diabetics are at risk for numerous multisystem complications, all healthcare personnel, including nurse practitioners, have a responsibility to patients to be knowledgeable and competent in advanced assessment skills in hopes of preventing further complications. According to Rogers et al (2011, p. 2123), “the Charcot foot in diabetes poses many clinical challenges in its diagnosis and management. Despite the time that has passed since the first publication on pedal osteoarthropathy in 1883, we have much to learn about the pathophysiology, and little evidence exists on treatments of this disorder.” Identification of Charcot foot in its early stages is crucial to successful treatment. Patients should be referred to a podiatric specialist at the first indication or onset of symptoms. Diagnosis may often be challenging, mimicking of other major conditions such as cellulitis or deep venous thrombosis, since diagnosis of a Charcot fracture is unable to be definitively made until bone changes occur. The initial clinical manifestations of Charcot foot are frequently mild in nature; however, they can become more pronounced with repetitive trauma. Worsening usually occurs slowly with age and rapid progression is rare but warrants a prompt re-evaluation. Since undiagnosed Charcot can lead to serious complications including infection, deformity, amputations, disability, loss of employment, financial and mental strains, and life-long devastating effects, it is crucial for practitioners to be knowledgeable and skilled in assessment and treatment methods.

### **Summary**

This chapter described the significance and relevance of a competent and skilled foot assessment for all type 2 diabetics suffering from impaired sensory and are at risk for the development of Charcot foot. Lack of knowledge may contribute to undiagnosed cases of Charcot and therefore place patients at risk of further complications. An assessment tool could assist healthcare providers in rapidly identifying the signs and symptoms of Charcot and determining the appropriate treatment or referral to a podiatry specialist.

## Section 2: Review of Literature and Theoretical and Conceptual Framework

### **Introduction**

The purpose of this project was to develop an assessment and screening tool for nurse practitioners to assist in the early recognition, diagnosis, and treatment of Charcot foot in type 2 diabetic patients. The goal was to determine appropriate treatment or referral to a podiatric specialist for further evaluation and treatment in order to prevent further complications, including loss of limb. This section will examine literature regarding the effects of untreated Charcot foot as well as appropriate treatment methods.

### **Literature Search Strategy**

The literature search was electronically conducted and used the following databases: CINAHL, Medline, PubMed, EBSCO, and Walden University Library. Articles older than 10 years were not considered. The terms used for the search were: *diabetes, type 2 diabetes, diabetes statistics, neuropathy, peripheral neuropathy, diabetic complications, Charcot, Charcot foot, Charcot-Marie-Tooth, podiatry, podiatric, orthopedic complications, foot deformities, diabetic assessment forms, foot assessment, and peripheral neuropathy assessment.*

### **Literature Review**

“Charcot neuroarthropathy is an often overlooked complication in diabetic patients with peripheral neuropathy. A group of experts reported that 25% of patients referred to their facility who had Charcot neuroarthropathy had not received a correct diagnosis at the referring institution. The incorrect diagnoses included infection, gout,

arthritis, fracture, venous insufficiency, and tumor” (Botek, Anderson & Taylor, 2010, p. 596). Botek et al. (2010) focused in detail on the devastating effects of misdiagnosed Charcot and emphasized the importance of accurate assessment by healthcare providers. The authors also discussed a case in which a 53 year-old male presented to the emergency department with a 3 day history of redness, pain, and swelling to the foot and ankle and was misdiagnosed with cellulitis, admitted to the hospital for a course of antibiotics, discharged home with oral antibiotics, seen at his primary healthcare providers office 2-3 more times for follow up, then finally referred to an orthopedic specialist where he was accurately diagnosed with Charcot foot in the acute phase. By this time, there was irreversible extensive damage to the foot.

According to O’Rourke (2010), from 1999-2008, of patients who underwent either a below or above the knee amputation, 60% suffered from diabetic neuropathy and had some type of trauma, nonhealing wound, or other complication such as Charcot foot. Centered from a thorough review and analysis of the study, the primary issue for patients at high risk of ankle and foot problems was the identification and referral to the appropriate specialist (O’Rourke, 2010). Healthcare professionals, including nurse practitioners, were among those who did not recognize potential issues, which delayed care and led to amputations of the 3,445 patients included in the study.

Symptoms of Charcot foot affect sensory, motor, and autonomic systems of the body. When neuropathy progresses to Charcot arthropathy, it becomes a serious, potential limb-threatening complication and during the acute phase is considered to be an



inflammatory syndrome. Due to the rarity of this condition, diagnosis and treatment pose a critical issue for healthcare practitioners including nurse practitioners (Rogers et al, 2011). Therefore, an assessment and screening tool for nurse practitioners is needed to assist in the recognition, diagnosis, and treatment of Charcot foot in order to prevent further injury and possible loss of foot or lower extremity.

Mumoli & Camaiti (2012) discussed a case of Charcot in the *Canadian Journal of Medicine* in which a 59 year-old male with complaints of a plantar ulcer for two months presented to his healthcare provider's office. However, after examination, his healthcare provider discovered that his foot was also deformed. The finding was that the patient had such severe neuropathy that he felt no pain at all. They go on to state early detection is essential and "prevention of disease progression remains the mainstay of treatment, including prompt immobilization, absolute non-weight-bearing and professional foot care on a regular basis" (p. 1392). While even the slightest of infection, injury, or minor surgery may trigger the body's inflammatory response, without the protective barrier of pain being present, diabetic patients with sensory impairment are at greater risk of further injury, and early recognition is crucial (Kaynak, Birsal, Guven & Ogut, 2013).

Another valid argument derives from a literature review by Milne et al. (2013), which discussed suggestions to assist healthcare providers in making early diagnoses of Charcot foot, choosing the appropriate treatment regimen, and reducing the incidence of further complications including amputations, sepsis and death. "Charcot neuroarthropathy (CN) continues to be a persistent challenge for clinicians, especially in its acute phase.

The report indicated that the diagnosis of CN is missed in as many as 79% of cases and an accurate diagnosis can be delayed up to 29 weeks” (p. 9).

According to Gouveri & Papanas (2011), accurate diagnosis of Charcot can often be challenging. The authors stress the significance of patient and physician awareness as a means to obtain a prompt diagnosis and reduce the incidence of foot complications.

“Charcot arthronuropathy is a potentially limb-threatening condition which, beyond the emotional and social burden of physical dysfunction, has been associated with increased mortality” (Gouveri & Papanas, 2011, p. 59). In addition, the article contains five practical point recommendations for clinicians to aid them in early detection and management. They include:

- Charcot should be ruled out in every diabetic patient with impaired sensory perception, regardless if the diagnosis is only a suspicion.
- Immediate off-loading is recommended; if plain x-rays are negative, this should not delay off-loading.
- Patient and physician education regarding early detection is essential.
- Ulceration or infection in the plantar aspect of the foot should be avoided and if surgical intervention is required, a podiatric specialist should be consulted.
- A detailed foot assessment and documentation utilizing a specified assessment tool, which follows ADA guidelines by a skilled practitioner, is recommended for all diabetic patients.

Finally, according to Jackson (2011), many diabetic patients with existing neuropathy may present with other distracting issues such as foot ulcerations, swollen extremities, or have no complaints of pain or discomfort at all; however, clinicians still have the responsibility to perform a thorough examination of the diabetic foot and must be skilled in their assessment techniques. Most complications of Charcot can be avoided with immediate treatment in the acute phase. While it is equally important to exclude other infectious processes or conditions such as deep vein thrombosis (DVT), “the overriding goal of treatment is to avoid amputation and prevent further deformity. Good outcomes can be managed with footwear that allows adequate gait and activity, thus sustaining overall quality of life” (Jackson, 2011, para. 21).

### **Evidence-Based Practice Model**

The need for an assessment and screening tool for nurse practitioners, based on the increased risk of Charcot foot in the diabetic patient population, is an example of the Iowa model of evidence-based practice. This model begins with a trigger or identified problem, which may also be a knowledge-based problem. It involves the development of a team of stakeholders to develop, implement, and evaluate a practice change (Malone & Bucknall, 2013, 139).

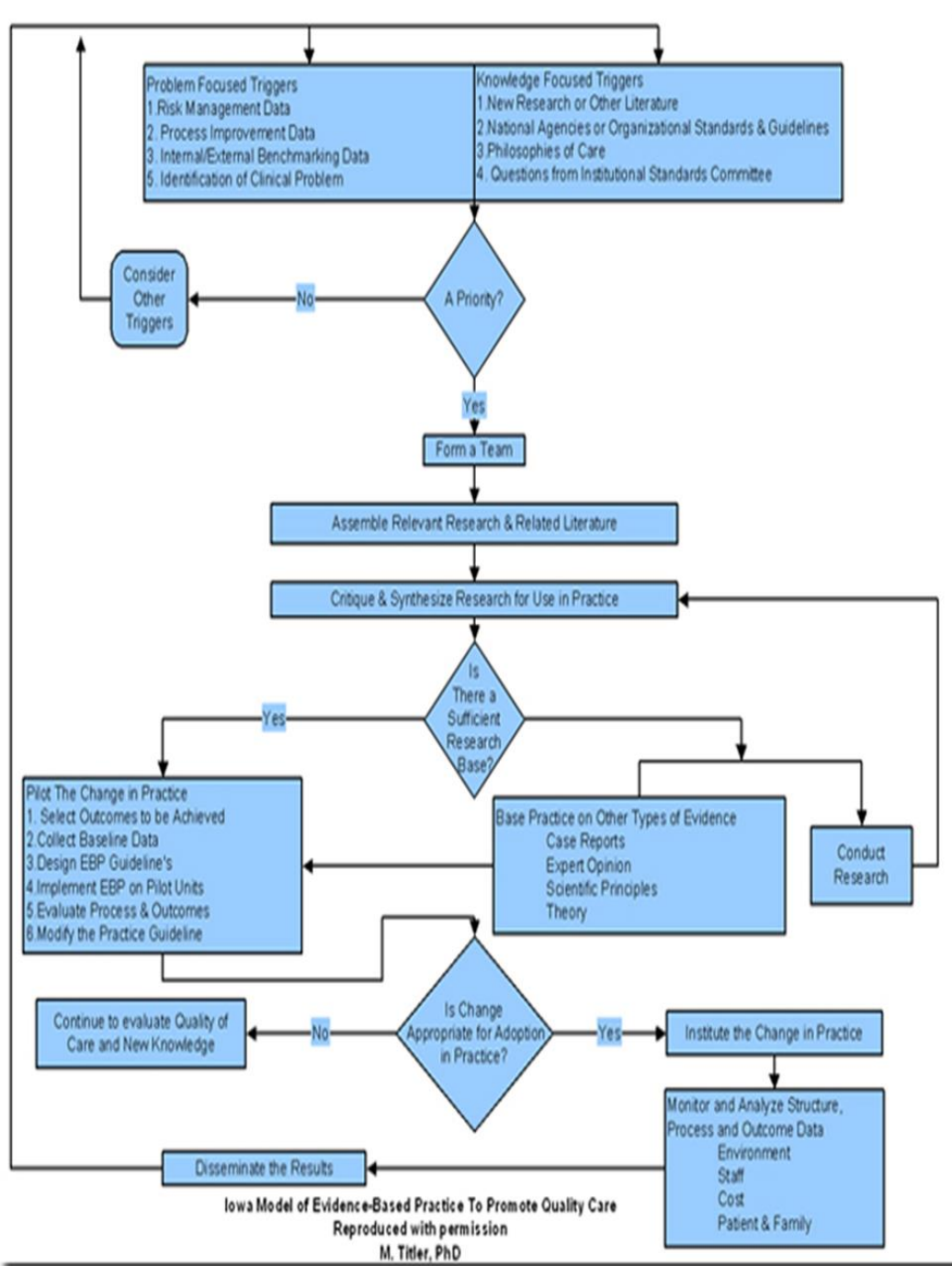
The Iowa model for evidence-based practice includes knowledge and problem triggers, which prompt providers to evaluate current practices as well as promote research when evidence is lacking (Rempher, 2006). “The Iowa Model of Research in Practice infuses research into practice to improve the quality of care, and is an outgrowth of the

Quality Assurance Model Using Research (QAMUR). Research utilization is seen as an organizational process. Planned change principles are used to integrate research and practice. The model integrates evidence-based healthcare acknowledges and uses a multidisciplinary team approach” (Mercy Medical Center, 2014, para. 8).

According to a study by Varaei, Salsali & Heshmat (2013), the Iowa model was followed in a before and after design and involving 19 baccalaureate nurses who were currently working on an endocrinology unit in which the primary patient population consisted of diabetics with chronic leg ulcers. The focus of the study was whether evidence-based practice training courses could improve nursing skills. Results indicated trained nurses can prevent significant complications in diabetic patients including amputations and other adverse effects by means of early recognition and treatment interventions.

This model has served as a reference for the project since the primary goal is directed at improving patient health and outcomes by identifying a trigger such as misdiagnosed Charcot foot, then integrating a multidisciplinary team to design an improvement plan such as assessment tool development and review of ADA policy and practice guidelines. “In this model, knowledge- and problem-focused triggers lead staff members to question current nursing practice and whether patient care can be improved through the use of research findings” (Titler & Moore, 2010, p. S3). Putting evidence into practice can be a complex process, but it is necessary for improvements in healthcare and

patient outcomes. The Iowa model has been a valuable resource in the project by providing a systematic process to identify and address an issue in diabetic health.



*Figure 2. Iowa model of evidence-based practice*

### **Prevalence and Incidence**

The American Diabetes Association reports that approximately 60–70% of people with diabetes will develop peripheral nerve damage, which can lead to Charcot foot with an estimated 0.5% of those patients actually developing the condition. In most cases, the onset occurs after the age of 50 and in those patients who have been diagnosed for 15 to 20 years (Peng & Swierzerswki, 2011).

Despite the fact that uncontrolled diabetes and loss of proprioception is the main contributing factor leading to Charcot, researchers now believe other predisposing elements may increase the risk such as widespread atherosclerosis, inflammation caused by minor injury, infection, ulceration, or any other disorder in which blood flow is impeded (Kaynak et al., 2013). Discovering the underlying etiology is a crucial aspect in successful treatment.

The incidence and prevalence of Charcot is not known exactly but is estimated that approximately 0.8-8% of the diabetic population are affected. The number is increased up to 10% when radiographic studies are used in diabetics with neuropathy. In addition, studies have shown men and women are equally affected and typically have had diabetes for at least 10 years and are between the ages of 50-70 (Gouveri & Papanas, 2011).

### **Impact of Charcot Foot**

Charcot is a devastating complication of diabetic peripheral neuropathy and not only may affect a person's physical appearance and their ability to work; it also has the potential of having a significant effect on their mental capabilities. Patients are often left with feelings of depression, guilt from financial strains, and isolation. In addition, patients suffering from Charcot experience a high rate of depression and anxiety due to physical mobility restraints and chronic pain. Male patients are even more at risk of complications due to an inability to work and provide for their families financially (Chapman, Shuttleworth & Huber, 2014).

Finally, studies show that mortality rates of individuals with Charcot foot are significantly higher than those who have simple diabetic foot ulcerations and also those with type 2 diabetes not suffering foot complications at all. The comparable rates are 28.3, 37.0, and 18.8% (Sohn, Lee, Stuck, Frykberg & Budiman-Mak, 2009).

### **Risk Factors**

There are a variety of risks factors associated with the development of Charcot arthropathy and occur in patients with peripheral neuropathy resulting from diverse conditions including diabetes mellitus, leprosy, syphilis, poliomyelitis, chronic alcoholism or syringomyelia. Repetitive microtrauma that exceeds the rate of healing may also cause fractures and dislocations as well as changes in circulation causing resorption of bone, weakening the bone and increasing susceptibility to fracture and dislocation" (American Orthopedic Foot & Ankle Society, n.d.). Other contributing

factors may consist of sprains or other injury, which goes unnoticed as a result of sensory impairment. Continued pressure on the foot while walking may worsen the extent of the injury with subsequent dislocation or fractures in one or more bones of the foot or ankle.

### **Signs and Symptoms**

Symptoms may include: foot deformity with elevated arch; foot drop, which is an inability to hold the foot horizontal); “slapping” gait (feet slap on the floor when walking due to foot drop); muscle atrophy in the lower extremities, leading to thin calves; numbness in the feet; balance or gait instability; later, similar symptoms may also develop in the arms and hands; joint dislocation; heat insensitivity in the foot; joint instability; erythema; bounding pulses; edema of the foot and ankle (caused by leakage of synovial fluid from the joint capsule); and subluxation (bone misalignment from a joint).

### **Complications**

If left untreated or misdiagnosed, further serious complications may develop for the patient and include the following: ulcerations, especially if foot deformity is present or if there is a delay in diagnosis during early stages, calluses, bony protrusions (these have a greater risk of infection if friction persists for an extended period on the inner portion of the shoe), compression of blood vessels and/or nerves, osteomyelitis (bone infection), impaired or loss of sensation in the foot, and loss of foot function.

### **Prevention**

To effectively prevent the formation of Charcot, patients in the diabetic population, or any person with peripheral neuropathy, should follow a strict foot regimen



including daily inspection in an effort to reduce the incidence of foot, metatarsal, and lower extremity amputation. This regimen consists of daily foot self-exams, wearing closed toed shoes at all times, avoid going barefoot (even indoors), seeking medical attention immediately if any open sores, injury, or changes to the appearance of the foot or ankle, keeping feet clean and dry, and avoiding moisture. Referral is also a key component in preventing Charcot. Patients considered being at high risk for developing ulceration, infection, and Charcot arthropathy deformities should be referred to a group of specialists who focus on mechanical, medical, and surgical intervention in the treatment of the diabetic foot and lower extremity ("Charcot Foot | Charcot Foot Information | Charcot Foot Treatment | Charcot Foot Prevention | Charcot Foot Symptoms," n.d.)

### **Treatment**

Presently, there are numerous treatment methods available for treatment of Charcot foot with the primary goal being joint stabilization. Although there are currently no known treatments to stop or slow the progression of Charcot foot, research efforts continue in hopes of finding a solution. Recovery period may extend upwards of eight weeks or longer in the acute stage, during which time patients will be required to be non-weight-bearing. Treatment options for non-surgical interventions include:

- Immobilization
- Custom shoes and bracing
- Use of crutches, casts, and wheelchair used to protect foot
- Limiting activities that cause the condition

Although surgical treatment is an option, treatment is primarily nonoperative due to the added factor of diabetes associated poor wound healing. Conservative treatment of Charcot foot relies on halting the destructive phase of progression, and then protecting and supporting the joints throughout the healing process. Other activities to assist in maintaining muscle strength include physical and occupational therapy, as well as physical activity directed toward improving independent functioning. Treatment plans can be broken into two phases, acute and post-acute. The acute treatment phase is considered the onset until Charcot is inactive, which is 3-6 months after onset. Also, immobilization is recommended to prevent further destruction. The goal in the treatment of Charcot foot is intended to offload the foot, treat bone disease, and prevent further injury. Offloading during the active acute stage of Charcot is the most crucial management strategy and could prevent further progression to deformity, according to ADA recommended guidelines.

### **American Diabetes Association Recommendations**

Since Charcot foot in the diabetic patient poses many clinical diagnosis and management challenges, the American Diabetes Association [ADA] task force met in 2011 and created recommendations for appropriately managing this devastating lower extremity complication of diabetes, which is serious and potentially limb-threatening. The ADA recommendations are based on expert opinion and are as follows. They are available for access in *Diabetes Care* (Rogers et al, 2011).

### **Diagnostic Recommendations for Active Charcot Foot**

- Diagnosis of active Charcot foot is based primarily on clinical assessment and patient history but should be confirmed by imaging.
- The earliest clinical manifestation is inflammation, which is an important aspect in the pathophysiology of Charcot foot.
- Despite absence of deformity, Charcot foot is considered to be acute and active in sensory impaired individuals with foot or ankle fractures or dislocations due to the inflammatory process of bone healing.
- Initial radiologic imaging should be performed and healthcare providers are urged to observe for subtle or underlying fractures or subluxations, regardless of without obvious visible pathology.
- Clinical suspicions may be confirmed with MRI or nuclear imaging in the presence of normal-appearing radiographs.

### **Recommendations for Medical Therapy**

- Foot offloading and immobilization are the most vital treatment recommendations in active Charcot foot and have the potential of preventing further destruction.
- Little evidence is available to guide in the use of available pharmacological therapies to promote healing of Charcot foot.
- Weight-bearing devices such as braces, prescription shoes, boots, or other protective measures are required post active occurrence

- Lifetime monitoring is advised to monitor for diabetic foot complications or recurrence or new signs of Charcot foot.

### **Summary**

The severity of untreated or misdiagnosed Charcot foot can lead to potentially life-threatening and or life changing complications. Patients are left with significant and devastating alterations to their body and endure substantial financial costs. Individuals with peripheral neuropathy have even higher rates of mortality than persons without ulcerations than type 2 diabetics with intact peripheral sensation. Charcot is a major health issue affecting an infinite number of patients each year, many of whom have never heard of it and are unaware of its overwhelming and destructive potential. Prevention and early detection are the keys to avoiding such effects.

## Section 3: Approach

### **Introduction**

The purpose and goal of this quality improvement project was to develop an assessment and screening tool to assist healthcare providers in the early detection, diagnosis, and treatment of Charcot foot in the diabetic population. This project included the target population of adult type 2 diabetic patients who have been diagnosed for at least ten years, been treated with either oral hypoglycemic or insulin therapy, and either have or are at risk of having peripheral neuropathy. Also included were those patients with a history of or currently being treated for any type of foot ulceration, wound, injury, or complaints of foot or ankle pain, and patients who have a documented change of foot appearance. Stakeholders for this project were the patients, private insurance carriers, Medicare and Medicaid, podiatrists, and healthcare practitioners who provide care to diabetic patients. Accomplished project development activities are outlined as listed below.

The steps in the process of this project were as follows:

1. Assemble interdisciplinary project team with various stakeholders guiding the project;
2. review best practices of diabetic foot assessment as presented in evidence-based literature;

3. integrate ADA policies and practice guidelines for the assessment, treatment, and referral of the diabetic patient with, or at risk for developing, Charcot foot in conjunction with the project team;
4. develop an assessment and screening tool of the diabetic foot in conjunction with the project team;
5. develop an implementation plan in collaboration with the project team; and
6. develop an evaluation plan in collaboration with the project team.

### **Rationale**

I assembled an interdisciplinary project team of community stakeholders interested in supporting interventions to improve assessment and prevention of Charcot foot in diabetic patients with peripheral neuropathy. Invited stakeholders included nurse practitioners, diabetic educators, podiatrists, and health information specialists. A literature review was conducted to identify current best practice on how to develop, implement, and evaluate policy and practice guidelines, and this information was shared with the project team. In addition, a meeting was conducted to inform members of the Texas Panhandle Nurse Practitioners Group of the proposed project. During the meeting, I solicited members of various clinics, such as medical directors, to participate in the advisory group to support the creation and sustainment of the policies and guidelines.

From the project team and meeting, stakeholders were identified from various groups to compose an advisory group, which aided in the development of an assessment tool and its implementation and evaluation. “For a number of reasons, it is necessary to

involve or consult with appropriate community members at the very beginning of the program planning process and to include them on an advisory panel or planning committee. As with the needs assessment process, target population and stakeholder involvement is necessary during the planning and implementation stage” (Hodges & Videto, 2011, p. 109).

Advisory committee members consist of individuals who offer expert skills and unique knowledge, which strengthen the expertise of the board of directors as a means of guiding the organization more effectively. They offer expert opinions and suggestions, provide diversity, and offer fresh perspectives on programmatic issues (National Abandoned Infants Advisory Resource Center, n.d.) One factor that facilitated the development of an interdisciplinary team who supported the assessment and treatment of Charcot foot was that of continuous community input via stakeholder engagement. Stakeholder feedback and input is an integral part of any successful healthcare program. Stakeholders offer valuable insight such as suggestions on plan development, and they assist in setting strategic direction, goals, and performance targets (Curran & Totten, 2010). A review of the literature, in conjunction with feedback from project team members, stakeholder input, and continued engagement through means of email follow up and NP website discussion postings can increase the likelihood of program success.

### **Interdisciplinary Project Team**

The multidisciplinary team consisting of five members was invited to participate in the project based on their knowledge and expertise in the area of diabetes and

management of complications. Disciplines included diabetes education, nurse practitioner, podiatry, IT computer personnel, and nursing informatics. Members were selected for their knowledge and experience in treating diabetic patients and their medical specialty in podiatric medicine, computer technology, and informatics. Each member reviewed the policy and practice guidelines regarding the early detection and intervention of patients at risk of Charcot foot as well as appropriate treatment regimens. Utilization of valid resources such as medical specialists and those having experience in one particular area is beneficial for ensuring all essential elements are included in the plan design. According to Nancarrow et al., (2013), interdisciplinary teamwork is “a dynamic process involving two or more health professionals with complementary backgrounds and skills, sharing common health goals and exercising concerted physical and mental effort in assessing, planning, or evaluating patient care” (p. 2).

### **Reviewing Evidence**

The interdisciplinary team members each received a copy of the goals and objectives for the project prior to development of an assessment tool and were led through the review of scholarly literature. Furthermore, a Gantt chart was dispersed to each member to illustrate the incidence of Charcot foot along with information obtained from the American Diabetes Association as well as the American Podiatric Medical Association. All of the above was provided during an initial meeting with the interdisciplinary team.



### **Implementing Policies and Practice Guidelines**

According to the 1992 Institute of Medicine (IOM) report, clinical practice guidelines, are among the foundations in which to improve healthcare through systematically developed statements that are meant to assist the practitioner, as well as the patient, in decision-making regarding suitable healthcare for specific clinical circumstances. This process involves problem identification, evidence assessment, translation of the evidence, and implementation into clinical practice guidelines, followed by evaluation and revision as necessary (Woolf, Schünemann, Eccles, Grimshaw & Shekelle, 2012).

Charcot foot continues to be a complicated and complex diagnosis that remains a clinical challenge for practitioners. As a result of the number of missed cases of Charcot foot, in as many as 79%, most clinical guidelines available do not involve a rigorous evidence-based process (Milne et al, 2013). Therefore, development of a screening tool and algorithm will require input from multiple experts. Although not all diabetic foot complications are preventable, it is possible to drastically lessen the incidence through proper management and prevention platforms. “The multidisciplinary team approach to diabetic foot disorders has been demonstrated as the optimal method to achieve favorable rates of limb salvage in the high-risk diabetic patient” (Frykberg et al, 2006, p. S49).

Although there is no specific cure for Charcot foot, the goal in developing policy and practice guidelines will be directed toward early detection, accurate diagnosis, immediate initiation of treatment, and the referral process. Despite the fact that healthcare

professionals are ultimately responsible for identifying patients at highest risk of Charcot foot and completing an extensive and thorough assessment, the fact remains that patients themselves are responsible for adhering to treatment regimens and following up with referred specialists; for that reason, patients will be encouraged to be an active participant in their care.

### **Content Validation**

Content validation in the area of Charcot foot is essential in order to go forth with the development of policy and practice guidelines. One method of validation is the computation of a Scale Content Validation Instrument (S-CVI) with two expert raters for a 10-Item scale, which is defined by Polit & Beck (2006) as the proportion of items given a rating of quite/very relevant by both raters involved. This particular method allows the entire scale of items, up to 10, to be ranked by the raters as valid and relevant by the two experts and the proportion of total items judged content valid. Appendix A is an example of this type of scale.

### **Implementation Plan**

Following Internal Review Board (IRB) approval by Walden University, the proposed assessment tool was developed by the project team for later implementation with the nurse practitioner community in Northern Texas where there are currently 65 members of the Texas Panhandle Nurse Practitioners Association (TXPNPA). The assessment tool was distributed only to practitioners who are the primary care giver of adult type 2 diabetic patients. Part of the implementation phase included written forms of

the assessment tool as well as the computerized version for those providers who have converted to electronic documentation. One benefit of utilizing the electronic medical record is the assessment tool will be a mandatory inclusion for providers, which will serve as an assessment reminder and hopefully reduce the number of undiagnosed cases. The computerized health information system being utilized at the health clinic has the capability of revisions to assessment templates and will be maintained by the clinic's computer personnel. These plans were presented to the project team for consideration and refinement. The final DNP Project included an implementation plan developed by the project team.

### **Evaluation Plan**

The evaluation plan development transpired after implementation planning and was included as an appendix in the final DNP project paper. Evaluation was scheduled after a 3-6 month assessment trial period to include key stakeholders of the project, nurse practitioners in the Texas panhandle. The project team was the ultimate authority on development of the evaluation plan and the following is the plan for evaluation that was presented to the stakeholders as an integral part of this DNP project. The evaluation plan for this project involved both a verbal and written formal process in the form of an electronic anonymous survey. The focus of the evaluation was on the overall opinion of the form as an effective means of assessment for the diabetic patient, ease of completing, inclusion of pertinent focus areas, and appropriate referral documentation if needed.

### **Financial Considerations**

Budget is one of the most principal aspects to consider when developing a health program. Finding the most appropriate resources for the target population often means the planner must endure certain costs to ensure the highest quality services. Financial considerations for this project included the utilization of resources such as computer system IT personnel to load and maintain the EMR assessment tool. Each clinical setting is equipped with computer equipment, which was in place prior to this project. For those healthcare settings who do not have access to a computer based system, the financial costs associated with this project were minimal and involved ordering of a paper form of the assessment tool.

### **Ethical Considerations**

Ethical considerations are essential for all members of the healthcare team. Nurses have a responsibility to care for all patients, regardless of race, age, gender, national origin, religion, or ability to pay for care. Diabetes is a serious health problem for many Americans and affects a broad cultural diversity of individuals such as African Americans, Asian and Pacific Islanders, American Indians, Hispanics, and Alaskan Natives. Several of these individuals have little or no insurance coverage or access to healthcare; therefore, are at an increased threat of acquiring problems such as Charcot foot. Another issue is the cultural diversity of patients in today's society. For these reasons, ethical considerations for the development of an assessment tool included awareness of healthcare providers in the areas of culture, financial, and even access to

transportation. “The code of ethics for the American Association of Diabetic Educators (AADE) urges diabetes educationalists to “respect and uphold basic human rights”, and “respect the uniqueness, dignity, and autonomy of each individual” (“Cultural Sensitivity and Diabetes Education”, 2012).

IRB approval ensuring that the project complied with the university’s ethical standards and federal regulations was obtained from Walden University, IRB approval number 02-20-15-0357309, and permission was given to move forward with the project after an oral proposal defense.

### **Summary**

Prevention of Charcot foot is an important aspect of assessment in the diabetic population and more importantly, in patients suffering from peripheral neuropathy. The ability to rapidly and accurately identify risk factors, signs and symptoms, and appropriately treat this serious complication of diabetes is a significant measure in preventing life-threatening injuries to patients’ feet and ankles. Following recommendations set forth by the American Diabetes Association holds the responsibility of every healthcare provider who cares for the diabetic patient and an accurate focused assessment is a key factor of this care. Development of an assessment tool not only assisted practitioners in this feat but has the potential to prevent devastating life-long effects for the patient as well.

## Section 4: Findings, Discussion, and Implications

### **Introduction**

While the project was developmental, no research was conducted, and it did not include patient involvement. The purpose of this DNP scholarly project was to assist nurse practitioners in the early detection, treatment, and referral of Charcot foot in type 2 diabetic patients. I developed an assessment and screening tool based on the American Diabetes Association's (2011) recommendations that could be utilized in the clinical setting and integrated into the patient's electronic medical record. In addition, a screening algorithm and assessment and treatment practice guidelines were created for adjunct purposes.

Focus points on the assessment were derived from key features of the foot, which included monofilament points, evidence of outward physical abnormalities, and severity of peripheral neuropathy. Monofilament testing, otherwise known as Semmes-Weinstein monofilament exam, contains "5.07 monofilament nylon wires exert 10 g of force when bowed into a C shape against the skin for 1 second. Patients who are unable to reliably detect application of the 5.07, 10-g monofilament to designated sites on the plantar surface of their feet are considered to have lost protective sensation" (Morgan, 2013, para. 2). The assessment and screening tool also included a recommendation for annual follow up or podiatric referral based on findings of the examination by way of a screening algorithm. Finally, assessment and treatment practice guidelines were developed to utilize at clinical or primary care sites.

### **Summary and Evaluation of Findings**

Due to the potential life threatening complications of type 2 diabetes and the complexity in diagnosing Charcot foot, it is imperative that healthcare professionals, such as nurse practitioners, be educated and competent in their assessment skills. According to the U. S. Department of Health and Human Services Health Resources and Services Administration Bureau of Health Professions Division of Nursing; (2002), “the adult nurse practitioner employs evidence-based clinical practice guidelines to guide screening activities, identifies health promotion needs, and provides anticipatory guidance and counseling addressing environmental, lifestyle, and developmental issues” (p. 17). Providers must maintain a degree of proficiency to support detect and treat all major disease complications.

I presented the assessment and screening tool, assessment and treatment practice guidelines, and screening algorithm to members of the Texas Panhandle Nurse Practitioners Association at the Annual NP Conference, which included my practicum mentor. Paper copies were dispersed during this time and members were allowed the chance to ask questions and offer comments and suggestions immediately following. There were several practitioners who voiced a need for clarification regarding monofilament testing as well as a request to include the patient’s BMI on the assessment tool; these suggestions were later included.

In addition, two content experts reviewed the tool using the Computation of an S-CVI for a 10-Item Scale with Two Expert Raters (Appendix A). Content experts included

a DNP-prepared nurse practitioner and a podiatrist. Revisions were made to the assessment tool to include BMI and specific monofilament testing results. The final revised assessment tool, screening algorithm, and practice guidelines are attached as Appendices B, C, D, and E.

I have provided the practicum mentor with a final copy of each of the above mentioned forms as well, which can be integrated into the electronic medical record for use when screening the diabetic patient population at the practicum site.

### **Discussion of Findings in Context of Literature**

After conducting an extensive literature search using databases such as CINAHL, Medline, PubMed, EBSCO, and Walden University library, I discovered a need to educate nurse practitioners as well as other healthcare providers in the severe and conceivable life-threatening complications of Charcot foot in the diabetic populace. Through the use of evidence based practice, I identified the necessity for an assessment and screening tool to contribute to the prevention and early detection of Charcot foot and the immediate need of podiatric referral. The assessment tool is an excellent guide to support practitioners in the evaluation of high risk patients such as diabetics suffering from peripheral neuropathy. In today's realm of healthcare, providers depend on various sources and experts to improve patient care through collaboration (Barry, 2015).

Up until the mid-1990s, Charcot foot was thought of as a rare sensory deficit condition but experts later recognized it as a destructive process that led to immobilization to prevent further injury or trauma by imposing non weight-bearing until



the acute phase had been resolved (Veillette, 2016, p.99). Success of treatment is based on increasing awareness in practitioners who routinely provide care for the diabetic patient population.

One particular study conducted by Botek et al. (2010) referred to a 53 year-old male who was misdiagnosed in the emergency department after presenting with multiple symptoms including pain, redness, and edema to the foot and ankle. This patient was kept in the hospital and received a course of IV antibiotics, then discharged home with oral antibiotics and instructed to follow up with his primary care physician. After being seen by the primary care physician (PCP) two to three additional times, the patient was eventually referred to an orthopedic specialist and diagnosed accurately with Charcot foot, but the damage suffered to the foot and ankle was irreversible at that point.

Estimations are that 0.1 to 5% of all diabetics will acquire Charcot foot at some point during their disease with an increase in odds for those suffering from end-stage neuropathy. Furthermore, those patients having foot sores or ulcerations are more prone to require limb amputation; therefore, “it is extremely important for the foot and ankle specialist to judiciously approach the Charcot joint” (Bernstein, Ritter & Diamond, 2012, pg. 2).

Another study consisted of two groups of patients. Group 1 was comprised of eleven patients diagnosed within one month of onset of Charcot symptoms while Group 2 consisted of thirteen patients, all being diagnosed within three months of onset. Both groups were treated immediately upon diagnosis with non-weight-bearing measures;

however, the study found those in Group 1 were only immobilized for a time period of 3 months as opposed to those in Group 2 who had to remain immobilized for a total of 5 months. The delay in diagnosis and treatment had a substantial impact on the patients' outcomes. All participants in Group 2 advanced to fracture of the foot and resulted in rocker bottom foot deformities (Schade & Anderson, 2015). The ultimate goal of acute Charcot of the foot and ankle is early detection and stabilization to minimize the risks of infection, ulcerations, calluses, and amputation.

According to O'Rourke (2010), a total of 3,445 patients who had either an above or below the knee amputation were included in a study over a period of nine years. Over 60% of the patients had peripheral neuropathy from diabetes, trauma, or other complication of Charcot foot. The study showed that healthcare professionals, including nurse practitioners, were among those who did not recognize potential issues, which delayed care and led to amputations.

As a result of impaired peripheral sensory neuropathy in patients suffering from type 2 diabetes, patients may have no specific recollection of injury. The initial indicator of Charcot foot may include an abrupt alteration in the appearance of the foot or ankle and or discoloration (Sanders, 2014). Therefore, patients often delay seeking medical treatment due to vague symptoms or being unaware they have sustained any type of injury.

The current literature supports the need for further education and assessment tools to aid in the correct diagnosis and treatment referrals for patients who are at higher

probability of Charcot foot. It is imperative that practitioners be given every means of identifying these patients and intervening before life threatening complications occur. Currently, there are various advanced assessment tools available, but they are directed toward the advanced specialist skills. This project assessment tool will serve as a user friendly assessment tool for nurse practitioners to assist in the early detection and prevention of complications such as Charcot foot and as a guide in the next step of treatment options.

### **Implications for Practice**

Due to the rarity and often overlooked complication of peripheral neuropathy known as Charcot foot, diagnosis and treatment poses a critical issue for healthcare practitioners, including nurse practitioners (Rogers et al, 2011). Therefore, an assessment tool is needed to serve as a guide for nurse practitioners to assist in the early recognition and treatment and to prevent further complications and possible loss of limb.

Nurses have a vital responsibility in helping to prevent foot ulcers and amputations through means such as education, screening high-risk populations, and assessment and intervention. Foot care education is crucial for all diabetic patients but more so those at an increased risk due to neuropathy. Nurses can encourage and teach patients how to perform daily foot exams as well as consequences of untreated wounds or delay in care. According to the WHO, diabetes is becoming an epidemic in most countries; therefore, evidence demonstrates that the burden of helping to avoid to

significant consequences lie on both healthcare providers as well as communities as a whole (Aalaa, Malazy, Sanjari, Peimani, & Moharjeri-Tehrani, 2012).

Diabetic foot complications are foremost contributors to greater morbidity and mortality rates. Without obvious signs of inflammation such as warmth, erythema, or function deficit, it is a significant challenge for healthcare providers to diagnose Charcot foot. “Foot complications in people with diabetes can be difficult to treat and conventional therapies often fail, leading to amputations; thus, prevention of this condition is of paramount importance” (Houghton, Bower & Chant, 2013, p. 1).

Advanced practice nurses must be willing to accept continuous new evidence and tools that will improve patient outcomes as an integral part of their practice. Patients rely on the knowledge and skill of healthcare professionals to ensure their well-being and positive outcomes. Assessment is a key element of the nursing role for all patient populations but more so for those individuals suffering from major diseases such as diabetes or other causes of peripheral neuropathy. The American Diabetes Association reports that 60–70% of people with diabetes are affected with peripheral nerve damage, which can advance to Charcot foot, and approximately 0.5% of these patients will progress to Charcot. This data is especially relevant to nursing practice and advanced assessment skills.

### **Implications for Social Change**

Diabetic neuropathy is considered the most frequent complication of type 2 diabetes mellitus and affects generally 50% of all diabetic patients. As stated by the

American Diabetes Association [ADA] (2013), type 2 diabetes has the potential for severe systemic complications, such as peripheral neuropathy, which is likely to lead to devastating injuries. Due to the loss of sensation, patients are often unaware of wounds or other abnormalities and therefore; delay seeking treatment. Due to the rarity of Charcot foot, healthcare providers often dismiss or overlook this serious complication and initiate other forms of treatment. According to Fowler (2007), “current statistics indicates diabetes will continue to affect the United States population for the foreseeable future and is by no means limited to the United States” (p. 42). Additionally, the complications associated with this disease will also continue to be prevalent among those affected and it is the responsibility of providers to seek resources to assist them with accurate and appropriate diagnoses and treatment options.

As with many other chronic health conditions, the social and mental aspects of type 2 diabetes can be devastating for patients, families, and care givers alike. Diabetic treatment regimens must be maintained on a daily basis, despite social pressures, economic status, or distracting life events (Welch, Jacobson & Weinger, 2008). While type 2 diabetes typically develops or manifests in middle adulthood, this may significantly influence motivation to seek treatment and may require greater efforts or willingness to change. Even in the early phase, subtle complications such as foot calluses may appear to be minor and unimportant for the diabetic patient, thus delay in seeking treatment.

Other facets to consider are the costs of medical management, wound care, potential vascular interventions, infection control, wound closure, off-loading, and alternative and adjunctive therapies. The primary preventative goal is tight glycemic control and includes patient monitoring of blood glucose levels in addition to periodic hemoglobin A1C levels. The cost of diabetic testing supplies can be overwhelming for many people who do not have access to healthcare coverage. In addition, once an ulceration or infection has occurred, management of these wounds can be difficult to treat and may require numerous and lengthy treatment options. Furthermore, once aggressive therapy has been initiated, weight bearing is often limited or may necessitate complete offloading of the foot.

Socioeconomic issues begin with extensive healing. For patients who are unaware of an injury, which progresses to an ulceration, “the average cost of treatment ranges from \$3609 to \$27, 721” (Sumpio, 2012, p. 13). Regardless of whether a patient is in need of complex therapy over an extended period of time or is simply required to be in some form of offloading device during the acute phase of Charcot foot, the potential for financial strain is inevitable. Complications of diabetic foot conditions are typically debilitating to patients, families, and caregivers alike. Patients are often times unable to continue working and have to rely on others or governmental assistance programs to sustain their daily lives. Others who are permanently disabled are forced to file for long-term social security disability, which is an extremely long and drawn out process that

may or may not be approved initially. For those who gain approval, the length of time for their first payment is typically six to seven months.

As stated previously, early detection is vital in advancement to further injury and reduce the incidence of long-term or permanent disability. The development of an assessment and screening tool specific to the diabetic foot is one method of ensuring early detection and intervention, following ADA recommended guidelines for treating Charcot foot.

### **Project Strengths, Limitations, and Recommendations**

The strengths of the assessment tool include the outlined specific areas of the foot to be assessed and inclusion of any identified abnormalities. Also, a section exists for pertinent patient data to be considered such as latest HgA1C levels, which indicate controlled or uncontrolled blood glucose levels over a three month period. This data is especially important since this directly relates to progression of healing. Additionally, the tool contains instruction for further treatment or referral based on the assessment findings.

Limitations of the project involved an initial negate by one practitioner to accept the terminology of Charcot foot but rather felt it was simply a complication of diabetes and felt it could be treated as such. After further education and the development of the assessment tool, which was presented at the annual nurse practitioner symposium, the project and tool were more widely accepted. Additionally, various other advanced practice nurses have since voiced an interest in gaining information on how to perform a

more structured foot and ankle examination on their diabetic patient population. The interest has been from practitioners within local acute care settings as well as community clinics.

Recommendations for the project were made by members of the area nurse practitioners and consisted of the addition of BMI (body mass index) and specific interpretation of monofilament points to the assessment tool.

### **Analysis of Self as a Scholar**

Throughout this journey, I have learned so many things about myself, not only as a person but as a contributing academic scholar. I have grown exponentially in the areas of professionalism, academic peer, clinical specialist, and hope that my contribution to the diabetic patient population will have a positive effect on patient outcomes. Although this was a long and sometimes tiring feat, I have remained steadfast on my path to a doctoral degree. As an educator, I have also learned to be more detail oriented and know that whatever experience and knowledge I can offer will hopefully have a lasting impression on the careers of my students. They rely on me to be knowledgeable on the content I present to them in order for them to be successful. Remaining current on evidence based practices and having a desire for knowledge will have a direct impact on patients whether it be at the bedside or through experiences shared with students or novice nurses. Lastly, I have gained confidence in myself as a nurse and scholar and will be eternally grateful to my mentors, peers, fellow students, and professors for seeing me through this process.



### **Analysis of Self as a Practitioner**

Confidence is a word that comes to mind when I think about myself as a practitioner. When I began as a novice nurse over twenty years ago that was a descriptor I never believed would be a part of who I was as a nurse. I was withdrawn, timid, and fearful of making mistakes. Although I had received the same education as my peers, I was lacking confidence as a practitioner. However, as time went on and I was forced to step up and advocate for my patients, I could visibly see a difference in myself. I knew I had to be the voice for those who could not speak for themselves. Despite this newly gained confidence, I was unaware of what was missing. The years of experience of practicing in the emergency department had exposed me to a vast array of situations that would expand my knowledge of diseases, trauma related injuries, skills, and treatments, but little did I know it I was not practicing holistic nursing.

Without the DNP program at Walden University, I believe I was confident and even competent in the skills and tasks I was performing, but did not realize there was so much more I needed to learn until I reached this point in my career. The DNP path has given me a new feeling of confidence in myself as a person and a practitioner. Assessment was always a skill I felt I possessed but throughout the scholarly progression, I came to realize there was so much more to learn. The entirety of my career had been based on the premise of short term interventions that would provide a temporary stability until definitive treatment could be attained elsewhere. I value the time I spent in the

emergency department all these years but my view of what patient care really was had been distorted.

My goal after attaining an advanced education is to deliver the utmost quality of care to my patients and improve overall quality of life through prevention, anticipating patient needs, and integrating advanced practices into patient care.

### **Analysis of Self as Project Developer**

An integral part of the project was the use of literature review as a means of incorporating evidence based practices into patient care through the development of an assessment tool for use by nurse practitioners to assist in the early identification of Charcot foot. In collaboration with my mentor, I recognized a need for further education and design of a tool that would be easy to follow and would adhere to ADA recommendations. In addition, I utilized content experts such as diabetic educators, podiatry, and a nursing informatics specialist to assist with the project. As an integral part of the process, I have taken into consideration the vast amount of recommendations and assessment techniques from various podiatric specialists who are experts in their fields and have treated patients with Charcot foot. Once I had gained a sense of the current need and gained knowledge on this topic, I was able to develop the tool and present it to areas nurse practitioners for further input.

Throughout the development process, a majority of the inspiration came from personal experience with my husband who suffers from Charcot foot due to the effects of type 2 diabetes and peripheral neuropathy. The delay in diagnosis was in part due to the

severity of sensory deficit in his feet but also due to the lack of knowledge on the part of the practitioner who was treating him for a simple nondisplaced foot fracture. After several long months of seeing no improvement and the edema continuing, the inevitable happened and he incurred full blown Charcot foot. I as a practicing member of the healthcare team, had not been exposed to this condition before and was not something I learned throughout my nursing education; therefore, I was unaware of the severity of his condition until we sought treatment from a podiatrist specializing in diabetic foot conditions. The delay in diagnosis had resulted in permanent deformity of his foot and he underwent an extended acute phase in which he was placed in a correct offloading boot until the remodeling phase was completed. The physical and mental trauma he had endured was just beginning and would carry forward with him as an everlasting reminder. I found myself being left with feelings of inadequacy as a practitioner and felt as though I should have recognized the manifestations and intervened sooner. This turn of events is what inspired me to dedicate the DNP project to early detection and prevention for other diabetic patients.

Despite the amount of time this project entailed, the reward was the overall end project, which was an assessment and screening tool that would be utilized in the care of diabetic patients and could potentially save at least one person from suffering from the devastating effects of Charcot foot. I have learned that with persistence and dedication, I can make a contribution to the outcome of patients in the future and also that I have the ability to make a difference. One of the single most important aspects of this project was

the continued support from my professors and my mentor who provided me with valuable feedback and encouragement.

### **Analysis of Self as a Professional**

Of all my years in nursing, I feel more of a professional and contributor than ever before. Despite the various roles and titles throughout my career, my role as an educator and scholar is the most important. I have a long road ahead of me regarding contribution to the academic world, but I know the end result will be a sense of gratification in knowing I had an impact on someone's life and will be respected in my field. In spite of the fact that I have not yet reached completion, I have already gained a new respect from my peers and students. Regardless of what the future holds, I can honestly say I have made a difference. I am able to see proof of this through the eyes of students who have that aha moment when things start to come together or during graduation when I can see the growth and maturity from the day they entered the nursing program to being confident and ready to practice independently. My confidence has reached a new high and I look ahead to what the future holds. I plan to continue with expanding my professional horizons by publishing in various medical and nursing journals with the hope of having a positive effect in the nursing profession.

### **Summary**

Charcot foot is a devastating and potential life threatening complication of diabetes and those suffering from peripheral neuropathy. As stated previously, many patients suffering from peripheral neuropathy or impaired sensory perception may

experience injuries that are unaware until they begin to see visible signs of trauma such as edema, discoloration, or deformity. For these reasons, patients often times delay seeking treatment or are treated by healthcare providers with little or no knowledge on the clinical manifestations of diabetic foot complications.

If left untreated, Charcot foot may progress to permanent disfigurement or amputations. Early detection and intervention is the key to preventing this serious condition. The development of an assessment screening tool and following ADA recommendations will assist nurse practitioners and benefit the diabetic population. Currently, there are multiple assessment tools available to specialists in this area such as orthopedics and podiatry but are far more advanced than what is needed for early recognition and referral for advanced practice nurses. After receiving feedback regarding a need from local advanced practice nurses, I created an assessment and screening tool, along with screening algorithm, and assessment and treatment practice guidelines, as a means to assist them in the care of the diabetic patient population who are at risk due to peripheral sensory deficits. In doing so, the goal is for immediate intervention, treatment, and referral to podiatry specialty if warranted and prevent further damage or injury.

Also, a lack of education regarding the rarity and complexity of Charcot foot was identified and therefore; the information was presented to area nurse practitioners at an annual conference, which is discussed further in the following section.

## Section 5: Scholarly Project

### **Introduction**

The DNP project is intended to improve patient care with the use of an assessment and screening tool and algorithm to aid in early identification of Charcot foot in the type 2 diabetic patient populations. The project involves the identification of a practice problem and the completion of a project that will lay ground work for future scholarship. According to the American Association of College of Nurses (AACN) (2006), “doctoral education in nursing is designed to prepare nurses for the highest level of leadership in practice and scientific inquiry. The DNP is a degree designed specifically to prepare individuals for specialized nursing practice, and The Essentials of Doctoral Education for Advanced Nursing Practice articulates the competencies for all nurses practicing at this level” (p. 7) Assessment is a key element in nursing practice and this project addressed a need involving early identification of Charcot foot and referral for type 2 diabetic patients suffering from peripheral neuropathy.

### **Problem Statement**

Diabetic neuropathy is the most prevalent complication of type 2 diabetes mellitus and affects equal to 50% of all type 2 diabetics. Peripheral neuropathy, or peripheral nerve damage, causes significant issues such as nonhealing wounds, major infections, amputations, and Charcot neuropathic osteoarthropathy (CN), commonly referred to as Charcot foot, which involves the soft tissue and bones of the foot and ankle and thus leads to permanent deformities. This may transpire if the bones in the feet suffer fractures

and the foot becomes misaligned. Although experiencing a fracture would be extremely painful to most people, this particular condition can be painless to the diabetic patient since nerves were damaged from diabetes prior to the fracture. The foot or feet may subsequently lose muscle support, eventually converting to deformity. Diagnosis can sometimes be difficult due to the potential of mimicking other conditions like cellulitis or deep venous thrombosis, and because diagnosis of a Charcot fracture cannot be made definitively until bone changes occur. Therefore, the focused problem in the project was inconsistency of healthcare providers in the recognition and referral of patients with potential Charcot foot.

### **Purpose Statement**

According to Lin and Lorenzo (2013), “in type 1 DM, distal polyneuropathy typically becomes symptomatic after many years of chronic prolonged hyperglycemia, whereas in type 2, it may be apparent after only a few years of known poor glycemic control or even at diagnosis” (para. 2) Symptoms affect sensory, motor, and autonomic systems of the body. When neuropathy progresses to Charcot foot, it becomes a serious, potential limb-threatening complication and during the acute phase, is considered to be an inflammatory syndrome. Due to the rarity of this condition, diagnosis and treatment poses a critical issue for healthcare practitioners including nurse practitioners (Rogers et al, 2011). For this reason, the intent of the project was the development of an assessment and screening tool, with integration of ADA recommendations, for nurse practitioners to

promote early detection and treatment of Charcot foot so as to avoid additional injury and possible loss of lower limb or foot.

### **Goals and Outcomes**

The purpose of this project was to develop an assessment and screening tool and integrate recommendations set forth by the American Diabetes Association in an effort to assist nurse practitioners in the assessment, diagnosis, and treatment of Charcot foot in the diabetic patient with peripheral neuropathy. In doing so, the goal was to improve consistency of healthcare providers in the detection and treatment of patients with or at risk of Charcot foot.

This section outlines the process by which an assessment tool was developed, along with implementation and evaluation. No data was collected nor were participants involved as the project involved the development of an assessment tool to further assist NPs in the early detection, identification, and treatment of type 2 diabetic patients at risk of Charcot foot.

The outcomes that were used to determine goal attainment for the project included an evaluation planning step at the end of this DNP Project. The following outcomes were suggested as possible starting points for evaluation planning:

Outcome 1: Healthcare providers will identify, assess, and treat patients with Charcot foot.

Outcome 2: Healthcare providers will refer patients with Charcot foot to appropriate specialty for follow up care.



The detection of patient risks by nurses, which is “the ability of nurses to accurately identify signals can lead to early interventions so that harm to patients is minimized or circumvented” (Despins, Scott-Cawiezell & Rouder, 2010, p. 465). Nurses and nurse practitioners are at the forefront of patient assessment, which is the first opportunity for detection and intervention of potentially life-threatening illness and injuries. They have a responsibility to patients to be skilled in their assessment abilities and intervene when necessary. Charcot foot, although complex and often difficult to diagnose, is a major complication of diabetes that requires immediate treatment after a detailed and skilled assessment by competent healthcare professionals.

The project design was a qualitative approach, which provided an opportunity for nurse practitioners to share their experiences and challenges when assessing the adult diabetic patient population. “Qualitative methods offer the opportunity to obtain an in-depth understanding of patient experiences and may elicit a deeper understanding of patient’s perceptions and behaviors and the meanings they attach to their experiences” (LaVela & Gallan, 2014, p. 32).

### **Background**

The American Diabetes Association reports that 60–70% of people with diabetes suffer from peripheral nerve damage, which can progress to Charcot foot and an estimated 0.5% of these patients will actually advance to Charcot. In the majority of cases, onset occurs following the age of 50 and after having been diagnosed with diabetes for 15 to 20 years (Peng & Swierzerswki, 2011).

Despite the fact that uncontrolled diabetes and loss of proprioception is the main contributing factor leading to Charcot, researchers now believe other predisposing elements may increase the risk such as widespread atherosclerosis, inflammation caused by minor injury, infection, ulceration, or any other disorder in which blood flow is impeded (Kaynak, Birsnel, Guven & Ogut, 2013). Discovering the underlying etiology is a crucial aspect in successful treatment. The incidence and prevalence of Charcot is not known exactly but is estimated to affect 0.8-8% of the diabetic population. This number increases to 10% when radiographic studies are used in diabetics with neuropathy. In addition, studies have shown men and women are equally affected and typically in their 5<sup>th</sup> and 6<sup>th</sup> decades of life and having had diabetes for at least 10 years or more (Gouveri & Papanas, 2011).

Charcot is a devastating complication of diabetic peripheral neuropathy that may affect a person's physical appearance and their ability to work and has the potential of having an effect on their mental capabilities as well. Patients are often left with feelings of depression, guilt from financial strains, and isolation. In addition, patients suffering from Charcot experience a high rate of depression and anxiety due to physical mobility restraints and chronic pain. Male patients are at an even greater threat of these complications as a result of an inability to work and provide for their families financially (Chapman, Shuttleworth & Huber, 2014).

Finally, studies show that mortality rates of individuals with Charcot arthropathy are significantly higher than those who have simple diabetic foot ulcerations as well as

those with type 2 diabetes lacking foot complications at all. The comparable rates are 28.3, 37.0, and 18.8% (Sohn, Lee, Stuck, Frykberg & Budiman-Mak, 2009).

### **Significance for Future Practice, Research and Social Change**

The American Diabetes Association has developed recommendations for all healthcare practitioners to follow regarding the diagnosis, treatment, and surgical intervention of Charcot foot with the goal of rapid identification of signs and symptoms and appropriate treatment regimens as a means of preventing further complications. The guidelines address the areas of diagnostics, medical therapy, and surgical treatment of active Charcot neuropathy and stress the importance of early recognition and offloading and prevention of recurrence or new episodes of CN or other diabetic foot complications. (Rogers et al, 2011).

Accurate assessment of the diabetic foot is a complex process requiring skill, experience, and knowledge of not only the disease but also signs and symptoms of potential complications. The loss of sensation due to peripheral nerve damage makes it difficult for providers to diagnose issues as well as unseen internal problematic issues such as destruction of bone tissue and cartilage as a result of uncontrolled hyperglycemia. It is critical that diabetic patients are adequately counseled and made mindful of the possible complications that derive from this disease. Through lessening the percentage of amputations and enhancing quality of life by way of education and consistent monitoring, there will be a decrease in the amount of money spent on the long-term support of the

patient with diabetes (Meyers, 2013). However, many clinicians lack experience in the area of Charcot foot assessment and often consider it as simply “a diabetic foot”.

According to Zgonis (2010), there is a limited amount of scientific literature in regard to treatment protocols and guidelines for management of Charcot foot and ankle deformities and may be in part due to the presence of each individual case of Charcot of the foot and ankle. Whereas many patients pose with obvious deformities, there are a higher number of those who have, little, or vague complaints, which add to the difficulty of accurate diagnosing for the practitioner.

Due to the fact that type 2 diabetics are at risk for numerous multisystem complications, all healthcare personnel, including nurse practitioners, have a responsibility to patients to be knowledgeable and competent in advanced assessment skills in hopes of preventing further complications. According to Rogers et al (2011), “the Charcot foot in diabetes poses many clinical challenges in its diagnosis and management. Despite the time that has passed since the first publication on pedal osteoarthropathy in 1883, we have much to learn about the pathophysiology, and little evidence exists on treatments of this disorder” (p. 2123). Identifying this problem in its initial stages is critical to effective treatment. Patients should contact a podiatrist at the earliest onset of symptoms. Occasionally, diagnosis is problematic given this condition is capable of mimicking other major disorders such as cellulitis or deep venous thrombosis, and especially since diagnosis of a Charcot fracture is unable to be made definitively until bone changes occur. The initial indications of the Charcot foot are frequently mild in

nature, but can become abundantly more pronounced with unperceived repetitive trauma. Charcot foot typically worsens slowly, with age; rapid progression is uncommon, and should motivate a rapid re-evaluation. Since undiagnosed Charcot can advance considerably to grim outcomes including infection, deformity, amputations, disability, loss of employment, financial and mental strains, and life-long devastating effects, it is crucial for practitioners to be knowledgeable and skilled in assessment and treatment methods.

### **Implications for Practice**

Due to the rarity and often overlooked complication of peripheral neuropathy known as Charcot foot, diagnosis and treatment poses a critical issue for healthcare practitioners including nurse practitioners (Rogers et al, 2011). Therefore, an assessment and screening tool is needed to serve as a guide for nurse practitioners to assist in the early recognition and treatment and to prevent further injury and possible loss of limb. Nurses' position in prevention of foot ulcers and amputations is imperative by means of education, screening high-risk populations, and assessment and intervention. Foot care education is vital for all diabetic patients but more so for those posing an increased threat due to neuropathy. Nurses can encourage and teach patients how to perform daily foot exams as well as consequences of untreated wounds or delay in care. According to the World Health Organization, diabetes is becoming an epidemic in most countries; therefore, evidence demonstrates significant consequences lie on both healthcare

providers as well as communities as a whole (Aalaa, Malazy, Sanjari, Peimani, & Moharjeri-Tehrani, 2012).

Diabetic foot complications are key contributors to soaring morbidity and mortality rates. Without obvious signs of inflammation such as warmth, erythema, or function deficit, it is a demanding challenge for healthcare providers to diagnose Charcot foot. “Foot complications in people with diabetes can be difficult to treat and conventional therapies often fail, leading to amputations; thus, prevention of this condition is of paramount importance” (Houghton, Bower & Chant, 2013, p. 1).

Advanced practice nurses must be willing to accept continuous new evidence and tools that will improve patient outcomes as an integral part of their practice. Patients rely on the knowledge and skill of healthcare professionals to ensure their well-being and positive outcomes. Assessment is a key element of the nursing role for all patient populations but more so for those individuals suffering from major diseases such as diabetes or other causes of peripheral neuropathy. According to the American Diabetes Association, 60–70% of people with diabetes acquire peripheral nerve impairment that can expand to Charcot foot and roughly 0.5% of these patients progress to Charcot. This data is especially relevant to nursing practice and advanced assessment skills.

### **Implications for Social Change**

Diabetic neuropathy has the utmost widespread effect of type 2 diabetes with up to 50% of all diabetic patients affected. As per the American Diabetes Association [ADA] (2013), type 2 diabetes involves uncompromising systemic consequences, such as

peripheral neuropathy, which has the potential of leading to devastating injuries. Due to the loss of sensation, patients are often unaware of wounds or other abnormalities and therefore; delay seeking treatment. Additionally, due to the rarity of Charcot foot, healthcare providers often dismiss or overlook this serious complication and initiate other forms of treatment. According to Fowler (2007), “current statistics indicates diabetes will continue to affect the United States population for the foreseeable future and is by no means limited to the United States” (p. 42) The complications associated with this disease will also continue to be prevalent among those affected and it is the responsibility of providers to seek resources to assist them with accurate and appropriate diagnoses and treatment options.

As with many other chronic health conditions, the social and mental aspects of type 2 diabetes can be devastating for patients, families, and care givers alike. Diabetic treatment regimens must be maintained on a daily basis, despite social pressures, economic status, or distracting life events (Welch, Jacobson & Weinger, 2008). While type 2 diabetes typically develops or manifests in middle adulthood, this may significantly influence motivation to seek treatment and may require greater efforts or willingness to change. Even in the early phase, subtle complications such as foot calluses may appear to be minor and unimportant for the diabetic patient, thus delay in seeking treatment. Other facets to consider are the costs of medical management of wound care, potential vascular interventions, infection control, wound closure, off-loading, and alternative and adjunctive therapies.

Socioeconomic issues begin with extensive healing. For patients who are unaware of an injury, which progresses to an ulceration, “the average cost of treatment ranges from \$3609 to \$27, 721” (Sumpio, 2012, p. 13). Regardless of whether a patient is in need of complex therapy over an extended period of time or is simply required to be in some form of offloading device during the acute phase of Charcot foot, the potential for financial strain is inevitable. Complications of diabetic foot conditions are typically debilitating to patients, families, and caregivers alike. Patients are often times unable to continue working and have to rely on others or governmental assistance programs to sustain their daily lives. Others who are permanently disabled are forced to file for long-term social security disability, which is an extremely long and drawn out process that may or may not be approved initially. For those who gain approval, the length of time for their first payment is typically six to seven months. Early detection is vital in advancement to further injury and reduces the incidence of long-term or permanent disability.

### **Definition of Terms**

The principal terms used throughout this project included type 2 diabetes, peripheral neuropathy, Charcot foot, podiatric, acute, inflammatory, deformity, amputation, and offloading.

*Type 2 diabetes* is the most common form of diabetes and is defined as a condition in which the body fails to utilize insulin properly, otherwise known as insulin resistance. Typically, the pancreas produces an excess of insulin to accommodate but,



over time it is adequately produce the body's requirement of insulin to maintain blood glucose at normal levels (ada.org, n.d.). *Peripheral neuropathy* refers to the destruction or dysfunction of peripheral nerves, which are damaged by uncontrolled elevated blood glucose levels, traumatic injuries, infections, metabolic problems and exposure to toxins (mayoclinic.org, n.d.). Charcot-Marie-Tooth (*Charcot Foot* or CMT) is named for three physicians who were first to describe it in 1886: Jean-Martin Charcot, Pierre Marie, and Howard Henry Tooth (CMTA, 2010). It is defined as a serious and potentially life-threatening complication associated with diabetes, which is characterized by various degrees of bone, joint, soft tissue, foot and often ankle involvement and is derived from underlying neuropathy, trauma, and perturbations of bone metabolism and involves inflammation during the acute phase (Rogers et al, 2011). *Podiatric* refers to the specialty of a podiatrist who is a doctor of podiatric medicine (DPM), also known as a podiatric physician or surgeon. Podiatrists diagnose and treat conditions of the foot, ankle, and related structures of the leg ("what is a podiatrist?" 2014). *Acute* is characterized by sharpness or severity, sudden onset, short course, or requiring short-term medical care (as for serious illness or traumatic injury) (merriam-webster.com, 2014). *Inflammatory* refers to having to do with the body's response to either invading foreign substances (such as viruses or bacteria) or to direct injury of body tissue ("inflammatory", 2014). Deformity is defined as the quality or state of being deformed, disfigured, or misshapen ("deformity", 2014). *Amputation* is the accidental or intentional removal of a limb or body part ("amputation", 2014). *Offloading* refers to taking the load off or transfer from

one place to another such as reduction of pressure. Removing pressure from one area of the foot to another; effective reduction in pressure (“offload”, 2016).

### **Evidence-Based Practice Model**

The problem identified within the adult type 2 diabetic population, who are at risk of Charcot foot, and the need for an assessment tool for healthcare practitioners is an example of the Iowa model of evidence-based practice. The Iowa model begins with a trigger or identified problem, which may also be a knowledge-based problem and involves the development of a team of stakeholders and a practice change is developed, implemented, and evaluated (Malone & Bucknall, 2013, 139).

The Iowa Model for evidence-based practice includes knowledge and problem triggers, which prompt providers to evaluate current practices as well as promoting research when evidence is lacking (Rempher, 2006). “The Iowa Model of Research in Practice infuses research into practice to improve the quality of care, and is an outgrowth of the Quality Assurance Model Using Research (QAMUR). Research utilization is seen as an organizational process. Planned change principles are used to integrate research and practice. The model integrates evidence-based healthcare acknowledges and uses a multidisciplinary team approach” (“Evidence-based Practice”, 2014).

According to a study by Varaei, Salsali & Heshmat (2013), the Iowa Model was followed in a before and after design and included 19 baccalaureate nurses working on an endocrinology unit in which the primary patient population consisted of diabetics with chronic leg ulcers. The focus of the study was whether evidence based practice training

courses could improve nursing skills. Results indicated trained nurses can prevent significant complications in diabetic patients including amputations and other adverse effects by means of early recognition and treatment interventions.

This model has served as a reference for the project since the primary goal is directed at improving patient health and outcomes by identifying a trigger such as misdiagnosed Charcot foot, then integrating a multidisciplinary team to design an improvement plan such as assessment tool development and review of ADA policy and practice guidelines. “In this model, knowledge- and problem-focused triggers lead staff members to question current nursing practice and whether patient care can be improved through the use of research findings” (Titler & Moore, 2010, p. S3). Putting evidence into practice can be a complex process but necessary for improvements in healthcare and patient outcomes. The IOWA Model has been a valuable resource in the project by providing a systematic process to identify and address an issue in diabetic health.

### **Theory**

Change is brought about in healthcare through various driving forces. The concept of identifying a problem and using evidence-based practice to implement change is an example of following the nursing process, which is a systematic approach to patient care with the goal of improving patient care. Lippitt’s theory of change is a model of nursing that mirrors the nursing process and follows the same four process elements including assessment, planning, implementation, and evaluation (Mitchell, 2013). The project has identified the problem of assessing the diabetic patient at risk of Charcot foot as a

problematic area for nurse practitioners due to its complexity and challenges in diagnosis. The plan was to develop an assessment and screening tool to aid in early detection in those patients at risk or who display clinical manifestations correlating to Charcot foot. The planning stage is designed to utilize the screening algorithm to determine the correct treatment or referral action for the patient and followed up at an appropriate time, which is the final evaluation stage.

### **Literature Search Strategy**

The search for literature was conducted electronically and used the following databases: CINAHL, Medline, PubMed, EBSCO, and Walden University Library. Articles older than 10 years were not considered and the terms used for the search were: diabetes, type 2 diabetes, diabetes statistics, neuropathy, peripheral neuropathy, diabetic complications, Charcot, Charcot foot, Charcot-Marie-Tooth, podiatry, podiatric, orthopedic complications, foot deformities, diabetic assessment forms, foot assessment, offloading, and peripheral neuropathy assessment.

### **Literature Review**

“Charcot neuroarthropathy is an often overlooked complication in diabetic patients with peripheral neuropathy. A group of experts reported that 25% of patients referred to their facility who had Charcot neuroarthropathy had not received a correct diagnosis at the referring institution. The incorrect diagnoses included infection, gout, arthritis, fracture, venous insufficiency, and tumor” (Botek, Anderson & Taylor, 2010, p. 596). This article focused in detail on the devastating effects of misdiagnosed Charcot

and emphasized the importance of accurate assessment by healthcare providers. The authors also discussed a case in which a 53 year-old male presented to the emergency department with a 3 day history of pain, redness, and swelling to the foot and ankle and was misdiagnosed with cellulitis, admitted to the hospital for a course of antibiotics, discharged home with oral antibiotics, seen at his primary healthcare providers office 2-3 more times for follow up, then finally referred to an orthopedic specialist where they were accurately diagnosed with Charcot foot in the acute phase. By this time, there was irreversible extensive damage to the foot.

According to O'Rourke (2010), from 1999-2008 of patients who underwent either a below or above the knee amputation, 60% suffered from diabetic neuropathy and had some type of trauma, nonhealing wound or other complication such as Charcot foot. Based on an exhaustive review and analysis of the study, the primary issue for patients at a heightened chance of foot and ankle problems was the identification and referral to the appropriate specialist (O'Rourke, 2010). Healthcare professionals, including nurse practitioners, were among those who did not recognize potential issues, which delayed care and led to amputations of the 3,445 patients included in the study.

Symptoms of Charcot foot affect sensory, motor, and autonomic systems of the body. When neuropathy progresses to Charcot arthropathy, it becomes a serious, potential limb-threatening complication and during the acute phase, is considered to be an inflammatory syndrome. Due to the rarity of this condition, diagnosis and treatment poses a critical issue for healthcare practitioners including nurse practitioners (Rogers et al,

2011). Therefore, an assessment and screening tool for nurse practitioners is needed to assist in the early recognition and treatment of Charcot foot to prevent further complications and possible loss of foot or lower extremity.

Mumoli & Camaiti (2012) discussed a case of Charcot in the *Canadian Journal of Medicine* in which a 59 year-old male reported complaints of a plantar ulcer for two months but after examination, his healthcare provider discovered that his foot was also deformed; however, the patient had such severe neuropathy that he felt no pain at all. They go on to state early detection is essential and “prevention of disease progression remains the mainstay of treatment, including prompt immobilization, absolute non-weight bearing and professional foot care on a regular basis” (p. 1392). While even the slightest of infection, injury, or minor surgery may trigger the body’s inflammatory response, without the protective barrier of pain being present, diabetic patients with sensory impairment are at greater risk of further injury and early recognition is crucial (Kaynak et al, 2013).

Another valid argument derives from a literature review by Milne, Rogers, Kinnear, Martin, Lazzarini, Quinton & Boyle (2013), which discussed suggestions to assist healthcare providers in making early diagnoses of Charcot foot, choosing the appropriate treatment regimen and reducing the incidence of further complications including amputations, sepsis and death. “Charcot neuroarthropathy (CN) continues to be a persistent challenge for clinicians, especially in its acute phase. The report indicated

that the diagnosis of CN is missed in as many as 79% of cases and an accurate diagnosis can be delayed up to 29 weeks” (p. 9).

According to Gouveri & Papanas (2013), accurate diagnosis of Charcot can often be challenging. The authors stress the significance of patient and physician awareness in order to gain prompt diagnosis and lessen the burden of foot complications. “Charcot arthronuropathy is a potentially limb-threatening condition which, beyond the emotional and social burden of physical dysfunction, has been associated with increased mortality” (Gouveri & Papanas, 2013, p. 59). In addition, the article contains six practical point recommendations for clinicians to aid them in early detection and management and include: Charcot should be considered in every diabetic patient with neuropathy; irrespective of whether the diagnosis is only suspected, immediate offloading should be initiated; if plain x-rays are negative, this should not deter offloading; education to patients and physicians to increase early detection will be beneficial; ulceration or infection in the plantar aspect of the foot should be avoided and; surgical intervention may be required (consult a podiatric specialist). A detailed foot assessment and documentation utilizing a specified assessment tool, which follows ADA guidelines by a skilled practitioner, is recommended for all diabetic patients.

Finally, according to Jackson (2011), many diabetic patients with existing neuropathy may present with other distracting issues such as foot ulcerations, swollen extremities, or have no complaints of pain or discomfort at all; clinicians still have the responsibility to perform a thorough examination of the diabetic foot and must be skilled

in their assessment techniques. Most complications of Charcot can be avoided with immediate treatment in the acute phase. While it is equally important to exclude other infectious processes or conditions such as DVT, “the overriding goal of treatment is to avoid amputation and prevent further deformity. Good outcomes can be managed with footwear that allows adequate gait and activity, thus sustaining overall quality of life” (Jackson, 2011, para. 2).

### **Methods Approach: Introduction**

The purpose of this quality improvement project was to develop an assessment and screening tool and integrate ADA recommendations to assist healthcare providers in the early detection of Charcot foot for the diabetic population. The target population for this project was the adult diabetic population who have been diagnosed as having type 2 diabetes for at least ten years, being treated with either oral hypoglycemic or insulin therapy, and those either having or at risk of peripheral neuropathy. Inclusion also involved those patients with a history of or currently being treated for any type of foot ulceration, wound, and injury, complaints of foot or ankle pain, and patients who have a documented change of foot appearance. Stakeholders for this project were the patients, private insurance carriers, Medicare and Medicaid, podiatrists, and healthcare practitioners who provide care to diabetic patients. This section will outline how the project achieved these development activities.

The steps in the course of this project were as follows:



7. Assemble an interdisciplinary project team community of stakeholders to guide the project
8. Review of best practices of diabetic foot assessment as presented in evidence-based literature.
9. Integrate ADA policies and practice guidelines for the assessment, treatment, and referral of the diabetic patient with, or at risk for developing, Charcot foot in conjunction with the project team.
10. Develop an assessment tool of the diabetic foot in conjunction with the project team
11. Develop an implementation plan in collaboration with the project team
12. Develop an evaluation plan in collaboration with the project team

### **Interdisciplinary Project Team**

The multidisciplinary team members, consisting of five members, who were invited to participate in the project based on their knowledge and expertise in the area of diabetes and management of complications. Disciplines included diabetes education, nurse practitioner, podiatry, IT computer personnel, and nursing informatics. Members were selected for their knowledge and experience in treating diabetic patients, medical specialty in podiatric medicine, computer technology, and informatics. Each member reviewed ADA treatment recommendations regarding early detection and intervention of patients at risk of Charcot foot as well as appropriate treatment regimens. Utilization of valid resources such as medical specialists and those having experience in one particular

area is beneficial for ensuring all essential elements are included in the plan design.

According to Nancarrow et al., (2013), interdisciplinary teamwork is “a dynamic process involving two or more health professionals with complementary backgrounds and skills, sharing common health goals and exercising concerted physical and mental effort in assessing, planning, or evaluating patient care” (p. 2)

### **Team Literature Review**

The interdisciplinary team members each received a copy of the goals and objectives for the project prior to development of an assessment tool and were led through the review of scholarly literature. Furthermore, a Gantt chart was dispersed to each member to illustrate the incidence of Charcot foot along with information from the American Diabetes Association and the American Podiatric Medical Association. All of the above was provided during an initial meeting with the interdisciplinary project team.

### **Products**

Throughout the development of this project, I collaborated with a diverse group of experts who embodied the interdisciplinary team. The team members continuously provided input on the needs of the nurse practitioner stakeholders as well as feedback on the assessment and screening tool. The project was accepted and adopted by various NP clinicians in the geographical area who were willing to integrate it into their examination and treatment of adult type 2 diabetic patients. Furthermore, for those NPs who were utilizing electronic medical record systems, the project tools were incorporated as part of the patient assessment process for each visit.

*Appendix A.*

Appendix A. is an example of the computation of a Scale Content Validation Instrument (S-CVI) for a 10-Item scale with two expert raters, which was used by two expert raters for ranking and validation of this project.

*Appendix B.*

Appendix B. is the Charcot Foot Assessment and Screening Tool to be used by nurse practitioners in the adult type 2 diabetic patient population who are at risk due to neurosensory deficits or other identified risk factors. The assessment and screening tool is based on the American Diabetes Associations' (2011) recommendations, which could be utilized in the clinical setting and integrated into the patient's electronic medical record. Focus points on the assessment were derived from key features of the foot, which included monofilament points, evidence of outward physical abnormalities, and severity of peripheral neuropathy. Patients who cannot reliably detect application of the 5.07, 10-g monofilament to designated sites on the plantar surface of their feet are considered to have lost protective sensation" (Morgan, 2013, para. 2). The assessment and screening tool also includes a recommendation for annual follow up or podiatric referral based on findings of the examination by way of a screening algorithm.

*Appendix C.*

Appendix C. is the Charcot Foot Screening Algorithm, which provides a clear guidance of treatment recommendations based on assessment findings. The algorithm is

designed to guide practitioners in the care and treatment of patients based on assessment findings.

*Appendix D.*

Appendix D. includes Charcot Foot Assessment and Treatment Practice Guidelines. Due to the potential life threatening complications of type 2 diabetes and the complexity in diagnosing Charcot foot, it is imperative that healthcare professionals, such as nurse practitioners, be educated and competent in their assessment skills. According to the U. S. Department of Health and Human Services Health Resources and Services Administration Bureau of Health Professions Division of Nursing; (2002), “the adult nurse practitioner employs evidence-based clinical practice guidelines to guide screening activities, identifies health promotion needs, and provides anticipatory guidance and counseling addressing environmental, lifestyle, and developmental issues” (p. 17). Providers must maintain a level of expertise to aid in the diagnosis and treatment of all major disease complications.

*Appendix E.*

Appendix E. includes the implementation and evaluation plan for the project. Implementation is an essential component in the success of the scholarly project and addresses the key objectives for the project and makes for a smoother transition for completion of the project (Moran, Conrad & Burson, 2014, p. 338). Equally important is the evaluation of the project by stakeholders to ensure the objectives are being met as well as opportunity for revisions. The intent of both the implementation and evaluation of

the project is to make certain that evidence-based practices are being followed (Forsyth, Wright, Scherb & Gaspar, 2010).

### **Development of Products**

The proposed assessment and screening tool, treatment algorithm, and treatment and practice guidelines were developed by the project team for later implementation with the nurse practitioner community in Northern Texas where there are currently 65 members of the Texas Panhandle Nurse Practitioners Association (TXPNPA). The assessment tool was distributed only to practitioners who are the primary care giver of adult type 2 diabetic patients. Part of the implementation phase included written forms of the assessment tool as well as the computerized version for those providers who have converted to electronic documentation. One benefit of utilizing the electronic medical record is the assessment tool will be a mandatory inclusion for providers, which will serve as an assessment reminder and hopefully reduce the number of undiagnosed cases. The computerized health information system being utilized at the health clinic has the capability of revisions to assessment templates and will be maintained by the clinic's computer personnel. These plans were presented to the project team for consideration and refinement. The final DNP Project included an implementation plan developed by the project team.

### **Validation of Products**

Content validation in the area of Charcot foot is essential in order to go forth with the development of treatment and practice guidelines. One method of validation is the

computation of a Scale Content Validation Instrument (S-CVI) for a 10-Item scale with two expert raters, which is defined as the proportion of items given a rating of quite/very relevant by both raters involved (Polit & Beck, 2006). This particular method allows the entire scale of items, up to 10, to be ranked by the raters as valid and relevant by the two experts and the proportion of total items judged content valid. An example of this scale is attached on Appendix A.

### **Development of Implementation and Evaluation Plan**

The goal for this project is to pilot for a period of 6 months, which would allow area nurse practitioners ample time to integrate it into their diabetic patient exam and screening process. The project will include the assessment and screening tool, algorithm, and treatment and practice guidelines. At the end of the allocated time period, an electronic survey will be dispersed to practitioners via email to provide feedback on the project tools and forms.

### **Project Dissemination**

Dissemination of the scholarly project is an important step in the DNP project. According to Ahmed, Andrist, Davis & Fuller (2012, p. 62), “it is our professional responsibility to share knowledge-knowledge generated from practice.” Among the various methods of disseminating the project, publishing in peer-reviewed journals ranks the most prestigious. This allows the scholar to project findings to professional colleagues rapidly. Another means is through poster presentations and at various conferences as a podium speaker. Regardless of the chosen method of dissemination, the

goal is to improve practice and patient safety through the process of developing a scholarly project.

Dissemination of this project included a presentation at the annual nurse practitioner symposium two consecutive years and initially was presented as a project proposal. Throughout the following year, the assessment tool was developed with assistance from my DNP mentor and members of the project team. Final dissemination was conducted via podium presentation, as well as hand out copies of the assessment tool, with question and answer session following. By sharing the project with an area community network of nurse practitioners who are members of a particular region, I contributed to the growth and development of a community organization. This option is frequently overlooked but is an ideal collaboration to improve the overall health and well-being of those patients it serves (Anderson, Knestruck & Barraso, 2014).

### **Discussion of Findings in Context of Literature**

The assessment and screening tool is an excellent guide to support practitioners in the evaluation of high risk patients such as diabetics suffering from peripheral neuropathy. In today's world of healthcare, providers rely on multiple sources and experts to improve patient care through collaboration (Barry, 2015). Up until the mid-1990s, Charcot foot was thought of as a rare sensory deficit condition but experts later recognized it as a destructive process, which led to immobilization to prevent further injury or trauma by making the patient non weight-bearing until the acute phase had been

resolved (Veillette, 2016, p. 99). Success of treatment is based on increasing awareness in practitioners who routinely provide care for the diabetic patient population.

One study conducted by Botek, Anderson & Taylor (2010) described a 53 year-old male who was misdiagnosed in the emergency department after presenting with multiple symptoms including pain, redness, and edema to the foot and ankle. This patient was admitted to the hospital and given a course of IV antibiotics, then discharged home with oral antibiotics and instructed to follow up with his primary care physician. After being seen by the PCP 2-3 additional times, the patient was eventually referred to an orthopedic specialist and diagnosed accurately with Charcot foot but the damage suffered to the foot and ankle was irreversible at that point.

It is estimated that 0.1 to 5% of all diabetics will develop Charcot foot at some point during their disease with an increase in odds for those suffering from end-stage neuropathy. Furthermore, those patients with foot ulcerations are more likely to require extremity amputation; therefore, “it is extremely important for the foot and ankle specialist to judiciously approach the Charcot joint” (Bernstein, Ritter & Diamond, 2012, p. 2).

As a result of impaired peripheral sensory neuropathy in patients suffering from type 2 diabetes, patients may have no specific recollection of injury. The earliest sign of Charcot foot may include a sudden change in the appearance of the foot or ankle and or discoloration (Sanders, 2014). Therefore, patients often delay seeking medical treatment due to vague symptoms or being unaware they have sustained any type of injury.



The current literature supports the need for further education and assessment tools to aid in the correct diagnosis and treatment referrals for patients who are at high risks for developing Charcot foot. It is imperative that practitioners be given every means of identifying these patients and intervening before life threatening complications occur. Currently, there are various advanced assessment tools available but are directed toward the advanced specialist skills.

### **Project Strengths, Limitations, and Recommendations**

The strengths of the assessment and screening tool include the outlined specific areas of the foot to be assessed and inclusion of any identified abnormalities. Also, a section exists for pertinent patient data to be considered such as latest HgA1C levels, which indicate controlled or uncontrolled blood glucose levels over a three month period. This data is especially important since this directly relates to progression of healing. Additionally, the tool contains instruction for further treatment or referral based on the assessment findings.

Limitations of the project involved an initial negate by one practitioner to accept the terminology of Charcot foot but rather felt it was simply a complication of diabetes and felt it could be treated as such. After further education and the development of the assessment tool, which was presented at the annual nurse practitioner symposium, the project and tool were more widely accepted. Furthermore, various other advanced practice nurses have since voiced an interest in gaining information on how to perform a more structured foot and ankle examination on their diabetic patient population. The

interest has been from practitioners within local acute care settings as well as community clinics.

Recommendations for the project were made by members of the area nurse practitioners and consisted of the addition of BMI (body mass index) and specific interpretation of monofilament points to the assessment tool.

### **Project Summary**

In summary, the DNP project has the potential to impact the diabetic patient population through a process of identifying a need and developing a project to address the issue through evidence-based practice. Charcot foot is a devastating and potential life threatening complication of diabetes and those suffering from peripheral neuropathy. As stated previously, many patients suffering from peripheral neuropathy or impaired sensory perception may experience injuries that are unaware until they begin to see visible signs of trauma such as edema, discoloration, or deformity. For these reasons, patients often times delay seeking treatment or are treated by healthcare providers with little or no knowledge on the clinical manifestations of diabetic foot complications.

If left untreated, Charcot foot may progress to permanent disfigurement or amputations. Early detection and intervention is the key to preventing this serious condition. The development of an assessment and screening tool and following ADA recommendations will assist nurse practitioners and benefit the diabetic population. Currently, there are multiple assessment tools available to specialists in this area such as orthopedics and podiatry but are far more advanced than what is needed for early

recognition and referral for advanced practice nurses. After receiving feedback regarding a need from local advanced practice nurses, an assessment and screening tool was developed, along with screening algorithm and assessment and treatment practice guidelines, as a means to assist them in the care of the diabetic patient population who are at risk due to peripheral sensory deficits. In doing so, the goal is for immediate intervention, treatment, and referral to podiatry specialty if warranted and prevent further damage or injury.

## Scholarly Product References

- Aalaa, M., Malazy, A. T., Sanjari, M., Peimani, M., & Moharjeri-Tehrani, M. (2012). Nurses' role in diabetic foot prevention and care; a review. *Journal of Diabetes and Metabolic Disorders*. doi: 10.1186/2251-6581-11-24
- Acute – Definition and More from the Free Merriam-Webster Dictionary. (2014). Retrieved from <http://www.merriam-webster.com/dictionary/acute>
- Ahmed, S. W. (2013). Capstone Project: Development, Implementation, Evaluation, and Dissemination. In *DNP education, practice, and policy: Redesigning advanced practice roles for the 21st century* (p. 62). New York, NY: Springer Pub.
- American Association of Colleges of Nursing. (2006). The essentials of doctoral education for advanced nursing practice. American Association of Colleges of Nursing. Retrieved from <http://www.aacn.nche.edu/DNP/pdf/Essentials.pdf>
- American Diabetes Association: Living with diabetes; complications. (2013). Retrieved from <http://www.diabetes.org/living-with-diabetes/complications>
- Amputation – definition of amputation by Medical dictionary. (2014). Retrieved from <http://medical-dictionary.thefreedictionary.com/Amputation>
- Anderson, B. A., Knestruck, J. M., & Barroso, R. (2014). Implementation and Dissemination of DNP Practice Scholarship. In *DNP Capstone Projects: Exemplars of Excellence in Practice* (p. 178).
- Barry, M. E. (2015, April 20). Better, safer patient care through evidence-based practice and teamwork. *The American Nurse*. Retrieved from

<http://www.theamericannurse.org/index.php/2014/09/02/better-safer-patient-care-through-evidence-based-practice-and-teamwork/>

Bernstein, B., Ritter, Z., & Diamond, R. (2012). Neuropathic Ankle Arthrodesis with Intramedullary Nail Fixation. *The Foot and Ankle Online Journal*, 5(7), 1st ser. Retrieved April 11, 2016, from <https://faoj.org/tag/charcot-foot/page/2/>

Botek, G., Anderson, M. A., & Taylor, R. (2010). Charcot neuroarthropathy: An often overlooked complication of diabetes. *Cleveland Clinic Journal of Medicine*, 77(9), 593-599. doi:10.3949/ccjm.77a.09163

Chapman, Z., Shuttleworth, C., & Huber, J. (2014). High levels of anxiety and depression in diabetic patients with Charcot foot. *Journal of Foot and Ankle Research*, 7(22). Retrieved from <http://www.jfootankleres.com/content/pdf/1757-1146-7-22.pdf>

Charcot Arthropathy. (n.d.). Retrieved from <http://www.aofas.org/footcaremd/conditions/diabetic-foot/Pages/Charcot-Arthropathy.aspx>

Charcot Foot | Charcot Foot Information | Charcot Foot Treatment | Charcot Foot Prevention | Charcot Foot Symptoms. (n.d.). Retrieved from <http://healthwellnessanddisease.com/charcot-foot.htm>

Charcot-marie-tooth-association: What is charcot-marie-tooth (cmt)? (2010, December 10). Retrieved from [http://www.cmtausa.org/index.php?option=com\\_content&view=article&id=70&Itemid=159](http://www.cmtausa.org/index.php?option=com_content&view=article&id=70&Itemid=159)

- Deformity | Define Deformity at Dictionary.com. (2014). Retrieved from  
<http://dictionary.reference.com/browse/deformity>
- Despins, L. A., Scott-Cawiezell, J., & Rouder, J. N. (2010). Detection of patient risk by nurses: a theoretical framework. *Journal of Advanced Nursing*, 66(2), 465–474.  
doi:10.1111/j.1365-2648.2009.05215.x
- Evidence-based Practice | Canton Mercy. (2014). Retrieved from  
<http://www.cantonmercy.org/nursing-research>
- Forsyth, D. M., Wright, T. L., Scherb, C. A., & Gaspar, P. M. (2010). Disseminating Evidence-Based Practice Projects: Poster Design and Evaluation. *Clin Schol Rev*, 3(1), 14-21. doi:10.1891/1939-2095.3.1.14
- Fowler, M. (2007). Diabetes: Magnitude and mechanisms. *Clinical Diabetes*, 25(1), 25-28. doi:10.2337/diaclin.25.1.25
- Gouveri, E., & Papanas, N. (2011). Charcot osteoarthropathy in diabetes: A brief review with an emphasis on clinical practice. *World Journal of Diabetes*, 2(5), 59-65.  
doi:10.4239/wjd.v2.i5.59
- Houghton, V. J., Bower, V. M., & Chant, D. C. (2013). Is an increase in skin temperature predictive of neuropathic foot ulceration in people with diabetes? A systematic review and meta-analysis. *Journal of Foot and Ankle Research J Foot Ankle Res*, 6(1), 31. doi:10.1186/1757-1146-6-31
- Inflammatory – definition of inflammatory by Medical dictionary. (2014). Retrieved from  
<http://medical-dictionary.thefreedictionary.com/inflammatory>

- Jackson, K. (2011, March 1). Charcot Neuroarthropathy. Retrieved from <http://nursing.advanceweb.com/Regional-Content/Articles/Charcot-Neuroarthropathy.aspx>
- Kaynak, G., Birsal, O., Guven, M. F., & Olgut, T. (2013). An overview of the Charcot foot pathophysiology. *Diabetic Foot and Ankle*, 4(10).  
doi:10.3402/dfa.v4i0.21117
- LaVela, S. L., & Gallan, A. S. (2014). Evaluation and Measurement of Patient Experience. *Patient Experience Journal*, 1(1). Retrieved May 11, 2016, from <http://pxjournal.org/cgi/viewcontent.cgi?article=1003&context=journal>
- Lin, H., & Lorenzo, N. (2013, November 18). Diabetic neuropathy. Retrieved from <http://emedicine.medscape.com/article/1170337-overview>
- Malone, R., & Bucknall, T. (2013). Models and frameworks for implementing evidence-based practice: Linking evidence to action. (1<sup>st</sup> ed., pp. 137-146). Malden, MA: Wiley-Blackwell Publishing. Retrieved from [http://books.google.com/books?hl=en&lr=&id=iFFBt\\_PULWcC&oi=fnd&pg=PR3&dq=Iowa model of evidence based practice in nursing&ots=nDvfGINa7w&sig=-C3SdnXCqyW8vm9iCsUF2e5xgu0](http://books.google.com/books?hl=en&lr=&id=iFFBt_PULWcC&oi=fnd&pg=PR3&dq=Iowa model of evidence based practice in nursing&ots=nDvfGINa7w&sig=-C3SdnXCqyW8vm9iCsUF2e5xgu0)
- Meyers, L. A. (2013, May 30). Diabetic Foot: Prevention, Assessment, Treatment and Interventions | WoundSource. Retrieved from <http://www.woundsource.com/blog/diabetic-foot-overview>

- Milne, T. E., Rogers, J. R., Kinnear, E. M., Martin, H. V., Lazzarini, P. A., Quinton, T. R., & Boyle, F. M. (2013). Developing an evidence-based clinical pathway for the assessment, diagnosis and management of acute Charcot Neuro-Arthropathy: a systematic review. *Journal of Foot and Ankle Research*, 6(30), 1146. doi: 10.1186/1757-1146-6-30
- Mitchell, G. (2013). Selecting the best theory to implement planned change. *Nursing Management*, 20(1), 32-37. doi:10.7748/nm2013.04.20.1.32.e1013
- Moran, K. J., Burson, R., & Conrad, D. (2014). Driving the Practicum to Impact. In *The doctor of nursing practice scholarly project: A framework for success* (2nd ed., p. 338). Burlington, MA: Jones & Bartlett Learning.
- Morgan, N. (2013). How to do a Semmes Weinstein monofilament exam. *Wound Care Advisor*, 2(1), 23-24. Retrieved from [http://woundcareadvisor.com/wp-content/uploads/2013/01/AB\\_J-F13.pdf](http://woundcareadvisor.com/wp-content/uploads/2013/01/AB_J-F13.pdf)
- Mumoli, N., & Camaiti, A. (2012). Charcot Foot. *Canadian Journal of Medicine*, 184(12). doi:10.1503/cmaj.111972
- Nancarrow, S. A., Booth, A., Ariss, S., Smith, T., Enderby, P., & Roots, A. (2013). Ten principles of good interdisciplinary team work. *Human Resources for Health*, 11(19). doi: 10.1186/1478-4491-11-19
- Nurse Practitioner Primary Care Competencies in Specialty Areas: Adult, Family, Gerontological, Pediatric, and Women's Health. (2002). Retrieved from



<http://c.ymcdn.com/sites/www.nonpf.org/resource/resmgr/competencies/primarycarecomps02.pdf>

Offload – Definition and More from the Word Reference Dictionary. (2016). Retrieved from <http://www.wordreference.com/definition/off-load>

O'Rourke, I. (2010). Model of care for the high risk foot. *ANZ Journal of Surgery*, 72(4), 286. Retrieved from [http://www.healthnetworks.health.wa.gov.au/modelsofcare/docs/High\\_Risk\\_Foot\\_Model\\_of\\_Care.pdf](http://www.healthnetworks.health.wa.gov.au/modelsofcare/docs/High_Risk_Foot_Model_of_Care.pdf)

Peng, H., Swierzewski, S., & (2011, May 23). Charcot foot overview. Retrieved from <http://www.healthcommunities.com/charcot-foot/charcot-foot-overview.shtml>

Peripheral neuropathy Definition – Diseases and Conditions – Mayo Clinic. (n.d.). Retrieved from <http://www.mayoclinic.org/diseases-conditions/peripheral-neuropathy/basics/definition/CON-20019948>

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? critique and recommendations. *Research in Nursing & Health*, 2006(29), 489-497. doi:10.1002/nur.20147

Rempher, K. J. (2006). Putting theory into practice: Six steps to success. *American Nurse Today*. Retrieved from <http://www.americannursetoday.com/assets/0/434/436/440/5120/5122/5136/5142/73b32c8a-b00a-42ee-8ac5-638619fe8752.pdf>

- Rogers, L., Frykberg, R., Armstrong, D., Boulton, A., Edmonds, M., Ha Van, G., & Hartemann, A. (2011). The Charcot foot in diabetes. *Diabetes Care*, 34(9), 2123-2129. doi:10.2337/dc11-0844
- Sanders, L. (2014). *Ask the experts: Expert answers about your diabetes from the pages of Diabetes forecast*. Alexandria, VA: American Diabetes Association.
- Sumpio, B. E. (2012). Contemporary Evaluation and Management of the Diabetic Foot. *Scientifica*, 2012, 1-17. doi:10.6064/2012/435487
- Titler, M. G., & Moore, J. (2010). Evidence-Based Practice: A Civilian Perspective. *Nursing Research*, 59(1), S2 – S6. doi:10.1097/NNR.0b013e3181c94ec0
- Type 2 Diabetes. (n.d.). Retrieved from <http://www.diabetes.org/diabetes-basics/type-2/>
- Varaei, S., Salsali, M., & Heshmat, R. (2013). Education and implementing evidence-based nursing practice for diabetic patients. *Iranian Journal of Nursing and Midwifery Research*, 18(3), 251-257. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3748547/>
- Veillette, C. (2016). Charcot Arthropathy. *Orthopaedics One*, 2, 99. Retrieved April 11, 2016, from <http://www.aofas.org/education/OrthopaedicArticles/Charcot-foot.pdf>
- Welch, G. W., Jacobson, A. M., & Weinger, K. (2008). The Psychological and Social Impact of Type 2 Diabetes. *Health AM*. Retrieved April 11, 2016, from <http://www.health.am/db/more/the-psychological-and-social-impact-of-type-2-diabetes/>

*What is a Podiatrist? | Learn About Feet | APMA.* (2014). Retrieved from

<http://www.apma.org/learn/content.cfm?ItemNumber=992&navItemNumber=558>

Zgonis, T. (2010). How To Manage The Charcot Midfoot Deformity. *Podiatry Today*,

23(7), 68-75. Retrieved from

<http://www.podiatrytoday.com/how-manage-charcot-midfoot-deformity>

## References

- Aalaa, M., Malazy, A. T., Sanjari, M., Peimani, M., & Moharjeri-Tehrani, M. (2012). Nurses' role in diabetic foot prevention and care; a review. *Journal of Diabetes and Metabolic Disorders* 11(1). doi:10.1186/2251-6581-11-24
- Ahmed, S. W. (2013). Capstone Project: Development, Implementation, Evaluation, and Dissemination. In S. Ahmed, L. Andrist, S. Davis, & V. Fuller (Eds.). *DNP education, practice, and policy: Redesigning advanced practice roles for the 21st century* (p. 62). New York, NY: Springer Publishing Co.
- Acute. (2014). In *Merriam-Webster's* online dictionary. Retrieved from <http://www.merriam-webster.com/dictionary/acute>
- American Association of Colleges of Nursing. (2006). The essentials of doctoral education for advanced nursing practice. American Association of Colleges of Nursing. Retrieved from <http://www.aacn.nche.edu/DNP/pdf/Essentials.pdf>
- American Diabetes Association. (2013). Living with diabetes: Complications. Retrieved from <http://www.diabetes.org/living-with-diabetes/complications>
- American Diabetes Association. (n.d.). Type 2. Retrieved from <http://www.diabetes.org/diabetes-basics/type-2/>
- American Orthopedic Foot & Ankle Society. (n.d.). Charcot arthropathy. Retrieved from <http://www.aofas.org/footcaremd/conditions/diabetic-foot/Pages/Charcot-Arthropathy.aspx>

- Amputation. (2014). In *The Free Dictionary Medical* online dictionary. (2014). Retrieved from <http://medical-dictionary.thefreedictionary.com/Amputation>
- Anderson, B. A., Knestrick, J. M., & Barroso, R. (2014). Implementation and dissemination of DNP practice scholarship. In B. A. Anderson, J. M Knestrick, & R. Barroso (Eds.), *DNP capstone projects: Exemplars of excellence in practice* (p. 178). New York, NY: Springer Publishing Co.
- Barry, M. E. (2015, April 20). Better, safer patient care through evidence-based practice and teamwork. *The American Nurse*. Retrieved from <http://www.theamericannurse.org/index.php/2014/09/02/better-safer-patient-care-through-evidence-based-practice-and-teamwork/>
- Bernstein, B., Ritter, Z., & Diamond, R. (2012). Neuropathic Ankle Arthrodesis with Intramedullary Nail Fixation. *The Foot and Ankle Online Journal*, 5(7), 1st ser. Retrieved from <https://faoj.org/tag/charcot-foot/page/2/>
- Botek, G., Anderson, M. A., & Taylor, R. (2010). Charcot neuroarthropathy: An often overlooked complication of diabetes. *Cleveland Clinic Journal of Medicine*, 77(9), 593-599. doi:10.3949/ccjm.77a.09163
- Chapman, Z., Shuttleworth, C., & Huber, J. (2014). High levels of anxiety and depression in diabetic patients with Charcot foot. *Journal of Foot and Ankle Research*, 7(22). Retrieved from <http://www.jfootankleres.com/content/pdf/1757-1146-7-22.pdf>

- Charcot-Marie-Tooth-Association: (2010, December 10). What is CMT? Retrieved from [http://www.cmtausa.org/index.php?option=com\\_content&view=article&id=70&Itemid=159](http://www.cmtausa.org/index.php?option=com_content&view=article&id=70&Itemid=159)
- Cultural Sensitivity and Diabetes Education. (2012). *The Diabetes Educator*, 38(1), 137-141. doi:10.1177/01457217111431928
- Curran, C. R., & Totten, M. K. (2010). Mission, Strategy, and Stakeholders. *Nursing Economics*, 28(2), 116-118. Retrieved from [https://www.nursingconomics.net/necfiles/BestonBoard/MA\\_10\\_BoB.pdf](https://www.nursingconomics.net/necfiles/BestonBoard/MA_10_BoB.pdf)
- Deformity. (2014). In *Dictionary.com* online dictionary. Retrieved from <http://dictionary.reference.com/browse/deformity>
- Despins, L. A., Scott-Cawiezell, J., & Rouder, J. N. (2010). Detection of patient risk by nurses: a theoretical framework. *Journal of Advanced Nursing*, 66(2), 465–474. doi:10.1111/j.1365-2648.2009.05215.x
- Fowler, M. (2007). Diabetes: Magnitude and mechanisms. *Clinical Diabetes*, 25(1), 25-28. doi:10.2337/diaclin.25.1.25
- Frykberg, R. G., Zgonis, T., Armstrong, D. G., Driver, V. R., Giurini, J. M., Kravitz, S. R., Vanore, J. V. (2006). Diabetic Foot Disorders: A Clinical Practice Guideline (2006 Revision). *Journal of Foot & Ankle Surgery*, 45(5), S48-49. doi:10.1016/S1067-2516(07)60001-5

- George, A., Daniel, M., Frankish, C. J., Herbert, C. P., & Bowie, W. R. (n.d.). Introduction to program evaluation for public health programs, 14. Retrieved from <http://www.cdc.gov/getsmart/program-planner/Step1.pdf>
- Gouveri, E., & Papanas, N. (2011). Charcot osteoarthropathy in diabetes: A brief review with an emphasis on clinical practice. *World Journal of Diabetes*, 2(5), 59-65. doi:10.4239/wjd.v2.i5.59
- Hodges, B. C., & Videto, D. M. (2011). Program planning: The big picture. In *Assessment and planning in health programs* (2nd ed.), 109. Retrieved from [https://books.google.com/books?id=bxnG7AgjNIQC&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.com/books?id=bxnG7AgjNIQC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)
- Houghton, V. J., Bower, V. M., & Chant, D. C. (2013). Is an increase in skin temperature predictive of neuropathic foot ulceration in people with diabetes? A systematic review and meta-analysis. *Journal of Foot and Ankle Research J Foot Ankle Res*, 6(1), 31. doi:10.1186/1757-1146-6-31
- How can you successfully collect and analyze data? (n.d.). Retrieved from <http://www.hrsa.gov/healthit/toolbox/RuralHealthITtoolbox/PatientQuality/analyzedata.html>
- Inflammatory. (2014) In *The Free Dictionary Medical* online dictionary. Retrieved from <http://medical-dictionary.thefreedictionary.com/inflammatory>

- Jackson, K. (2011, March 1). Charcot Neuroarthropathy. Retrieved from <http://nursing.advanceweb.com/Regional-Content/Articles/Charcot-Neuroarthropathy.aspx>
- Kaynak, G., Birsal, O., Guven, M. F., & Olgut, T. (2013). An overview of the Charcot foot pathophysiology. *Diabetic Foot and Ankle*, 4(10).  
doi:10.3402/dfa.v4i0.21117
- LaVela, S. L., & Gallan, A. S. (2014). Evaluation and Measurement of Patient Experience. *Patient Experience Journal*, 1(1). Retrieved May 11, 2016, from <http://pxjournal.org/cgi/viewcontent.cgi?article=1003&context=journal>
- Lin, H., & Lorenzo, N. (2013, November 18). Diabetic neuropathy. *Medscape*. Retrieved from <http://emedicine.medscape.com/article/1170337-treatment> Malone, R., & Bucknall, T. (2013). Models and frameworks for implementing evidence-based practice: Linking evidence to action. (1<sup>st</sup> ed.), 137-146. Malden, MA: Wiley-Blackwell Publishing. Retrieved from [http://books.google.com/books?hl=en&lr=&id=iFFBt\\_PULWcC&oi=fnd&pg=PR3&dq=Iowa model of evidence based practice in nursing&ots=nDvfGINa7w&sig=-C3SdnXCqyW8vm9iCsUF2e5xgu0](http://books.google.com/books?hl=en&lr=&id=iFFBt_PULWcC&oi=fnd&pg=PR3&dq=Iowa model of evidence based practice in nursing&ots=nDvfGINa7w&sig=-C3SdnXCqyW8vm9iCsUF2e5xgu0)
- Mayo Clinic. (n.d.). Peripheral neuropathy. Retrieved from <http://www.mayoclinic.org/diseases-conditions/peripheral-neuropathy/basics/definition/CON-20019948>



- Mercy Medical Center. (2014). Evidence-based practice. Retrieved from <http://www.cantonmercy.org/nursing-research>
- Meyers, L. A. (2013, May 30). Diabetic Foot: Prevention, Assessment, Treatment and Interventions | WoundSource. Retrieved from <http://www.woundsource.com/blog/diabetic-foot-overview>
- Milne, T. E., Rogers, J. R., Kinnear, E. M., Martin, H. V., Lazzarini, P. A., Quinton, T. R., & Boyle, F. M. (2013). Developing an evidence-based clinical pathway for the assessment, diagnosis and management of acute Charcot Neuro-Arthropathy: a systematic review. *Journal of Foot and Ankle Research*, 6(30), 1146. doi:10.1186/1757-1146-6-30
- Mitchell, G. (2013). Selecting the best theory to implement planned change. *Nursing Management*, 20(1), 32-37. doi:10.7748/nm2013.04.20.1.32.e1013
- Morgan, N. (2013). How to do a Semmes Weinstein monofilament exam. *Wound Care Advisor*, 2(1), 23-24. Retrieved from [http://woundcareadvisor.com/wp-content/uploads/2013/01/AB\\_J-F13.pdf](http://woundcareadvisor.com/wp-content/uploads/2013/01/AB_J-F13.pdf)
- Mumoli, N., & Camaiti, A. (2012). Charcot foot. *Canadian Journal of Medicine*, 184(12). doi:10.1503/cmaj.111972
- Nancarrow, S. A., Booth, A., Ariss, S., Smith, T., Enderby, P., & Roots, A. (2013). Ten principles of good interdisciplinary team work. *Human Resources for Health*, 11(19) 2. doi:10.1186/1478-4491-11-19

- National Abandoned Infants Advisory Resource Center. (n.d.). Program advisory committees. Retrieved from <http://aia.berkeley.edu/media/getting-started/AdvisoryCommittee.pdf>
- Nurse Practitioner Primary Care Competencies in Specialty Areas: Adult, Family, Gerontological, Pediatric, and Women's Health. (2002). Retrieved from <http://c.ymcdn.com/sites/www.nonpf.org/resource/resmgr/competencies/primarycarecomps02.pdf>
- Offload – Definition and More from the Word Reference Dictionary. (2016). Retrieved from <http://www.wordreference.com/definition/off-load>
- O'Rourke, I. (2010). Model of care for the high risk foot. *ANZ Journal of Surgery*, 72(4), 286. Retrieved from [http://www.healthnetworks.health.wa.gov.au/modelsofcare/docs/High\\_Risk\\_Foot\\_Model\\_of\\_Care.pdf](http://www.healthnetworks.health.wa.gov.au/modelsofcare/docs/High_Risk_Foot_Model_of_Care.pdf)
- Peng, H., Swierzewski, S., & (2011, May 23). Charcot foot overview. Retrieved from <http://www.healthcommunities.com/charcot-foot/charcot-foot-overview.shtml>
- Perez, R. (2014). Charcot Deformity. Retrieved from <http://podlink.com/pathology/charcot.php>
- Peterson, M. (2013). Economic Costs of Diabetes in the U.S. in 2012. *Diabetes Care*, 36(4), 1033-1046. doi:10.2337/dc12-2625

- Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? critique and recommendations. *Research in Nursing & Health*, 2006(29), 489-497. doi:10.1002/nur.20147
- Rempher, K. J. (2006). Putting theory into practice: Six steps to success. *American Nurse Today*. Retrieved from <https://americannursetoday.com/putting-theory-into-practice-six-steps-to-sucsess/>
- Rogers, L., Frykberg, R., Armstrong, D., Boulton, A., Edmonds, M., Ha Van, G., & Hartemann, A. (2011). The Charcot foot in diabetes. *Diabetes Care*, 34(9), 2123-2129. doi:10.2337/dc11-0844
- Role of Advisory Committee. (n.d.). Retrieved from <http://www.champsonline.org/assets/files/ToolsProducts/CHCBoardResources/BoardDocs/AdvCommRolesResponsibilities.pdf>
- Sanders, L. (2014). *Ask the experts: Expert answers about your diabetes from the pages of Diabetes forecast*. Alexandria, VA: American Diabetes Association.
- Schade, V. L., & Andersen, C. A. (2015). A literature-based guide to the conservative and surgical management of the acute Charcot foot and ankle. *Diabetic Foot & Ankle*, 6(0). doi:10.3402/dfa.v6.26627
- Sohn, M., Lee, T. A., Stuck, R. M., Frykberg, R. G., & Budiman-Mak, E. (2009). Mortality Risk of Charcot Arthropathy Compared With That of Diabetic Foot Ulcer and Diabetes Alone. *Diabetes Care*, 32(5), 1695. doi: 10.2337/dc08-1695

- Sumpio, B. E. (2012). Contemporary Evaluation and Management of the Diabetic Foot. *Scientifica*, 2012, 1-17. doi:10.6064/2012/435487
- Titler, M. G., & Moore, J. (2010). Evidence-Based Practice: A Civilian Perspective. *Nursing Research*, 59(1), S2-S6. doi:10.1097/NNR.0b013e3181c94ec0
- Varaei, S., Salsali, M., & Heshmat, R. (2013). Education and implementing evidence-based nursing practice for diabetic patients. *Iranian Journal of Nursing and Midwifery Research*, 18(3), 251-257. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3748547/>
- Veillette, C. (2016). Charcot arthropathy. *Orthopaedics One*, 2, 99. Retrieved from <http://www.aofas.org/education/OrthopaedicArticles/Charcot-foot.pdf>
- Welch, G. W., Jacobson, A. M., & Weinger, K. (2008). The Psychological and Social Impact of Type 2 Diabetes. *Health AM*. Retrieved April 11, 2016, from <http://www.health.am/db/more/the-psychological-and-social-impact-of-type-2-diabetes/>
- What is a Podiatrist? | Learn About Feet | APMA*. (2014). Retrieved from <http://www.apma.org/learn/content.cfm?ItemNumber=992&navItemNumber=558>
- Woolf, S., Schünemann, H. J., Eccles, M. P., Grimshaw, J. M., & Shekelle, P. (2012). Developing clinical practice guidelines: types of evidence and outcomes; values and economics, synthesis, grading, and presentation and deriving recommendations. *Implementation Science*, 7(61). doi:10.1186/1748-5908-7-61

World Health Organization. (2016). Diabetes (Fact sheet No. 138). Retrieved from

<http://www.who.int/mediacentre/factsheets/fs312/en/index.html>

Zgonis, T. (2010). How To Manage The Charcot Midfoot Deformity. *Podiatry Today*,

23(7), 68-75. Retrieved from

<http://www.podiatrytoday.com/how-manage-charcot-midfoot-deformity>

## Appendix A: Computation of an S-CVI for a 10-Item Scale with Two Expert Raters

	Expert Rater No 1	Expert Rater No 2	Total
Items rated 1 or 2	2	0	2
Items rated 3 or 4	0	8	8
Total	2	8	10
S-CVI $8/10 = .80$			

S-CVI, content validity index for the scale.

*Ratings of 1 = not relevant*

*Ratings of 2 = somewhat relevant*

*Ratings of 3 = quite relevant*

*Ratings of 4 = highly relevant*

## Appendix B: Charcot Foot Assessment and Screening Tool

Patient \_\_\_\_\_

DOB \_\_\_\_\_ Age \_\_\_\_\_

Diabetes Type \_\_\_\_\_ Duration \_\_\_\_\_

PCP \_\_\_\_\_

Height \_\_\_\_\_ Weight \_\_\_\_\_ BMI \_\_\_\_\_

**Management**

Insulin \_\_\_\_\_

Oral \_\_\_\_\_

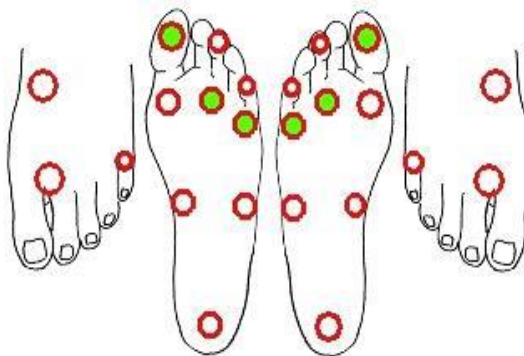
Diet \_\_\_\_\_

Latest HgA1C \_\_\_\_\_

**Neuropathy Monofilament Testing Sites**

**Monofilament testing for diabetic neuropathy using preferred testing locations colored green**

If all sites are tested and the client feels the monofilament in each of the areas; then the score is 10 /10



**If the monofilament is not felt in an area on the foot, this indicates loss of protective sensation (LOPS) in that area and requires referral to a podiatrist**

**SKIN**

Turgor \_\_\_\_\_ Color \_\_\_\_\_

Temperature \_\_\_\_\_ Nails \_\_\_\_\_

Calluses \_\_\_\_\_ Other \_\_\_\_\_

**SENSORY**

**RIGHT FOOT**

Sensation: Present \_\_\_\_\_ Absent \_\_\_\_\_  
 Numbness/Tingling Yes \_\_\_ No \_\_\_\_\_  
 Burning Yes \_\_\_ No \_\_\_\_\_  
 Sharp Pain Yes \_\_\_ No \_\_\_\_\_

**LEFT FOOT**

Sensation: Present \_\_\_ Absent \_\_\_\_\_  
 Numbness/Tingling Yes \_\_\_ No \_\_\_\_\_  
 Burning Yes \_\_\_ No \_\_\_\_\_  
 Sharp Pain Yes \_\_\_ No \_\_\_\_\_

**VASCULAR**

**RIGHT FOOT**

Pedal pulse: Present \_\_\_\_\_ Absent \_\_\_\_\_  
 Edema: None \_\_\_ 1+ \_\_\_ 2+ \_\_\_ 3+ \_\_\_ 4+ \_\_\_

**LEFT FOOT**

Pedal Pulse: Present \_\_\_ Absent \_\_\_\_\_  
 Edema: None \_\_\_ 1+ \_\_\_ 2+ \_\_\_ 3+ \_\_\_ 4+ \_\_\_

**WOUNDS**

**RIGHT FOOT**

Ulcer Yes \_\_\_ No \_\_\_\_\_  
 Description (approx. size in mm)  
 \_\_\_\_\_  
 \_\_\_\_\_

**LEFT FOOT**

Ulcer Yes \_\_\_ No \_\_\_\_\_  
 Description (approx. size in mm)  
 \_\_\_\_\_  
 \_\_\_\_\_

**DEFORMITIES**

**RIGHT FOOT**

Bunion Yes \_\_\_ No \_\_\_\_\_  
 Corns Yes \_\_\_ No \_\_\_\_\_  
 Arch intact Yes \_\_\_ No \_\_\_\_\_  
 Other \_\_\_\_\_

**LEFT FOOT**

Bunion Yes \_\_\_ No \_\_\_\_\_  
 Corns Yes \_\_\_ No \_\_\_\_\_  
 Arch intact Yes \_\_\_ No \_\_\_\_\_  
 Other \_\_\_\_\_

**RISK LEVEL**

**Low Risk** \_\_\_\_\_

No sensory loss, ulcerations, or deformities  
Treatment: Annual Assessment

**Moderate Risk** \_\_\_\_\_

Altered sensory, minimal structural deformity, or beginning onset of ulcerations  
Treatment: Refer to Podiatry



**High Risk**\_\_\_\_\_

Impaired sensory, + numbness/tingling, healed or active ulcerations, amputation, deformities

Treatment: Refer to Podiatry

**REFERRAL**

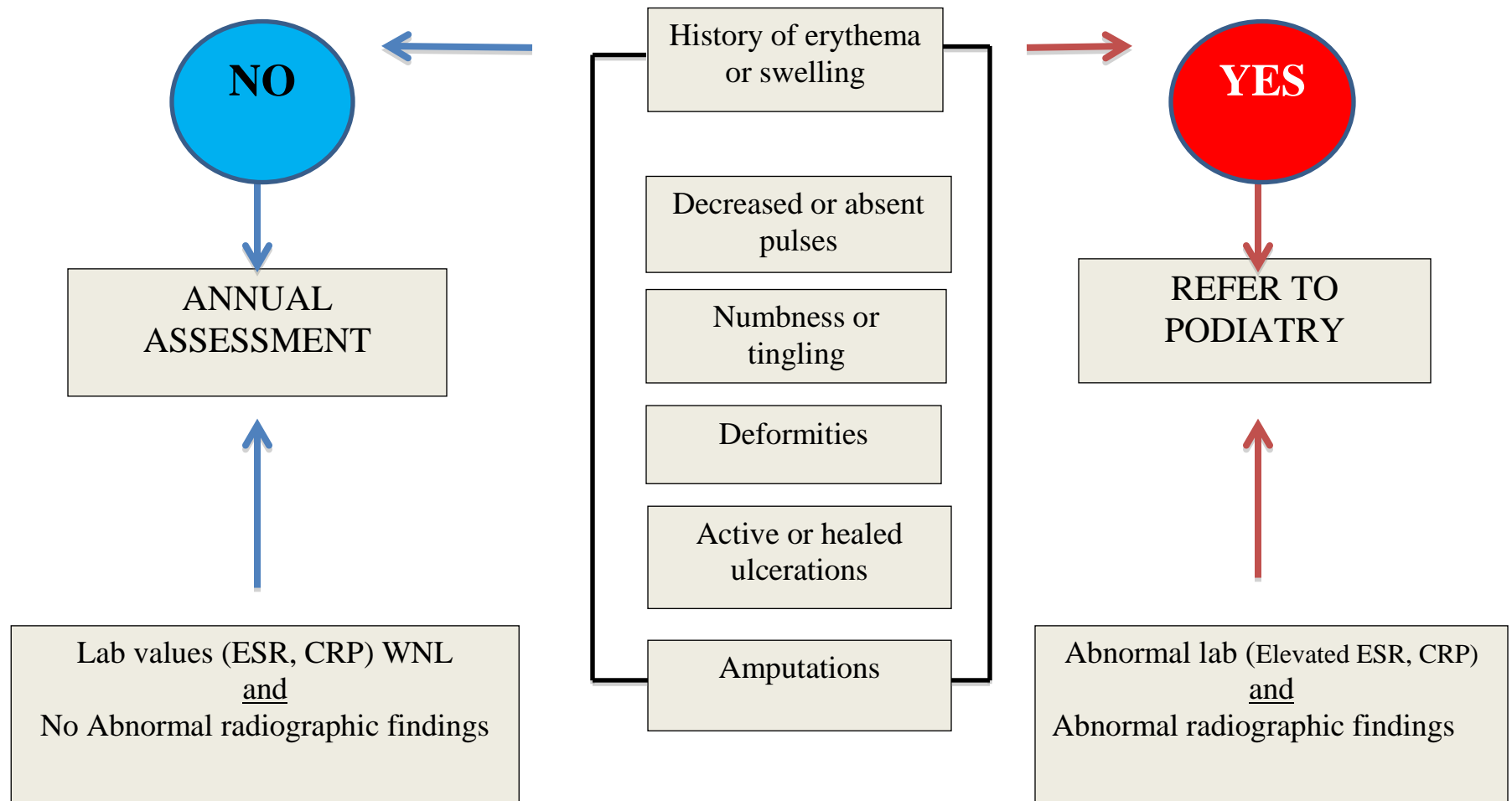
Name of Podiatrist\_\_\_\_\_ Date Contacted\_\_\_\_\_

Person making referral\_\_\_\_\_ Appointment Date\_\_\_\_\_

Special instructions or treatment given by  
podiatrist\_\_\_\_\_

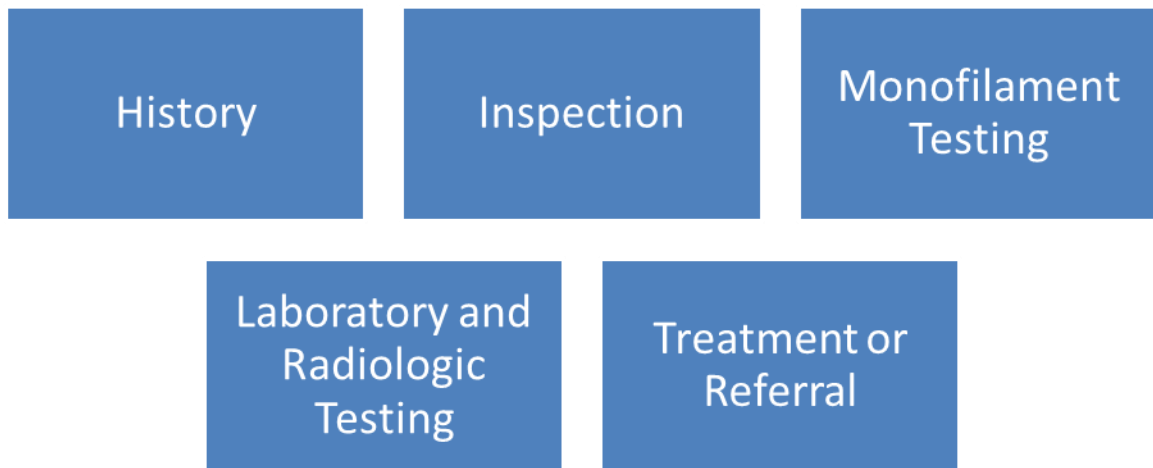
Signature of  
Provider\_\_\_\_\_ Date\_\_\_\_\_

## Appendix C: Charcot Foot Screening Algorithm

**Charcot Foot Screening Algorithm**

## Appendix D: Charcot Foot Assessment and Treatment Practice Guidelines

The following areas have been identified as primary focus points to aid in the detection, prevention, and treatment of Charcot foot in the diabetic patient population.



### HISTORY

- Edema or erythema
- Impaired neurovascular symptoms
- Recent injury or trauma
- Previous foot ulceration or amputation

### INSPECTION

- Foot deformities or ulcerations
- Erythema or blisters
- Evidence of nonhealing areas
- Dryness, cracking, calluses, or fungal infections

### MONOFILAMENT TESTING

- Recommended of four sites (1st, 3rd, and 5th metatarsal heads and plantar surface of distal hallux) be tested on each foot
- Apply the monofilament along the perimeter of (not on) the ulcer site
- Apply the monofilament to each site three times, including at least one additional mock application in which no filament is applied

#### LABORATORY AND RADIOLOGIC TESTING

- ESR and CRP (Erythrocyte Sedimentation Rate and C-Reactive Protein)
- Radiologic exams on affected foot and ankle

#### TREATMENT OR REFERRAL

- Offloading of affected foot (orthopedic boot)
- Non weightbearing of affected foot (crutches)
- Referral to podiatry if identified as at risk or abnormal findings
- Annual foot examinations of no abnormal findings or risk factors identified

## Appendix E: Development of Assessment and Screening Tool

**Development of Assessment and Screening Tool  
to Assist with Prevention and Identification of Charcot Foot in Type 2 Diabetics**

**IMPLEMENTATION PLAN and EVALUATION PLAN**

**Goal:** Promote patient safety, improve patient outcomes, and reduce the risk of infection, deformity, amputation, or loss of life.

Objective	Strategy/Tasks	Stakeholder	Date to be Completed	Evaluation Status
1. Assemble an interdisciplinary project team community of stakeholders to guide the project	Collaboration of experts related to the treatment of adult type 2 diabetic patients, focusing on the diabetic foot  Contact individual team members	Adult type 2 diabetic patient population	October 1, 2015	Met
2. Development of assessment and screening tool of the diabetic foot	Collaborate with members of the interdisciplinary team for development of the tool  Review various assessment tools currently being utilized by healthcare practitioners and incorporate key assessment areas as recommended by team experts as well as American Diabetes Association (ADA) recommendations	Adult type 2 diabetic patient population  Advanced practice nurses	February 1, 2016	Met
3. Development of assessment and treatment algorithm	Collaborate with members of the interdisciplinary team for development of the	Adult type 2 patient population	March 1, 2016	Met

	algorithm  Follow ADA recommendations for treatment of Charcot foot	Advanced practice nurses		
4. Development of treatment and practice guidelines	Collaborate with members of the interdisciplinary team for development of guidelines  Follow ADA recommendations for treatment of Charcot foot and collaborate with experts in the area of policy and practice guidelines	Adult type 2 patient population  Advanced practice nurses	April 1, 2016	Met
5. Present assessment and screening tool, algorithm, and treatment and practice guidelines to area nurse practitioners	Power point and oral presentation  Present at annual nurse practitioner conference	Advanced practice nurses	April 23, 2016	Met
6. Dissemination of project tools	Electronic dissemination  Email project tools	Advanced practice nurses	June 1, 2016	Not met
7. Evaluation of project tools	Electronic survey  Email online survey link	Advanced practice nurses	December 1, 2016	Not met