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Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in Rural Healthcare Settings

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PREVENTING COMPLICATIONS OF UNDIAGNOSED DIABETIC PERIPHERAL
NEUROPATHY IN RURAL HEALTHCARE SETTINGS

A DNP Project Submitted to the
Graduate Faculty
of Jacksonville State University
in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Nursing Practice

By

KENDRA WARD HARRIS

Jacksonville, Alabama

June 28, 2021

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ABSTRACT

Background: Diabetic peripheral neuropathy (DPN) affects the lives of approximately 50% of all persons diagnosed with diabetes. Patients who are minorities, residents of rural communities, low income, or non-compliant with treatment, have a higher risk of developing DPN. The long-term effects interfere with the patient's abilities to carry out activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Patients incur debt from medical expenses, depression from the inability to perform self-care, and became withdrawn because of their distorted body image.

Purpose: The purpose of this project was to use the Michigan Neuropathy Screening Instrument (MNSI) scale to improve patient outcomes by promoting better identification of individuals who need to be referred out to a specialist.

Design Methods: The patients were interviewed and surveyed using the Michigan Neuropathy Screening Instrument (MNSI). After using the MNSI tool, patients were evaluated for possible referral to podiatry and vascular specialty.

Conclusion: Results demonstrated the use of the MNSI tool improves the screening process of patients diagnosed with diabetes reporting signs and symptoms of DPN.

Implications for Nursing: This project has the potential to improve patient quality of life, and lower cost to both patient and healthcare providers.

Keywords: diabetes mellitus 2, peripheral neuropathy, screening, prevention

DEDICATION

To my ancestors who were not seen as EQUAL,
but whose strength resides in me and is still GREATER
than those who have endured LESS.

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Table of Contents

Abstract	iv
Introduction	1
Background	2
Problem Statement	4
Organizational Description of Project Site	5
Review of the Literature	5
Evidence-Based Practice: Verification of Chosen Option.....	8
Theoretical Framework/Evidence-Based Practice Model.....	8
Goals, Objectives & Expected Outcomes	9
Project Design.....	10
Project Site and Population.....	11
Setting Facilitators and Barriers.....	12
Implementation Plan/Procedures	13
Measurement Instrument(s)	14
Data Collection Procedure	14
Data Analysis	14
Results.....	16
Interpretation/Discussion	16
Cost-Benefit Analysis/Budget	17
Timeline	17

Ethical Considerations/Protection of Human Subjects	18
Conclusion	18
References.....	20
Appendix.....	24
Appendix A.....	24
Appendix B.....	26
Appendix C	27
Appendix D.....	28
Appendix E.....	29
Appendix F.....	30
Appendix G.....	31
Appendix H.....	32
Appendix I.....	33
Appendix J.....	34
Appendix K.....	36

Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in a Rural Healthcare Settings

Introduction

Type 2 Diabetes Mellitus (T2DM) affects over 30 million people in the United States of America (U.S.A.) (Jiwani et al., 2021). The strain to the healthcare system is costly and impacts the quality of care distributed to all patients (Levy, 2021). Providers are strained with the task of seeing more patients in less time. In the rush of seeing patients, quality measures are not being met. Yearly referrals for foot exams, vision screenings, and glycated hemoglobin (A1cs) check are being missed (Anastasi & Klung, 2021). The patients are the ones who suffer from the lack of tracking their participation in these gold standard screenings (Anastasi & Klung, 2021).

There is a shortage of healthcare providers, and the onboard training of new providers is often not inclusive of all standard protocols (Magny-Normilus et al., 2021). Due to the recent pandemic, staff meetings have been limited and quality measures are not the priority. In previous years, all staff were included in quality measures. This method allowed everyone to be informed and active from start to finish within a patient encounter. For example, medical assistants (MA) often assisted the provider in tracking patients annual screenings during the triage process (Anastasi & Klung, 2021).

Prevention of peripheral neuropathy is an essential step in caring for the self-esteem in patients with T2DM (Hicks & Selvin, 2019). Foot ulcers are a risk in 25% of identified patients with diabetic peripheral neuropathy (DPN) (Hicks & Selvin, 2019). These patients are then at higher risk for lower limb amputations, foot ulcers, chronic pain, and an increase in mortality. The decline in motor function causes a decrease in

self-esteem and ability to complete activities of daily living (ADLs) (Parasoglou, Rao & Slade, 2017). The effects of DPN causes impaired balance in majority of all patients (Kukidome et al., 2017). In rural healthcare settings, transportation and financial hardships can limit the number of times healthcare providers encounter their patients diagnosed with diabetes.

Research has shown screening tools used specifically for DPN assist in achieving better outcomes (Hershey, 2017). The purpose of this project was to use the scale to improve patient outcomes by promoting better identification of individuals who need to be referred out to a specialist (Fateh, Madani, Heshmat, & Larijani, 2016).

Background

If one was able to prevent T2DM, then the complications, in turn, are also prevented (Hoogendoorn et al., 2021). In this case, diabetic peripheral neuropathy (DPN) was the focused complication. Studies have shown there are clinical implications prior to the final diagnosis. Healthcare facilities would benefit from a system used to screen and provide assess for early signs of DPN. This diagnosis results in increased cost for patients, a decrease in their independence, and a decrease in patient self-esteem (Hoogendoorn et al., 2021).

In a 2020 publication by Ahary, the researcher found compliance in T2DM management was low, especially in women (Ahrary, 2020). Patients often suffer from preventable complications of this disease. The responsibility of education and implementation of early prevention lies in the hands of the healthcare team. When patients were asked in routine visits of their last podiatric or visual screening, they were unaware of the need. The observation of this lack of awareness of their basic care needs raised a red flag. The increase of communication assisted patients of both genders with

diabetic compliance (Ahrary, 2020).

This DNP project was implemented to assist the rural community in early detection of DPN (Levy, 2021). Studies show living in rural communities, belonging to a minority group, or living below the poverty line, increase your mortality rate. This project was conducted in two separate private practices. Each practice was enthusiastic to participate in a quality improvement project which could result in better patient outcomes. Both healthcare clinics had a high prevalence of diabetic patients with the need of preventative care. Individuals in the participant group ranged from newly diagnosed patients to those with very advanced cases of T2DM. Staff explored the importance of early detection at a primary care level. Patients were assessed for this project during regularly scheduled appointments. Levy (2021) suggested implementing a screening into the normal triage process that would benefit both the patient and healthcare quality measures.

Insurance providers hold insurers to a high standard of care (Chicharro-Luna et al., 2020). Many organizations are reimbursed based on the percentage of quality measures completed. Foot screening and diabetic eyes exams are a part of the quality measures. Ensuring patients are compliant with each of these not only benefits the patient, but increases financial reimbursement for the organization. This was not the sole reason for this project, but it did offer an incentive (Chicharro-Luna et al., 2020).

The goal of this study was to maximize each patient encounter for individuals with a diagnosis of T2DM in order to actively assist in maximizing their quality of life. Research has shown providers should maximize contact time with each appointment (Levy, 2021). This process did not inconvenience the participants, while still providing them an improvement in care.

A study by Bauer et al., (2018) took into careful consideration a plan to implement strategies to increase self-esteem in patients diagnosed with T2DM. Patients identified as being diagnosed with T2DM were screened using the Michigan Neuropathy Screening Instrument (see Appendix A) (MNSI, 2000).

Problem Statement

There is a need to identify and screen for diabetic peripheral neuropathy in diabetic patient populations in rural healthcare settings. For this project, a needs assessment revealed there was no protocol in place to identify DPN in patients on scheduled visits. Facilities current practices resulted in providers treating signs and symptoms as the patient brought it to their attention. Patients reported being unsatisfied with their providers efforts to prevent future DPN complications. This project focused on creating a screening policy for each patient with T2DM using the Michigan Neuropathy Screening Instrument, the integration of this screening tool will encourage patient/provider discussion which should result in earlier treatment (MNSI, 2000). Obstacles that one encountered included provider and patient openness to change. Transportation to and from scheduled appointments also proved difficult for indigent patients. One project goal was to minimize the increase in patient triage times and one-on-one time with providers due to screening.

The PICO format is used to articulate questions to assist in Evidence Based Practice (EBP) (Evidence Based Medicine, 2021). Using the PICO model helped outline all elements deemed essential in this project. The model aided team members to support the project presented. In rural patients previously diagnosed with diabetes mellitus (P) how does being screened for diabetic peripheral neuropathy using the Michigan Neuropathy Screening Instrument (MNSI) (I) compared to the same patients (C) prior to

screening, when addressing the rate of detection of peripheral neuropathy (O) (Evidence Based Medicine,2021).

Organizational Description of Project Site

The project was conducted at two privately owned healthcare practice locations. The two locations were rural practices where each provider sees on average 30 to 40 patients daily, respectively. The population consisted of patients diagnosed with diabetes, hypertension, chronic pain, pulmonology, and peripheral neuropathy. The patient employment ranged from retirees to adolescents entering college full-time.

Review of the Literature

The databases used most in this research were Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and BioMed Central. The search was limited to scholarly articles published within the past five years. The following terms which produced the most beneficial articles were DPN, diabetic foot ulcers, diabetic vascular complications, and diabetic complications.

Hicks and Selvin (2019) conducted a quantitative study focused on the impact of DPN and found that 50% of patients suffering with DPN will continue to develop further complications. DPN cannot be reversed, and providers' goal was to prevent and treat. The authors found patient outcomes increased when patients maintained a desirable weight, patient education, increased physical activity, foot care, and pain control (Hicks & Selvin, 2019).

The American Diabetes Association (ADA) recommended early prevention and screening of DPN due to their review of cross-sectional data (Hicks & Selvin, 2019).

Ahrary, Khosravan, Alami, and Nesheli, (2020) conducted an individual randomized controlled trial focusing on the effects of diabetic education in women. Hicks and Selvin (2019) found patient education was an important preventative method in treating DPN. Ahrary et al. (2020) comprised two trial groups totaling 115 participants. The trial group (N=60) was given one-month close interventions with consistent in-person education specific and appropriate for the group's DPN diagnosis (Ahrary et al., 2020). There was a significant decrease in the reporting of symptoms related to DPN.

Baurer et al. (2018) used increased technology to improve patient symptoms related to DPN. The study randomized patients over six months to take part in a usual care (UC) test. Patient demographics were balanced (N=62; 53% female, mean age = 63 years, 94% type 2 diabetes). Patients included in the test group reported increase in pain threshold (Baurer et al., 2018). Text messaging was the chosen method of communication and support to the patients identified. The text messages increased self-care and education of T2DM for the patients (Baurer et al., 2018).

Hershey (2017) explored the comfort levels of clinical providers in recognizing DPN in diabetic patients. The MNSI tool was used to explore its usefulness and accuracy in screening patients. Using the MNSI tool helped identify asymptomatic patients with DPN. Patients who were not identified early as suffering from DPN or T2DM were more likely to have amputations. The article showed how important continuing education is for all healthcare staff.

Hoogendoorn et al. (2020) shared similar ideology with Luciani et al. (2021) that self-care improves the outcomes of those diagnoses with DPN. The exploration of income, educational level, and personal determination helped predict the progression of the disease process (Iqbal, 2018). Patients who were willing to learn proper dietary

requirements and measure their blood glucose levels were successful in a team approach treatment plan. Having a basic knowledge of reportable signs and symptoms assists providers in an outpatient care setting (Iqbal, 2018). Both articles agreed more studies are needed relating to selfcare and responsibility.

Rodriguez et al. (2021) and Joo and Liu (2021) both took an interest in race as it relates to T2DM. The data generated from these studies supports the hypothesis that minorities are affected at a disproportionately higher rate than others. Unlike Rodriguez et al. (2021), Joo and Liu (2021) believed in tailoring learning tools around the culture of the audience being educated. Tools that include culturally considerate material are proven to result in higher rates of acceptance (Joo & Liu, 2021). DPN caused progressive nerve damage which results in amputations in some patients. Patients may also experience pain and paresthesia (Hershey, 2017). The tool can be used in all patients at high risk for nerve damage.

Hershey (2017) investigated depression, amputation risk, sleep disturbances, and chronic pain patients often report to their providers. The MNSI was the gold standard for early detection. The tool had two parts. There was a questionnaire and exam to be performed during this proposal. The patient's history was assessed with 15 questions that was answered using 'yes' or 'no' (Hershey, 2017). The examination was conducted by examining: (a) appearance (b)ulceration (c) ankle reflexes (d) vibration sensation at the great toe, and (e) monofilament exam (Hershey, 2017). For purposes of this DNP project, onlythe questionnaire was used for data collection for ethical considerations for the patients.

As part of their routine exam, the assessment was also completed but was not used for data collection in the project.

Evidence-Based Practice: Verification of Chosen Option

The MNSI is considered the gold standard for early detection of DPN (Hershey, 2017). The tool has two parts involving a questionnaire and exam to be performed during this proposal. For purposes of this DNP project, only the questionnaire was used for data collection for ethical considerations for the patients. As part of their routine exam, the assessment was also completed but was not used for data collection in the project.

Theoretical Framework/Evidence-Based Practice Model

The framework model utilized for this project was the Iowa model (Cullen et al., 2019). This model was developed by members of the Iowa University system and allows for practitioners to bridge the gap between research and practice using an evidence-based approach. An organized project design is needed to assist one in furthering the nursing profession.

The model provides practitioners with a method of project development and implementation and utilizes a template to guide researchers from the start to finish on their project (Cullen et al., 2019). Identifying problem-focused or knowledge-focused triggers is step one of using the model. In the case of this project, the PICO is categorized as 'Process Improvement Data'. The need to identify early signs and symptoms of DPN is important to prevent costly outcomes for patients and the healthcare system (Cullen et al., 2019).

Topics not categorized as priority are not recommended per the Iowa model (Cullen et al., 2019). The model encourages the writer to confront more challenging topics. Once the topic is formed, a team is organized. One is encouraged to formulate a

team in which each participant can contribute to the outcome of the project. A team should encompass personnel of all skill sets and educational levels. Staff employed individuals in different positions have perspectives which can benefit the results of the study (Cullen et al., 2019).

Literature is reviewed to find out if the project is supported by research (Cullen et al., 2019). If one uses the Iowa model, it allows early identification of a project that is not well researched. Without this template, one would waste valuable time on a project that would not yield results. Time is important when addressing quality improvement tasks. The project will then move into the implementation stage (Cullen et al., 2019).

After careful organization of the data, the decision to apply the data should be made by the team (Cullen et al., 2019). The leadership team will monitor the project from start to finish, while ensuring to review feedback of the participants and staff. There are often barriers that cannot be predicted during the planning process. If the project is to be repeated, correcting errors each time will allow for smoother execution. The Iowa model is useful in organizing a project from beginning to end (Cullen et al., 2019).

Goals, Objectives, and Expected Outcomes

The purpose of this project was to use the Michigan Neuropathy Screening Instrument (MNSI) scale to improve patient outcomes by promoting better identification of individuals who need to be referred out to a specialist.

The goals and expected outcomes were:

- The first section of the MNSI tool will be completed on all qualifying patients who consent, during regularly scheduled patient appointments.

- There will be a goal of 12-13 MNSI exams within a 2-week period.
- This implementation will occur during scheduled appointments as a component of the normal assessment. There was no financial incentive for participation. However, the possibility for improved quality of life is the ultimate goal for patients. The staff at both facilities have generously agreed to volunteer their time.
- The goal of both facilities is to identify patients at high risk of experiencing complications of T2DM specifically related to DPN.
- The MNSI tools should only add an additional 20-30 minutes to the patient's total treatment time. The project data was able to be completed in approximately three months' time.

Project Design

The project design was a quality improvement (QI) project. It will assist in developing a health policy to detect signs of peripheral neuropathy in patients within two rural facilities. The QI project was a quasi-experimental design using purposive sampling from two clinical sites. The project consisted of short yes or no answer questions which will be asked verbally to patients by healthcare providers trained on the use of the tool. The data was used to show the percent of patients without a prior diagnosis of peripheral neuropathy who were identified as high risk using the MNSI scale. The screening added approximately five minutes to each visit.

Project Site and Population

Diabetic peripheral neuropathy costs the United States (U.S.) \$10.9 billion per year in healthcare (Hershey, 2017). DPN is typically under-reported and under-treated, adding a burden to an already vulnerable population (Hershey, 2017). The chosen clinical sites were home to an abundant number of diabetic patients who lived in rural communities. The sites were considered rural, due to the level of economic and healthcare services available. “Site A” had two medical doctors and two nurse practitioners. “Site B” had four vascular surgeons and one nurse practitioner. The patients seen daily ranged from approximately 90-120 patients collectively among providers at each site. Among the patients seen, roughly 30% were diagnosed with T2DM.

Diabetes is ranked Alabama’s ninth health concern (Alabama, 2019). During the project phase, the population surrounding “Site A” was 35,957 (U.S. Census Bureau, 2019). Women made up 51.1% of that population; 14.9% of the people in the area were age 65 and older (U.S. Census Bureau, 2019). The majority of the population’s race was Caucasian and made up 75.8%, while African Americans made up 18.7% (U.S. Census Bureau, 2019). The remaining races were a mixture of American Indian and Alaska Native alone, Asian alone, Native Hawaiian and Other Pacific Islander alone, Hispanic or Latino, and two or more races, (U.S. Census Bureau, 2019).

The median value of owner-occupied housing was \$162,700 (U.S. Census Bureau, 2019). There were 14,069 households, which averages out to be approximately 2.5 people per home. The median household income was \$61,110. Thirteen point one percent of the population were under the age of 65 with a disability, and there were 7.9% of individuals without health insurance under the age of 65. The poverty level was 15.9% (U.S. Census Bureau, 2019).

The population surrounding “Site B” was 226,486 (U.S. Census Bureau, 2019).

Women made up 53% of that population. A small percentage, 15.6%, of the people in the area were age 65 and older. The majority of the population's race was White alone and made up 35.5%, while Black or African Americans made up 59.3%. The remaining races were a mixture of American Indian and Alaska Native alone, Asian alone, Native Hawaiian and Other Pacific Islander alone, Hispanic or Latino and two or more races, (U.S. Census Bureau, 2019).

The median value of owner-occupied housing was \$129,800 (U.S. Census Bureau, 2019). There were 89,527 households, which averages out to be approximately 2.46 people per home. The median household income was \$50,124. A reported 11.7% of the population were under the age of 65 with a disability and there were 12.2% without health insurance under the age of 65. The poverty level was at 15.8%, (U.S. Census Bureau, 2019).

Setting Facilitators and Barriers

Conducting projects at two sites could have led to complications in implementation. Rural patients live, on average, more than 30 minutes from the two clinical sites used in this project. Many of the participants are transported to their routine appointments by a family member or close friend. This often leaves patients feeling rushed. This distance often causes patients to miss their scheduled appointments. Patients who were illiterate may not have understood questions asked by the screeners. There are staff members who may have reservations of the DNP project, and see this and an unnecessary task.

Implementation Plan/Procedures

The author created a PowerPoint with voiceover that explained the process of the study. The officer manager at each site assisted with identifying up to six staff members

for training. After the staff members volunteered, the training was scheduled at their convenience. The PowerPoint covered the complete process and allowed for questions. The staff members had the contact information of the project coordinators for all inquiries.

Staff members were provided a copy of steps of the implementation. The staff assisted primarily with gaining consent and distributing and collecting the MNSI tool. The providers conducted the assessment portion which completes the tool. Patients were educated about their right to confidentiality, privacy, and that they could opt out at any time and their information would not be used. A demographic form (see appendix B) was also used, and data was coded. The participants were assigned a designated number. That number was used on the demographic form where data were collected. The patient may have experienced minimal distress when they learned of the need for a referral to a specialist depending on the findings of the survey. Confidentiality was also protected. Personal information was redacted from all study forms prior to data analysis. Participants were only identified with numbers. A form containing information linking names to numbers was kept on a password protected computer in the PI's office and will be destroyed 3 years after study completion. The project was implemented on November 9th, 2020 and continued until February 17th, 2021. A total of 31 participants were interviewed.

Measurement Instruments

In order to measure the outcomes of this DNP project, the MNSI instrument was used. The MNSI tool can be found in Appendix A. This instrument was used with permission and it specifically addressed the peripheral neuropathy that could be undetected at times in the diabetic patient.

The MNSI has become a part of the triaging process of all patients with a diagnosis of T2DM. The history was completed with the nurse prior to the clinical provider entering the room. After the patient completed the history, the nurse helped remove the patient's shoes and socks with their permission. The provider then conducted the physical exam on the patient as part of their routine care. If deficits were found, the patient was referred to the appropriate specialist to carry out additional diagnostic exams.

Data Collection Procedures

The patients entered the triage room as they typically do upon a visit. The author reviewed all paperwork with participants. This ensured all guidelines were followed per the IRB's standard. After informed consent was obtained, the MNSI survey was administered. The feedback was immediate, and the patient was advised of the recommendations.

Data Analysis

A professional statistician was hired to review all data produced in this project. A Bayesian analysis was used to analyze the data collected in this quality improvement project. The analysis was broken down by race, gender, age, and site locations. The participants were sent to podiatry and vascular specialist if the MNSI tool called for a more detailed look for the interest of the patient's quality of care. The use of a statistician ensured the quality of the calculations of datum collected in this project. A Bayesian approach is appropriate for this study because it provides ratio estimates regarding two differing hypotheses. It is also helpful with analyzing observed data as opposed to unobserved quantities (Hackenberger, 2019).

The data showed 84% of participants needed podiatry referrals and 44% required vascular consults. This was a key finding as diabetic patients are recommended to have

annual podiatric visits to increase their quality of care. The analysis reported African American participants were referred to a vascular specialist with a mean of 0.47 and standard deviation (SD) of 0.11. The Caucasian population's vascular referral rate was 0.44 with a SD of 0.12. This yielded a mean difference of 0.03 and showed no significant differences among races for vascular referrals. Podiatry referrals in African American participants had a mean of 0.82 with a SD of 0.09 and Caucasian participants were 0.79 with SD of 0.10. Again, there was a mean difference 0.03 with a SD of 0.13 difference that showed both races were fairly equal (see Appendix C).

Age was another variable that was important to analyze in this project. The age of the participants ranged from 40-70s. Mean vascular referrals for participants in their 40s were reported at 0.44 with a SD of 0.17, 70-year-old participants' mean was 0.39 with a SD 0.13. The mean was higher in patients in their 50- and 60-year age range. There were mean differences seen in podiatry referrals. There was no pattern seen related to age. The mean was reported above 0.50 for patients in all reported age participants (see Appendix D).

Male participants needed vascular consults at a significantly higher rate than female participants. The mean for males was 0.64 with a SD of 0.12 and female was 0.34 with a SD of 0.10 (see Appendix E). This is a mean difference of -0.30 and SD 0.16. This is a credible difference statistically. The podiatry means were high for both genders. The female means were 0.84 with a SD of 0.08 a mean of 0.77 for males and SD of 0.11 with a mean difference between genders was 0.07 with a SD of 0.13.

Using the MNSI tool helped identify patients in need of specialty care who would have otherwise been overlooked.

Results

There were two rural facilities studied in this project. The ability to compare two sites allowed for in depth comparison of patient type. The “Site A” vascular referrals had a mean of 0.35 and SD of 0.09; “Site B” vascular referrals had a mean of 0.75 and a SD of 0.13. There was a statistically significant mean difference of -0.40 with a SD of 0.16. This type of QI data is important, due to improvements that can be made for the sake of the patients. The podiatry referrals needed were high and similar at both facilities. “Site A” mean was 0.83 with a SD of 0.07, “Site B”; mean was 0.75 with a SD of 0.13. The difference mean was 0.08 with a SD of 0.15 (see Appendix F).

Interpretation/ Discussion

Some of the data yielded from this project was statistically significant. Due to implementing the DNP project as written, patients were able to receive real-time feedback. A total of 84% of participants were sent to a podiatrist and educated on yearly podiatric exams. Another 44% of participants showed concerning signs and symptoms that permitted an immediate vascular referral. The leadership team was able to gather pertinent feedback to assist in the future operations of their practice.

Male patients have a significantly higher rate of unnoticed complications of T2DM. It is recommended that providers educate the staff and screen the population closer, to improve their quality care. The primary care practice also had a significantly higher rate of patients who had been overlooked for early signs and symptoms of DPN. This data supports the use of the MNSI tool in the primary care setting to prevent patients suffering preventable complications.

Cost-Benefit Analysis/Budget

Clinical sites A and B did not have to operate outside of their normal office hours to accommodate the project. There was no cost to conduct the experiment at the two designated sites. The employees at “Site A” and “ Site B” volunteered their time to assist with the quality improvement project. Each clinical site assigned individuals who would be briefed to conduct the survey during the normal triaging period. Patients were not financially compensated but were provided screening to improve their quality of life.

It is recommended to use the screening tools during the patients triage process. The tool is provided free via the internet. Quality measures require that the necessary tools are used during each patient encounter. Each facility offered their sites free of cost.

Timeline

The timeline for the project followed the model (Appendix G). The timeline takes into consideration the project due date and personnel involved. There was leniency in adjustments, but great effort was given to adhere to the timeline for planning phase, implementation phase, and data analysis phase. Consideration was given to the normal

operating practice of the two facilities. The project was modeled in that it could be implemented during regular patient visits.

Ethical Considerations/Protection of Human Subjects

The Jacksonville State University Institutional Review Board (IRB) (see Appendix H) approval was obtained before initiating the DNP project. Permission to use the MNSI tool was obtained (see Appendix I) prior to use. Permission to conduct the project at the locations was also obtained (see Appendix J). There was minimal risk associated with this project. The patients who volunteered to participate were ensured their demographic data will be used only for the sake of the project. Informed consent was obtained prior to screening (see Appendix K).

One benefit to the institutions was gaining a systematic approach to screen for (DPN). This project will assist in preventing unforeseen complications of T2DM. Patients will benefit from a screening that may assist in improving the quality and length of life. The information received could be used to improve the quality-of-care patients receive at each location. The patient can have an increased sense of protection knowing their provider was allowing forward thinking research in their office. Patients who volunteered had the potential for a better quality of life and earlier detection.

Conclusion

The MNSI tool improves the screening process of patients diagnosed with diabetes reporting signs and symptoms of DPN. Each of the facilities recognized the increase of patients identified early for DPN which improved quality care and adherence

to the gold standards of diabetes. Many of the participants reported contributing symptoms to their age not their diabetic diagnosis. The strength of this QI project is that it took minimum time for the patients and staff to complete, improved patient-provider trust, and has the potential to improved quality of life for the patient. The completion of the project sparked the interest of the staff and providers of surrounding healthcare facilities. This interest made the implementation of the project easy for those involved. The recommendation is to follow the model used in this project, screening with the MNSI tool during regularly scheduled visits. The MNSI tool has proven to be highly effective in recognizing early symptoms of DPN in patients who do not recognize common signs and symptoms. The wording of the tool was phrased in a way that patients of all educational levels understood the questions being asked in the tool. The use of this tool has the potential to save a significant amount of money for healthcare clinics, hospitals, and patients annually. It is recommended that further QI projects are preformed to increase the quality-of-care patients diagnosed with diabetes living in rural healthcare are receiving. This DNP project would benefit the inner cities, underserved, and lower income communities.

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APPENDIX A

Patient version

MICHIGAN NEUROPATHY SCREENING INSTRUMENT

A. History (To be completed by the person with diabetes)

Please take a few minutes to answer the following question about the feeling in your legs and feet. check yes or no based on how you usually feel. Thank you.

- | | | |
|---|------------------------------|-----------------------------|
| 1. Are you legs and/or feet numb? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. Do you ever have any burning pain in your legs and/or feet? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. Are your feet too sensitive to touch? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Do you get muscle cramps in your legs and/or feet? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. Do you ever have any prickling feelings in your legs or feet? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. Do you ever have any prickling feelings in your legs or feet? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7. When you get into the tub or shower, are you able to tell the hot water from the cold water? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8. Have you ever had an open score on your foot? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 9. Has your doctor ever told you that you have diabetic neuropathy? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 10. Do you feel weak all over most of the time? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 11. Are your symptoms worse at night? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 12. Do your legs hurt when you walk? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 13. Are you able to sense your feet when you walk? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 14. Is the skin on your feet so dry that it cracks open? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 15. Have you ever had an amputation? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Total: _____

MICHIGAN NEUROPATHY SCREENING INSTRUMENT

B. Physical Assessment (To be completed by health professional)

1. Appearance of feet

Right
 a. Normal ₀ Yes ₁ No
 b. If no, check all that apply:

Deformities
 Dry skin, callus
 Infection
 Fissure
 Other
 Specify: _____

Left
 Normal ₀ Yes ₁ No
 If no, check all that apply:

Deformities
 Dry skin, callus
 Infection
 Fissure
 Other
 Specify: _____

2. Ulceration
 Right
 Absent ₀ Present ₁

Left
 Absent ₀ Present ₁

3. Ankle reflexes
 Present ₀ Present/Reinforcement _{0.5} Absent ₁

Present ₀ Present/Reinforcement _{0.5} Absent ₁

4. Vibration perception at great toe
 Present ₀ Decreased _{0.5} Absent ₁

Present ₀ Decreased _{0.5} Absent ₁

5. Monofilament
 Normal ₀ Reduced _{0.5} Absent ₁

Normal ₀ Reduced _{0.5} Absent ₁

Signature: _____

Total score _____ /10 points

APPENDIX B

Demographic Information

Identifying Number: _____

Gender: M/F/T/A _____

Age: _____

Race or Self-Identified Cultural Background: _____

Years of Diagnosis of Diabetes: _____

Smoker: Y/N _____ **years smoked**

HTN: Y/N Hyperlipidemia: Y/N

Podiatrist Y/N Last Visit

Reason for today's appointment _____

Diabetic Medications patient prescribed/Duration:

Treatment

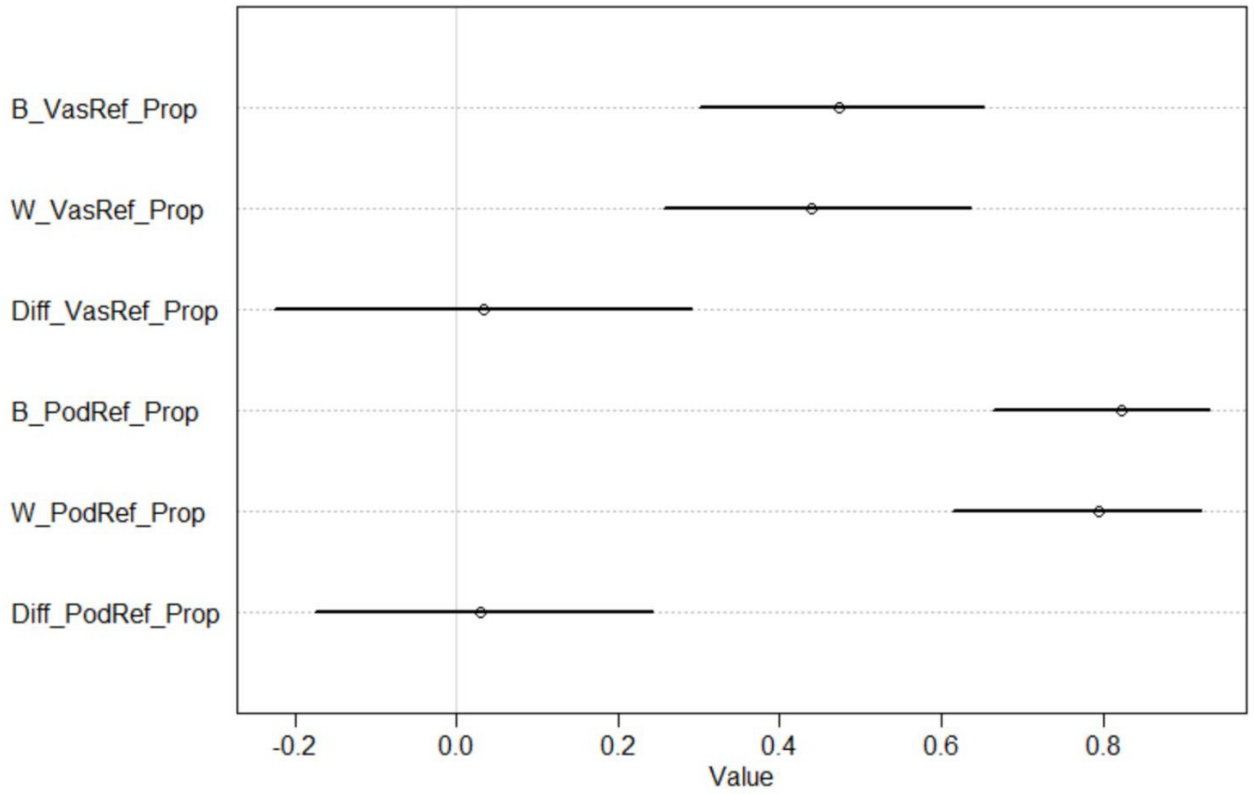
Action _____

Vascular Referral: Y/N

Podiatrist Referral: Y/N

APPENDIX C
Bayesian Analysis

Difference in Race variable

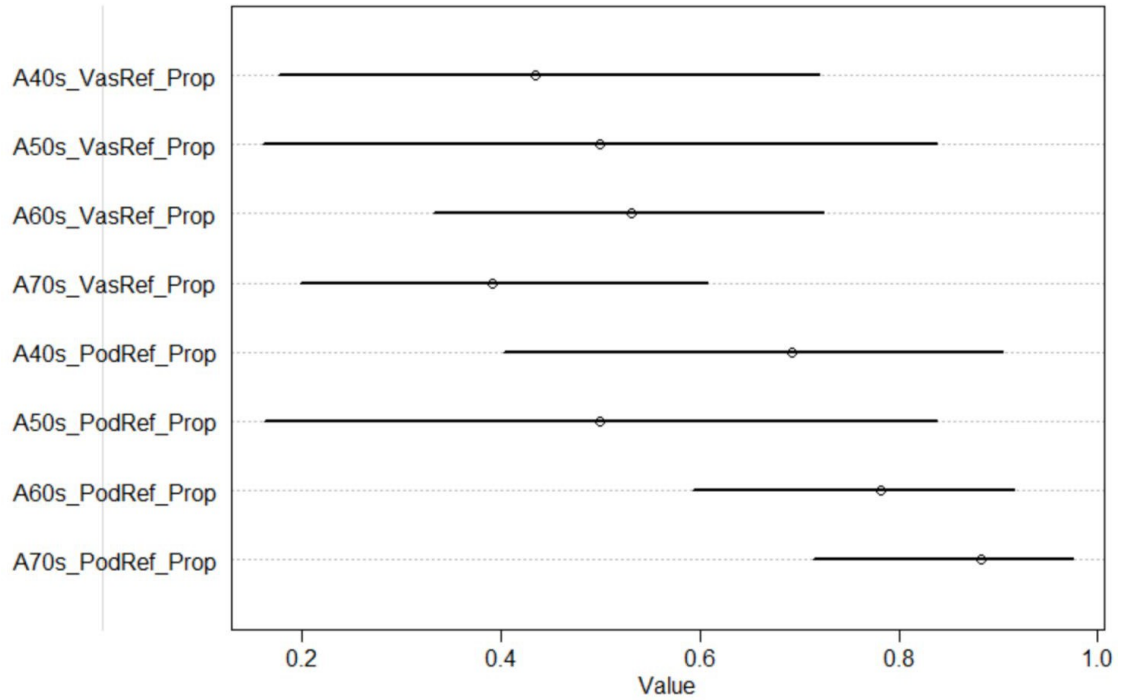


	mean	sd	5.5%	94.5%
B_VR_p	0.47	0.11	0.30	0.65
W_VR_p	0.44	0.12	0.26	0.64
Diff_VR_p	0.03	0.16	-0.23	0.29
B_PR_p	0.82	0.09	0.67	0.93
W_PR_p	0.79	0.10	0.61	0.92
Diff_PR_p	0.03	0.13	-0.17	0.24

All the credible intervals contain zero which means the difference values are plausibly zero.

APPENDIX D

Difference in Age range (by decade) variable

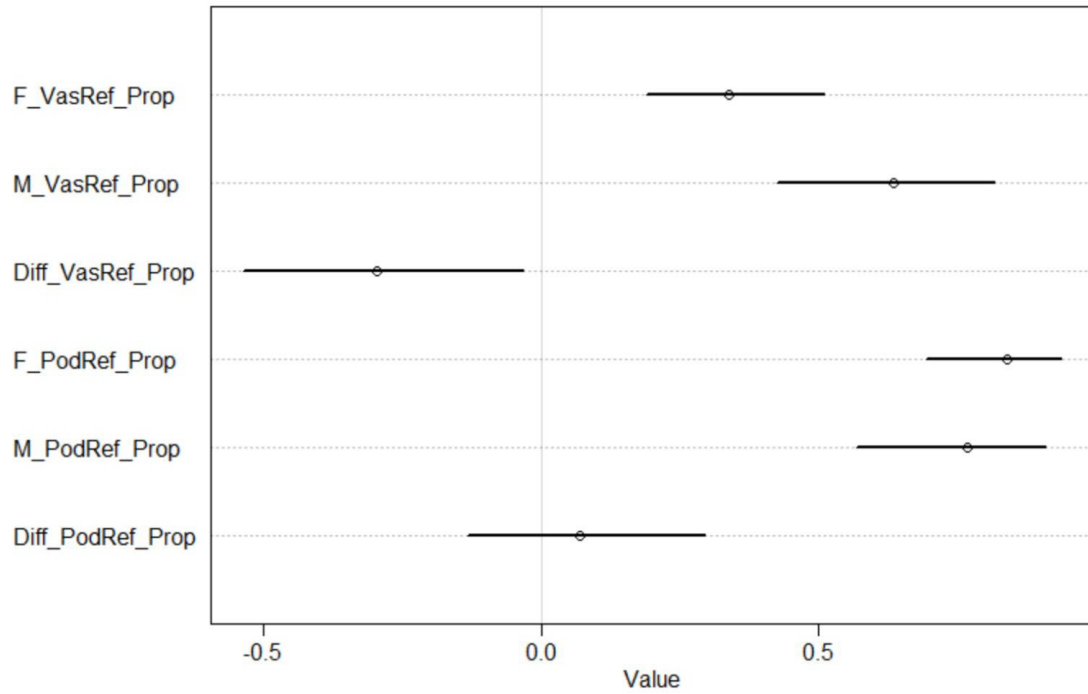


	mean	sd	5.5%	94.5%
40s_VR_p	0.44	0.17	0.18	0.72
50s_VR_p	0.50	0.21	0.16	0.84
60s_VR_p	0.53	0.12	0.33	0.72
70s_VR_p	0.39	0.13	0.20	0.61
40s_PR_p	0.69	0.16	0.40	0.90
50s_PR_p	0.50	0.21	0.16	0.84
60s_PR_p	0.78	0.10	0.59	0.92
70s_PR_p	0.88	0.09	0.71	0.97

All the credible intervals overlap which means the difference values are plausibly zero.

APPENDIX E

Difference in Gender variable

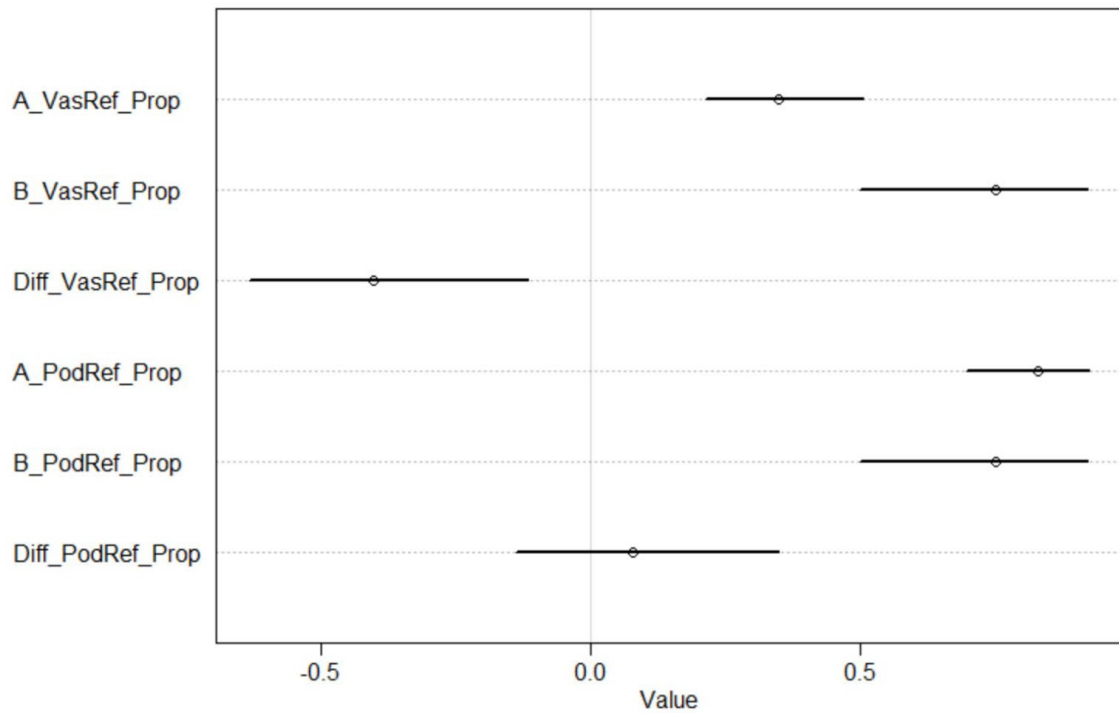


	mean	sd	5.5%	94.5%
F_VR_p	0.34	0.10	0.19	0.51
M_VR_p	0.64	0.12	0.43	0.82
Diff_VR_p	-0.30	0.16	-0.54	-0.03
F_PR_p	0.84	0.08	0.69	0.94
M_PR_p	0.77	0.11	0.57	0.91
Diff_PR_p	0.07	0.13	-0.13	0.30

The credible interval does not contain zero which means the difference values are plausibly different (statistically significant)

APPENDIX F

Difference in Site location variable



	mean	sd	5.5%	94.5%
A_VR_p	0.35	0.09	0.21	0.51
B_VR_p	0.75	0.13	0.50	0.92
Diff_VR_p	-0.40	0.16	-0.63	-0.12
A_PR_p	0.83	0.07	0.70	0.93
B_PR_p	0.75	0.13	0.50	0.92
Diff_PR_p	0.08	0.15	-0.14	0.35

The credible interval does not contain zero which means the difference values are plausibly different (statistically significant).

APPENDIX G

Timeline

DNP Project Timeline

Task	October	November	December	January	February	March	April
Recruitment of eligible participants	X	X	X	X			
Intervention: Evaluation; Toolkit	X	X	X	X	X		
Post-test and Analysis of outcomes				X	X	X	X
Results presented to local providers							X

APPENDIX H


OFFICE OF THE VICE PROVOST
JACKSONVILLE STATE UNIVERSITY

October 30, 2020

Dear Kendra Ward Harris:

Your proposal submitted for review by the Human Participants Review Protocol for the project titled: "Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in Rural Healthcare Settings" has been approved as exempt. If the project is still in process one year from now, you are asked to provide the IRB with a renewal application and a report on the progress of the research project.

Sincerely,



Joe Walsh
Executive Secretary, IRB

JW/dh

201 Bibb Graves Hall
700 Pelham Road North
Jacksonville, AL 36265-1602
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APPENDIX I

Michigan Neuropathy Screening Instrument Consent

RE: DNP student seeking permission to use MNSI tool

Campbell, Pam <pamcamp@med.umich.edu>

Sat 9/26/2020 7:37 AM

To:

- Kendra Ward Harris <kwardharris@stu.jsu.edu>

Dear Ms. Harris,

Please feel free to use our MNSI survey instrument. We just ask that you please cite our Center as follows: The project described was supported by Grant Number P30DK020572 (MDRC) from the National Institute of Diabetes and Digestive and Kidney Diseases.

Thank you,

*Pam Campbell
Michigan Diabetes Research Center
Michigan Center for Diabetes Translational Research
University of Michigan Medical School
1000 Wall Street
RM# 6100 Brehm Tower
Ann Arbor, Michigan 48105
Tel: 734-763-5730
Fax: 734-647-2307*

Remember to cite the Michigan Diabetes Research Center (MDRC) and/or the Michigan Center for Diabetes Translational Research (MCDTR) in publications:

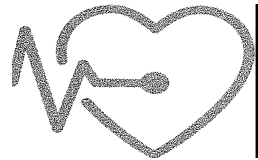
"The project described was supported by Grant Number P30DK020572 (MDRC) from the National Institute of Diabetes and Digestive and Kidney Diseases" OR the project described was supported by Grant Number P30DK092926 (MCDTR) from the National Institute of Diabetes and Digestive and Kidney Diseases."

APPENDIX J

Agency Letters

A.

MedicalcareAssociates
PRATVILLE



To Whom It May Concern:

I, Kendra Ward Harris, MSN, RN, FNP-C, a Doctor of Nursing Practice (DNP) student at Jacksonville State University has permission to conduct a Quality Improvement DNP project titled: Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in a Rural Healthcare Settings. This DNP project will be conducted at 102 Medical Center Dr. Prattville AL, 36066.

A handwritten signature in black ink, appearing to read 'Derrick Brown', written over a horizontal line.

Signature of Derrick Brown, CEO

Derrick Brown, JD
CEO
12052532205
attydbrown@gmail.com

B.



2055 East South Boulevard, Suite 908
Montgomery, Alabama 36116
(334) 284-6500 - Office
(334) 284-6202 - Fax
www.montgomeryvascular.com

ROBERT E. ENGLES, JR., MD, FACS
RALPH B. REDD, MD, FACS
BENJAMIN T. RUSH, DO
JONATHAN CUDNIK, MD

September 29, 2020

To Whom It May Concern:

I, Kendra Ward Harris, MSN, RN, FNP-C, a Doctor of Nursing Practice (DNP) student at Jacksonville State University has permission to conduct a Quality Improvement DNP project titled: Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in a Rural Healthcare Settings. This DNP project may be conducted at 2055 E South Blvd #908, Montgomery, AL 36116.

A handwritten signature in black ink, appearing to read "Ralph Redd", is written over a horizontal line.

Ralph Redd, MD
Vascular Surgeon, Co-owner
334-284-6500
rbreddmd@yahoo.com

APPENDIX K

CONSENT FOR PARTICIPATION IN A STUDY

Title of Project: “Preventing Complications of Undiagnosed Diabetic Peripheral Neuropathy in Rural Healthcare Settings”

Investigator Names: Kendra Ward Harris & Laura E. Barrow E-Mail Contact Information: kwardharris@stu.jsu.edu , lbarrow@jsu.edu

You are being asked to participate in a research study. Before you give your consent to volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you are being asked to do.

Investigators

Kendra Ward Harris, MSN, CRNP, FNP-C

Laura E. Barrow, PhD, RN

Purpose of the Research

This project identifies patients with diabetes mellitus 2 who unknowingly suffer with diabetic peripheral neuropathy. Identifying the early onset of disease in a rural healthcare setting, during subsequent healthcare visits. The patients will become educated and referred to the proper specialist to slow the progression of the disease. The early screening will allow one to prevent the consequences of untreated diabetic peripheral neuropathy.

Procedures

If you volunteer to participate in this study, you will be asked to respond to questions asked in a semi-structured interview. Questions will be focused on personal symptoms you experience with diabetes mellitus 2. Your participation will consist of participating in one interview taking approximately 45 minutes.

Potential Risks or Discomforts

There are no foreseeable risks, however, participants may experience positive or negative feelings that may be experienced as they respond to questions or when reflecting onto the interview. The interview will be conducted at the patient's regularly scheduled chronic care appointment. There are no costs associated with your participation in the study. You have the right to discontinue participation, temporarily or permanently, without any consequence.

Potential Benefits of the Research

There are personal benefits for patients participating in the study. The patients with participation will identify early signs diabetic peripheral neuropathy (DPN). The nursing profession and clinical practice standards will increase due to the knowledge obtained in this study.

Confidentiality and Data Storage

Identifying information will be confidential and not be shared with anyone. You will be asked to select a pseudonym, unrelated to your name, which will be used during your interview, on all transcriptions and notes and journaling, and your demographic datasheet. Your demographic datasheet will be kept in a locked location, separate from audio recordings and transcriptions. Your name will not be used in discussion with others regarding this research. If any identifying information is mentioned during your interview, that will be redacted from the written transcript and replaced with an alternative pseudonym. Other than any information that is redacted to protect the confidentiality, the interview will be transcribed verbatim.

Data will be stored in the researchers' offices on a password-protected computer. Only the researchers will have access to the surveys. Following the completion of the project, the surveys will be destroyed six months after the study.

Questions, Participation, and Withdrawal

Your participation in this research study is voluntary. As a participant, you may refuse to participate at any time. To withdraw from the study please contact the researchers at 334-333-6544, 256-490-3625, kwardharris@stu.jsu.edu , or lbarrow@jsu.edu.

Reasons for Exclusion from this Study

The exclusion criteria for this study include the inability to speak English or no diagnosis of diabetes mellitus 2.

Signature of Research Participant	Date
<hr/>	<hr/>

Participant Name (Please Print)

Date

Signature of Person Obtaining Consent

Date