The Effects of Dietary and Lifestyle Management on Diabetic Neuropathy

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Courtney Wyatt, BSN, RN

Liberty University

Lynchburg, VA

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Abstract

Numerous patients who have uncontrolled diabetes have developed complications associated with diabetic neuropathy. The apparent knowledge deficit and noncompliance have led to the development of clinical concerns related to improving patient outcomes. This scholarly project assesses the effects of dietary, weight, and exercise management on improving diabetic neuropathy symptoms. The debilitating effects of diabetes continue to affect numerous people each day. Uncontrolled diabetes can create innumerable complications, including diabetic neuropathy. Appropriate nutrition associated with accountability, monitoring, and proper education can alleviate the progression of uncontrolled diabetes. Assessment of the improvement of diabetic neuropathy with dietary and exercise management is examined among a group of twelve participants selected randomly.

Keywords: diabetic, neuropathy, exercise, symptoms, dietary

Acknowledgments

I want to extend my appreciation and gratitude to all the faculty and staff at Liberty University for their support and guidance throughout this journey. Thank you to my supportive family during this stressful and demanding season. I plan to continue advocating for patients who have knowledge deficits to assist them in overcoming these barriers to improve their overall health. Nursing has always been a passion of mine, a profession that my loving and supportive mother urged me to pursue. I will be forever grateful for her support and guidance as a nurse, mother, and follower of Christ. This is for you, Mom!

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SECTION ONE: INTRODUCTION

Many patients who have signs and symptoms of diabetic neuropathy have poor blood glucose control. Patients would benefit from education and resources to help them participate actively in diabetes management. This topic is deemed a priority by the supporting research. Further assessment is warranted on the effect of diet and exercise management on the severity of diabetic neuropathy. Obesity and uncontrolled diabetes are the main causes of neuropathies. An extensive literature review focused on patient complications and improvements when patient compliance is promoted. The findings suggest a need to provide education to prevent symptoms and improve the severity of symptoms associated with diabetic neuropathy.

Background

Diabetic neuropathy can produce symptoms of paresthesia and pain in the hands and feet. The severity of pain can be debilitating for some individuals. Frequently deemed a circulatory issue, diabetes mellitus can lead to poor hand and foot circulation, thus causing paresthesia and pain (Iqbal et al., 2018).

Many individuals have a knowledge deficit concerning the proper management and lifestyle choices for diabetes mellitus. The choice of topic for this scholarly project was influenced by the patient population encountered at the scholarly project site. Many of the patients have a diagnosis of diabetes mellitus that is uncontrolled. An emphasis on dietary modifications, weight management, and blood sugar control could lead to an improvement in the signs and symptoms of diabetic neuropathy.

Diabetic neuropathy can be delayed and possibly avoided with adherence to a lifestyle that promotes a lowering of Hgb A1c. Feldman et al. (2019) systematically reviewed the literature on the pathophysiology and development of diabetic neuropathy. According to this

analysis, the development of diabetic neuropathy can be deferred with appropriate diabetes management. Many patients lack the proper education on the impact of proper nutrition, weight control, and exercise management on diabetes.

The Centers for Disease Control and Prevention (2020) emphasizes that people who are overweight and physically inactive have a high risk of developing complications from diabetes, such as diabetic neuropathy. With sedentary lifestyles, low physical activity, and poor nutrition, complications related to diabetes are inevitable. In a culture of quick fixes related to the impatience of the American lifestyle, diabetic patients have difficulty understanding that diabetic management is a lifelong process.

In a cross-sectional analysis, physical exercise and dietary management proved to be a positive intervention for diabetic neuropathy (Lewis et al., 2022). An undesirable outcome of diabetic neuropathy can be a result of uncontrolled diabetes. Unfortunately, a decrease in quality of life is related to this poor outcome. Therefore, education related to diabetes control is necessary for every patient.

Problem Statement

Pain related to diabetic neuropathy is continuously evident in many diabetic patients. A review of recent evidence-based research demonstrates support for this scholarly project. A gap in knowledge, poor blood glucose control, and poor lifestyle choices accelerates the progression of diabetic neuropathy.

Purpose of the Project

This study aimed to assess the effects of dietary control and weight management on the development and severity of diabetic neuropathy. This evidence-based project also aimed to determine the factors impacting positive outcomes in patients with diabetic neuropathy.

Education related to proper dietary choices and emphasis on weight management to improve blood glucose control were offered to evaluate the effectiveness of these factors on the severity of diabetic neuropathy. The goal was to make patients aware of the circulatory issues caused by the progression of uncontrolled diabetes (Iqbal et al., 2018). This project implemented a biweekly educational intervention for patients to influence and evaluate the effectiveness and feasibility of lifestyle and dietary management.

Clinical Question

The Patient, Intervention, Comparison, Outcome, Time (PICOT) framework was utilized to establish a clinical question. The clinical framework is focused on planning, implementing, and evaluating components to achieve a practice change to improve diabetes education (Gallagher & Melnyk, 2019).

PICOT Question: Does implementing a diet and exercise program with diabetic patients with neuropathy improve diabetic neuropathy scores (compared to the absence of dietary modifications or exercise interventions) over 12 weeks?

SECTION TWO: LITERATURE REVIEW

A cohesive synthesis of the literature review is available in Appendix A. Numerous studies were assessed and analyzed with a focus on how dietary and lifestyle management improved outcomes for patients with diabetes mellitus. Some difficulty was experienced with selecting specific literature for review, as there are an abundance of data on the issue of diabetic neuropathy. An organized review of the literature with appraisal, limitations, level of evidence, and a description of each study can be found in Appendix A.

Search Strategy

A systematic search was conducted for literature related to diabetic neuropathy. PubMed was utilized to gather evidence-based research data and obtain peer-reviewed articles concerning dietary and lifestyle management to improve diabetic neuropathy. The following keywords were used in the search: *diabetes, diabetic neuropathy, improving blood glucose levels,* and *long-term effects of uncontrol diabetes mellitus*. Initially, the term "*improving diabetic neuropathy*" was searched in the entire database; the search yielded 3,125 articles. The selected 14 articles for this review provided the most relevant information related to the PICOT question. Six systematic reviews, four randomized-control trials, two cross-sectional studies, one quasi-experimental analysis, and one observational study were critiqued. These articles emphasized the impact of dietary management, lifestyle management, and exercise on the severity of diabetic neuropathy.

Critical Appraisal

Feldman et al. (2019) systematically reviewed the literature on the pathophysiology and development of diabetic neuropathy. According to this systematic review, the development of diabetic neuropathy can be postponed based on diabetes management. This Level 1 research article found that dietary interventions effectively modify diabetic neuropathy. Iqbal et al. (2018) provided evidence for improving diabetic neuropathy with diabetes management in a comprehensive review of 188 articles. A systematic review by Jahantigh Akbari et al. (2020) showed improvement in neuropathy with the initiation of regular exercise. Azizi et al. (2019) took a similar approach by implementing aerobic conditioning to improve symptoms in a study of 35 patients with diabetic neuropathy.

In a randomized clinical trial, Vas et al. (2018) examined the effectiveness of aerobic exercise on the severity of diabetic neuropathy. Patients in this study with impaired glucose

tolerance showed improvement in the severity of symptoms with the implementation of moderate-intensity aerobic activity. Zilliox and Russell (2019) conducted a systematic review of 20 studies assessing the improvement of diabetic neuropathy with diet and exercise management resulting in improved diabetic neuropathy. Although there was no widely agreed upon outcome measurement, improvement in diabetic neuropathy symptoms was evident within each research study.

In a Level 1 research study, Smith and Singleton (2021) assessed the influence of the degree of obesity on the severity of diabetic neuropathy in a clinical study of 131 participants with a body mass index (BMI) > 35 kh/m^2. This observational study showed significant improvement in neuropathy symptoms in 72 of the 131 patients due to weight loss. Storz and Küster (2020) completed a systematic review of numerous studies to assess the effectiveness of whole-food plant-based diets on diabetic neuropathy. This Level 1 research study found that diabetic neuropathy improved with a plant-based diet.

Lewis et al. (2022) implemented a research study with 75 patients to analyze the association between physical activity and neuropathy in diabetic patients. In this cross-sectional analysis, weekly physical activity was shown to affect significant nerve fiber function in the lower limbs and some measure of small nerve fiber, thus improving the severity of neuropathy. In addition, Hernández-Secorún et al. (2021) examined 656 articles and selected 29 for a systematic review. The research indicated that exercise and manual therapy proved effective for improving neuropathy in diabetic patients. Brown et al. (2021) examined significant changes between pre- and post-MRI outcomes over 10 weeks on lower extremity skeletal muscle composition and metabolic function in individuals with diabetic neuropathy. This quasi-

experimental Level 4 research study showed improvement related to exercise on the symptoms of diabetic neuropathy.

The effect of structured exercise was compared with education on neuropathic signs and symptoms in a study of 24 participants with diabetes and diabetic neuropathy (Perrin et al., 2022). Khan et al. (2022) evaluated the effectiveness of progressive resistance training on muscle strength, intraepidermal nerve fiber density, and motor function in individuals with Type2 diabetes and diabetic neuropathy. In this study, improvement in symptoms of diabetic neuropathy was evident. Sadiya and Mnla (2019) assessed whether food consumption is associated with the risk of poor glycemic control in Type 2 diabetes. In this retrospective cross-sectional study, consuming fizzy drinks, and fast food more than once weekly was found to potentiate poor glycemic control. Eating fresh fruits and vegetables once or more weekly decreased the incidence of poor glycemic control.

Synthesis

The information obtained during this research study yielded a plethora of knowledge related to the impact of exercise and dietary management on improving diabetic neuropathy. Noncompliance and knowledge deficits remain variable in the care of diabetic patients. When deficits are present, negative outcomes are evidenced by poorly controlled diabetes and neuropathy. Furthermore, improvement in these variables occurred with the implementation of a healthy diet and an exercise regimen.

Conceptual Framework

The Iowa Model was used as the conceptual framework for this scholarly project. The Iowa Model provided a step-by-step approach. Identification of the elected framework and components are delivered with consideration of limitations. The Iowa Model (Iowa Model

Collaborative, 2017) was used to establish the clinical question: Does implementing a diet and exercise program in diabetic patients with neuropathy improve diabetic neuropathy scores (compared to the absence of dietary modifications or exercise interventions) over 12 weeks. The topic is a priority based on research, so the clinic granted permission for the quality improvement project to be implemented.

Permission was obtained in September of 2022 to utilize the Iowa Model for this study (See Appendix B). Cullen et al. (2022) exemplifies the use of the Iowa Model to evaluate and strengthen this framework for utilization during research. The Iowa Model of Evidence-Based Practice, developed by the University of Iowa, provides a step-by-step guide for nurses to improve patient care during research studies.

The Iowa Model of Evidence facilitates the development of an implementation plan based on identifies issues and research solutions. This framework allows for visualization of research issues and explanations based on a seven-step approach. Results remain patient-centered, and the translation of research findings into clinical practice is focused on implementing change, demonstrating the significance of improved patient outcomes (Hanrahan et al., 2019). Haines et al. (2018) examined the use of the Iowa Model with a psychiatric patient population. The emphasis on positive patient outcomes reinforced the importance of patient-centered care.

Summary

Many patients with signs and symptoms of diabetic neuropathy have poor blood glucose control. The literature review emphasizes that patients must receive the necessary education and resources to participate in activities that improve their health to realize positive clinical outcomes.

The review of the research supported a likely need to move forward with exploring the clinical question. To implement a practice change in the desired setting, educational protocols for diabetic patients were needed. The evidence supported this research study based on trends in unmanaged diabetic patients with neuropathy. Furthermore, once standards were established focusing on decreasing knowledge deficits and barriers to compliance, there was an overall improvement in patient outcomes. Supporting research regarding the effects of dietary management and blood glucose control can lead to an improvement in the severity of diabetic neuropathy.

Health care providers must approach knowledge deficits in a methodical manner supported by evidence. The presence of diabetic neuropathy demonstrates poor control of diabetes mellitus. Basic knowledge was provided to the patient to promote compliance with their treatment plan to delay or avoid the progression of diabetic neuropathy. The literature reviewed (Appendix A) demonstrated a definitive need to manage diabetes mellitus to prevent or control neuropathy symptoms. Utilizing this evidence-based research project can facilitate the development of fundamental diabetes education for existing and newly diagnosed patients. With ongoing compliance among patients, improvement in the severity of diabetic neuropathy is evident.

SECTION THREE: METHODOLOGY

Design

This evidence-based guided project was developed and implemented based on the Iowa Model. An experimental design illustrated the components of this study utilizing the Plan-Do-Study-Act cycle. Current diabetes control was assessed by the patient's reported severity of diabetic neuropathy, a diagnosis of diabetes mellitus, and a BMI greater than 30. Participants'

consent was obtained; they were expected to follow a specific diabetic diet and weigh in weekly in the primary care office or home setting once a week for 12 weeks. After the results of this research study were analyzed, a presentation was shared with the clinic staff. Limitations included the attrition of five initial participants. At the beginning of this study, 12 potential participants were contacted. At the conclusion, only seven remained, even with a gift card incentive.

Measurable Learning Outcomes

The data from the participants were obtained utilizing a diabetic neuropathy severity screening tool (see Appendix C). Each participant was required to maintain a weekly log of food intake over the 12 weeks. Weekly weigh-ins were recorded by patients and logged for clinical review. During the research study, participants were also required to keep a weekly log of an exercise regimen to record their progress toward improving their diabetic neuropathy. Measuring weekly food intake, exercise, and weight management promoted patient compliance.

For this research study, the participants were given a pre-and post-test to assess the severity of their diabetic neuropathy. The Neuropathic Pain Scale can be found in Appendix C. This tool assisted the patients in describing their neuropathic symptoms as well as the symptoms' severity and location. The pre-and post-test allowed the patients to describe the severity of their symptoms to assess improvements after implementing the focused patient interventions.

After patients completed the Neuropathic Pain Scale, an education session was held to describe a nutritious diet, how to assess weight accurately, and specific exercises the patients would be doing during the 12-week period. These educational sessions were held over the telephone and in person, with handouts related to dietary education, accurate weight measurement, and physical activity mailed to the patient before the beginning of the study.

regimen were provided verbally. Individual concerns were assessed and addressed during each educational encounter. Barriers pertinent to each patient were discussed and mitigated based on patient concerns.

Setting

The data for this evidence-based project were collected at a community primary care practice. Low-socioeconomic status among this underserved patient populations yielded numerous barriers related to financial, health care access, and knowledge deficits. This primary care practice focuses on the management of acute and chronic illnesses. The effectiveness of this evidence-based project was demonstrated with positive outcomes related to the non-discriminating health care provided to these patients.

The Population

The goal was to enroll at least 20 participants in this evidence-based project. These patients were diagnosed with Type 2 diabetes mellitus, neuropathy, and a BMI greater than 30. This primary care practice typically cares for patients of lower socioeconomic status who are 18 years old and older. A database search was conducted by the Doctor of Nursing Practice (DNP)student that yielded participants meeting specific criteria: Type 2 diabetes mellitus, neuropathy, at least 18 years of age, and a BMI greater than 30.

Ethical Considerations

Training in research ethics had been completed by the project leader to ensure the protection of human subjects while the research was conducted. The project was submitted to Liberty University's Institutional Review Board (IRB) and was found to comply with ethical research standards for the protection of participants. A copy of IRB approval is included in this

final defense. A copy of the DNP student's Collaborative Institutional Training Initiative (CITI) Certificate is attached in Appendix J.

Informed consent was provided for all participants that listed the study's risks and benefits. The consent document explicitly explained that patients' personal information was only shared with the staff at the community health clinic and the DNP student. Participants' confidentiality was maintained throughout the project. Notification of their rights about their health care and their medical records was accessible to them throughout this research study.

Data Collection

The patient's contact information and medical records were obtained from the community health clinic via electronic medical records for review by the DNP student. In addition, each patient's diagnosis list was provided to the DNP before the research study began. This list provided the initial data for eligible participants. Participant written consent was obtained before the research study was started with an in-office meeting in a provided operatory.

Each participant was contacted via telephone for an educational session at the beginning of the 12-week study period. During this period, participants were educated on the project's criteria, the requirements of the participation, and exercise, dietary, and weigh-in requirements. An initial assessment of their diabetic neuropathy was obtained utilizing the severity tool in Appendix C. In addition, a one-page education handout reviewing a diabetic diet, instruction on how to properly weigh oneself, and appropriate exercise routines were mailed to each participant. These educational handouts can be found in Appendices D, E, and F.

A bi-weekly phone call to each participant was made by the DNP student to ask specific questions related to their compliance. The participant's weight, exercise regimen, and dietary intake were assessed during these phone calls. Each call provided an opportunity to address

knowledge deficits and offer encouragement. The post-test was completed at week 12 of the research study utilizing the Neuropathic Pain Scale to assess the patient's perceived improvement of neuropathy. All participants were encouraged to contact their health care provider with further questions. The responses related to the severity of the patients' neuropathy symptoms were collected and analyzed after the 12-week study period.

Tools/Equipment

Access to the electronic health record, Microsoft Excel, Microsoft Word, a telephone, and an operatory to obtain patient weights for those who did not have a home scale were the necessary tools and equipment for this research project. The participants were encouraged to use their home scale for weekly weigh-ins. However, the office was open for them to utilize the in-office scale. The participants were instructed to record their weight and report what foods they consumed each week by documenting these items in a daily journal. It was optimal if the patients weighed themselves the same day on the same scale at the same time of day for a more accurate result.

The pre- and post-test of the severity of the patients' neuropathy symptoms were used to determine if a change occurred in the severity of their symptoms. This allowed the researcher to assess improvement and whether any change was related to their dietary and lifestyle management.

The pre- and post-test for this research study (Appendix C) presented five questions for the participants to complete. This test gathered a description and severity of patients' diabetic neuropathy. The pre- and post-test were completed anonymously to ensure a nonbiased response, yielding helpful feedback.

The educational handouts related to exercise recommendations, dietary recommendations, and weight monitoring yielded a positive outcome in this research study. This positive outcome is demonstrated in the result that no participant gained weight during the study period.

The recommended dietary choices were based on a diabetic diet. The exercise regimen was based on the recommendation for any individual without physical limitations. The weekly educational handout for documenting food and exercise was offered and is included in Appendix F. Barriers to compliance such as poor dietary habits and sedentary lifestyle, were addressed during the initial telephone call. In addition, information on how participants can obtain healthy food on a fixed budget and community resources were offered and reviewed. After the educational session, participants were prompted to ask questions.

Intervention

This research study aimed to assess the effects of dietary and lifestyle management on the severity of diabetic neuropathy. Due to human subjects' involvement, IRB approval was essential. The participants were selected based on a definitive diagnosis of diabetes mellitus, diabetic neuropathy, and a BMI greater than 30. The community health clinic is in a low-income area and serves people with a lower socioeconomic status. The DNP student obtained participants' contact information (telephone numbers and mailing addresses). The participants were given a pre- and post-test to assess the severity level of their diabetic neuropathy (Appendix C). In addition, an educational session related to dietary recommendations, exercise recommendations, and weekly weight measurements was completed with each participant via telephone. Handouts (Appendices D, E, F) were mailed to each participant's mailing address.

Biweekly telephone calls were placed to each participant to allow ample time to assess barriers and alleviate knowledge deficits during the 12-week timeline.

For the initial educational session via telephone, the goal was for the DNP student to establish a trusting relationship with the participants and assess barriers to lifestyle compliance related to diabetes mellitus. After receiving each participant's written consent, biweekly phone calls were initiated that lasted approximately 2-5 minutes. These calls provided an opportunity to assess compliance, provide updates, and allow questions. Each participant was encouraged by the DNP student facilitating this research study at the community health clinic.

Weekly, the participants were instructed to log their weight, food choices, and activities completed for exercise. During the biweekly phone conferences, the participants reported this information to the DNP student. At the end of the 12-week study period, participants were given the identical Neuropathic Pain Scale to assess their symptoms. The variables related to activity level, food choices, and weight management were analyzed. The practice manager oversaw the participants. Any questions or concerns were relayed to her. The DNP student implemented this project for 12 weeks to gather, analyze, and summarize the data.

Timeline

Consent forms for the patients to sign (Appendix G) were developed before the research study implementation. General requirements were established with the research study's medical practice. A data report was generated through the electronic health record listing patients with Type 2 diabetes mellitus, diabetic neuropathy, and a BMI greater than 30. From this report, patients were randomly selected according to the research study's specific criteria. Participants from this report were then contacted via telephone to inquire about their interest in participating in this study. The initial telephone conference occurred at the beginning of the first week of the

12-week project period. Following this initial phone conference, biweekly telephone calls were placed to each participant and lasted 2-5 minutes.

At the conclusion of the 12 weeks, the data were collected from the pre-and post-test (Appendix C). An analysis was conducted to assess if there was a significant difference in the severity of diabetic neuropathy symptoms based on dietary and exercise management. The practice manager was notified of the study results. Future practice changes related to the study results were based on the data analysis.

Project Timeline

Table 1

Project Timeline

Step	Date
Step 1: Review scholarly project process	August 22, 2022
Step 2: Design project study with the practice manager and chair	August 30, 2022
Step 3: Complete CITI training	October 14, 2022
Step 4: Develop a primary draft of the proposal and submit to the chair for review	October 21, 2022
Step 5: Complete a final draft of the proposal	October 28, 2022
Step 6: Defend scholarly project proposal	November 4, 2022
Step 7: Obtain IRB approval for the proposed project	December 30, 2022
Step 8: Contact study participants and review the project/obtain consent.	January 24, 2023
Step 9: Initiate scholarly project	January 26, 2023
Step 10: Complete the initial draft	April 24, 2023
Step 11: Submit for editing	May 1, 2023
Step 12: Request a final defense appointment	May 4, 2023
Step 13: Submit the final PowerPoint for the defense	May 17, 2023
Step 14: Final defense	May 24, 2023
Step 15: Submit to Scholars Crossing	May 24, 2023

Feasibility Analysis

The DNP student conducted this research study with support from the community health clinic. This research study was cost-effective and required minimal time from the employees in

the practice setting. The telephone at the medical office was utilized at no extra cost. The necessary equipment (a scale, electronic health record, and phone) was available at the practice.

Data Analysis

Upon analysis of the data analysis, the study supported that dietary and lifestyle management were important interventions in improving the severity of diabetic neuropathy. Descriptive statistics were used to measure and illustrate the results yielded in this study. The DNP student selected participants based on the qualifying criteria: a diagnosis of Type 2 diabetes mellitus, neuropathy, and a BMI greater than 30. If the participants agreed to participate in the research study, the pre-and post-tests were provided in a Microsoft Word document. The pre-test was presented during the first encounter with each participant or via telephone. The post-test was conducted via telephone. The post-test was conducted after the 12-week implementation period to determine if the dietary and lifestyle management affected the severity of the patients' diabetic neuropathy.

Dietary and Lifestyle Management Education

Using the pre- and post-test (Appendix C), the participants could rate the severity level of their diabetic neuropathy. Comparing the pre- and post-test revealed improvements that were shared with the participants. This study increased the knowledge of a diabetic diet and lifestyle conducive to managing diabetes and slowing the progression of or preventing diabetic neuropathy. The participants' level of compliance with the dietary changes, increased exercise, and weight management criteria was paramount in assessing the effects on their reported diabetic neuropathy. Nutritional and lifestyle management is a compelling variable for reducing the severity of diabetic neuropathy.

SECTION FOUR: RESULTS

A total of 12 participants were contacted to participate in this study. Only seven continued throughout the entirety of the study. All 12 participants were contacted to conduct the pre-test on the severity of their diabetic neuropathy. All 12 participants received pamphlets that provided dietary, exercise, and weight measurement instructions. These instructions were verbally reviewed with each patient, with time allowed for questions and feedback. This meeting to review the instruction pamphlets (Appendices D, E, and F) was held via telephone conference. Of the 12 contacted participants, five could not be reached via telephone after the initial phone conference. The five participants who could not be contacted via telephone were excluded from the study. The remaining seven participants were able to be contacted bi-weekly for one-on-one sessions regarding their compliance with weight measurement and dietary and exercise interventions. The seven participants completed the post-test to assess the effectiveness of dietary and lifestyle management. This allowed for a 58.3% completion rate.

Of the seven participants who completed some portion of the research study, there were four men and three women ranging in age from 62 to 80. All were African American. The participants reported education levels, including not graduating high school or completing trade school.

Descriptive Statistics

Inferential statistics were utilized for Measurable Outcomes 1, 2, 3, and 4. This analysis concluded that the participants valued follow-up phone calls in which they were allowed to ask questions and receive guidance. A paired *t*- test was utilized to analyze the two samples of pre- and post-test results. The same participants were evaluated before and after the interventions to determine if their diabetic neuropathy improved. For the results to be significant, the *p* value

must be < 0.05. The *t*-test revealed no significant reduction in the participants' neuropathy severity based on results of a *p* value of 0.478325 which is > 0.05.

Figure 1

Diabetic Neuropathy Results After Educational Sessions and Biweekly Phone Calls

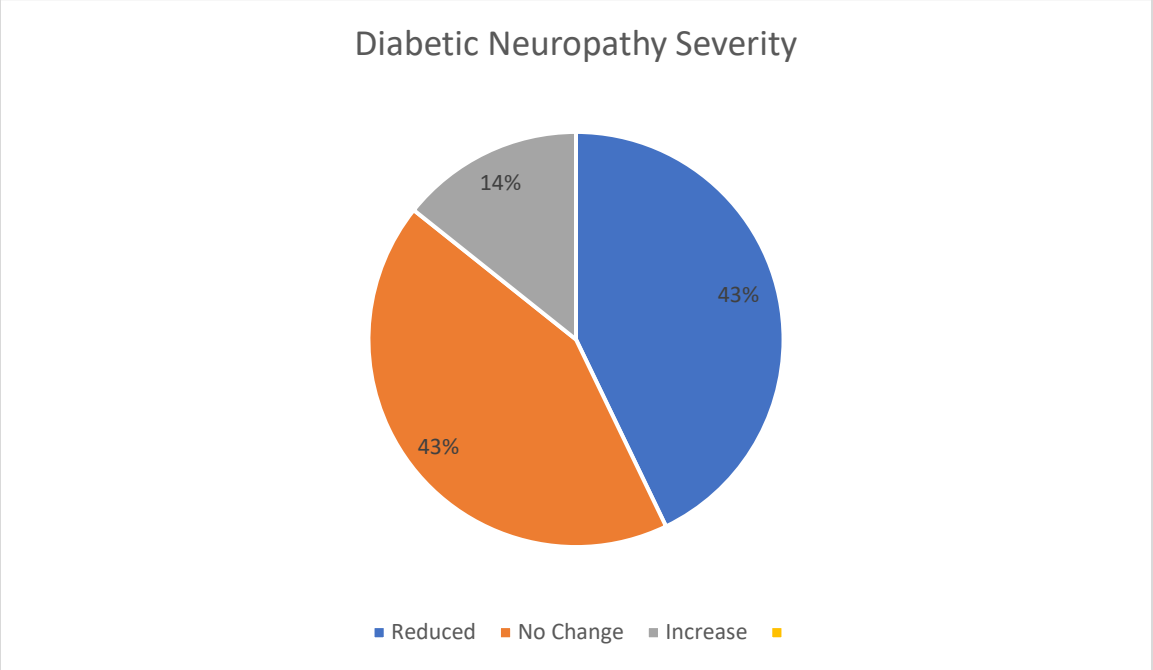

Table 2

Specific Patient Results

Patient number	Initial diabetic neuropathy severity score	Final diabetic neuropathy score	Difference
1	8	7	1
2	11	10	1
3	8	8	0
4	12	13	-1.0
5	8	8	0
6	13	10	3
7	7	7	0
Mean	9.5714286	9.0	0.5714286
STD	2.1946130708196	2.0	

Table 3

Determining the p *Value* t *Test: Paired Two Sample for Means*

	Initial diabetic neuropathy severity	Final diabetic neuropathy severity score
M	9.5714286	9.0
Variance	4.8163265306122	4
Observations	7	7
Pearson Correlation	0.8462	
Hypothesized Mean Difference	0	
Df	6	6
t Stat	0.7559289838149029	
p (T<=t) one-tail	0.239163	
t critical one-tail	1.943	
p (T<=t) two-tail	0.478325	
t critical two-tail	2.4469	

Measurable Outcome 1

For this research study, there were four measurable outcomes, the first concerning the pre- and post-test. There was a 100% completion rate for the pre-test and a 100% completion rate for the post-tests. The pre-and post-test results were collected via telephone conference with each participant. From the post-test results, analysis of a change in diabetic neuropathy was conducted.

Measurable Outcome 2

Twelve participants participated in the initial phone conference to discuss the goal of the research study and review the educational handouts mailed to each patient. Of the 12 participants, only seven remained in the research study. The remaining seven participants

participated in bi-weekly phone calls. However, at some point during the research study, each participant missed at least one scheduled phone conference.

Measurable Outcome 3

Following the initial phone conference to review all the educational handouts and expectations of the research study, seven patients participated in the weekly weight measurement. This measurement was collected on a biweekly basis. During the biweekly phone conference, the patient was instructed to log their weight weekly and relay this information to the DNP student. The weights were collected later if the patient did not participate in the bi-weekly phone call-100% of the seven patients complied with ongoing participation in the study.

Measurable Outcome 4

On average, 40% of the seven patients participated in their food journaling each week. This food journal was reviewed during biweekly phone conferences. If the patient did not participate in a biweekly phone conference, information regarding their food journaling was collected during a later phone call. Four patients needed to be more compliant with journaling their weekly food intake.

SECTION FIVE: DISCUSSION

This research study allowed the participants to receive education related to diabetes and lifestyle management to improve neuropathy. One participant reported a decline in the severity of their diabetic neuropathy. Although most of the participants did not report improvement in their neuropathy, five reported eating more nutritious meals consistently; two patients lost three pounds, and all seven reported they had started exercising regularly. All participants felt like they benefited from their participation in the study.

Patients also reported a need for more time to have biweekly phone conferences. Biweekly phone calls often became lengthy as some patients missed a phone conference. The final limitation was the length of the study. More time was needed for patients to adopt healthy lifestyle changes to evaluate the reported improvement of diabetic neuropathy. This study might have produced an increase in positive results if there had been a longer period to work with the participants to support the proposed changes and critically assess their perception of overall improvement in their diabetic management.

Opportunities for improvement include beginning this education before the progression of diabetic neuropathy. Newly diagnosed patients need to be made aware of what diabetic neuropathy is and the complications of its progression. Overall improvement may be realized by having younger age criteria for study participants. The average age of participants in the study was 78. People at this age often resist change. An ongoing review of participant compliance could be conducted over a longer period if diabetic education was started at the time of the initial diagnosis. Emphasis on the importance of appropriate dietary and lifestyle management may prevent the development and progression of diabetic neuropathy. This begins with early patient education on the management of diabetes.

Sustainability

This practice would greatly benefit a diabetes educator. Onboarding an additional employee to oversee diabetes education can significantly improve patient care, thus improving patient outcomes (Sekhar, 2022). An individualized patient plan could positively impact patients to sustain dietary and lifestyle modifications. Assessment of each patient's strengths and weaknesses could assist in developing this personalized patient plan. Providing daily nutritional

and exercise logs for each patient could positively impact compliance with these measurements and improve patient outcomes.

Dissemination Plan

The need for a diabetic educator was emphasized after the study results were reviewed. It was determined throughout the study that this medical practice could benefit the diabetic population by taking more responsibility for providing appropriate diabetes education to newly diagnosed patients and those with progressing diabetic neuropathy.

Conclusion

Improvement in dietary and lifestyle habits have proven beneficial in managing and avoiding the progression of diabetic neuropathy. Positive results in education related to lifestyle and nutritional modifications were evident for the participants in this study. Providers can play a large role in improving outcome for their patients by providing education regarding the complications with the progression of uncontrolled diabetes.-Additional research studies would be beneficial for this patient population. They should be conducted over a longer period to determine all variables that could impact outcomes for diabetic patients and prevent complications, including diabetic neuropathies.

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Appendix A

Evidence Table

Article	Study Purpose	Sample	Methods	Study Results	Level of Evidence	Study Limitations	Would Use as Evidence to Support a Change?
Azizi, S., Najafi, S., Rezasoltani, Z., Sanati, E., Zamani, N., & Dadarkhah, A. (2019). Effects of aerobic exercise on electrophysiological features of diabetic peripheral neuropathy: Single-blind clinical trial. *Topics in Geriatric Rehabilitation, 35*(2), 164–169. https://doi.org/10.1097/TGR.0000000000000229	Effects of aerobic exercise on diabetic neuropathy	35 patients (21 women) with diabetic neuropathy	Single-blind clinical trial	Aerobic exercise improves electrophysiological features and should be considered in the therapy of diabetic neuropathy.	Level 1 blinded clinical trial.	Lack of uniformity in study design, patient characteristics, and generalizability of study results.	Yes, the conclusion yields that aerobic exercise improves diabetic neuropathy.
Brown, R., Sharafi, A., Slade, J. M., Convit, A., Davis, N., Baete, S., Milton, H., Mroczek, K. J., Kluding, P. M., Regatte, R. R., Parasoglou, P., & Rao, S. (2021). Lower extremity MRI following 10-week supervised exercise	Characterize using MRI the effects of a 10-week exercise program on lower extremity skeletal muscle composition, nerve	Twenty participants with diabetic neuropathy. Participants completed a longitudinal trial of a 30-day control period where	Quasi-experimental	Significant changes in pre- and post-MRI results. The 10-week supervised exercise intervention program	Level 4	The trial did not specify randomization. The test was conducted only over ten weeks.	Yes, the study showed that short-term exercise intervention improves diabetic neuropathy.

intervention in patients with diabetic peripheral neuropathy. *BMJ Open Diabetes Research & Care, 9*(1), Article e002312. https://doi.org/10.1136/bmjdrc-2021-002312	microarchitecture, and metabolic function in individuals with diabetic peripheral neuropathy.	no change was made to their lifestyle. Following this control period, ten weeks of intervention were implemented with supervised aerobic and resistance exercise sessions.		reduced diabetic neuropathy.			
Feldman, E. L., Callaghan, B. C., Pop-Busui, R., Zochodne, D. W., Wright, D. E., Bennett, D. L., Bril, V., Russell, J. W., & Viswanathan, V. (2019). Diabetic neuropathy. *Nature Reviews. Disease Primers, 5*(1), Article 41. https://doi.org/10.1038/s41572-019-0092-1	Analysis of the pathophysiology and development of diabetic neuropathy.	No study sample.	Systematic review	Dietary interventions are effective in modifying diabetic neuropathy.	Level 1: Systematic Review	Systematic Review; needs randomized control trials.	Yes, it provides valuable information for lifestyle modifications related to the success of improving diabetic neuropathy.
Hernández-Secorún, M., Vidal-Peracho, C., Márquez-Gonzalvo, S., Corral-de-Toro, J., Müller-Thyssen-Uriarte,	Effectiveness of exercise and manual therapy for diabetic	Six hundred fifty-six articles were registered, and 29 were	Systematic review, randomized clinical trial	Exercise and manual therapy are beneficial for patients	Level 1	Lack of homogeneity in the sample selection criteria did not include	Yes, the conclusion yielded a positive correlation between

J., Rodríguez-Sanz, J., Lucha-López, M. O., Tricás-Moreno, J. M., & Hidalgo-García, C. (2021). Exercise and manual therapy for diabetic peripheral neuropathy: A systematic review. *Applied Sciences, 11*(12), Article 5665. https://doi.org/10.3390/app11125665	peripheral neuropathy.	selected for review.		with diabetic neuropathy.		ischemic heart disease or the diversity of exercises.	exercise and improvement in diabetic neuropathy.
Iqbal, Z., Azmi, S., Yadav, R., Ferdousi, M., Kumar, M., Cuthbertson, D. J., Lim, J., Malik, R. A., & Alam, U. (2018). Diabetic peripheral neuropathy: Epidemiology, diagnosis, and pharmacotherapy. *Clinical Therapeutics, 40*(6), 828–849. https://doi.org/10.1016/j.clinthera.2018.04.001	Improve diabetic neuropathy about diabetes management.	188 articles in a systematic review for a comprehensive literature review	Systematic review	Glycemic control is the only effective method to improve diabetic neuropathy.	Level 1; Systematic review	Systematic review of the literature. Need control trial.	Yes, it provides useful information relevant to the study question.
Jahantigh Akbari, N., Hosseinifar, M., Naimi, S. S., Mikaili, S., & Rahbar, S. (2020). The efficacy of physiotherapy interventions in mitigating the symptoms and complications of diabetic	Exercise therapy on the improvement of Diabetic Neuropathy.	Nine hundred sixty-eight articles in a systematic review for review of the effects of exercise and	Systematic review	Exercise and physiotherapy improved the severity of diabetic neuropathy.	Level 1; Systematic review	Systematic review of the literature. Need control trial.	Yes, it provides supporting data for the clinical research question.

peripheral neuropathy: A systematic review. *Journal of Diabetes and Metabolic Disorders, 19*(2), 1995–2004. https://doi.org/10.1007/s40200-020-00652-8		physiotherapy on diabetic neuropathy.					
Khan, K. S., Overgaard, K., Tankisi, H., Karlsson, P., Devantier, L., Gregersen, S., Jensen, T. S., Finnerup, N. B., Pop-Busui, R., Dalgas, U., & Andersen, H. (2022). Effects of progressive resistance training in individuals with Type 2 diabetic polyneuropathy: A randomized assessor-blinded controlled trial. *Diabetologia, 65*(4), 620–631. https://doi.org/10.1007/s00125-021-05646-6	Evaluate the effects of progressive resistance training on muscle strength, intraepidermal nerve fiber density, and motor function in individuals with Type 2 diabetes and diabetic neuropathy.	Forty-two participants with Type 2 diabetes and diabetic peripheral neuropathy, 32 participants with Type 2 diabetes 35 in a healthy control group	A randomized assessor-blinded controlled trial	Progressive resistance training improved muscle strength of the knee extensors and flexors and motor function in individuals with Type 2 diabetic polyneuropathy at levels comparable with those seen in individuals with diabetes without diabetic polyneuropathy and	Level 2	Participants randomized to the non-progressive resistance training were not advised to refrain from exercising. The trial duration was short.	This study reflects that progressive resistance training improved muscle strength in patients with Type 2 diabetes and diabetic neuropathy.

				healthy control individuals.			
Lewis, E. J. H., Lovblom, L. E., Lanctot, S., Scarr, D., Cardinez, N., Boulet, G., Weisman, A., Lovshin, J. A., Lytvyn, Y., Keenan, H. A., Brent, M. H., Paul, N., Cherney, D. Z. I., Bril, V., & Perkins, B. A. (2022). The association between physical activity time and neuropathy in longstanding Type 1 diabetes: A cross-sectional analysis of the Canadian longevity study in Type 1 diabetes. *Journal of Diabetes and Its Complications, 36*(3), Article 108134. https://doi.org/10.1016/j.jdiacomp.2022.108134	Analysis of association between physical activity and neuropathy in diabetic patients.	Seventy-five participants with > 50 years of diabetes Type 1 diagnosis participated in this study. Participants were 66 years or older.	Cross-sectional	Weekly physical activity time affects superior significant nerve fiber function in the lower limbs and some better measures of small nerve fiber function.	Level 1	Reverse causality, no measurement of HgbA1c, limited data pool related to participant criteria.	Yes, results provide insight into the association between physical activity and diabetic neuropathy.
Perrin, B. M., Southon, J., McCaig, J., Skinner, I., Skinner, T. C., & Kingsley, M. I. C. (2022). The effect of structured exercise compared with education on neuropathic signs and symptoms in	The effect of structured exercise compared with education on neuropathic signs and symptoms in	Twenty-four adult participants with diabetes and peripheral neuropathy.	Randomized clinical trial	Eight weeks of exercise training or lifestyle education can improve neuropathic signs and	Level 2	Small sample size. Inability to detect a statistically significant difference between the	Yes, the study showed exercise improved diabetic neuropathy

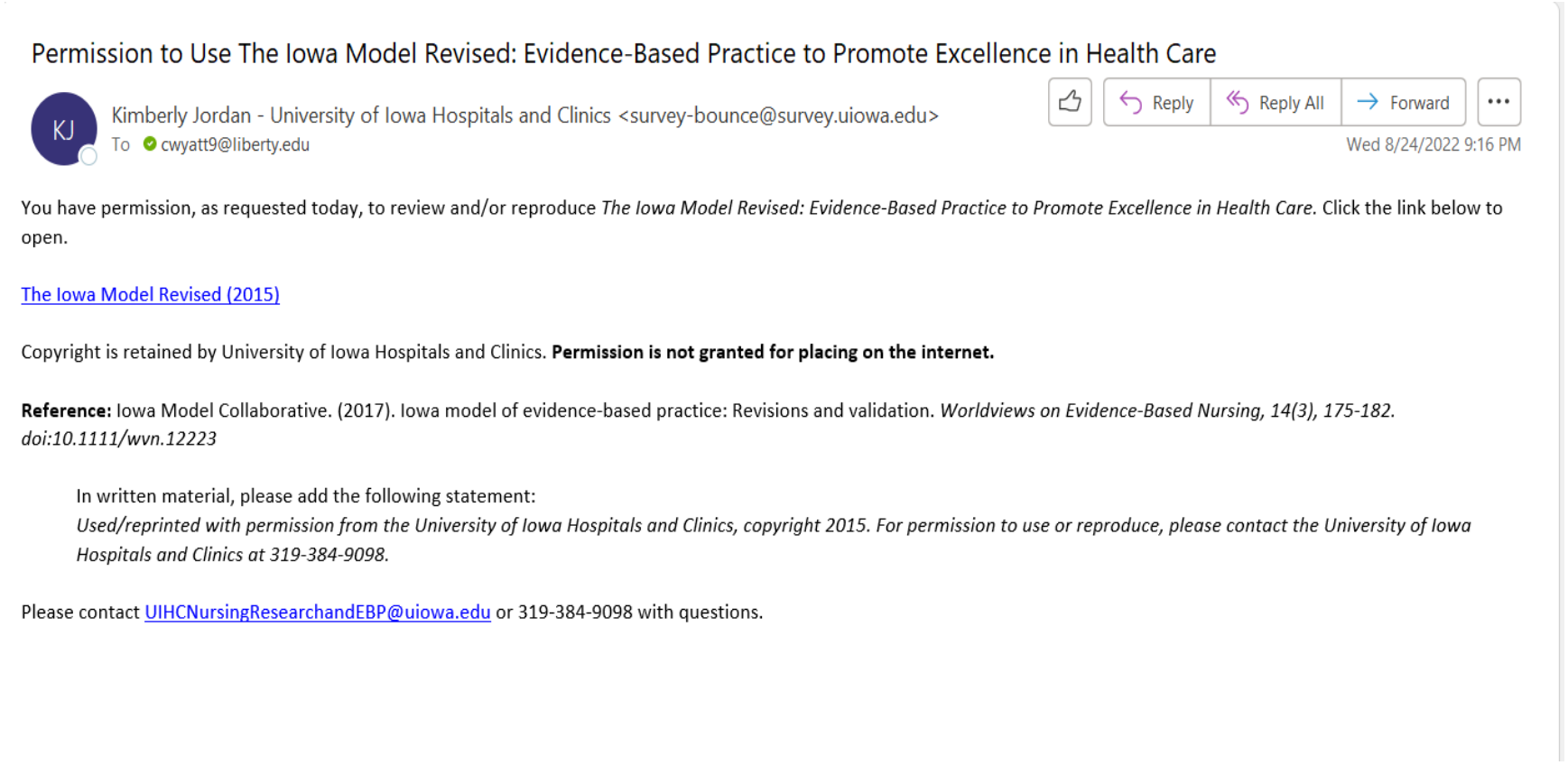
people at risk of neuropathic diabetic foot ulcers: A randomized clinical trial. *Medicine, 58*(1), Article 59. https://doi.org/10.3390/medicina58010059	people at risk of neuropathic foot ulcers.			symptoms in people with diabetes and peripheral neuropathy.		intervention groups	in participants.
Sadiya, A., & Mnla, R. (2019). Impact of food pattern on glycemic control among Type 2 diabetic patients: A cross-sectional study in the United Arab Emirates. *Diabetes, Metabolic Syndrome and Obesity, 12,* 1143–1150. https://doi.org/10.2147/DMSO.S209320	Assess food group/item consumption and its association with poor glycemic control (HgbA1c >7%) risk among Type 2 diabetes.	3,653 patients were screened, and 843 were recruited and diagnosed with Type 2 diabetes	Retrospective cross-sectional study	Consuming fizzy drinks and fast food at least once more weekly could potentiate poor glycemic control. Eating fresh fruits once or more weekly could decrease the incidence of poor glycemic control.	Level 2	Method of dietary data collection (self-reported). Numerous factors can contribute to the frequency of food consumption.	Yes, the study showed improvement in glycemic control. Better glycemic control can decrease the incidence of severity of diabetic neuropathy.
Smith, A. G., & Singleton, J. R. (2021). Dietary management of obesity-associated neuropathy: Implications for clinical	Assesses the degree of obesity on the severity of	131 participants with BMI > 35 kh/m^2	Observational	The 72 patients that completed the study trial of 2 years lost an	Level 1	Lack of treatment control group, significant	Despite study limitations, the study conclusion yielded an improvement

practice and trial design. *Obesity, 29*(12), 1990–1991. https://doi.org/10.1002/oby.23304	diabetic neuropathy.			average of 12.4 kg and showed significant improvement in neuropathy symptoms.		drop-out rate, and no definitive criteria for obesity.	in neuropathy symptoms related to eight changes.
Storz, M. A., & Küster, O. (2020). Plant-based diets and diabetic neuropathy: A systematic review. *Lifestyle Medicine, 1*(1), Article e6. https://doi.org/10.1002/lim2.6	The use of a whole-food, plant-based diet benefits diabetic neuropathy.	Numerous studies related to plant-based diets were included in this Systematic review. Assessment of whole-food plant-based diets on the improvement of diabetic neuropathy is examined.	Systematic review, PubMed database, systematic review	A plant-based diet could provide benefits for improvement in diabetic neuropathy.	Level 1	A limited number of studies and caloric restrictions could have potentiated results.	Yes, diet and exercise should be beneficial for improving diabetic neuropathy.
Vas, P. R. J., Pafili, K., & Papanas, N. (2018). Exercise to improve diabetic peripheral neuropathy: An additional option? *Neurophysiologic Clinique, 48*(4), 191–193. https://doi.org/10.1016/j.neucli.2018.05.001	The improvement of diabetic neuropathy with exercise.	Patients with impaired glucose tolerance.	Randomized control-study design	Moderate-intensity aerobic exercise improves diabetic neuropathy.	Level 1; Randomized control-study	Apprehension regarding the selection of the subjects. Generalizability study sample.	Yes, the conclusion yields an improvement in diabetic neuropathy with implementing aerobic exercise.
Zilliox, L. A., & Russell, J. W. (2019). Physical	To assess the effectiveness	Twenty studies were	Systematic Review	No widely agreed upon	Level 3	No control trials and no	No, there are no

activity and dietary interventions in diabetic neuropathy: A systematic review. *Clinical Autonomic Research, 29*(4), 443–455. https://doi.org/10.1007/s10286-019-00607-x	of lifestyle modification (diet and exercise) on diabetic neuropathy improvement.	included in this review, including patients with diabetes, pre-diabetes, and metabolic syndrome.		outcome measures.		agreed-upon outcome measures. Studies included mice as well as humans.	effective means of measuring outcomes.

Appendix B

Permission to Use the Iowa Model



Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

KJ

Kimberly Jordan - University of Iowa Hospitals and Clinics <survey-bounce@survey.uiowa.edu>

To cwyatt9@liberty.edu

Reply | Reply All | Forward

Wed 8/24/2022 9:16 PM

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

The Iowa Model Revised (2015)

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Reference: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

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Please contact UIHCNursingResearchandEBP@uiowa.edu or 319-384-9098 with questions.

Appendix C

Neuropathic Pain Scale

The intensity of pain on a scale of 0 (no pain) to 10 (worst pain of your life _____

Is the pain stabbing in nature? (yes = 1 point 0 = 0 point) _____

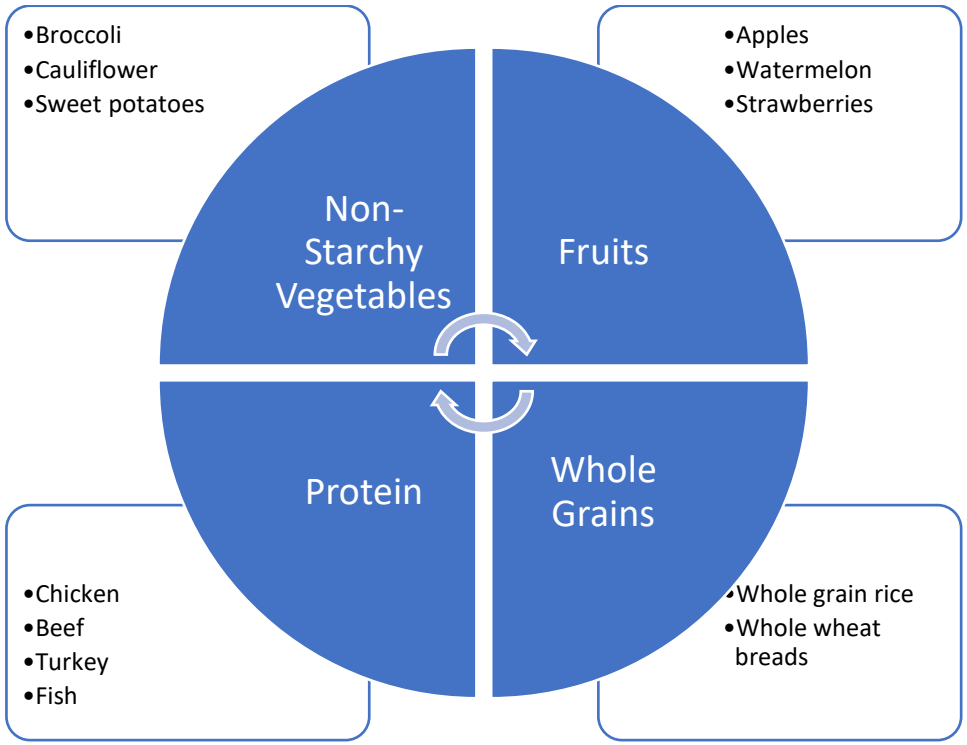
Is the pain hot? (yes = 1 point 0 = 0 point) _____

Is tingling present? (yes = 1 point 0 = 0 point) _____

Is the pain tolerable? (yes = 1 point 0 = 0 point) _____

Appendix D

Dietary Management



Appendix E

Instruction to Properly Assess Your Weight

1. Place scale on a flat hard surface (tile floor, hardwood floor, avoid carpet)
2. Remove all clothing and empty the bladder and bowels.
3. Step on the scale with minimal clothing on
4. Be sure to weigh yourself on the same day FIRST thing in the morning before eating or drinking.
5. Record your weekly weight.

Appendix F

Exercises and Activities Suggestions

- **Walking**
- **Swimming**
- **Biking**
- **Jump Roping**
- **Gardening**

Appendix G

Patient Consent

Title of the Project: The Effects of Dietary and activity management on the Severity of Diabetic Neuropathy

Principal Investigator: Courtney Harlow

Invitation to be part of a Research Study

You are invited to participate in a research study. To participate, you must be at least eighteen years old, have a diagnosis of Type II Diabetes Mellitus, a Body Mass Index > 30, and have a diagnosis of Diabetic Neuropathy.

I encourage you to read this consent form and ask any questions you have before your consent.

What is the study about, and why is it being done?

This study aims to assess dietary, activity level, and weight management effects on the severity of Diabetic Neuropathy symptoms. Numerous patients are diagnosed with Type II Diabetes and Diabetic Neuropathy with severe symptoms. Assessment of improvement of these symptoms aims to improve patient outcomes related to Diabetes management.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following things:

1. Make appropriate food choices according to a diabetic diet.
2. Exercise at least 30 minutes three times a week
3. Record your food intake, activity level, and weekly weight.
4. Participate in biweekly phone conference telephone calls.
5. Discuss results with the primary researcher biweekly during the conference telephone call.

How could you or others benefit from this study?

The direct benefits participants should expect from participating in this study are improving their body mass index and neuropathy symptoms.

What risks might you experience from being in this study?

There is minimal risk involved in this research study.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher can access the documents. Your data may be shared in future research studies or with other researchers. If data collected from you is shared, any information that could identify you, if applicable, will be removed before the data is shared.

- Participants will be given a number once they have completed their initial Diabetic Neuropathy Severity Questionnaire. Their future responses will be categorized under that number rather than their name to keep their information confidential. Phone conferences will be conducted in a location where others will not easily overhear the conversation.
- The patient data will be done on paper, and the paper copies will be kept on-site under lockup at the clinic. The information will also be logged and stored on a password-locked computer. After three years, the data and electronic records will be deleted.
- Recordings will not be used for this project, but the participants will be able to write down the information from the educational sessions.
- Confidentiality cannot be guaranteed in focus group settings related to the educational sessions. While discouraged, other focus group members may share what was discussed with people outside the group.

How will you be compensated for being part of the study?

Compensation for entering a drawing to win a $100.00 gift card will be provided after this study.

What are the costs to you to be part of the study?

To participate in the research, there will be a reasonable cost to you. Conference phone calls will be held biweekly to obtain data from you concerning your weight, weekly food intake, and activities for exercise. Owning a weight scale to measure your weight at least every week is ideal. Finally, you will need to have something to write down your weekly weight, food intake, and activities completed for exercise.

Does the researcher have any conflicts of interest?

The researcher serves as a DNP student at Liberty University. To limit potential or perceived conflicts, students in Liberty University's nursing department will be managed by a research assistant who will ensure that all data is stripped of identifiers before the researcher receives it.

Is study participation voluntary?

Participation in this study is voluntary. Participation will not affect your current or future relations with Liberty University or [redacted]. If you decide to participate, you are free not to answer any question or withdraw at any time without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please get in touch with the researcher at the email address/phone number in the next paragraph. Should you decide to cancel, data collected from you [during any conference call] will be destroyed immediately and will not be included in this study. [Conference call session data will not be destroyed, but your contributions to the conference call sessions will not be included in the investigation if you choose to withdraw.]

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Courtney Harlow. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at You may also contact your healthcare provider at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

Suppose you have any questions or concerns regarding this study and want to talk to someone other than the researcher. In that case, contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515, or email at irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) ensures that human subjects research will be conducted ethically as defined and required by federal regulations. The topics covered, and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you agree to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy of the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

_____

Printed Subject Name

_____

Signature & Date

Appendix H

Site Permission Letter

October 7, 2022

To Whom it May Concern,

I give Courtney Harlow, DNP student at Liberty University, permission to conduct a scholarly research study project at [redacted] in [redacted] to assess the effects of dietary and lifestyle management on the severity of Diabetic Neuropathy.

Respectfully,

[redacted]

Appendix I

Script for Speaking With Participants

Tell me about your eating habits over the last two weeks.

What activities have you been participating in over the past two weeks?

Have you been checking your blood sugar?

What was your calculated weight for the past two weeks?

What questions do you have for me?

Appendix J

CITI Training Certificate

CITI PROGRAM

Completion Date 03-Oct-2022
Expiration Date 02-Oct-2025
Record ID 51805861

This is to certify that:

Courtney Harlow

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Biomedical Research - Basic/Refresher
(Curriculum Group)
Biomedical & Health Science Researchers
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Liberty University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w97155975-ae11-418a-b8bd-b8c5c08f1c35-51805861