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Educating Primary Care Nurses on Phosphorus Management in Chronic Kidney Disease Patients

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This is to certify that the doctoral study by

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

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Walden University
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Abstract

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MSN, Walden University, 2012

BSN, Virginia Commonwealth University, 2008

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Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Fifteen percent of adults in the United States have been diagnosed with chronic kidney disease (CKD). CKD is the slow, progressive, and irreversible loss of kidney function. The most effective means of controlling CKD is by managing dietary phosphorus intake. It is important that staff nurses be educated about effective patient education tools to improve dietary phosphorus management. The purpose of this project was to educate primary care nurses about phosphorus management in CKD patients through the introduction of the phosphorus pyramid as a visual tool. The project sought to understand if an educational intervention regarding phosphorus management in CKD patients could increase the primary care nurse's knowledge. The John Hopkins evidence-based practice model informed the development of this project. Ten primary care nurses participated in a 45-minute education program which focused on the use of the Phosphorus Pyramid. A pre and post-test of knowledge was completed via a Likert scale questionnaire that measured knowledge related to the educational objectives of the program. The posttest scores showed an increase of 15% overall in staff's knowledge regarding dietary phosphorus management, the participants were more likely to correctly answer questions related to the phosphorus content of food and drink. The phosphorus pyramid will serve as a user-friendly tool to assist patients in identifying high phosphorus foods that need to be avoided and low phosphorus foods that are recommended to incorporate in their renal diet. This project supports social change by improving the healthcare team's knowledge regarding dietary recommendations for CKD patients thereby contributing to improved patient outcomes and reduced healthcare costs.

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Dedication

I would like to thank God almighty for keeping me grounded throughout this process. Through faith and perseverance, I have learned to never give up in this journey to attain my DNP degree. I am dedicating this project to my beloved husband, Stephen Somuah, Jr., my wonderful children, Tyrus, Etienne, Stephanie, and Annalise, who have been understanding and supportive throughout this process. Thank you for believing in me and especially to my husband Stephen, thanks for the words of encouragement when the load seems unbearable and unachievable. I truly thank my mother and father who are my guardian angels watching from heaven and proud of my progress. I thank you mom and dad for the values you've instilled in me which have made me the woman that I am today.

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A big thank you to DNP chair, Dr. Lewis, for coaching and guiding me through this process. I know you want me to succeed and complete this program and I appreciate your feedback and comments; your expertise has helped me improve academically. I will also like to thank the entire review committee for the time and effort invested in assisting me with my DNP project. I will like to appreciate Dr. Minnick, the approval member of methodologist, and Dr. Whitehead, member of review committee. A special thanks to Dr. Karen Spencer- Patrick for your time and mentorship in the beginning phases of my DNP project. A sincere thank you to Dr. Terry Guyton- Smith, a friend and mentor for your support and guidance with my project. Finally, I thank my family, colleagues, and friends for their encouragement and willing support in making this journey a rewarding success.

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Section 1: Nature of Project

Introduction

Chronic kidney disease (CKD) is a critical illness that increases a patient's risk of cardiovascular disease (CVD) that leads to mortality (Kalantar-Zadeh, 2013; Shaman & Kowalski, 2016). CKD patients who cannot remove phosphorus efficiently with their kidneys will experience phosphorus retention (Ritter & Slatopolsky, 2016). CKD patients experience mineral metabolism impairment and increased phosphorus levels as the disease progress. The progression of CKD, which is known as hyperphosphatemia, is caused by the increase in serum phosphorus levels (Caldeira, Amaral, David, & Sampaio, 2011). Hyperphosphatemia is a life altering condition in CKD patients that can lead to cardiovascular calcification, metabolic bone disease, and development of secondary hyperparathyroidism (SHPT).

Fast foods and processed foods contain the following high phosphorus ingredients: phylates, proteins, and additives (Kalantar- Zadeh, 2013). These additives reflect high phosphorus intakes amongst the lower socioeconomic groups that live in poverty-saturated areas (Kalantar- Zadeh, 2013). Maintaining a low phosphorus intake in CKD patients helps to reduce morbidity and mortality associated with hyperphosphatemia. Sustaining serum phosphorus-recommended levels encompasses a proper diet and CKD patient proactive comprehension, participation, adherence, and persistence with the phosphorus binders.

Problem Statement

CKD affects patients globally across the world. CKD is the irreversible loss of normal kidney functions that is a slow and progressive disease (Kidney Disease: Improving Global Outcomes [KDIGO], 2012). The Center for Disease Control and Prevent (CDC, 2015) states that the ninth leading cause of death in the United States is kidney disease (CDC, 2015). The progression of CKD to end-stage renal disease (ESRD) is linked to poor serum phosphorus regulation levels despite instituted renal replacement therapy. Phosphorus plays a role in the cause of CKD bone disease and cardiovascular morbidity (Pollock & Jaffery, 2007). The onset of mineral and bone disorders with CKD patients resides vitally on phosphorus retention. Secondary hyperparathyroidism, CVD, and bone disease includes phosphate retention as the initial factor causing multiple observed complications associated with CKD patients despite unchanged new discoveries from research (Ritter & Slatopolsky, 2016). The beginning stages of CKD disease progression must be managed properly with a good dietary phosphorus management prior to dialysis treatment. The lifestyle and dietary modifications that CKD patients must endure to maintain a manageable dietary phosphorus levels are challenging.

Phosphorus is the main ingredient of food additives that include phosphoric acid and polyphosphates that is used in food processing to extend the food shelf-life, enhance flavor or color, and retain moisture in most can foods. Food preservatives are often added

to food preparation stages process and production (D'Alessandro, Piccoli, & Cupisti, 2015).

Hyperphosphatemia is one of the mortality and morbidity determinants for CKD patients. CKD patients are advised to maintain a low phosphate diet while taking their phosphate-lowering medications (Kalantar - Zadeh, 2013). Many commercially prepared foods and drinks may contain phosphate compounds that are not included as part of the food label list, making it difficult for CKD patients to manage their dietary phosphorus intake. CKD patients often will have mineral metabolism impairment and increased phosphorus levels with disease progression (Caldeira et al., 2011). Hyperphosphatemia increases mortality and morbidities that causes bone disease and hyperparathyroidism (Kalantar - Zadeh, 2013). Restricting dietary phosphorus can be used to help control serum phosphorus. Patients are provided dietary counsel routinely regarding phosphorus foods content levels that reinforces adherence and consequences of high serum phosphorus food intake.

Practice-Focused Question

Will an educational intervention aimed at improving staff knowledge regarding phosphorus management in CKD patients increase their knowledge of high phosphorus foods?

Purpose Statement

The purpose of this DNP project was to determine if an educational program used to educate staff will improve their knowledge of dietary phosphorus management in

CKD patients. In this quality improvement project, I reviewed the literature to assess the effectiveness of different educational programs that have increased patient knowledge about phosphorus management. I used the evidence found to develop a recommended education program for staff nurses to increase their knowledge of phosphorus management through the introduction of a visual tool known as the phosphorus pyramid. To determine the success of each educational program, the objectives needs to be evaluated throughout the process (Hodges & Videto, 2011). Program objectives were developed for the educational program and were used to evaluate the participants' change in knowledge regarding phosphorus management in CKD. Ultimately this project has the potential to improve patient outcomes for CKD patients and contribute to social change through improved health and reduced healthcare costs.

Nature of the Doctoral Project

Throughout the evidence review process, I discussed the effectiveness of educational strategies that have been used in educating staff nurses about phosphorus management in CKD patients. I identified strengths and weaknesses of each educational program approach. Nurses are provided with the evidence-based practice models as a framework to assist them to effectively initiate evidence-based protocols, clinical guide lines, and policies (Goode, Fink, Krugman, Oman, & Traditi, 2013).

Significance

There is little emphasis on using educational tools to inform CKD patients with hyperphosphatemia about phosphorus management. The management of serum

phosphorus is important to reduce the risk of mortality and cardiovascular trials in CKD patients (Kalantar - Zadeh, 2013). Hyperphosphatemia, which is a mortality predictor in advanced CKD, can be rectified by using phosphorus binders, dialysis, and patient diet modifications (Kalantar - Zadeh, 2013). Patient education has been ineffective in the process of decreasing serum phosphorus levels of CKD patients (Kalantar - Zadeh, 2013). Consequently, the use of phosphorus binders and renal replacement therapy are first-line treatment options instead of educating patients about phosphorus management in the early stages of CKD.

The review of literature, described in Section 2, guided the development of the staff education information. I used the collected evidence to help the direct care staff gain the knowledge and educational tools that can be used in informing CKD patients about dietary phosphorus management.

Summary

Patients who want to maintain acceptable phosphorus levels during an adequate compliance diet regimen will need to gain knowledge about foods containing high phosphorus levels and do their best to alleviate eating those types of foods (Caldeira et al., 2011). Education has not been effective in reducing phosphorus levels. In this project, I assessed the effectiveness of educational strategies in reducing the serum phosphorus levels in CKD patients and applied the learned strategies in a staff development project.

Section 2: Background and Context

A program needs an effective timeline that moves the program ahead to positive outcomes and guides the evaluation process. An evaluation tool is used to document and monitor the program to understand the program's elements and the outcomes of a well-implemented program (Saunders, Evans, & Joshi, 2005). The John Hopkins Evidence-Based Practice Model (JHNEBP) (Dearholt, & Dang, 2017) was used to assist in the translation of the influence of patient education in decreasing phosphorus serum levels and increasing the knowledge of patients with hyperphosphatemia and CKD. This model provides concepts and strategies aimed at guiding nurses to transform research to practice (Newhouse, Dearholt, Poe, Pugh, & White, 2007).

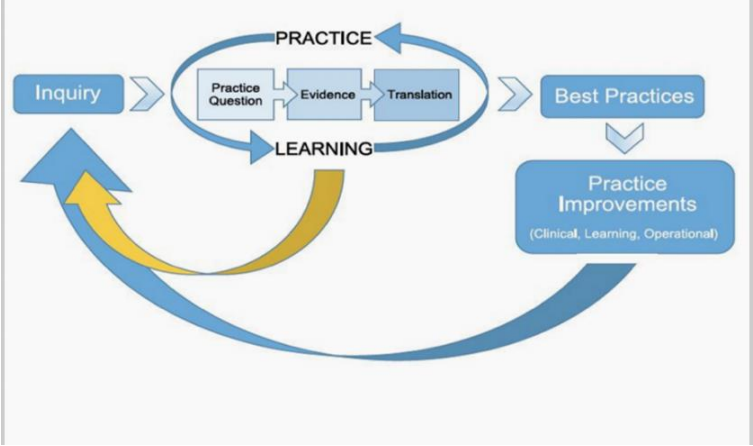

Figure 1. The John Hopkins Evidence-Based Practice Model

The JHNEBP (Dearholt & Dang, 2017) is a problem-solving technique to clinical decision making with tools that are user friendly to guide individuals or in a group environment. This three-step practice model process includes practice question, evidence, and translation (PET). PET was orchestrated to meet the needs of the

practicing nurse. The practice model goals are used to certify the most current research findings and best practice strategies that will be incorporated into patient care practice.

The databases that were searched for this section were peer-reviewed journals from Walden University library. Databases used were CINHAL Plus with full text, PubMed, CINHAL & MEDLINE, Science Direct, Annual reviews, and ProQuest databases from 2005 to 2016. A variety of separate keywords and various combinations was used in order to identify relevant studies: *kidney disease, nursing, patient, nursing interventions, nursing perceptions, nutritional intervention, CKD, phosphorus binders, outcomes,* and *review*. The search parameters were set with the following: written in English, research done in hospital or institutional settings, nurses, dialysis patient populations, and quantitative design. Each article was assessed using the JHNEBP (Dearholt & Dang 2017).

Relevance to Nursing Practice

Hyperphosphatemia is a complication associated with CKD that can be managed with diet modification. In the following literature review, I will identify factors that affect the patient's ability to adhere to prescribed dietary regimen to maintain phosphorus levels within normal limits. I provided visual tools to help educate staff about high phosphorus foods that need to be avoided. I recommended educational tools to increase knowledge in patients with CKD about phosphate management in their diet.

Clinical Practice

To determine the food types and drinks that contain artificial phosphate that brings a noticeable awareness level, Shutto et al. (2013) examined CKD patients

undergoing hemodialysis and found that most CKD patients (93%) were aware of the high sugar content in soda, but only 25% knew the presence of phosphate. Nearly half of the CKD patients (46%) did not know that the phosphate preservatives are routinely added to processed foods including hamburgers and pizza (Kalantar - Zadeh, 2013). Saldana et al. (2012) found that there was an increased risk for CKD when individuals consumed more than two cola beverages per day. Saldana et al. did not see an increase of risk associated with drinking noncola carbonated beverages or with noncola caffeinated beverages.

Ritter and Slatopolsky (2016) noted that it is crucial to treat phosphate retention at the early stages of CKD to keep a close to normal phosphorus levels, although most treatment for phosphate retention begins after hyperphosphatemia. There is no evidence indicating when or how early intervention of CKD should take place. Martin and Gonzalez (2011) concluded that phosphate retention does lead to serum phosphorus increases and hyperphosphatemia that is caused by poor clinical outcomes in CKD patients. Clinical guidelines highlight the importance of normal phosphorus levels in predialysis patients and working towards normal levels in dialysis patients make phosphate control a CKD management ingredient. Scholars have indicated the importance of treating phosphate retention at CKD beginning stages (Kalantar - Zadeh, 2013). To maintain near normal phosphorus levels with CKD progression for a long period of time, it is best to start treatment at the beginning stages of the illness. It is a better approach to treat CKD patients earlier although most current practices delay treatment until serum phosphorus is elevated.

The Kidney Disease Improving Global Outcomes and Kidney Disease Outcomes Quality Initiative guidelines provide guidance on restricting dietary phosphate in order to lower serum phosphate in CKD patients. A low-phosphate diet must include the phosphorus source, phosphorus-to-protein ratio, and the phosphorus content of the diet (Kalantar - Zadeh, 2013). The patient diet should consist of foods that are high in protein and low in phosphorus. The phosphorus-to-protein ratio should be 10 mg/ (ie., egg whites are a good food to consider at 2 mg/g; (Kalantar - Zadeh, 2013). A plant-based, phosphorus-enriched diet is proposed because the stomach can absorb less and digest the food (Ritter & Slatopolsky, 2016).

Importance of Education

According to Caldeira et al. (2011), hyperphosphatemia management entails restricted diet, phosphorus-binding agents, and dialysis. Patients' knowledge and understanding of high phosphorus foods, coupled with a disciplined diet, helps to maintain acceptable phosphorus levels. Caldeira et al. found that patients with hyperphosphatemia on dialysis reduced their phosphorus levels through educational intervention. Montazeri and Sharifi (2014) also found that patients' knowledge scores regarding the dietary sources of phosphorus and potassium were low. Montazeri and Sharifi recommend that health care providers should educate hemodialysis patients in relation to their literacy levels, especially when providing sources of phosphorus, potassium, and protein.

Mayne et al. (2012) provided one-to-one education and support for a 6-month period and found that there was a significant reduction (p=.04) in patients' phosphorus

levels. Kalantar-Zadeh et al. (2013) found a significant (p=0.016) change in phosphorus levels for a group of 50 patients who received food-labeling patient education over a 6-month period.

Although patient education might improve a patient's phosphate levels management, one of the barriers to patient education is the patient's understanding of the importance to make dietary modifications to decrease phosphorus levels. CKD patients who do not incorporate diet management tend to have complications with high phosphorus levels (Kalantar - Zadeh, 2013). One issue might be the providers' lack of knowledge and preparation to provide this education for their patients (Kalantar - Zadeh, 2013). This project was used to educate staff to impact positive patient health outcomes.

Local Background and Context

The lack of dietary knowledge regarding CKD has been identified anecdotally by clinical staff in the outpatient clinic. The focus of this project was on educating staff about phosphorus management with the use of the phosphorus pyramid as a visual tool. This quality improvement education project included the introduction of the phosphorus pyramid as a visual tool to educate patients with CKD about dietary phosphorus management. The desired outcome was increased staff knowledge and patient adherence to a low phosphorus diet.

Definitions

Chronic kidney disease (CKD): CKD describes the gradual loss of kidney function. The kidneys filter wastes and excess fluids from the blood, which are then

excreted in urine. When CKD reaches an advanced stage, dangerous levels of fluid, electrolytes, and wastes can build up in the body (KDIGO, 2012).

CKD Stage 3: A person with Stage 3 CKD has moderate kidney damage. "A decrease in glomerular filtration rate (GFR) of 30-59 ml/min" (KDIGO, 2012, p. 6).

CKD Stage 4: A person with Stage 4 CKD has advanced kidney damage with a severe decrease in GFR to 15- 30 ml/min. "It is likely that someone with stage 4 CKD will need dialysis or kidney transplant in the near future" (KDIGO, 2012, p. 6).

CKD Stage 5: "A person with CKD stage 5 has ESRD with a GFR of 15 ml/min or less. At this advanced stage of kidney disease, the kidneys have lost nearly all their ability to do their job effectively, and eventually need dialysis or kidney transplant to live" (KDIGO, 2012, p. 6).

Glomerular filtration rate (GFR): "A sign of how well kidneys are cleaning your blood" (KDIGO, 2012, p. 6). This is determined by blood work/ lab results.

Hyperphosphatemia: An elevated level of phosphate in the blood. Higher-than-normal levels can be caused by ingestion of phosphate-rich foods, such as dairy products, or by kidney failure. Any level above 4.5 mg/dl is considered hyperphosphatemia (KDIGO, 2012, p. 83).

Phosphorus: "Phosphorus is a mineral found in your bones. Along with calcium, phosphorus is needed to build strong healthy bones, as well as, keeping other parts of your body healthy. Normal range is 2.5 to 4.5 mg/dl" (KDIGO, 2012, p. 83).

Role of the DNP Student

The American Association of Colleges of Nursing (2006) addressed the clinical prevention and health activities population application measures that are essential in attaining a healthy lifestyle within the U.S. population. The evidenced-based practice change in my practicum site included the introduction of the phosphorus pyramid as a visual tool by educating nursing staff in the use of the tool for patients with CKD. The desired outcome was increased staff knowledge. I assumed that baseline knowledge will be low. Upon completion of the 45-minute in-service, staff knowledge will increase based on posttest scores. One of the limitations for this study was that the sample population was limited; only ten staff members in the outpatient clinic participated.

Summary

CKD is categorized as a health problem that increases CVD risk and mortality (Kalantar- Zadeh, 2013). The progression of CKD to renal failure derives from poor phosphorus management and noncompliance after initiating dialysis (Pollock et al., 2007). An increase in staff knowledge will lead to better information given to patients and may facilitate an improvement in the quality of care for patients with CKD. Several guidelines and educational programs are encouraged by health care professionals in an effect to raise CKD awareness. Educational interventions aimed at empowering staff and patients are successful in CKD management (Tan, Hoffman, & Rosas, 2010).

Section 3: Approach

Project Design/Method

This quality improvement, educational staff intervention was a nonexperimental DNP project that was conducted at a primary care clinic in the Mid-Atlantic region. Over 50% of their patients have CKD. The need to educate staff nurses was important, so that they can be effective at educating their patients.

Population and Sampling

I met with the chief of the clinic and other sponsors to deliberate the purpose, goal, and objectives of the project to obtain authority from the clinic to conduct the study. The participants were a convenience sample recruited from the current clinic staff that worked directly with CKD patients. The projected population consists of three nurse practitioners, three registered nurses, three LPNs, and one dietician. I arranged a time for the in-service that was convenient to allow for the largest number of participants.

Data Collection

I conducted the following:

1. I assisted the participants with the first question to ensure they understand how to complete the survey. I showed the participants how to use the 5-item Likert scale. If the patients did not know how to fill out the questionnaires, I informed the participants that the information will help me understand their baseline knowledge about CKD. If the participant requested clarification, I reread the question as written. I tried not to explain the question because the participants should answer the question

based on their understanding of it, as recommended by (Wright, Wallston, Elasy, Ikizler, & Cavanaugh, 2011).

2. If the participants did not want to respond to some or the entire question, I emphasized that they can mark zero responses to indicate that it does not apply.
3. The in-service was presented, and an education tool was provided for the participants' use.
4. At the end of the presentation, the questionnaire was repeated to assess knowledge gained through the in- service.

Participants' names were not be placed on the questionnaire, and an ID number was annotated on the questionnaire instead of a name. Also, their answers were combined with other participants, and the data were analyzed as a group, as recommended by Pietri et al. (2004). Participants were given ample time to complete the questionnaire. The data were placed in a secure file on the hard drive on my computer. Finally, SPSS statistical software was used to analyze the data.

Ethical Considerations

Maintaining patient privacy and confidentiality is crucial. Privacy can be considered a person's ability to control the access to others' information about him or herself. Confidentiality is the protection of information. Permission was acquired from the Walden University Institutional Review Board (IRB) before any participants were recruited to participate. A written consent was signed by each participant prior to participation in the in-service.

Instrument

A questionnaire that was focused on phosphorus management diet that was developed by Caroll et al. (2004) was used to evaluate the staff nurse's knowledge of phosphorus with respects to pre and post educational intervention. Permission was obtained via e-mail to use question. The questionnaire consisted of 18 questions in multiple choice format. This piloted questionnaire test that researchers have used prior on another homogeneous participants at a different dialysis center for a separate study was modified based on participant reaction. Each item received a score of 1 if correct, 0 if incorrect. A total score was calculated by summing the number of correct answers. The test scores were divided into three categories: 1-*Poor knowledge*= total score less than 8, 2-*Average knowledge* = total score between 8 and 16, and 3- *Good knowledge* = total score greater than 16. This tool was used for the prequestionnaire and postquestionnaire to compare knowledge scores to determine if there was an increase or decrease in scores after a 45-minute in-service.

A sample questionnaire that was used to evaluate the staff's knowledge on kidney diseases, diet, and phosphate binders is included in Appendix A. This questionnaire was revised from Carroll et al.'s (2004) questionnaire that was used to evaluate knowledge about kidney disease, diet in particularly phosphate diet and recommended amount of phosphorus consumption in CKD patients.

The phosphorus pyramid tool (Appendix B) was introduced as a new, user-friendly visual tool for nutritional education in patients. This food pyramid has six levels arranged based on their phosphorus content, phosphorus to protein ratio, and phosphorus

bioavailability. Every level has an outside color edge (green to red) that correlates with the intake frequency, and ranges from “unrestricted” to “avoid as much as possible.” According to D’Alessandro et al. (2015), the focus of the phosphorus pyramid entails support to dietary counseling for CKD patients to decrease the consumption of high phosphorus load foods such as whole milk, pork, liver (beef), and sardines with bones. The focus was on helping participants to identify the foods that causes a lower or a higher phosphate load. The distribution of food on the various levels should visually promote the best practices without the need to track the phosphorus content of each food item (D’Alessandro et al., 2015). Demographic data included gender, level of education, and years of nursing experience. These data were collected to help understand the demographic characteristics of the primary care nurse’s population.

Data Analysis

Reliability and Validity of the Instrument

The questionnaire developed by Caroll et al. (2004) was created to evaluate knowledge on kidney diseases and diet focused on phosphorus management. The reliability of the questionnaire was measured using a Cronbach's alpha, which was calculated to be 0.84 (Caroll, 2004). The phosphorus pyramid has been developed since the late 70s (D’Alessandro et al., 2015). The new version included the phosphorus pyramid formulated by D’Alessandro et al. (2015) was a visual, user-friendly tool.

Analytical Techniques

Demographic data included gender, level of education. and years of nursing experience. There data were collected on the demographic nurse experience questionnaire

(Appendix C). This short questionnaire summarized the results from the demographic data collected from the nurses to help understand the demographic characteristics of the primary care nurse population.

The kidney disease and phosphorus management in CKD data were collected to compare pre and posttest results of the Likert-scaled questions; the Wilcoxon signed ranks tests were used. The Wilcoxon a nonparametric signed rank test, is a statistical analysis that compares the average of two dependent samples and assess for significant differences. It is used to compare and contrast two sets of scores that come from the same participants (McDonald, 2015).

Project Evaluation Plan

The logic model was used to provide a framework for the planning process, which represents the program elements, proposed outcomes, and the theoretical constructs. The first step was the input phase, where I identified the staff who worked with CKD patients, classroom, and time used to implement the study. The key persons involved in the project were instrumental in ensuring the research was successful such as, the directors, investigators, and other stakeholders. A Powerpoint presentation was used to describe the project and included a pre/post questionnaire. A timeline was created for the study. I identified constraints that would prevent the project from progressing in a timely manner, such as participation challenges and compliance to attend class. The second step, which was the output phase, was used to ascertain the number of participants enrolled in the educational intervention program and control groups, as well as the amount of time it would take each veteran to complete the questionnaire. Finally, the outcome of the study

showed that a structured educational intervention will improve the staff knowledge about dietary phosphate management in CKD.

Conclusion

CKD is considered a worldwide epidemic that increases the risk of CVD and mortality (Kalantar- Zadeh, 2013). The progression of CKD to renal failure is aligned with poorly regulated phosphorus and calcium despite renal replacement therapy implementation (Pollock, et al., 2007). The increase of staff educational training given to nurses will allow them to provide improved information to patients with poor phosphorus control that may result in improved quality of care given to CKD patients.

Section 4: Findings and Recommendations

Introduction

CKD is the ninth leading cause of death in the United States, and it continues to grow in prevalence (National Kidney Foundation [NKF], 2017). CDK has become an urgent issue, according to the NKF (2017), because of the increasing rates of diabetes and high blood pressure. CKD has affected 30 million people in the United States, with 90% of those affected don't know that they have it. One out of three Americans is at risk for CKD (NKF, 2017). A role of the kidney is to maintain phosphorus homeostasis. When renal function begins to decline in CKD patients, the homeostasis is disrupted, serum concentration of phosphorus begins to increase, which is known as hyperphosphatemia. Hyperphosphatemia is a complication of CKD that has attracted more concerns. Hyperphosphatemia is a life threating condition that leads to cardiovascular disease, bone disease, and SHPT (Shaman & Kowalski, 2016).

The contributing factors to manage hyperphosphatemia depends on the intake and elimination of phosphorus from the body. Restricting dietary phosphate intake is needed to lower phosphorus levels in CKD patients. Staff nurses need to have the knowledge base to educate CKD patients about managing phosphorus intake. There was a gap in nursing staff and patient education regarding phosphorus management in CKD patients. This was also noted by high serum phosphorus levels in the clinic.

The practice focus question was the following: Will an educational intervention aimed at introducing the phosphorus pyramid as an educational tool improve staff

knowledge regarding phosphorus management in CKD patients increase their knowledge of high phosphorus foods?

There was a lack of staff knowledge and confidence in educating CKD patients about dietary phosphorus management. Patient education is overlooked as an effective way of reducing phosphate levels in CKD patients. There is less emphasis made on using educational tools to educate CKD patients with hyperphosphatemia (author, year_. The management of phosphorus is important in decreasing the mortality and cardiovascular risk factors in CKD patients (Kalantar - Zadeh, 2013). Hyperphosphatemia is an indicator of deuteriation in advanced CKD and can be corrected through diet modification, phosphorus binders, and renal replacement therapy. Patient education has not been effective in decreasing serum phosphorus levels in patients with CKD (Kalantar - Zadeh, 2013). The use of phosphorus binders and renal replacement therapy are used as first-line treatment instead of educating patients about phosphorus management in the early stages of CKD.

A primary care clinic was designated as the site to perform educational sessions to educate staff nurses about phosphorus management in CKD patients. In the past 6 months, preceding the staff education intervention, 50% of CKD patients seen at the clinic had high phosphorus serum levels above 4.5 mg/dl. The main focus of the educational intervention was to assess the effectiveness of a 45 minutes in-service in increasing knowledge of staff nurses about phosphorus management in CKD patients. The overall goal was to increase staff nurses' knowledge, which will boost their

confidence in teaching CKD patients about phosphorus management. This will decrease high serum levels noted at the clinic.

In this section, I will discuss the results of the pre and postquestionnaire given to the staff participates during the 45-minute in-service on dietary phosphorus management in CKD patients. In this section, I will elaborate on the findings based on the context of literature, implications for practice, the project's strengths and weaknesses, and provide a personal analysis of educational projects influenced on the professional growth of the DNP student.

Findings and Implications

During the CKD phosphorus management educational session, an emphasis was placed on the importance of patient education for all health care personnel. All nurses with different experiences and educational background contribute to empowering CKD patients in managing phosphorus levels through diet modification. Participants were given allotted time to ask questions refencing the new phosphorus pyramid tool that was introduced in class to serve as a visual tool to educate CKD patients about phosphorus management to ensure understanding.

Education

There was a 45 min educational session held 1 day in the week to accommodate staff from various units and different shifts. Total staff who participated were 10 in number. Education was provided by introducing the phosphorus pyramid as a guide to differentiate between high phosphorus foods and low phosphorus foods. In a PowerPoint presentation, I explained dietary phosphorus foods to be avoided by CKD patients, how to

read food labels, and low phosphorus foods that are recommended for CKD patients using the phosphorus pyramid. See Appendix B for a diagram of the phosphorus pyramid.

To assess staff's prior knowledge of phosphorus management in CKD patients, a prequestionnaire was administered before the class. After the class, a postquestionnaire was administered to assess staff retention of knowledge. The pre and postquestionnaire was graded to evaluate the effectiveness of educational sessions provided based on the amount of significant increase in scores on the posttest following the educational sessions.

Table 1

Characteristics of Attendees at CKD Phosphorus Management Class

Staff/ Titles	*n (%)*
Nurse Practitioner (NP)	3 (30)
Registered Nurse (BSN)	2 (20)
Registered Nurse (ADN)	1 (10)
Licensed Practice Nurse (LPN)	3 (30)
Dietician	1 (10)
Gender	
Male	1 (10)
Female	9 (90)

All 10 staff members (*n*=10) attended the CKD phosphorus management class and participated in both the pre and posttest questionnaire. The characteristics of these 10 participants is displayed in Table 1. On average, participants had 5.9 years of experience (*SD* = 3.2). Half had at least a bachelor's degree. There were other employees who did not attend the educational session but had a chance to review and answer the pretest, but these data were not tracked because of their nonparticipation in the CKD phosphorus

management class, and they were not able to complete post questionnaire appendix A.

The pre and postquestionnaire consist of 18 questions that was mirrored. The scores were provided to me in a de-identified manner, using numbers to identify employees who participated in educational session. The information was entered into an Excel spreadsheet and imported into SPSS 25 for analysis. See Table 2 for the results of staff pre and postquestionnaire scores for CKD Phosphorus management class.

Table 2

CKD Phosphorus Pre and Post Questionnaire Scores

Question	% Correct Pre	% Correct Post	*P*
1. Which of the following problems may result from high phosphorus in blood?	100	100	1.00
2. What happens when phosphorus levels are high in blood?	100	100	1.00
3. What would high blood phosphorus level lead to?	90	100	.317
4. Why do you need to avoid all food items that are rich in phosphorus?	100	100	1.00
5. Which of the following foods contain high amounts of phosphorus?	30	90	.014
6. What are phosphate binders?	100	100	1.00
7. When is the right time to take phosphate binders?	90	100	.317
8. Controlling an adequate blood phosphorus binders:	100	100	1.00
9. Which of the following food contain low amounts of phosphorus?	20	70	.025
10. Which of the following drinks contain low amounts of phosphorus?	20	80	.014
11. Which of the following sweets is poor in phosphorus?	70	80	.317
12. Which of the following food items are rich in phosphorus?	10	100	.003
13. Which are optimal ways to control an adequate blood phosphorus level?	40	100	.014
14. Which of the following food items are	60	90	.083

Question	% Correct Pre	% Correct Post	*P*
rich in phosphorus?			
15. What is the optimal level for blood phosphorus?	100	100	1.00
16. Which food groups from the following are rich in phosphorus?	30	100	.025
17. Which of the following pills are phosphate binders?	100	100	1.00
18. Who is responsible in controlling your phosphate blood levels?	100	100	1.00
Total Score	12.6	17.1	.005
Total Percent Correct	70	95	.005

Note. Significance level based on Wilcoxon signed ranks test

The average prequestionnaire score was 70% correct, and the average postquestionnaire score was 95% correct with an increase of 15% in correct responses. The increase in correct responses was statistically significant, Wilcox $Z = 2.814$, $p = .005$. The average score pretraining was 12.6 ($SD = 1.7$), an average score. The post score of 17.1 ($SD = .99$) is considered a good score. Because the percentage correct is a transformation of the total score (percentage correct = total score/18 *100), the Wilcoxon Z is identical for comparing both total scores and percentages. Participants were significantly more likely to correctly answer questions related to food and drink that were high or low in phosphorous (see Table 2). Once staff had increased their knowledge about phosphorus management in CKD patients they were more confident in educating patients, and copies of the phosphorus pyramid diagram was also given to patients during their visits as a tool and reference to assist them in choosing low phosphorus foods and modifying diet as recommended. In this sample, the internal reliability of the questionnaire was low; Cronbach's alpha=.38. This is much lower than the .84 found by Caroll et al. (2004). The items are testing more than one underlying construct.

Recommendations

The phosphorus pyramid should be used as a standardized tool by the primary care nurse to educate CKD patients. A pamphlet with the diagram of the tool will be given to patients to use as a reference guide when they go grocery shopping. The phosphorus pyramid will serve as a user-friendly tool to assist patient in identifying high phosphorus foods that need to be avoided and low phosphorus foods that are recommended to incorporate in their renal diet. All nurses will be oriented to use the phosphorus pyramid to educate all CKD patients, especially those with hyperphosphatemia.

Strengths and Limitations of the Project

This project's strength was the addition of a convenience sample of clinical staff who participated in this educational intervention. These nurses had different educational backgrounds and experience. The phosphorus pyramid was validated and used by D'Alessandro et al. (2015). The weakness in this project was seen in the small sample size of participants. The pilot site had a small sample of 10 nurses who participated in the CKD management educational session.

Section 5: Dissemination Plan

At the primary care clinic, the CKD phosphorus management class with the introduction of the phosphorus pyramid as a visual patient education tool has increased staff nurses' confidence in educating their patients. The patients' phosphorus lab levels have improved and have been maintained with normal levels. To ensure that the CKD phosphorus management educational intervention is beneficial in improving staff nurses' knowledge and confidence in educating patients, the results of the pre and posttest questionnaire will be discussed with the facility's stakeholders and the quality improvement committee through their monthly meetings. Due to the success of the class through the increase in staff knowledge, the nurse educators and nursing leadership are working with me to initiate teleconference classes for our partnering clinics. The postimplementation data will be routed to all departments and staff in the form of a handout that highlights how effective the nursing education intervention increased staff knowledge about phosphorus management in CKD patients. This will be done to applaud the successful results seen during the implementation phase and to show all staff how nursing education is vital in improving patient outcomes.

The postimplementation data, along with a brief introduction of the phosphorus pyramid as an educational tool, will be shared on the clinic's employee intranet website to disseminate the postimplementation data and encourage patient education throughout the clinic. Flyers and take-home pamphlets will be placed in common areas at the clinic lobby with a brief introduction of the educational intervention and the 30 days

postimplementation results to educate the patients and caregivers about the pilot program and the importance of dietary phosphorus management.

Dissemination in the Field of Nursing

The CKD phosphorus management educational intervention with the phosphorus pyramid would be beneficial in outpatient clinics and other inpatient health care organizations. I advertised the use of the phosphorus pyramid as a learning tool for CKD patients to assist them in successfully managing dietary phosphorus consumption through in-services provided to staff nurses, with the goal of nurses introducing the phosphorus pyramid as a tool to guide patients in maintaining serum phosphorus levels within normal limits. The phosphorus pyramid will be introduced to neighboring outpatient clinics to facilitate with the prevention and management of hyperphosphatemia using a systematic approach. I will create a brochure that highlights the phosphorus management initiative developed at the clinic for CKD patients, and the postimplementation, data will be posted at the clinic to promote interest for the use of the phosphorus pyramid as a visual tool at other local outpatient clinics. I plan on submitting an abstract for publication to the appropriate health journals targeting the CKD and dialysis population for patient and staff educational purposes.

Using the phosphorus pyramid as an educational tool for staff nurses to educate CKD patients, health care institutions can decrease hyperphosphatemia complications such as cardiovascular disease, bone diseases, hyperparathyroidism that causes cardiovascular disease and raises mortality rates in patients. This will decrease health care costs, emergency room visits, and improve patient outcomes and overall wellbeing.

Analysis of Self

Looking at the topic of hyperphosphatemia education in staff nurses and management in CKD patients, my intention was to educate patients and guide them with resources to help them in successfully managing their dietary phosphorus intake. However, after interviewing staff nurses and realizing that education was lacking in our nurses regarding phosphorus management in CKD patients, I decided to educate our staff nurses to increase their knowledge so that they can be well equipped educators to provide the patients with the proper education needed to independently manage dietary phosphorus intake while at home. A lack of staff knowledge hurts patients in the sense that they do not get educated by nurses when the nurse is not familiar with the topic. We have one dietician who provides education to over 200 patients who visit the clinic. The nurses' role is to be an advocate and educate patients in preventative care. As I participated in the evidence-based practice committee meetings, I realized that most times, educational programs were based only on perception not research. Additionally, I realized that educational programs and policies were based on principles that have been used for years and the importance of incorporating new literature through evidence - based practice was needed.

My goal was to introduce an evidence-based, user-friendly tool that will be used by all nursing staff to address the issue of hyperphosphatemia in CKD patients. This tool will be used as a standardized tool to educate all patients in the prevention and management of hyperphosphatemia. The phosphorus pyramid was a user-friendly tool created by D'Alessandro et al. (2015). This standardized phosphorus management tool

will serve as a guide for both nurses and patients to help better manage dietary phosphorus. Introducing the phosphorus pyramid provided me with the experience, knowledge, and working all ends of the spectrum in developing an educational program. To successfully initiate and complete the educational program, the program was developed based on evidence-based practice with a theory to show the program success by the increased in staff knowledge. The DNP project has provided me with the tutelage to be an effective change agent and improve the patient outcomes. It has improved my evidence-based practice and project skills development. My long-term professional goal is to devote time and effort to staff development and education as well as participate in quality improvement projects that supports improved patient outcomes. I have developed the necessary knowledge and understanding for program development. My understanding was achieved by applying theory and research throughout the project completion.

Summary

CKD patients are at risk of hyperphosphatemia due to the progressive decrease in renal function. The NKF estimated that in about 20 million individuals diagnosed with CKD inducing progressive decrease in renal function in the United States (KDIGO, 2012). Addressing and managing this hyperphosphatemia problem with increased mortality is important across all clinics to develop programs that will help decrease further complications. Implementing the phosphorus management initiative through an educational program increased staff nurses' knowledge, and nurses expressed a sense of confidence in educating CKD patients with the use of the phosphorus pyramid as a visual

guide for both staff nurses and patients. The postquestionnaires scores showed a 15% increase in knowledge.

By introducing the phosphorus pyramid as a standardized tool for the pilot clinic for phosphorus management in CKD patients, staff had increased education and team collaboration with the weekly nursing staff meetings. The most effective means of controlling hyperphosphatemia is by managing dietary phosphorus intake (Friedman, 2005). It is important that staff nurses be educated about effective patient education tools using an evidence-based approach, through the commitment of patient education to prevent and improve dietary phosphorus management in health care institutions.

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Appendix A: Pre and Post Questionnaire

Appendix A. Questionnaire to evaluate knowledge Kidney Disease and Phosphorus Management in CKD.

1. Which of the following problems may result from high phosphorus in blood?	* Liver disease * Cardiac disease * Bone and joint disease * High blood pressure
2. What happens when phosphorus levels are high in blood?	* Calcium will be pulled out of bones * Osteodystrophy * Calcium levels in blood will drop * All of the above
3. What would high blood phosphorus level lead to?	* Heart arrhythmia * Muscle cramp * Dizziness * Itchy skin
4. Why do you need to avoid all food items that are rich in phosphorus?	* There is no reason * Because my liver is incapable of removing the excess phosphorus from the blood * Because my kidney is incapable of removing the excess phosphorus from the blood * Food items rich in phosphorus should consumed abundantly
5. Which of the following foods contain high amounts of phosphorus?	* Sesame seeds, sesame paste, halawa * Nuts & seeds * Organ meats, Liver, sausage * Lentils, Chick peas, White kidney beans * All of the above
6. What are phosphate binders?	* Medicine that decreases the absorption of potassium from food (in stomach) to the blood * Medicine that decreases the absorption of calcium from food (in stomach) to the blood * Medicine that decreases the absorption of phosphorus from food (in stomach) to the blood * Medicine that decreases the absorption of magnesium from food (in stomach) to the blood
7. When is the right time to take phosphate binders?	* Between meals * 8:00 – 13:00 – 18:00 * With every time I eat a meal * Before every meal
8. Controlling an adequate blood	* The Dialysis process

phosphorus binders:	* A low phosphorus diet * Phosphate binders The doctor * All of the above
9. Which of the following food contain low amounts of phosphorus?	* Bread sticks without sesame seeds * Sardine * Honey, Apple jam, quince jam * Coffee mate * Brown bread
10. Which of the following drinks contain low amounts of phosphorus?	* Pepsi/Cola * Lemonade * Seven Up/Sprite * Crush/Miranda * Red Bull – Mountain Dew * Coffee – Nescafe * Tea (not dark color), Mint tea, Anise tea
11. Which of the following sweets is poor in phosphorus?	* Rice milk, pudding (made from milk) Custard, * Jell-O * Sorbet * “Kunafa” with cheese (Arabic sweet) * Chocolate – Chocolate cake * Biscuits * Milk based ice-cream
12. Which of the following food items are rich in phosphorus?	* String beans or green beans * Milk and Yogurt * White bread and rice Tomatoes.
13. Which are optimal ways to control an adequate blood phosphorus level?	* Take phosphate binders regularly * Commitment to a low phosphorus diet * Starving oneself
14. Which of the following food items are rich in phosphorus?	* Full fat milk and yogurt * Low fat milk and yogurt * Fat free milk and yogurt * All have the same quantity
15. What is the optimal level for blood phosphorus?	* Higher than 8 mg/dl * Less than 6 mg/dl * Higher than 11mg/dl * Less than 1 mg/dl
16. Which food groups from the following are rich in phosphorus?	* Fruits * Legumes: Lentils, chick peas, white kidney beans * Nuts & seeds * Vegetables * Carbohydrates: bread, rice, pasta

	* Dairy products: yogurt, milk, cheese
17. Which of the following pills are phosphate binders?	* Caltrate * One Alpa * Renagel * Aspirin
18. Who is responsible in controlling your phosphate blood levels?	* The doctor * The nurse * You * The dietitian

Adapted from: Carroll J et al, Journal of Renal Nutrition, 14,1, pp:36-44, 2004

Appendix B: The Phosphorus Pyramid

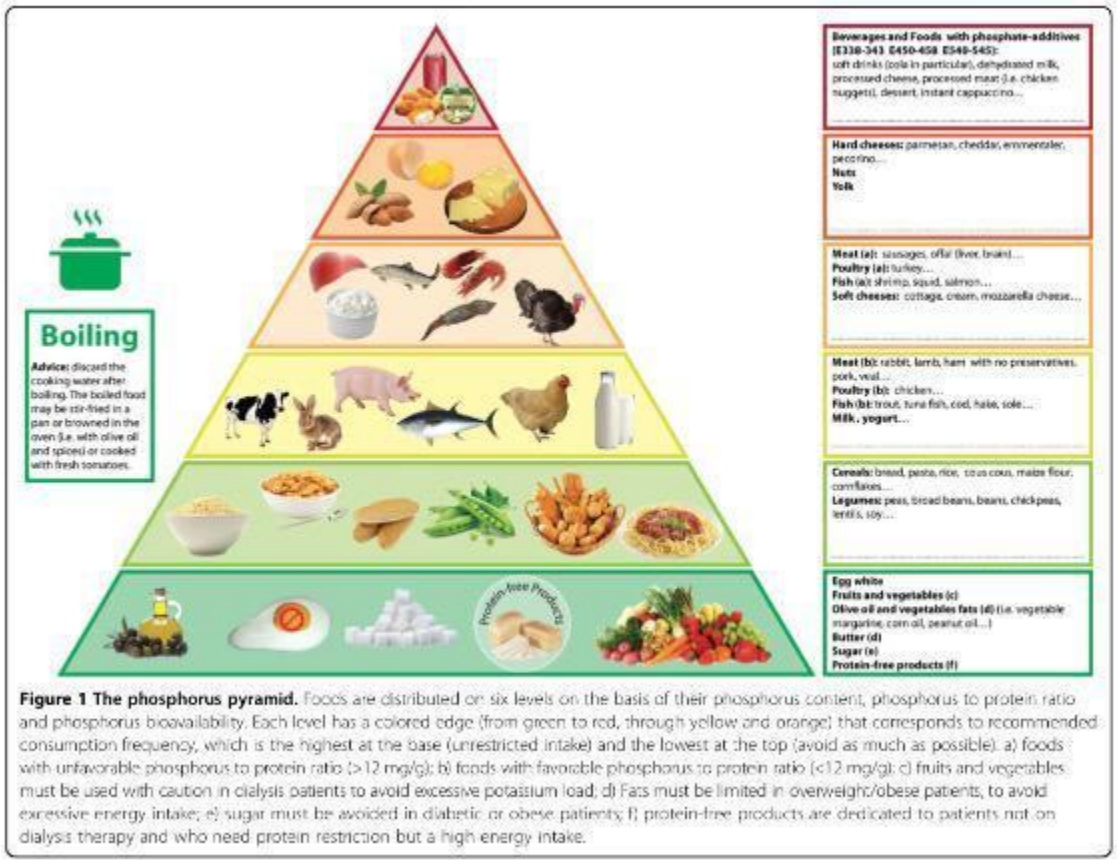

Figure 1 The phosphorus pyramid. Foods are distributed on six levels on the basis of their phosphorus content, phosphorus to protein ratio and phosphorus bioavailability. Each level has a colored edge (from green to red, through yellow and orange) that corresponds to recommended consumption frequency, which is the highest at the base (unrestricted intake) and the lowest at the top (avoid as much as possible). a) foods with unfavorable phosphorus to protein ratio (>12 mg/g); b) foods with favorable phosphorus to protein ratio (<12 mg/g); c) fruits and vegetables must be used with caution in dialysis patients to avoid excessive potassium load; d) Fats must be limited in overweight/obese patients, to avoid excessive energy intake; e) sugar must be avoided in diabetic or obese patients; f) protein-free products are dedicated to patients not on dialysis therapy and who need protein restriction but a high energy intake.