Early Identification of Chronic Kidney Disease Using a Nurse-Led Screening Protocol for At Risk Elderly Patients: A Best Practice Implementation Project

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Abstract

Chronic kidney disease (CKD) remains a global health threat resulting in debilitating effects on patients and society. However, early treatment of CKD can prevent progression into end-stage kidney disease. Thus, the project aimed to save lives and reduce healthcare costs by slowing or halting CKD progression through early screening and management. The target population was elderly patients in a home health care agency in San Bernardino, California, who were ≥60 years old and diagnosed with diabetes and hypertension. The project participants were 17 home-based primary care providers, including family nurse practitioners (FNPs), medical doctors (MDs), and physician assistants (PAs). The CKD screening and management protocol was created based on the most current Kidney Disease Improving Global Outcomes (KDIGO) guidelines and tailored to the population's needs. The Institute for Healthcare Improvement's (IHI's) model for improvement (MFI) also guided the project implementation. The results suggest that the education session improved the participant's knowledge of CKD screening and management by 3.82 points post-intervention. The intervention also increased the site's revenue based on the 10.32% increase in CPT codes for CKD screening (10.32%) and management (10.10%) post-intervention. The participants' compliance rate was 100% in the utilization of the CKD protocol. Thus, the project will continue to be implemented at the project site. The project's impact will also be closely monitored to ensure sustainability. Other home health agencies wanting to introduce early CKD screening and management in their facility to reduce CKD-related morbidity, mortality, and healthcare costs may use this project as a guide.

Keywords: *chronic kidney disease, CKD, elderly, high-risk group, early screening, early management*

Early Identification of Chronic Kidney Disease Using a Nurse-Led Screening Protocol for At Risk Elderly Patients

Chronic kidney disease (CKD) remains a global health threat with debilitating effects on population health and the economic stability of health systems worldwide. Millions are afflicted by this disorder globally, nationally, and locally (America's Health Rankings, 2021; Centers for Disease Control and Prevention [CDC], 2021; Global Burden of Disease [GBD] Chronic Kidney Disease Collaboration, 2020). CKD also increases the risk for comorbidities and early death (CDC, 2016; Cockwell & Fischer, 2020; Lv & Zhang, 2019; National Institute of Diabetes and Digestive Kidney Diseases [NIDDK], 2016; Weiner & Seliger, 2014). Moreover, CKD is associated with increased financial burdens for both the patient and healthcare system (America's Health Rankings, 2021; GBD Chronic Kidney Disease Collaboration, 2020; Lv & Zhang, 2019; NIDDK, 2016).

CKD refers to an abnormal kidney function for three months with related health implications (Gaitonde et al., 2017; McManus et al., 2017). CKD is characterized by albuminuria, glomerular filtration rate <60 mL per minute per 1.73 m^2, and abnormal findings in urine sediment, renal imaging results, and serum electrolyte or acid-base (Gaitonde et al., 2017). CKD has five stages based on the estimated glomerular filtration rate, with one as very mild damage stage and five as complete kidney failure (Gaitonde et al., 2017; NIDDK, 2016). However, CKD 1 can gradually progress to kidney failure or end-stage renal disease and death (America's Health Rankings, 2021; Gaitonde et al., 2017). In the most advanced stage (CKD 5), only dialysis and kidney transplant can prolong the life of patients (American Kidney Fund; n.d; Gaitonde et al., 2017).

Nevertheless, early treatment of CKD can prevent progression into end-stage kidney disease (Bansal et al., 2020). Therefore, early CKD screening and management will be addressed through implementation of a nurse-led screening protocol. Through early detection, screening, and adequate kidney care, patients with early-stage CKD can lower their risk for kidney failure and lead healthier and more productive lives (CDC, 2020a). Unfortunately, the current primary care practices at the project site do not include CKD screening and management as a routine intervention for high-risk patients. Therefore, a practice change is being proposed. to promote early CKD screening and management among high-risk individuals.

Background

CKD is a pervasive illness that burdens millions of people. In 2017, roughly 697.5 million individuals were diagnosed with CKD globally (GBD Chronic Kidney Disease Collaboration, 2020). In the United States (US), it is estimated that 37 million adults have CKD, which is more than one in seven American adults (CDC, 2021). In addition, CKD is more pervasive in women, patients 65 and older, and among the Black and Hispanic American populations (America's Health Ranking, 2021). Furthermore, in California, 3% of adults have CKD in 2019, exceeding the national average of 2.9% (America's Health Rankings, 2021).

CKD also directly affects morbidity (Lv & Zhang, 2019). For example, data from Medicare in 2013 noted that patients with CKD have higher rates of readmission (22.3%) within 30 days compared to individuals without CKD [15.8%] (NIDDK, 2016). The increased hospitalization among this cohort is attributed to the fact that untreated CKD is associated with increased comorbidities, including hypertension, stroke, heart attack, microvascular disease, cognitive impairment, and frailty (CDC, 2021; NIDDK, 2016; Weiner & Seliger, 2014).

Furthermore, CKD can result in early mortality (Cockwell & Fischer, 2020). In 2017, roughly 1.2 million deaths worldwide were attributed to CKD, a 41.5% increase between 1990 and 2017 (GBD Chronic Kidney Disease Collaboration, 2020). Meanwhile, in the US, CKD is the ninth leading cause of mortality (CDC, 2020b). A review of adjusted mortality rates among Medicare patients in 2013 also noted that those with CKD had a significantly higher mortality rate at 117.9 per 1,000 individuals than those without CKD (47.5 per 1,000 individuals (NIDDK, 2016).

Apart from that, the effects of CKD expand to the economy (Lv & Zhang, 2019). In 2017, CKD led to approximately 35.8 million disability-adjusted life years (DALYs) worldwide, and it primarily affected countries with the lowest sociodemographic index (SDI) (GBD Chronic Kidney Disease Collaboration, 2020). Even though the US, is not included in the highest bracket, the report noted that the US and other high-income North American countries had increasing CKD DALYs between 1990 and 2017 compared to other world regions (GBD Chronic Kidney Disease Collaboration, 2020). Additionally, in 2017, Medicare costs for CKD were recorded at $84 billion (America's Health Rankings, 2021). Medicare also reported that patients with CKD 65 years and older accounted for 20% of the Medicare spending in that age group (NIDDK, 2016).

The leading risk factors for CKD are hypertension and diabetes (NIDDK, 2016). In the US, roughly one in five adults with hypertension and one in three adults with diabetes may have CKD (CDC, 2021). Hypertension gives rise to CKD by affecting the vascular and renal tissues. Consequently, the arterial walls in the kidneys thicken, leading to the gradual enlargement of the glomerulus and deterioration of the attached tubules. Over time, the reduced glomerular infiltration causes glomerulosclerosis, tubular damage, and fibrotic lesions (Mullins et al.,

2016). Hypertension is also implicated in the pathogenesis of CKD among diabetic patients. Evidence suggests that hyperglycemia coupled with an impaired hemodynamic result in the cyclical stretch to mesangial cells. The chronic mechanical strain eventually increases the expression of pro-fibrotic cells, which evolves to CKD (Mullins et al., 2016).

However, CKD in its early stages is asymptomatic and may go unnoticed until its advanced stage (NIDDK, 2016). For instance, a cross-sectional survey involving 489 teachers in Cape Town, South Africa, noted that even in young, working individuals, CKD is pervasive and may go undetected. The CKD prevalence for the cohort was recorded at 6.1% to 6.4%, and it was associated with a diagnosis of diabetes and hypertension (Adeniyi et al., 2017). Likewise, a cross-sectional study involving patients with systemic arterial hypertension in Minas Gerais, Brazil, noted a high CKD prevalence. Among the 293 participants, 38.6% of them have CKD, and 14% of the cases were at an advanced stage (Da Silva et al., 2016).

Advancing age is another risk factor for CKD (CDC, 2021). Data from a cross-sectional study of hypertensive patients in Minas Gerais, Brazil, noted that the risk of CKD among individuals >71 years old was 5.36 times higher than their younger counterparts (Da Silva et al., 2016). Nevertheless, the reason for the association between advanced age and CKD remains unknown (Mallappalli et al., 2014).

Unfortunately, CKD awareness among elderly patients is low. For example, a cross-sectional study of 374 adult patients with hypertension in Nablus, Palestine, revealed that elderly patients >65 years old have poorer knowledge, attitudes, and practice scores on CKD prevention (Sa'adeh et al., 2018). Furthermore, a systematic review of published reports regarding the health literacy of elderly patients noted that American elderly individuals have low health literacy (Chesser et al., 2016).

Based on the increased risk of elderly patients with hypertension and/or diabetes and their low health literacy on CKD, there is a need to develop evidence-based interventions that would address such health care needs. Such preventive measures are warranted as there is still no cure for CKD, and CKD is often asymptomatic and undiagnosed in its early stages (America's Health Ranking, 2021; NIDDK, 2016). Moreover, detection and treatment in the early stage of CKD is instrumental in deterring progression to end-stage renal disease (Bansal et al., 2020). Patient education is also linked with better patient outcomes (Narva et al., 2016; Taylor et al., 2018). Therefore, testing and CKD education is pivotal in lowering the risk for kidney failure and promoting healthier and more productive lives among high-risk elderly patients.

Moreover, CKD literacy among primary care providers is also suboptimal (Foti & Chang, 2020). A study of general practitioners noted that some providers struggle in interpreting eGFR values, they feel there is no fixed definition of CKD, and they cannot determine if CKD is a disease on its own or a risk factor for cardiovascular disease (Van Dipten et al., 2018). Primary care providers also admitted to having insufficient knowledge regarding the complications of CKD and difficulty staying abreast with current CKD guidelines (Sperati et al., 2019; Van Dipten et al., 2018). Thus, there is a significant need for a CKD screening and management protocol that can improve CKD literacy among primary care providers.

Many nephrology societies recommend CKD screening and management (Berns, 2014). Although the Agency for Healthcare Research and Quality [AHRQ] (2012) did not find sufficient evidence to recommend CKD screening among asymptomatic adults, the organization recommended angiotensin-converting enzyme inhibitors and angiotensin II-receptor blockers as CKD treatment of patients with CKD stages 1 to 3 and those with albuminuria and diabetes or cardiovascular disease. Nephrology societies that support CKD screening and management in

asymptomatic adults are the American Society of Nephrology, the National Kidney Foundation, the Renal Physicians Association, the American Diabetes Association, and the Kidney Disease Improving Global Outcomes [KDIGO] (Berns, 2014).

In October 2019, the KDIGO conference recommended that persons with hypertension and diabetes be screened for CKD because of their increased risk for developing CKD (Shilpak et al., 2020). The KDIGO panel also claimed that early CKD screening and management of high-risk patients meets the World Health Organization's principles of screening for disease, namely: early CKD has no symptoms; CKD screening involves low-cost and accurate tests; early management of CKD is accepted and highly effective; and CKD screening and management can transpire in primary care settings (Shilpak et al., 2020). Moreover, the KDIGO panel claimed that CKD screening could promote health equity, as CKD disproportionately burdens socially disadvantaged and vulnerable populations (Shilpak et al., 2020).

CKD screening among high-risk groups is also consistent with the CDC's CKD initiative, a multi-prong approach that aims to thwart and control predisposing factors of CKD, boost knowledge of CKD and its complications, foster early identification and treatment of CKD, and better the outcomes of individuals diagnosed with CKD (CDC, 2021). One of the studies under the CKD initiative is the CKD Health Evaluation Risk Information Sharing (CHERISH) project. CHERISH is a three-year demonstrated project created by the CDC and the National Kidney Foundation to explore the feasibility of a CKD screening and detection program among high-risk groups in four states (Burrows et al., 2018; CDC, 2021). The project revealed that individuals with diabetes, hypertension, and those aged $\geq$ 50 years old are at increased risk for CKD and that controlling risk factors for CKD or CKD complications among these groups was low. Therefore,

the CHERISH project recommends screening among patients who have diabetes, hypertension, and are at least 50 years old (Burrows et al., 2018).

Problem Identification

The primary care setting, including home health care, is the frontline for providing CKD testing and education. Primary care providers are well placed to monitor renal function and manage modifiable risk factors, especially blood pressure and proteinuria (Fraser & Blakeman, 2016). Nevertheless, competing demands, challenges in interpreting diagnostic results, and the complexity of CKD interfere with the early recognition and diagnosis of CKD (NIDDK, 2018). Moreover, poor awareness about CKD by patients and providers, inadequate screening and risk-stratifying, and lack of evidence-based interventions propagate suboptimal CKD care (Foti & Chang, 2020). Hence, CKD often goes undetected in primary care even though only two simple tests (glomerular filtration rate and urine albumin-to-creatine ratio) are needed to confirm CKD (NIDDK, 2018).

Nonetheless, the current primary care practices at the project site do not include CKD screening and CKD prevention education as a routine intervention for high-risk patients. The current practice follows the reactive paradigm, wherein CKD interventions are designed to mitigate symptoms after the disease has been established (Waldman & Terzic, 2020). Thus, in most cases, patients receive CKD education and treatment once they have become symptomatic and their disease is in an advance stage.

Therefore, this Doctor of Nursing Practice (DNP) project is being proposed based on the identified practice gap. This project consists of a nurse-led CKD screening and management protocol for at risk elderly patients to promote early identification of CKD. Evidence suggests that optimal CKD care in primary care can improve CKD outcomes (NIDDK, 2018).

Purpose Statement

The DNP project will involve early CKD screening and management to homebound elderly patients ≥60 years old diagnosed with diabetes and hypertension. This project will entail working with an intra- and inter-professional team to make early CKD screening and prevention education part of the project site's regular patient care. Requisite to the desired practice change is improving the providers' awareness about CKD testing, staging, risk factors, and management. Ultimately, through collaboration across the health care team, the project can improve early CKD screening and management that would lower the risk for end-stage renal disease (ESRD) among high-risk patients.

Project Question

Among homecare providers (Population), will a nurse-led early CKD screening and management protocol (Intervention) improve provider knowledge of CKD and promote early identification and treatment among high-risk groups (Outcomes) compared to the current practice of no protocol (Comparison) over four weeks (Time Frame)?

Search Methods

An electronic search of the Cumulative Index to Nursing and Allied Health Literature **(**CINAHL) Plus with Full Text database, Cochrane Library, and PubMed were performed to identify articles relevant to CKD. The search terms were determined using the PICOT question. The keywords were early CKD screening AND early CKD management AND protocol AND provider AND high-risk patient. In addition, the term guideline and barriers were also added as search terms. Afterward, the limiters full text, academic journals, 2016-2021, English language, peer-reviewed, and human subjects were applied to narrow down the search. A hand search was also conducted to locate guidelines, and to further broaden the search.

The initial electronic search identified 273 articles. Afterward, the titles were screened for relevance to the PICOT question. Then, the abstract and full article of potential studies were examined to determine its eligibility to inclusion criteria. Studies that discussed CKD screening and management and were written in English and published in a peer-reviewed journal within the last five years were included in the review. On the other hand, studies that were duplicates, involved pediatric patients, used CKD screening for prenatal visits, and ongoing trials or protocol studies without results were excluded. Based on these inclusion/exclusion criteria, 18 studies were selected for this literature review. Further, the guidelines included in this review are from AHRQ, KDIGO, the Kidney Disease Outcomes Quality Initiative (KDIQO), and NIDDH.

Review of Study

Impacts of CKD

Eleven articles tackled the debilitating effects of CKD. The literature review revealed CKD as a common illness in the US, affecting more than 20 million adults or 1 in 10 Americans (Peralta et al., 2017; Timmerman et al., 2019). CKD is most pervasive among Americans 70 years old and above (Khoong et al., 2019). Current evidence also showed that CKD is a common health concern worldwide, afflicting up to 16% of adults (Havas, 2016; Zala et al., 2017). Moreover, in 2015, 1.2 million fatalities were related to CKD; such incidence has increased by 32% since 2005 (Neale et al., 2020).

CKD also burdens patients and the healthcare systems (Havas, 2016; Neale et al., 2020; Wang et al., 2017). In its advanced stage, only transplantation or dialysis can treat CKD, resulting in significant expenditures. Evidence also shows that higher-income countries spend 2-3% of their annual health budget on the treatment of ESRD (Neale et al., 2020).

The literature review also noted that individuals with CKD are at increased risk for cardiovascular events and mortality (McCory et al., 2018; Neale et al., 2020). These patients are also more likely to develop ESRD, be hospitalized, and have cognitive and functional decline (Peralta et al., 2017). Moreover, patients with CKD have poorer mental and physical health and quality of life [QOL] (Havas, 2016; McCory et al., 2018; Suwanwaha et al., 2016). The QOL of these patients also declines as CKD progresses (Timmerman et al., 2019). Additionally, CKD puts a significant strain on the patient's family members and can lead to depression and poorer QOL (Zala et al., 2017).

However, CKD is mainly asymptomatic. In most cases, CKD is diagnosed in its advanced stage. Thus, early diagnosis of CKD can improve patient outcomes and delay CKD progression (Khoong et al., 2019; Leddy et al., 2019; Neale et al., 2020; Peralta et al., 2017; Wang et al., 2017).

Best Practices

There is enough evidence to guide the proposed early CKD screening and management protocol in the project site. The literature review determined that patients with hypertension and diabetes must be screened for CKD (Leddy et al., 2019; Travagim et al., 2016; Wang et al., 2017). Moreover, CKD screening involves using serum creatinine, cystatin C with eGFR, and urine albumin to creatine ratio [UACR] (Khong et al., 2019; Llewelyn, 2019; Peralta et al., 2017). Further, CKD management must include routine lab testing to monitor CKD progression, pharmacologic treatments for cardiovascular risk reduction and glucose control, patient and family education, nephrology referrals, and self-management support (Coleman et al., 2017; Havas, 2016; Khoong et al., 2019; Llewelyn, 2019; Suwanwaha et al., 2016; Timmerman et al., 2019; Zala et al., 2016). There is also a plethora of literature identifying the topics that must be

discussed in CKD education and self-management, such as CKD-specific knowledge, medications, enhancing social support, and diet (Havas, 2016; Cassidy et al., 2018; Suwanwaha et al., 2016; Timmerman et al., 2019; Zala et al., 2016). However, counseling must be straightforward and tailored to the learning needs of patients and families (Cassidy et al., 2018; Zala et al., 2016).

Further, this review uncovered that lack of time and poor knowledge regarding current CKD guidelines as barriers to CKD screening and management in primary care (Neale et al., 2017; Tam-Tham et al., 2016). However, the use of technology, involvement of an inter-professional team, and active engagement of patients and families can facilitate optimal CKD care (Cassidy et al., 2018; Neale et al., 2017; Tham et al., 2016). Early CKD screening is also found to be a feasible and cost-effective intervention (Wang et al., 2017).

Literature Theme Development

The literature review identified seven themes relevant to the DNP project. The themes are early CKD screening protocols, CKD management protocols, CKD self-management program, improving provider engagement, nurse-involved CKD interventions, barriers and facilitators to CKD screening and management, and national and international guidelines. Each theme is further presented below.

CKD Screening Protocols

Three studies evaluated patients with hypertension and diabetes for proteinuria and impaired creatinine clearance (Leddy et al., 2019; Travagim et al., 2016; Wang et al., 2017). The screening of these groups is aligned with the CDC's CKD initiative and KDIGO guideline, which recommends that patients with hypertension and diabetes be screened for CKD (CDC, 2021; Shilpak et al., 2020). In addition, the AHRQ guideline recommends CKD screening for patients

with cardiovascular risk factors or diabetes who are not being treated with angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) (Fink et al., 2012).

Moreover, five studies provided valuable input on the CKD screening tests used in primary care (Khong et al., 2019; Leddy et al., 2019; Peralta et al., 2017; Travagim et al., 2016; Wang et al., 2017). This review noted that primary care facilities used the triple-marker testing (serum creatinine, cystatin C with eGFR, and UACR) for early CKD screening among high-risk patients (Khong et al., 2019; Peralta et al., 2017). Meanwhile, in another study, primary care providers used eGFR or UACR to screen high-risk patients for CKD (Llewelyn, 2019). These early CKD screening recommendations are consistent with the NIDDK and KDIGO guidelines (NIDDK, 2018; Shilpak et al., 2021). Both agencies recommend eGFR and UACR to confirm CDK in primary care settings (NIDDK, 2018; Shilpak et al., 2021). Moreover, KDIGO noted that an eGFR of 45-49 ml/min/1.73 m^2 confirms CKD. The KDIGO guideline also recommends cystatin C to stage CKD accurately. However, KDIGO advised that cystatin C should not be required for routine monitoring after the diagnosis of CKD has been established (Shilpak et al., 2021).

CKD Management Protocols

Twelve studies provided pertinent insights in designing a CKD management protocol. For instance, three studies mentioned about routine lab testing for CKD monitoring (Coleman et al., 2017; Llewelyn, 2019; Zala et al., 2016). Such a practice is consistent with KDIGO and NIDDK guidelines, which recommend eGFR and UACR to monitor CKD progression (NIDDK, n.d., Shilpak et al., 2021).

Four studies also highlighted that CKD management must include cardiovascular risk reduction (Coleman et al., 2017; Khoong et al., 2019; Llewelyn, 2019; Zala et al., 2016). Such an approach is consistent with the KDIGO and AHRQ guidelines, which recommend using ACEI or ARB for treating hypertension among patients with albuminuria (De Boer et al., 2020; Fink et al., 2012; Shilpak et al., 2021). Current guidelines also highlighted the role of glucose control in CKD management. For example, the KDIGO guideline recommends that patients with type 2 diabetes and CKD aim for an HbA1c of less than 6.5% to 8.0%. Moreover, for patients with an eGFR >30, a sodium-glucose cotransporter-2 (SGLT2) inhibitor or metformin must be initiated. However, if the glycemic target remains unmet, a glucagon-like peptide-1 receptor agonist (GLP-1 RA) must be added to the oral hypoglycemic treatment (De Boer et al., 2020; Shilpak et al., 2021).

Additionally, nine studies emphasized the importance of patient education in CKD management. Havas (2016) noted that CKD education must tackle CKD-specific knowledge; prescribed medications; engaging friends, family, and community in CKD care; self-management; and using reminder systems to help patients keep up with their routines. Cassidy et al. (2018) also emphasized that CKD education must be straightforward, easy to comprehend, and tailored to the health literacy of patients and families. Moreover, education sessions must be limited to 15 minutes, highlighting three to five points, divided into simple concepts, and delivered over multiple one-on-one sessions.

Lambert et al. (2018), McCory et al. (2018), Peralta et al. (2017), and Suwanwaha et al. (2016) also found that CKD education must involve the use of visual aids, distribution of CKD booklets or written materials to patients and their families, and collaborative teaching with other

providers. Further, the educational resources for patients can be taken from the National Kidney Disease Education Program (Peralta et al., 2017).

These recommendations are aligned with the NIDDK's (2014) kidney disease education lesson builder. Patient education is also highlighted in the KDIGO guideline, which identifies patient engagement as a crucial factor in CKD screening and treatment success. In addition, KDIGO noted that patient and family education could enhance patient knowledge and self-management for secondary prevention of CKD (De Boer et al., 2020; Shilpak et al., 2021).

Current evidence also highlights the importance of a patient-centered approach in CKD management. Two studies highlighted delivering CKD care in a culturally appropriate manner. For example, Kelly et al. (2016) suggested using a cultural framework in creating an education package. Also, Neale et al. (2018) highlighted that the CKD education program must consider the patients' unique values and beliefs. Patient-centered care is in line with the KDIGO guideline that highlights the importance of making CKD education programs accessible across cultures to improve patient engagement (De Boer et al., 2020; Shilpak et al., 2021).

Moreover, three studies identified nephrology referral as an essential component of CKD care (Coleman et al., 2017; Llewelyn, 2019; Zala et al., 2016). According to the KDIGO and NIDDK guidelines, patients must be referred to a specialist when there is acute kidney injury or sudden sustained fall in GFR, eGFR of less 30 ml/min/1.73 m^2, persistent ACR of more than 300 mg/g or 30 mg/mmol, and CKD progression. Referral to a nephrologist is also recommended when the patient has red blood cells more than 20 per high power field, CKD and hypertension unresponsive to the treatment of at least four antihypertensive agents, chronic abnormalities of serum potassium, recurrent or severe nephrolithiasis, or hereditary kidney disease (NIDDK, n.d.; Shilpak et al., 2021).

CKD Self-Management Program

Four studies discussed the need to include self-management programs in CKD care (Havas et al., 2016; Suwanwaha et al., 2016; Timmerman et al., 2019; Zala et al., 2016). Evidence suggests the self-management program should include education about dietary intake, mindful eating practice, and guided mindful eating meditations (Timmerman et al., 2019). The self-management program must also focus on equipping the participants with nine self-management skills, namely: goal selection, information collection, information procession and evaluation, problem-solving, decision making, action-taking, self-reaction, resource utilization, and the patient-provider relationship (Suwanwaha et al., 2016). Likewise, the self-management programs must be tailored to the patients' and families' identified needs (Zala et al., 2016). These findings are consistent with the KDIGO guideline that recognizes the importance of a structured self-management educational program in CKD management. According to KDIGO, face-to-face, group-based, or online self-management CKD programs can empower patients to develop knowledge and skills that will help them reduce secondary complications of CKD, optimize their wellbeing, and obtain treatment satisfaction (De Boer et al., 2020).

One study also tackled CKD dietary education as a component of CKD self-management (Lambert et al., 2018). This article recommended that CKD dietary education involve a dietitian, encourage access to peers, and employ question prompt sheets for appropriate advice and instruction. A focus on renal diet is consistent with the KDIGO guideline. KDIGO highlights the need for patients with CKD to receive adequate patient education regarding diet modification (Boer et al., 2020). The KDIGO and KDOQI guidelines further recommend a diet high in fruits, vegetables, legumes, grains, fish, and unsaturated fats for patients with CKD (De Boer et al., 2020, Ikizler et al., 2020). KDIGO also endorses a protein intake of 0.8 g/kg (weight)/day for

patients with diabetes and CKD not treated with dialysis and a sodium intake of less than 2g per day in patients with diabetes and CKD (De Boer et al., 2020).

Apart from modifying diet, CKD management also entails lifestyle modifications. According to the KDIGO guideline, patients with CKD must abstain from smoking and using tobacco products. Patients with CKD should also exercise regularly and engage in moderate-intensity physical activity for at least 150 minutes per week based on their cardiovascular and physical tolerance (De Boer et al., 2020; Shilpak et al., 2021).

Improving Provider Engagement

Three studies revealed innovative ways on how provider engagement to CKD screening and management can be improved. In Khoong et al.'s (2019) study, primary care providers received evidence-based best practice advisory in the electronic health record. Likewise, providers in the study done by Peralta et al. (2017) received an electronic "research note," a summary of the KDIGO guidelines for CKD management, a reminder that providers must counsel patients regarding CKD. The use of guides for primary care providers is also echoed by Travagim et al. (2016). The group suggested creating an educational handbook as a reference tool for primary care providers and delivering a dialogue-based expository class to facilitate discussion and exchange of experience between the staff and researchers regarding CKD screening and management.

These findings are echoed in the KDIGO guideline. According to KDIGO, the uptake of CKD screening and management in a primary care setting can be improved by educating clinicians about CKD risk factors, CKD risk stratification, and treatment. KDIGO also advises using automated laboratory reporting, the use of risk questions, and clinical decision support tools integrated into the EHR. The organization also recommends creating simplified quick

reference guides for primary care providers. Additionally, KDIGO suggests using the Kidney Failure Risk Equation to stratify patients and recognize those needing a nephrologist referral (Shilpak et al., 2021).

Nurse-Involved CKD Interventions

Eight studies identified the different roles of nurses in CKD care. As a member of an intra- or inter-professional team, nurses act as educators and facilitators (Coleman et al., 2017; Llewelyn et al., 2019; Suwanwaha et al., 2016; Timmerman et al., 2019; Zala et al., 2016). Nurses also connected patients to other healthcare workers and patient peers to ensure comprehensive and holistic care (Coleman et al., 2017; Zala et al., 2016). Additionally, nurses acted as expert clinicians in a CKD care team. Nurses were involved in screening patients for CKD and reviewing laboratory findings with patients (Coleman et al., 2017; Llewelyn et al., 2019). Meanwhile, nurse practitioners adjusted patient medications and ordered diagnostic investigations (Coleman et al., 2017).

The nurses' involvement in CKD screening and management is consistent with the KDIGO guideline, which recommends a multi-stakeholder involvement in providing optimal CKD care. Nurses and other primary care clinicians are crucial in the success of CKD screening and management programs. CKD care also entails co-management of care between primary care providers and specialists (De Boer et al., 2020; Shilpak et al., 2021).

One of the interventions used by nurses that was proven to be effective was motivational interviewing. Nurses used motivational interviewing to encourage positive health behaviors and prevent lifestyle-modifiable risk factors. Such an approach fostered positive behavioral changes among patients (McCory et al., 2018). Additionally, CKD education delivered as flowcharts or animated cartoons with sounds and supplemented with a booklet and a personal written action

plan were proven beneficial (McCory et al., 2018; Suwanwaha et al., 2016). These interventions are consistent with the KDIGO guidelines that highlights the creation of education programs that are accessible across languages and cognitive abilities (Shilpak et al., 2021).

Barriers and Facilitators to CKD Screening and Management

Three studies identified barriers and facilitators to CKD screening and management in primary care. The barriers to CKD screening were lack of time, fear of delivering a CKD diagnosis, and poor satisfaction with CKD guidelines. In addition, many providers find the guidelines confusing, inappropriate, difficult to use, or erratic (Neale et al., 2017). Tam-Tham et al. (2016) also claimed that primary care providers admitted to difficulty helping patients and family members gain a realistic expectation about ESRD, providing optimal medical management, and co-managing the patients with nephrologists due to lack of role clarity and poor communication.

On the other hand, existing evidence determined different factors that can facilitate CKD management. Cassidy et al. (2018), Neale et al. (2017), and Tham et al. (2016) identified the importance of working with inter-professional renal experts, such as nephrologists, CKD nurses, social workers, dieticians, psychologists, physical therapists, and expert patients. Tham et al. (2016) also highlighted that primary care providers must have telephone access to clinicians familiar with the CKD care and a clinical care pathway to guide primary care management. Meanwhile, Cassidy et al. (2018) highlighted the importance of developing a trusting relationship between patients and providers in enhancing acceptance of medical advice. The authors also added that providers must keep patients and families engaged in treatment by providing decision aids, assisting them in using mobile health apps that support self-management, and offering access to CKD resources. Further, Neale et al. (2017) echoed the use

of supportive technology to assist primary care providers in identifying and managing CKD. In a separate study, Wang et al. (2017) noted that early CKD screening is feasible and cost-efficient. The study observed that early CKD screening among high-risk patients resulted to an estimated cost for each quality-adjusted life-year (QALYs) of between 69 US$1,262,74 to US$17,437.77.

National and International Guidelines

Guidelines from three organizations were included in this review. The KDIGO, AHRQ, and NIDDK guidelines offer recommendations on CKD screening and management. KDIGO and NIDDK advise CKD screening for patients with hypertension, diabetes, cardiovascular disease, and a family history of kidney failure (NIDDK, 2016; Shilpak et al., 2021). KDIGO also recommends CKD screening for patients with a history of acute kidney injury, obesity, advancing age, and environmental and genetic factors (Shilpak et al., 2021).

Moreover, NIDDK and KDIGO identify eGFR and UACR as tests for CKD screening and risk stratification (NIDDK, 2016; Shilpak et al., 2021). However, KDIGO highlights that cystatin C is needed for a more precise GFR measurement (Shilpak et al., 2021). Moreover, AHRQ suggests UACR for patients with cardiovascular disease or diabetes who are not being treated with ACEIs or ARBs and eGFR for patients with hyperlipidemia. UACR is also recommended for patients with eGRF and has a high risk for cardiovascular complications and are not treated with ACEis or ARBs (Fink et al., 2012).

AHRQ, KDIGO, and NIDDK also recommend intensive blood pressure-lowering drugs, such as statins and ezetimibe for CKD management (Fink et al., 2012; NIDDK, 2016; Shilpak et al., 2021). Moreover, KDIGO and NIDDK advise intensive glucose control using glucose-lowering drugs (metformin, SFLT2, and GLP-1) for patients diagnosed with CKD (De Boer et al., 2020; NIDDK, 2016; Shilpak et al., 2021). The HbA1c target for patients with CKD and

diabetes who are not in dialysis is <6.5% to <6.0% (De Boer et al., 2020). AHRQ and KDIGO further endorse treating albuminuria with ACEis/ARBs for patients with or without hypertension (De Boer et al., 2020; Fink et al., 2012; Shilpak et al., 2021).

Additionally, KDIGO and NIDDK recognize lifestyle modification such as smoking cessation, regular exercise, and a healthy diet to be beneficial in delaying CKD progression (De Boer et al., 2020; NIDDK, 2016; Shilpak et al., 2021). Furthermore, a moderate-intensity physical activity of at least 150 minutes per week is recommended (De Boer et al., 2020; NIDDK, 2016). KDOQI and NIDDK also endorse that a registered dietitian nutritionist or its international equivalent partner with primary care providers in providing medical nutrition therapy to patients with CKD (Ikizler et al., 2020; NIDDK, 2016).

KDOQI also suggests that adults with CKD stage 1-5 and who are metabolically stable limit their caloric intake of 25-35 kcal/kg body weight per day (Ikizler et al., 2020). KDOQI and KDIGO also advise that patients with CKD stage 1-4 consume fruits and vegetables to reduce their body weight, blood pressure, and net acid production (De Boer et al., 2020; Ikizler et al., 2020). In particular, KDOQI recommends the Mediterranean diet (Ikizler et al., 2020).

KDIGO and NIDDK also suggest limiting the protein intake to 0.8 g/kg body weight/day for patients with CKD and diabetes not undergoing dialysis (De Boer et al., 2020; NIDDK, 2016). Further, KDIGO and NIDDK advise sodium intake of <2g/day (De Boer et al., 2020; NIDDK, 2016). KDOQI and NIDDK also recommend adjusting phosphorus and potassium intake to the normal range (De Boer et al., 2020; NIDDK, 2016). Additionally, KDOQI states that enteral nutrition supplementation is recommended for patients who has chronic inadequate intake and total parental nutrition for those with protein-energy wasting. Moreover, patients with CKD stages 1-5 and have vitamin deficiency must take supplements (Ikizler et al., 2020).

KDIGO also advocates that patients and family be actively engaged in CKD screening and treatment. Such involvement warrants patients to undergo CKD care education and a structured self-management program (De Boer et al., 2020; Shilpak et al., 2021). Equally important, KDIGO calls on primary care providers and allied health professionals to implement strategies that would foster early CKD screening and management (Shilpak et al., 2021).

Review of Study Methods

This literature review included ten qualitative studies and eight quantitative studies. The predominant research designs were narrative reviews, phenomenological studies, and randomized controlled trials. More than half of the research studies were done in Australia and the US. The rest of the studies were done in Canada, Brazil, China, Saudi Arabia, and Thailand. Further, in eleven articles, the study population included-patients diagnosed with CKD stages 1-5. On the other hand, four studies included clinicians as participants, while four studies involved high-risk patients. The level of evidence also varied. Two studies were level I evidence, five were level II evidence, two were level IV evidence, four were level V evidence, and five were level VI evidence. Appraising the level of evidence helped determine the strength of studies that supports the practice change (Melnyk & Fineout-Overholt, 2019). Critical appraisal is also crucial in judging research evidence's credibility, value, and applicability into clinical practice (Fineout-Overholt, 2019).

This literature review also found enough evidence that shows CKD as a significant health problem that impacts individuals, the US, and the world. Current evidence also provides substantial information to guide an early CKD screening and management protocol in the project site. Hence, by underpinning the proposed nurse-led CKD identification and management project

on current evidence, the DNP project may help in improving patient care and systems outcomes in the project site who currently has no existing CKD care protocol.

Project Aims

The overarching aim of this DNP project is to save lives and reduce healthcare costs due to CKD progression by early screening and management of CKD among patients in a primary care home health agency.

Project Objectives

The following objectives will be met within the timeframe of the DNP project.

1. Create an evidence-based early CKD screening and management protocol.
2. Educate an inter-professional team to enhance the knowledge and acceptance of the new CKD screening and management protocol.
3. Evaluate providers' knowledge before and after the education session for improved understanding of CKD.
4. Increase in billing via CPT codes for early CKD screening and management by at least 10% at the project site through a billing report via NextGen.
5. Evaluate providers' compliance with the new CKD screening and management protocol with a chart audit via NextGen.

Framework

The Institute for Healthcare Improvement (IHI) created the model for improvement (MFI) in 1996. The model has two parts. The first component asks three fundamental questions, which will be discussed below. Meanwhile, the second part is the Plan-Do-Study-Act (PDSA) cycle to test changes in real work settings (AHRQ, 2013; IHI, 2021).

The MFI is a straightforward and robust tool for hastening improvements in an organization (AHRQ, 2013; IHI 2021). This model can be used with any change models currently being employed in the organization (IHI, 2021). The MFI process is presented in Appendix A.

Historical Development of the MFI Model

The MFI model was influenced by the early works of W. Edward Deming, a pioneer in the science of improvement. Deming was a statistician, and he used statistics to identify sources of variation associated with wasteful manufacturing. Deming also advocated for measuring and using data to determine the effectiveness of processes in achieving identified outcomes. Deming's approach to improving quality of care focused on the underlying processes that have contributed to mistakes and inconsistencies. In 1982, Deming established his concept of transforming organizations using quality management and recognizing variations. Deming also identified 14 points that guide QI methodologies for manufacturing, which was later adopted in health care (AHRQ, 2013). At present, the MFI is the most widely adopted quality improvement approach in health care (AHRQ, 2013).

Major Tenets and Application to the DNP Project

Fundamental Questions

The MFI model recommends raising three key questions.

1. The first question is - What does the organization want to achieve? Thus, the organization must identify a time-bounded and measurable aim that explicitly defines the patients or systems that would be impacted by the project (AHRQ, 2013; IHI, 2021). For example, the DNP project's overarching aim is to save lives and reduce healthcare costs due to

CKD progression by early detection and treatment of CKD among patients in a primary care home health agency.

2. The next question in the MFI approach is - How will the organization know if the change would improve the institution? In this regard, the project lead would identify quantitative variables that would be measured to help determine if the DNP project led to an improvement in practice (AHRQ, 2013; IHI, 2021). In this DNP project, the outcome measured will be the providers' knowledge before and after providing education and compliance with early CKD screening and management among home-based primary care providers. The project would also measure if CPT codes for early CKD screening and management had increased by at least 10%. Moreover, the participant's compliance to the new CKD screening and management protocol will be appraised.
3. The final question is - What must be changed to obtain the desired improvement? The project lead would identify a change in practice that would meet the organization's desired outcome (AHRQ, 2013; IHI, 2021). In the DNP project, the change of practice will be implementing an early CKD screening and management protocol.

After the three questions have been addressed, the project lead initiates the PDSA Cycle. PDSA is a systematic process for learning about the continuous improvement of a process or service (The W. Edwards Deming Institute, 2021). The next section discusses how the PDSA cycle is used in the DNP project.

PDSA Cycle and Application to the DNP Project

Plan

In the planning stage, the project lead would identify the objectives of the DNP project. Afterward, the project lead would examine the current context process, identify a relevant clinical issue, and do a cause analysis of the problem. Then, alternatives to mitigate the root causes would be explored to identify the best intervention. An action plan will be prepared, including the necessary resources and timeline (Minnesota Department of Health, n.d.). Consequently, a hypothesis would be formulated regarding the outcome. Then, a data collection plan and success metrics would be established (IHI, 2021; The W. Edwards Deming Institute, 2021).

To begin this project, the project lead and director worked collaboratively to identify a problem at the project site. Then, it was agreed that a practice change was needed to improve outcomes. The three fundamental questions were answered, and the objectives were identified. A literature review was performed to determine the scope of the problem, current best practices, and to obtain evidence-based solutions. Then the project lead created objectives, interventions, and formulated a hypothesis.

The planning stage will continue as the project lead will further develop the plan to implement the project. The project lead will review the literature for an evidence-based early CKD screening and management protocol that would fit into the workflow of the practice site. The project lead will present the project mentor and the project site management with the findings of an evidence-based CKD screening and management protocol. A collaborative effort is essential between the project lead, project mentor, and project site management to choose an appropriate protocol to implement. The tools for implementation published within the literature

will be utilized, or if needed, tools will be developed. The project lead would then plan a process for data collection and identify appropriate statistical tests to measure if the outcomes met the objectives.

Do

In this stage, the DNP project would be implemented on a small scale (IHI, 2021; The W. Edwards Deming Institute, 2021). Data would be collected during the implementation to evaluate the success of the DNP project (Minnesota Department of Health, n.d.). Problems and unexpected observations would be also documented. The project lead would also take note of how the patients, providers, and nurses react to the practice change. Moreover, the project lead would examine how well the DNP project fit into the system and participant' workflow (AHRQ, 2020). Then, the data analysis will start (IHI, 2013).

The Do phase commences with implementing the project in one primary care site. The intervention would include educating an inter-professional team to enhance their knowledge and acceptance of the new CKD screening and management protocol. Additionally, the participants' knowledge of CKD screening and management would be measured before and after the education session with a pre- and post-education test. Other outcomes that would be assessed are the billing rates for early CKD screening and management and the participants' compliance with the new CKD screening and management protocol. The participants and stakeholders would also be instructed to report any problems and unexpected observations to the project lead. Participants will also be encouraged to ask questions regarding the CKD protocol to the project lead. Any problems, unexpected observations, and questions will be addressed, collected, and complied. This phase would end with the start of data analysis (IHI, 2021).

Study

The data analysis will be completed during the study phase. The findings would be interpreted to answer the hypothesis or project question (IHI, 2021). The project results would be examined if the objectives of the project were met. The purpose of the study phase is to determine the project plan's validity and monitor for signs of progress and success or problems and areas for improvement (The W. Edwards Deming Institute, 2021). The project lead would synthesize and reflect on the evidence (IHI, 2021).

Act

Based on the findings from the PDSA cycle, the goals would be adjusted, the methods would be changed, the hypotheses would be reformulated. However, if the small-scale trial is successful, it would be implemented on a broader scale (The W. Edwards Deming Institute, 2021). If adjustments were made to the objectives or intervention process, the project lead would prepare for another PDSA cycle (IHI, 2021).

If the DNP project outcomes did not meet the objectives, changes would be completed based on the outcomes and feedback of participants and stakeholders. Another PDSA cycle would be conducted until the project is deemed adequate, feasible, and acceptable. The DNP project would be adopted in the project site, and the change in practice will become integrated into the organization's workflow. The project lead would recommend to the administrators that the outcomes be monitored regularly to track the project's impacts and progress.

Setting

The DNP project will be held in a primary care home health agency that offers comprehensive care to patients and caregivers. The services offered by the project site includes primary care services for patients in their homes and those residing at skilled facilities, board and

care, and senior assisted living residences. This privately-owned medical corporation was established in 2015 and is located in San Bernardino, in Los Angeles County, which is in the Southern region of California.

The project site serves a predominantly White population, with a mean household income of $68,044 in 2019, which falls below the state average of $75,325 (US Census Bureau, 2021a, 2021b). The mean income in Los Angeles County also falls below the national median household income of $68,703 in 2019 (Semega et al., 2020). Most patients served are elderly ages 60 to 90 years old. Approximately 1,000 patients are seen per month, and the estimated provider-patient ratio is 1:8.

The project site uses Practice Fusion as the electronic health record (EHR) system. The Practice Fusion system can order, bill, and record Current Procedural Terminology (CPT®) codes for CKD screening and management procedures. Hence, the EHR system will be part of the project for tracking the providers' compliance with the new early CKD screening and management protocol. Likewise, the number of billed CPT codes for CKD screening and management will also be tracked by the billing department using the NextGen software.

Population of Interest

The direct participants are home-based primary care providers consist of 12 family nurse practitioners (FNPs), 3 medical doctors (MDs), and 2 physician assistants (PAs). These providers are directly involved in patient care, and it is within their scope of practice to order CKD screening tests, prescribe CKD management medications and interventions, and refer patients to nephrologists and nutritionists. The average range the providers have been employed with the project site is six months to six years.

The indirect participants included in the DNP project are the patients seen by the population of interest, who are 60 years old and above and diagnosed with diabetes and/or hypertension. Exclusions include patients not diagnosed with diabetes or hypertension, younger than 60 years old, and those not seen during the implementation timeframe.

Stakeholders

The chief executive officer agreed to allow the project lead to conduct the DNP project by signing the non-affiliation agreement document. Further, the stakeholders in the DNP project consist of home-based primary care providers, patients and their families, the project site director, information technologist, nurses, and billers. The home-based providers will perform CKD screening and management using the protocol. Meanwhile, the patients will be the recipients of improved care. Furthermore, the patient's families and caregivers will also be crucial in the project, as they will continue to provide all aspects of patient care.

Additionally, nutritionists will be involved in this project, as newly diagnosed CKD patients will be referred to them for renal diet education and management. The medical director is another supporting stakeholder. Permission to implement the DNP project in the project site and use the EHR system to gather data for the project was obtained from the medical director (see Appendix A). Furthermore, the information technologist will be tapped to provide logistic support so the project lead can access the EHR system. The information technologists will also assist the project lead if there are technical difficulties while accessing the EHR.

Moreover, nurses will assign patients to the providers and send the patients' previous visit notes and most recent diagnostic workup, including CKD screening results prior to each home visit. Proper dissemination of patient information is crucial for the continuity of care because in some cases, providers (NPs, physicians, and PAs) are assigned to visit patients being managed

by other providers. Finally, the billers will record and generate reports of the billed CPT codes in CKD screening and management pre-and post-implementation. This report will determine if the project site had an increase in revenue due to the implementation of the project.

Interventions

The project will address the lack of a CKD screening and management protocol in the project site. Based on the literature review, the proposed intervention was drafted using the most current KDIGO guidelines on CKD screening and management (Ikilzer et al., 2020; Shilpak et al., 2021). This DNP project will include a five-week implementation phase and a week of evaluating the outcomes following the project implementation.

At week one, the project lead will obtain a four-week pre-implementation billing report for CPT codes for initial CKD screening and CKD management. Afterward, a one-time education session will be conducted on CKD screening and management for the participants. A pre-education test will be administered and collected prior to the education session. The education session will run for one hour and be delivered as a lunch-and-learn at a staff meeting. The education session will be followed by the implementation of the CKD screening and management protocol beginning in weeks two through five. Then, during week three, the project lead will start collecting data through a chart audit. The project lead will review the participants' charts to determine if a high-risk patient received an order for CKD screening and a patient diagnosed with CKD received an intervention for CKD management. Afterward, the post-education test will be administered in week four. Finally, in week five, the post-implementation chart audit will be completed, and a post-implementation billing report will be obtained from the billing department. Moreover, from weeks three through week five, the project lead will monitor the participants for compliance with utilizing the protocol through chart audits and be present at

the project site for questions and support. Finally, in week six, the data gathered will be compiled and analyzed.

Tools

CKD Screening and Management Protocol

This project lead will create a CKD screening and management protocol using the KDIGO guidelines on CKD screening and management (Ikilzer et al., 2020; Shilpak et al., 2021). The project lead will modify the KDIGO guidelines to fit the workflow and culture of the project site. Afterward, expert consultation with the project mentor and project site management will be done to seek approval of the protocol. The protocol will comprise two key components: CKD screening and CKD management. Billing will not be included in the protocol. The primary goal in using the protocol is to assist participants at the point of care to determine high-risk patients and implement early CKD screening and management. The links to the KDIGO guidelines are in Appendix C, and the protocol tool can be accessed in Appendix D.

CKD Screening

This protocol will assist the clinician in identifying patients eligible for CKD screening (those with hypertension and/or diabetes). The protocol will also contain the recommended initial and routine screening laboratory tests. Moreover, the different risk stratifications of CKD based on eGFR and UACR results will also be included in the protocol.

CKD Management

The purpose of this section of the protocol is to implement evidence-based interventions in managing CKD (Shilpak et al., 2020). This portion is also divided into four components, namely, patient safety, slowing CKD progression, reducing cardiovascular complications, and nephrology referral.

Patient Safety. This portion describes what medications to avoid based on CKD risk stratification.

Slowing CKD progression. This portion of the protocol identifies the medication management, nutrition therapy, and lifestyle recommendations for patients with CKD.

Reducing cardiovascular complications. This portion identifies the blood pressure goal and medications to prevent cardiovascular complications among patients with CKD. It does not include information when patients should be referred to cardiologists.

Nephrology referral. This portion of the protocol lists the conditions when patients with CKD should be referred to a nephrologist.

Education PowerPoint

The project lead will create an education PowerPoint presentation discussing the CKD screening and management protocol with the key stakeholders. Like the protocol, the content of the PowerPoint will be taken from the KDIGO guidelines (Ikilzer et al., 2020; Shilpak et al., 2021). The PowerPoint presentation will also discuss how CKD is identified, the pathophysiology and the progression of the disease if not treated. The CKD screening and management team and link to the KDIGO guidelines will also be discussed in the presentation. After the presentation, the providers will be able to ask questions and voice concerns regarding this project. This PowerPoint presentation can be examined in Appendix E.

Pre-and Post-Education Test

The project lead will create the pre-and post-education test based on the education provided and the CKD screening and management protocol. Since the test is not published, the project team will participate in performing a content validity index (CVI). The project team and project mentor will validate the tool utilizing the CVI rating form. This 15-item test will assess

the providers' knowledge regarding CKD and the new protocol before and after the education session. This pre- and post-education test can be reviewed in Appendix F.

Content Validity Index (CVI)

The pre-and post-education test was examined by three experts who examined the relevance of each item using a four-point scale. Afterward, each item was computed as the number of experts who gave a rating of 3 or 4 divided by the number of experts. The CVI is composed of the DNP project's purpose and objectives, population, length of the test, difficulty and discrimination levels of test items, scoring procedures, item format, and test blueprint. The tool also included the questions in the CKD Screening and Management Education Test and the expert rating from. The CVI is in Appendix G.

Chart Audit Tool

The project lead will perform a chart audit to evaluate compliance to CKD screening and management among the participants. The two indicators that will be assessed in the chart audit are documentation of a CKD screening for a high-risk patient and documentation of a CKD management for a patient diagnosed with CKD. After each chart audit is completed, a final tabulation of participants in compliance and out of compliance will be generated. This chart audit tool can be seen in Appendix H.

Billing Summary Report

The project lead will obtain the billing report from the facility. NextGen, an application incorporated in the Practice Fusion, is used by the billing department to generate billing reports based on Medicare requirements. The indicators that will be assessed in the billing report are the CPT code for initial screening of CKD and CKD management. For ease in tabulating the billing

report, the project lead will create the billing summary tool. The NextGen report does not tabulate the CKD screening and management. This tool can be accessed in Appendix I.

Study of Interventions/Data Collection

Consistent with the project objectives, three outcome measures will be determined by the data collected – billing via CPT code for early CKD screening and management (billing summary), participants' knowledge before and after the educational session (education tests scores), and participants' compliance with the new CKD screening and management protocol (chart audit).

Billing Summary

Data will be collected two times – at week one (baseline) and week five (post-implementation). CPT codes for CKD screening and CKD management performed four weeks before and after the education session will be generated by the billing department via NextGen. Following data collection, the results of CPT codes will be tabulated and recorded in the billing summary tool. Accordingly, the baseline and post-intervention data will be compared to determine if there was an increase in the billing due to the implementation of the DNP project. The goal is to have a revenue increase of at least 10%.

Education Test Scores

Participants will be invited to partake in a mandated staff meeting, which is being held for the purpose of the educational intervention and data collection. A paper and pencil test will be administered in person before and after the education session. The pre-education test will be administered and collected prior to the education session during the staff meeting on week one. On the other hand, the post-education test will be administered and collected on week four to determine if the participants retained the information discussed in the education session. The

project lead will administer and collect the educations tests. Additionally, the project lead will assign a unique number to each participant to maintain confidentiality. The assigned number will be used for both the tests and chart audit.

Chart Audit

A chart audit via Practice Fusion will be initiated on week three to determine the participants' compliance with CKD screening and CKD management. The chart audit tool created by the project lead will assist in the determination of compliance with the protocol. The project lead will search for the participants' names in Practice Fusion to obtain patient charts who were seen throughout the implementation period. Based on the data in Practice Fusion, patients diagnosed with hypertension and/or diabetes without the CKD diagnosis will be eligible for the CKD screening chart audit. Meanwhile, patients diagnosed with CKD as documented in Practice Fusion will be included in the CKD management chart audit. Only one patient eligible for CKD screening and CKD management will be included in the chart audit for each participant. Patients who do not meet either of the eligibility criteria for CKD screening or CKD management will be excluded in the chart audit.

The participants' notes will be reviewed to determine compliance by documentation of CPT codes for CKD screening tests (serum creatinine, cystatin C with eGFR, and UACR) and CKD management intervention (i.e., medication adjustment, medication management, nutrition therapy, lifestyle modification, reducing CVD complications, and nephrology referral). For example, a participant will be considered compliant to CKD screening if their patient's electronic health record shows a CPT code for serum creatinine, cystatin C with eGFR, and UACR for those with hypertension and/or diabetes but no CKD diagnosis. Meanwhile, the participant will be deemed adherent to CKD management if their patient's electronic health record show a CPT

code for ACEI or ARB for patients with hypertension and has an ACR of ≥ 30 mg/g or 3 mg/mmol. Only the charts of patients' seen within the project's implementation period will be audited. No patient personal health information (PHI) will be extracted from the charts.

In total, only two charts will be edited for each participant throughout the implementation period - one chart for patients with hypertension and diabetes who need a CKD order and the second chart for patients with CKD who need a CKD management order. Moreover, each participant will be audited once in the two-chart process. The post-implementation chart audit will conclude in week five.

Ethics/Human Subjects Protection

The project site has no Institutional Review Board (IRB) or Quality Improvement oversight committee Thus, the proposal was submitted to the Touro University Nevada project determination process. A project determination form was completed and evaluated by the project team to confirm if the project requires IRB review. The IRB materials were also submitted to the project team to review the type of proposed project. Additionally, the project lead has completed the Collaborative Institutional Training Initiative (CITI) modules, which has taught her to conduct the project in an ethical manner.

The project will adhere to ethical project implementation. All providers are mandated to participate in the project because the protocol is considered an organizational practice change. Hence, it is expected that all participants will attend the one-time education session regarding the new CKD screening and management protocol. However, participation in this DNP project is not a condition of employment and participation in the project will not result in special treatment or favors. However, the project is anticipated to benefit the participants by improving their knowledge of early CKD screening and management to better patient outcomes. Information

about the project's purpose and how data will be collected to safeguard the participants' anonymity and confidentiality will also be discussed.

There is a potential risk for the participants to experience distress for being evaluated through the pre-and post-education tests. Hence, the project lead will assure the participants that individual education test scores will not be shared and will be presented as an aggregate. Another potential risk is that some participants may have trouble adjusting to the new CKD management and CKD protocol. Hence, the project lead will be available to address any doubts, concerns, and questions about the protocol throughout the implementation of the project.

Finally, the billing summaries, pre-and post-education test scores, and chart audit data will be hidden in a locked filing cabinet at the project site to maintain confidentiality. The electronic data will also be protected and stored in a password-protected laptop. Only the project lead will have access to the locked filing cabinet and laptop. Moreover, the project lead will not collect any identifying patient or provider data during chart review. No names will be collected on any participant data such as the pre-and post-tests or the chart audit forms. Instead, the project lead will assign a unique number for each participant for identification. Only the project lead will know which assigned number correlates with each specific participant.

Measures/Plan for Analysis

A statistician from Touro University Nevada (TUN) was consulted to determine the relevance and applicability of the proposed statistical analyses. All collected data will be encoded on an Excel spreadsheet and exported into a Statistical Package for Social Services (SPSS) version 27 software for analysis. A paired *t*-test for pre-and post-education test scores will determine if improved knowledge on CKD screening and management at post-education is statistically significant. Additionally, a paired *t*-test will measure pre-and post-billing and coding

to examine if the DNP project implementation had any impact on the total CPT codes billed. The project will utilize parametrical statistical tests for data analysis because the education tests scores and CPT codes are ratio variables, the data were obtained from a related sample, the variables are normally distributed, and the data has no outliers (Kent State University, 2021). However, descriptive statistics will establish participant compliance with the new CKD screening and management protocol. The results will be reported as mean and standard deviation.

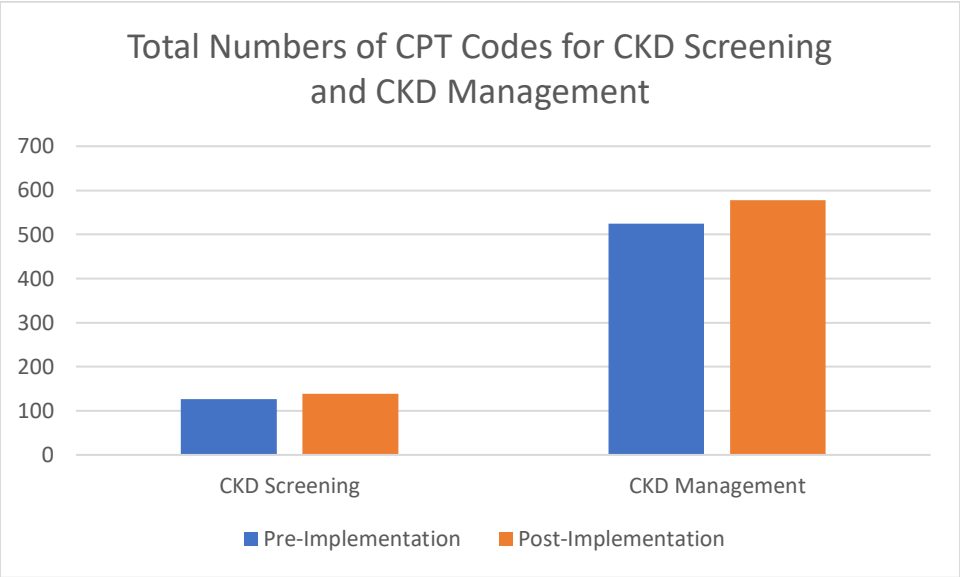
Analysis of Results

Billing Summary

The total number of CPT codes for CKD screening and CKD management pre-and post-implementation were collected to determine if the nurse-led early CKD screening and management protocol increased billing by at least 10%. There were 126 CPT codes for CKD screening and 525 CPT codes for CKD management at pre-implementation. One-month post-implementation, the CPT codes for CKD screening and management increased to 139 and 578, respectively. Hence, there was a 10.32% increase in CPT codes for CKD screening and 10.10% in CPT codes for CKD management. Figure 1 demonstrates the data.

Figure 1

Comparison of the Total CPT Codes for CKD Screening and CKD Management Pre- and Post-Implementation



A paired t-test was used for data analysis because the data met all the test assumptions. Normal distribution was met (p = 0.354 for CPT CKD screening pre, p = 0.423 for CPT CKD screening post, p = 0.385 for CPT CKD screening pre, and p = 0.352 CPT CKD management post). There were no outliers in all datasets.

The results of the paired *t*-test showed that the mean CPT codes for CKD screening pre- and post-implementation were statistically significant different, $t(16) = -3.79$, $p = 0.002$. The CPT codes for CKD screening had a mean increased of 0.77 (SD = 0.83, 95% CI [-1.20, -0.34]) at post-implementation. In addition, the paired *t*-test also found a statistically significant difference between the total CPT codes for CKD management at pre- and post-implementation, $t(16) = -3.50$, p = 0.00e. The mean post-implementation CPT codes for CKD management was 3.12 (SD = 3.12, 95% CI [-5.01, -1.23]) higher than pre-implementation. Table 1 presents the results of the analysis.

Table 1

Paired t-test Results for Pre- and Post-Implementation Billing Summary Based on CPT Codes

	Pre-implementation		Post-implementation				
Outcome	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
CKD screening	7.41	1.32	8.18	1.33	-3.79	16	.002
CKD management	30.88	2.69	34.00	2.15	-3.50	16	.003

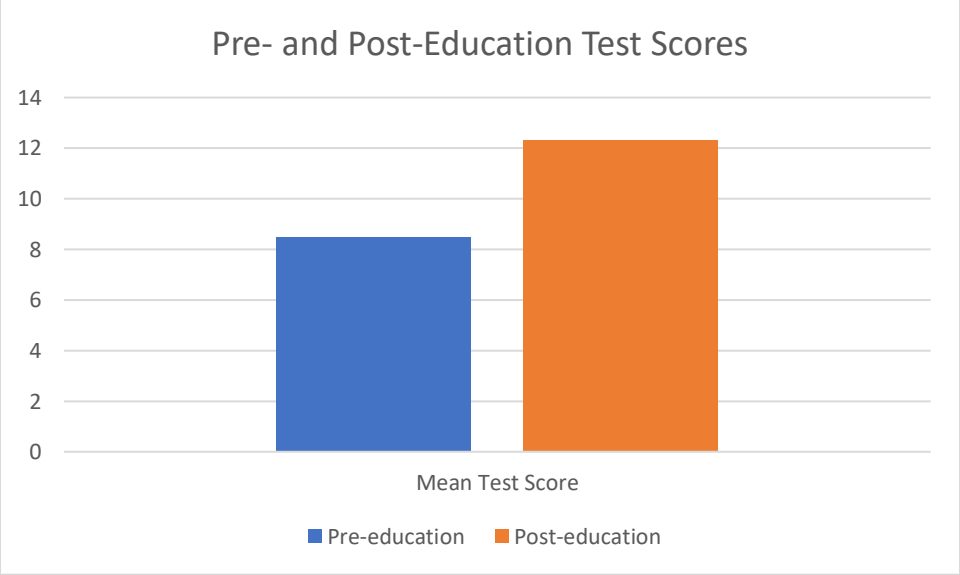
n = 17

Education Test

Seventeen participants attended the early CKD screening and management protocol education session. All participants completed the pre-and post-education test. On average, the participants' education test scores were 8.47 at pre-implementation and 12.29 at post-implementation. Figure 2 compares the participants' mean scores at two collection points.

Figure 2

Comparison of the Pre- and Post-Education Test Scores



The participants' mean test scores were compared using a paired *t*-test to examine if the education session improved the participants' knowledge of CKD screening and management. This parametrical statistical test was appropriate because the data met all the test assumptions. The pre-and post-implementation education test scores were normally distributed ($p = 0.520$ and $p = 0.187$, respectively). However, there was one outlier in the post-implementation education test scores. Outliers can result in overestimating or underestimating the mean and standard deviation (Kwan & Kim, 2017). Hence, the outlier was adjusted using the Winsorization. In this approach, the outlier value was replaced with the second smallest value, excluding the value of the outlier (Kwan & Kim, 2017). After adjusting the outlier, the post-implementation data was again checked for normality. The data were still normally distributed, $p = 0.280$. The paired *t*-test revealed a significant mean difference between the pre- and post-education test scores, $t(16) = -10.74$, $p < 0.001$. On average, the post-education test scores were 3.82 ($SD = 1.47$, 95% CI [-4.57, -3.07]) higher than the pre-education test scores. The result of the analysis is shown in Table 2.

Table 2

Paired t-test Result for Pre- and Post-Education Test Scores

	Pre-education		Post-education				
Outcome	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
Education test	8.47	2.65	12.29	1.49	-10.74	16	<.001

n = 17

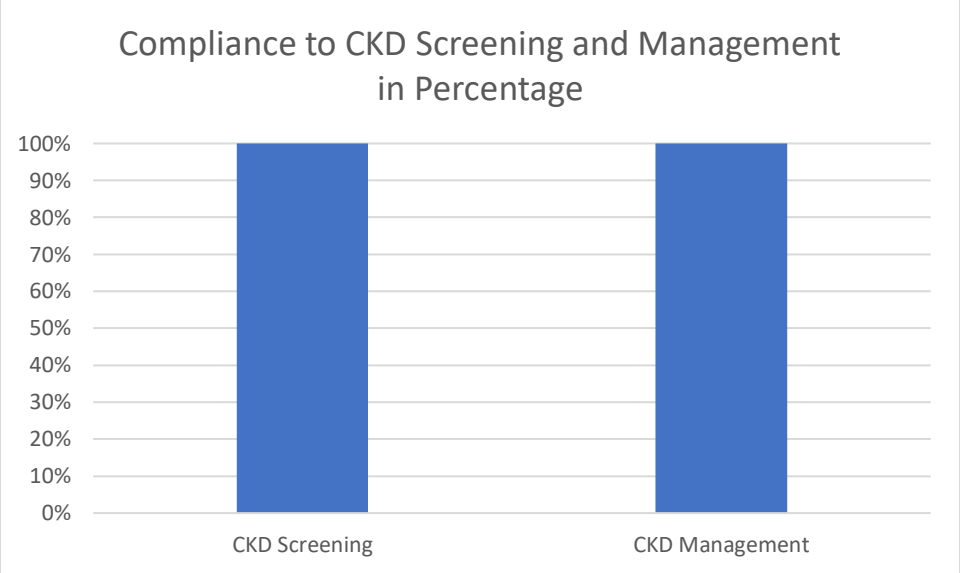
Chart Audit

A chart audit via Practice Fusion determined the participants' compliance with CKD screening and CKD management. The chart audit revealed that all the participants complied with

the new CKD screening and management. The audited charts showed all participants had at least one CPT code for CKD screening and CKD management. Figure 3 shows the CKD screening and CKD management compliance rate.

Figure 3

Participant Compliance to the New CKD Screening and Management Protocol



Discussion

This quality improvement project noted that among homecare providers, a nurse-led early CKD screening and management protocol improved provider knowledge of CKD and promoted early identification and treatment among high-risk groups over four weeks compared to the current practice of no protocol. This project observed the education session improved the participants' knowledge about CKD screening and management based on a significant 3.82 mean increase in the test scores post-intervention. The results also noted a clinical significance of a 10.32% increase in total CPT codes billed for CKD screening and 10.10% for CKD management at post-implementation. Finally, the education sessions improved providers' compliance with the new CKD screening and management protocol. All participants had at least one CPT code for

CKD screening and CKD management, translating to a 100% compliance rate. All these findings support the KDIGO recommendation that improving CKD screening and management uptake in healthcare facilities warrants educating the providers (Shilpak et al., 2021). A systematic study by Curran et al. (2021) also identified instructions on how to provide an effective intervention in promoting behavioral change. In this project, the instructions on how to implement CKD screening and management was discussed as an education session during a lunch and learn meeting.

This project also involved the creation of an evidence-based CKD screening and management protocol, which was disseminated as a PowerPoint presentation to 17 participants in a home health agency. Further, the project manager printed a one-page leaflet showing the CKD screening and management protocol workflow. The approaches utilized in this project were consistent with Travagim et al.'s (2016) and Shilpak et al.'s (2021) recommendations of creating simplified guides to facilitate the implementation of CKD screening and management among primary care providers.

Significance/Implications

Based on the positive findings of this project, the chief executive officer agreed to continue utilizing the protocol in the organization. The protocol will be integrated into the organization's annual training course and onboarding process. By sustaining the practice change, the new CKD screening and management protocol within the project site could potentially save lives and reduce healthcare costs by preventing CKD progression among high-risk patients in the facility. Current evidence posits that early CKD screening and treatment are pivotal in preventing CKD progression into ESRD, which is linked with increased healthcare costs and mortality (Bansal et al., 2020). ESRD costs about $34.3 billion per year (Ozieh et al., 2017). In addition,

individuals aged 40 to 44 years old diagnosed with ESRD are more likely to die 25 to 30 years earlier than their no ESRD counterparts (US Renal Data System, 2020).

Moreover, the chief executive officer supported the recommendation that the project's impact is monitored regularly to encourage compliance with the new CKD screening and management protocol. For that reason, the organization will continue to track the billing summary of CKD screening and CKD management every month and the provider compliance through a yearly chart audit. The organization will also administer pre- and post-education tests to determine the providers' knowledge of updated information during the annual training course and onboarding process. According to Curran et al. (2021), feedback on behavior and goal setting effectively reinforces behavioral change.

The project also has significant nursing implications. It showed that DNP-prepared nurses are sufficiently equipped to lead an evidence-based project and improve a significant health problem among the elderly. The project also contributes to the body of knowledge regarding the benefits of educating providers in enhancing the early CKD screening and management protocol implementation (Curran et al., 2021; Shilpak et al., 2021). Thus, the project can guide other home health agencies wanting to introduce early CKD screening and management in their facility. The project also serves as a foundation for future quality improvement projects on CKD in the organization. Further, this project adds proof that translation of KDIGO guidelines is feasible in real-world practice. Finally, this project can jumpstart future research studies that would examine if early CKD screening and management can reduce CKD-related morbidity, mortality, and healthcare costs.

Limitations of the Project

The DNP project has inherent limitations that may affect the findings' generalizability. The project has limitations in its design, data recruitment, and collection methods. The subsequent section further describes these limitations.

Project Design

The project was conducted in one single home health agency that serves predominantly elderly patients. Hence, the results may differ in other home health agencies that work with a more diverse age group. In addition, the project was only implemented for five weeks, and the long-term impacts of the new protocol were not determined.

The implementation also involved educating the participants about the CKD screening and management. The education session was done face-to-face and as a one-time education session. The project did not explore the effects of the education session delivered as a recorded webinar. This option may benefit home health agencies where it is difficult to gather all providers in one venue.

Data Recruitment

The project lead decided to collect data to measure the participants' knowledge before and after an educational session. Perhaps administering the post-test in week five at the end of project implementation would have provided a different measurement of knowledge acquisition. Also, the project did not measure the participants' satisfaction with the new protocol, which could help identify factors that may affect participants' continuous compliance. Additionally, data that measured the costs of diagnosing CKD before project implementation was only collected for four weeks. This data snapshot may not represent all the revenue lost over the year based on the average admission of patients diagnosed with CKD.

Data Collection Methods

The project only collected data on patients admitted during the implementation period and one-month pre-implementation. Therefore, the data may not represent the average annual data in the organization. Nevertheless, the data was collected based on the Health Insurance Portability and Accountability Act of 1996 (HIPAA) guideline. Any data containing patient health information was not collected in the project.

Dissemination Plan

A PowerPoint presentation discussing the project's results will be performed to showcase the project's success and encourage continuous participant commitment. The target population in this dissemination activity is the home health agency administrators and participants. Another target population is nurses at all levels working with patients at high risk for CKD. This audience will be reached by presenting the project to TUN faculty and fellow peers as a PowerPoint presentation. A poster will also be submitted at the TUN Research Day 2023, and the manuscript will be forwarded to the DNP repository. Additionally, an abstract will be presented at the annual national symposium of the American Nephrology Nurses Association in 2023. The project lead will also submit the manuscript to The Nurse Practitioner Journal for publication.

Project Sustainability

The positive results of the initial project persuaded the facility's Chief Executive Officer (CEO) to support the continuous implementation of the CKD screening and management. It was agreed that the protocol would be taught to all providers during the annual training courses and onboarding process. A pre- and post-education test will be administered to monitor the primary care providers' level of knowledge of the protocol. There will also be ongoing monthly reporting on CKD screening and management of CPT billing summary and yearly provider compliance to

the protocol. In addition, the project lead will serve as a protocol consultant at the practice site and will provide updated material on the protocol and monitor new EBP on CKD screening and management.

Conclusion

The nurse-led CKD screening and management protocol was implemented successfully in a home health agency in San Bernardino, California. As a result, the participants had enhanced knowledge of the CKD screening and management. The translation of the KDIGO guidelines into a protocol also increased the billing of CKD screening and management procedures. The project also resulted in 100% compliance among the providers. Because of the promising results, and endorsement by the CEO, the project will continue to be implemented at the project site. This project could potentially save lives and reduce healthcare costs through CKD screening among high-risk patients in the facility.

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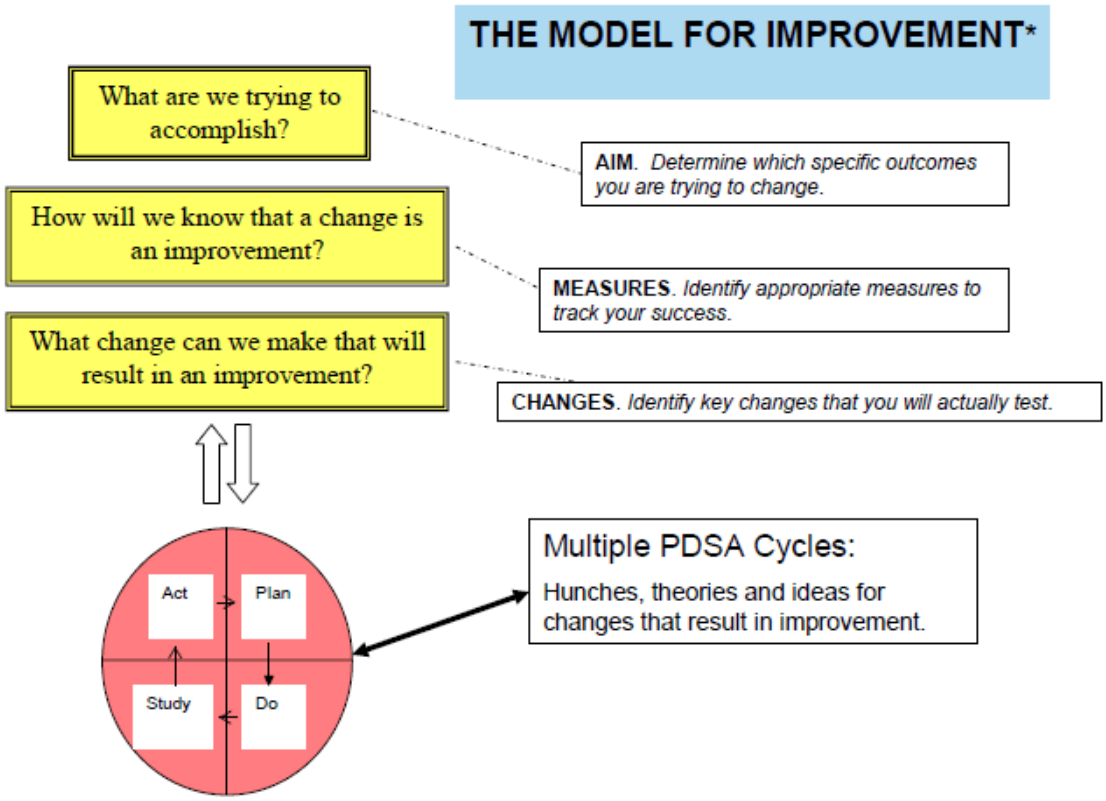
Appendix A

The Model for Improvement



Source: Agency for Healthcare Research and Quality. Module 4. Approaches to Quality Improvement. 2012.

Appendix B

Permission Letter

Prompt Healthcare Inc, A Medical Corporation
1300 Valley Vista Dr.Suite #102
Diamond Bar CA 91765

Touro University Nevada
874 American Pacific Dr.#8801
Henderson, Nevada 89014

November 2, 2021

To whom it may concern:

This letter is to inform you that Prompt Healthcare Medical Corporation is aware that Cynthia Cruz-Porto, a student of Touro University Nevada with the course of Doctorate in Nursing Practice, will be conducting a DNP Project at our facility.

We will help her gain access to practicum experience at our facility. An affiliation agreement is not necessary. We will be supporting her throughout the entire program.

Sincerely,

Beverly Chiong
Chief Executive officer

Appendix C

Links to the KDIGO Guidelines

https://www.kidney-international.org/article/S0085-2538(20)31210-2/fulltext

https://www.kidney-international.org/action/showPdf?pii=S0085-2538%2820%2930718-3

Appendix D

Chronic Kidney Disease (CKD) Screening and Management Protocol

Who: All CKD screening and management team members

Situation:

- CKD in its early stages is asymptomatic and may go unnoticed until its advanced stage (NIDDK, 2016).
- Detection and treatment in the early stage of CKD is instrumental in deterring progression to end-stage renal disease.
- CKD has no cure. CKD 1 can gradually progress to kidney failure or end-stage renal disease and death. In the most advanced stage (CKD 5), only dialysis and kidney transplant can prolong the life of patients.
- The project site does not include CKD screening and management as a routine intervention. Hence, a creating a CKD screening and management protocol is required.
- This document applies to all personnel who work directly and indirectly with elderly patients 60 years old and above.
- This document contains the protocol in screening eligible patients for CKD and managing patients who have CKD stages 1 to 5.
- This document was drafted using the KDIGO guidelines on CKD screening and management.

I. CKD Screening Protocol

A. All patients diagnosed with hypertension and/or diabetes are eligible to be screened for CKD annually.

- The initial CKD screening tests are serum creatinine, cystatin C with eGFR, and urine albumin to creatine ratio (UACR). Serum creatinine and cystatin C with eGFR measure glomerular filtration rate. UACR detects albuminuria.
- All patients with an eGFR of <60 ml/min/1.73 m^2, ACR $\geq$ 30 mg/g (3 mg/mmol), and markers of kidney disease for at least three months must be risk stratified for CKD stage. On the other hand, patients who does not meet the abovementioned criteria, should be evaluated annually for CKD.
- All providers will use the following criteria for risk stratification of CKD stages:
    - eGFR category
        - G1 (normal or high): $\geq$ 90 ml/min/1.73 m^2
        - G2 (mildly decreased): 60-89 ml/min/1.73 m^2
        - G3a (mildly to moderately decreased): 45-59 ml/min/1.73 m^2
        - G3b (moderately to severely decreased): 30-44 ml/min/1.73 m^2
        - G4 (severely decreased): 15-29 ml/min/1.73 m^2
        - G5 (kidney failure): <15 ml/min/1.73 m^2
    - Albuminuria category
        - A1 (normal to mildly increased): <30 mg/g
        - A2 (moderately increased): 30-300 mg/g or 3-30 mg/mmol
        - A3 (severely increased): >300 mg/g or >30 mg/mmol

B. All patients diagnosed with CKD must be monitored using eGFR and UACR every month.

II. CKD Management

A. Patient Safety

- eGFR <60: Adjust dosage of all prescribed medications based on eGFR, avoid dual ACEI and ARB blockade, withhold ACEIs or ARB before and after contrast use.
- eGFR 45-59: Avoid prolonged use of NSAIDs.
- eGFR 30-44: Avoid prolonged use of NSAIDs and use for metformin with close monitoring at 50% dose.
- eGFR <30: Avoid any NSAIDs, bisphosphonates, metformin, and PICC lines. Monitor PT-INR if on warfarin.

B. Slowing CKD Progression

1. Medication Management

- **Hypertension**
  - ACEI or ARB if ACR $\geq$ 30 mg/g or 3 mg/mmol
  - Loop diuretics (furosemide)
- **Type 2 diabetes**
  - HbA1c target <6.5% to <8.0%
  - eGFR $\geq$30: Use a sodium-glucose cotransporter-2 (SGLT2) inhibitor (empagliflozine), or metformin. If the glycemic target remains unmet, a glucagon-like peptide-1 receptor agonist (GLP-1 RA) must be added to the oral hypoglycemic treatment

2. Nutrition Therapy

- Hypertension

- Dietary sodium <2000 mg/d

- Diabetes
  - A diet high in fruits, vegetables, legumes, grains, fish, and unsaturated fats and nuts; lower in processed meats, refined carbohydrates, and sweetened drinks (i.e., Mediterranean diet)
  - Protein intake of 0.8 g/kg (weight)/day for patients not treated with dialysis
  - Dietary sodium < 2g per day
- All patients
- Involve a registered dietitian nutritionist or its international equivalent partner in providing medical nutrition therapy to patients with CKD

3. Lifestyle modification

- Abstain from smoking and using tobacco products.
- Exercise regularly and engage in moderate-intensity physical activity for at least 150 minutes per week based on their cardiovascular and physical tolerance.
- Influenza vaccination
- Pneumococcal vaccination and hepatitis B vaccination in CKD G4-G5
- Screen for hepatitis C

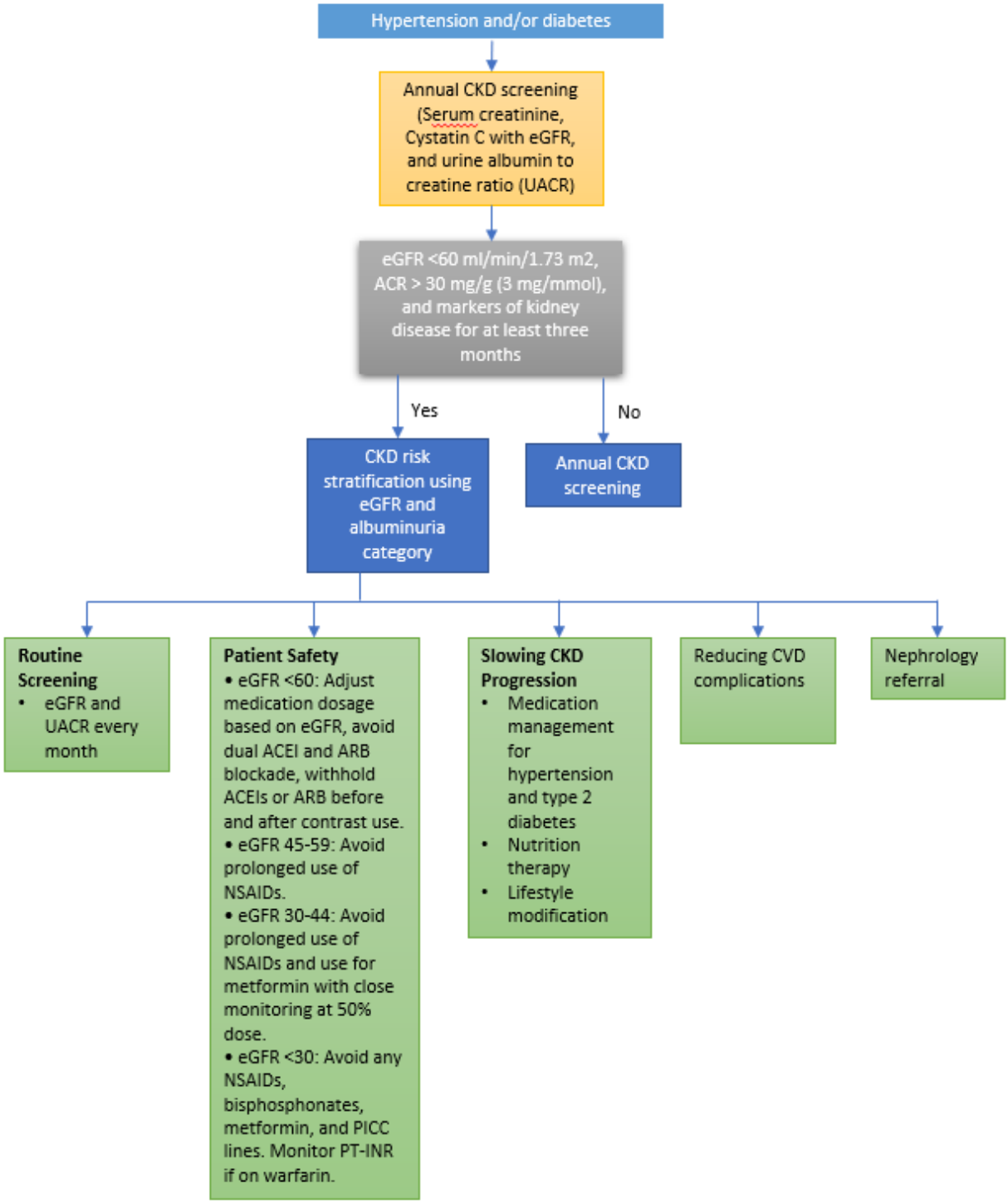
C. Reducing CVD Complications

- BP target of <130/80 mm Hg for patients with kidney transplant
- CKD and $\geq$ 50 years, start statin
- Aspirin unless bleeding risk outweighs benefits

D. Nephrology Referral

- Acute kidney injury or sudden sustained fall in GFR
- eGFR o< 30 ml/min/1.73 m2
- Persistent ACR of more than 300 mg/g or 30 mg/mmol,
- CKD progression
- Urinary red blood cells > 20 per high power field
- CKD and hypertension unresponsive to the treatment of at least four antihypertensive agents
- Chronic abnormalities of serum potassium
- Recurrent or severe nephrolithiasis
- Hereditary kidney disease

E. Flow Chart


Hypertension and/or diabetes
Annual CKD screening (Serum creatinine, Cystatin C with eGFR, and urine albumin to creatine ratio (UACR)
eGFR <60 ml/min/1.73 m2, ACR > 30 mg/g (3 mg/mmol), and markers of kidney disease for at least three months
Yes
No
CKD risk stratification using eGFR and albuminuria category
Annual CKD screening
Routine Screening
• eGFR and UACR every month
Patient Safety
• eGFR <60: Adjust medication dosage based on eGFR, avoid dual ACEI and ARB blockade, withhold ACEIs or ARB before and after contrast use.
• eGFR 45-59: Avoid prolonged use of NSAIDs.
• eGFR 30-44: Avoid prolonged use of NSAIDs and use for metformin with close monitoring at 50% dose.
• eGFR <30: Avoid any NSAIDs, bisphosphonates, metformin, and PICC lines. Monitor PT-INR if on warfarin.
Slowing CKD Progression
• Medication management for hypertension and type 2 diabetes
• Nutrition therapy
• Lifestyle modification
Reducing CVD complications
Nephrology referral

Appendix E

Education PowerPoint

Chronic Kidney Disease (CKD) Screening and Management

Cynthia Cruz Porto, MSN, FNP-C
Touro university Nevada
Doctor of Nursing Practice Student

1

CKD

Kidney damage or an estimated glomerular filtration rate (eGFR) of less than 60 mL/min per 1.73 square meters for at least three months

(Vaidya & Aeddula, 2021)

2

CKD Pathophysiology

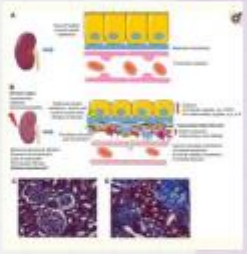


Image Source: Mullins et al., 2016

3

Complications of CKD

- Progressive loss of kidney function over time
- Early-stage CKD and end-stage renal disease (ESRD) = Increased morbidity and health care utilization
- CKD = Increased hospitalization and cardiovascular diseases
- ESRD = Increased mortality from cardiovascular disease

(Mullins et al., 2016)
(Vaidya & Aeddula, 2021)

4

CKD Screening and Management Team

- Beverly Chiong (CEO)
- Project lead
- All nurse practitioners, physicians, and physician assistants
- Nutritionist
- Nurses

5

Miscellaneous

- Address all questions or suggestions regarding the protocols to the project lead.
- The protocol can be accessed through the following websites - https://kdigo.org/wp-content/uploads/2020/10/KDIGO-2020-Diabetes-in-CKD-GL.pdf and https://www.kidney-international.org/article/S0085-2538(20)31210-2/fulltext

6

The Protocol

7

WHO

All chronic kidney disease (CDK) screening and management team members

8

Situation

- Early stages of CKD is asymptomatic.
- Detection and treatment in the early stage of CKD can deter progress to end-stage renal disease.
- CKD has no cure.
- In the most advanced stage (CKD 5), only dialysis and kidney transplant can prolong the life of patients.

9

Situation

The project site does have an existing CKD screening and management protocol.

The Kidney Disease Improving Global Outcomes (KDIGO) guidelines were used as framework in creating the protocol.

Applies to all personnel who work directly and indirectly with elderly patients 60 years old and above

Contents: (1) CKD screening, (2) CKD management, (3) CKD screening and management team members and roles , and (4) miscellaneous notes.

10

CKD Screening Protocol

Eligible patients: Patients with hypertension and/or diabetes

Initial screening tests:

1. Serum creatinine
2. Cystatin C with eGRF
3. Urine albumin to creatine ratio (UACR)

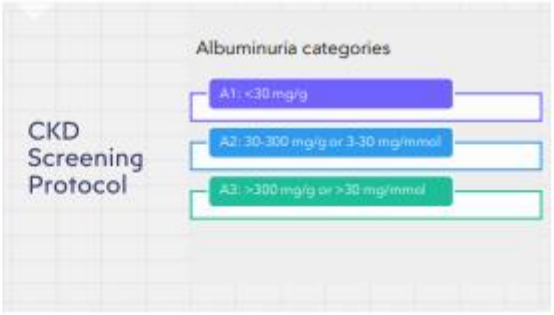
11

CKD Screening Protocol

With CKD	No CKD
• eGFR of <60 ml/min/1.73 m2 • ACR > 30 mg/g (3 mg/mmol) • Markers of kidney disease • At least three months • For risk stratification	• Does not meet the CKD criteria • Periodic evaluation for CKD

12

13



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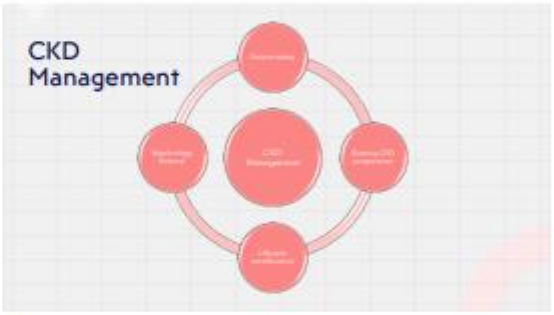

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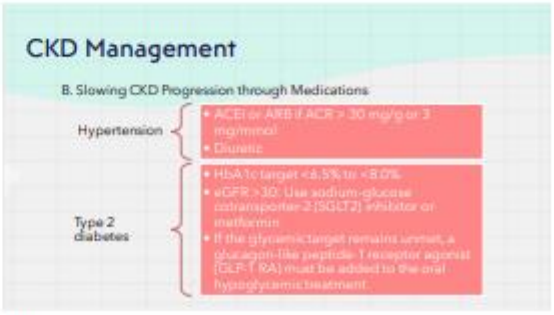

18

CKD Management

C. Slowing CKD Progression through Nutrition Therapy

19

CKD Management

C. Slowing CKD Progression through Lifestyle Modification

- Abstain from smoking and using tobacco products
- Exercise regularly and engage in moderate-intensity physical activity for at least 150 minutes per week based on their cardiovascular and physical tolerance
- Influenza vaccination
- Pneumococcal vaccination and hepatitis B vaccination in CKD G4-G5
- Screen for hepatitis C

20

CKD Management

C. Reducing Cardiovascular Complications

BP target of <130/80 mm Hg for patients with kidney transplant
CKD and > 50 years, start statin
Aspirin unless bleeding risk outweighs benefits

21

CKD Management

D. Nephrology Referral

22

Flow Chart of the Protocol

23

References

Mullins, L. J., Conway, B. R., Menzies, R. I., Denby, L., & Mullins, J. J. (2016). Renal disease pathophysiology and treatment: contributions from the rat. Disease Models & Mechanisms, 9(12), 1419–1433. https://doi.org/10.1242/dmm.027276

Vaidya, S. R. & Aeddula, N. R. (2021) Chronic renal failure. In StatPearls [Internet]. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK535404/

24

Appendix F

CKD Screening and Management Education Test

Name: _____ Date: _____

Please encircle the correct answer.

1. Which of the following elderly patients will be eligible for an early CKD screening?

a. A 77-year-old male with a known history of hypertension and diabetes

b. A 68-year-old female with a known history of hepatitis B and cigarette smoking

c. An 80-year-old male who is a known of BPH and recurrent UTI

d. All of the above

2. What are the recommended tests for CKD screening?

a. Urinary albumin-creatine ratio

b. Urinary albumin-creatine ratio and serum creatine

c. Urinary albumin-creatine ratio, serum creatine, and cystatin C

d. Urinary albumin-creatine ratio, serum creatine, cystatin C, and urea/blood urea nitrogen

3. A patient with an eGFR of 70 ml/min/1.73 m2 belongs to what CKD stage?

a. G1: Normal or high

b. G2: Mildly decreased

c. G4: Severely decreased

d. G5: Kidney failure

4. A patient with an eGFR of 15 ml/min/1.73 m2 belongs to what CKD stage?

a. G1: Normal or high

b. G2: Mildly decreased

c. G3: Mildly to moderately decreased

d. G4: Severely decreased

5. A patient with an eGFR of 22 ml/min/1.73 m2 belongs to what CKD stage?

a. G1: Normal or high

b. G2: Mildly decreased

c. G3: Mildly to moderately decreased

d. G4: Severely decreased

6. A patient with an ACR of 42 mg/g belongs to what CKD risk?

a. Normal

b. Mild risk

c. Moderate risk

d. Severe risk

7. A patient with an ACR of 108 mg/g belongs to what CKD risk?

a. Normal

b. Mild risk

c. Moderate risk

d. Severe risk

8. For a patient with an eGFR of 54 ml/min/1.73 m2, which of the following medications should be avoided?

a. Bisphosphonates

b. NSAIDs

c. Sulfides

d. Macrolides

9. For a patient with known hypertension and has an ACR of 30 mg/g, what are the recommended treatments to delay CKD progression?

a. ARB, diuretic, and no dietary restriction

b. ARB, diuretic, and limit salt intake to <2000 mg/day

c. Dual ACEi and ARB blockade, diuretic, and no dietary restriction

d. Dual ACEi and ARB blockade, diuretic, and limit salt intake to <2000 mg/day

10. For a patient with type 2 diabetes and has an eGFR of 36 ml/min/1.73 m^2, what are the recommended treatments to delay CKD progression?

a. GLP1-RA only

b. Metformin only

c. SGLT2 inhibitor only

d. Metformin and SGLT2 inhibitor

11. A female patient was recently diagnosed with CKD G4. She is interested in getting a COVID-19 vaccination as advised by her son. What other vaccines would you recommend for this patient?

a. Rotavirus vaccine, DPT vaccine, hepatitis B vaccine, and hepatitis C vaccines

b. Tetanus shot, pneumonia vaccine, hepatitis B vaccine, and hepatitis C vaccine

c. MMR vaccine, pneumonia vaccine, hepatitis B vaccine, and flu shot

d. Pneumonia vaccine, hepatitis B vaccine, and flu vaccine

12. For a male patient with known hypertension and post-kidney transplant, what is the blood pressure target?

a. < 120/80 mm Hg

b. <120/90 mm Hg

c. < 130/80 mm Hg

d. < 130/90 mm Hg

13. A 76-year-old female with known hypertension has an eGFR of 43 ml/min/1.73 m^2. She is currently being treated for hypertension. What other medications would you prescribe for her to reduce cardiovascular complications?

a. Statin only

b. Aspirin only

c. Metformin only

d. Statin and aspirin if without bleeding risk

14. Which of the following elderly patients must be referred to a nephrologist?

a. An 85-year-old female with persistently low serum potassium

b. A 65-year-old female with a history of acute kidney injury

c. A 90-year-old male with CKD and hypertension unresponsive to at least two antihypertensive agents

d. A 78-year-old male with of 53 ml/min/1.73 m2

15. Which of the following elderly patients should also be referred to a nephrologist?

a. A 73-year-old female with persistently low serum magnesium

b. A 81-year-old female with an extensive nephrolithiasis

c. A 66-year-old male with urinary red cell casts of 10 per high-power field

d. A 94-year-old male with of ACR 30 mg/g

Appendix G

Content Validity Index (CVI)

Item	Expert 1 (Dr. Tracey Johnson Glover)	Expert 2 (Dr. Denise Zabriskie)	Expert 3 (Dr. Pedro Morante, Jr.)	Mean
1	4	4	4	1
2	4	4	4	1
3	4	4	4	1
4	4	4	4	1
5	4	4	4	1
6	4	4	4	1
7	4	4	4	1
8	4	4	4	1
9	4	4	4	1
10	4	4	4	1
11	2	2	4	-0.33
12	3	3	4	1
13	3	3	4	1
14	4	4	4	1
15	4	4	4	1

The CKD screening and management education test was evaluated by three experts using a four-point scale relevance. Each item was computed as the number of experts giving a rating of 3 or 4 divided by the number of experts. The content validity index formula is as follows:

CVR = [(E - (N/2)/(N/2)] with E as the number of experts who rated the item as moderately relevant or highly relevant and N as the total number of experts. The mean total scores for each item determined the item's relevance.

The calculation is as follows:

a. For all items except item 12

CVR = [(3- (3/2)/(3/2)]

CVR = [3- (1.5)/1.5)]

CVR = 1.5/1.5

CVR = 1

b. For item 12

CVR = [(1- (3/2)/(3/2)]

CVR = [1- (1.5)/1.5)]

CVR = -0.5/1.5

CVR = -0.33

Appendix H

Chart Audit

Provider's Name: _____ Date: _____

Indicators	Answer
Documentation of a CKD screening for a high-risk patient	Yes ___ No ___
Documentation of a CKD management for a patient diagnosed with CKD	Yes ___ No ___

Appendix I

Billing Summary Report

Date: _____

Indicators	Total Number of CPT Codes
Billed initial screening of CKD CPT codes	
Billed CKD management CPT codes	