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EDUCATIONAL INTERVENTION ON KNOWLEDGE OF MANAGEMENT OF PATIENTS WITH CHRONIC KIDNEY DISEASE AMONG NURSES IN SECONDARY HEALTHCARE FACILITIES IN OSUN STATE

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Abstract

Chronic kidney disease prevalence is rising globally and poses a higher burden on the healthcare system. Good knowledge of chronic kidney disease management was reported to increase nurses' competence and improve patient outcomes. This study assessed the effect of an educational intervention on knowledge of management of patients with chronic kidney disease among nurses in secondary healthcare facilities in Osun State. The study adopted a quasi-experimental design, using a pretest-posttest method. Nurses (175) in secondary healthcare facilities in Osun State were purposively selected for the study. Samples were 135 nurses who gave consent and were gathered in one group from the nine (9) State and five (5) General hospitals for the study. A pre-intervention, post intervention and six weeks post-intervention data were assessed among nurses using a structured questionnaire. Data analysis employed descriptive and inferential statistics. Necessary ethical standards and approvals were followed. Findings showed significant improvement across multiple domains of CKD knowledge. At baseline, the overall mean score for CKD management knowledge was 14.40 ± 3.43, which increased to 19.01 ± 3.51 immediately after the intervention and further improved to 20.46 ± 2.84 six weeks post-intervention. ANOVA showed a significant effect of the intervention (F (1.88) = 58.801, $p < .001$) with a large effect size (η^2=.305), indicating that 30.5% of the variance in general knowledge scores was attributable to the intervention. The intervention also revealed a very large effect size ($\eta^2 = .468$), indicating that nearly 47% of the variance in CKD management knowledge scores could be attributed to the intervention. The educational intervention showed significant effect on knowledge of management of chronic kidney disease among study participants. Regular continuing education programs on management of chronic kidney disease for nurses may inform better CKD care outcomes.

Keywords: Chronic kidney disease, Educational intervention, Knowledge of CKD, Management of patients with CKD, Nurses

Introduction

Early identification, diagnosis, and effective management of risk factors associated with chronic kidney disease (CKD) are crucial strategies for achieving positive care outcomes in affected patients. CKD is a progressive condition, defined by an estimated glomerular filtration rate (eGFR) of less than 60ml/min/1.73m² or persistent albuminuria for over three months, irrespective of the underlying cause (Ulasi et al., 2023). The disruption of kidney function significantly increases the risk of morbidity and premature mortality, often due to cardiovascular complications, as highlighted by the Global Burden of Disease (GBD, 2019). CKD is rapidly becoming a global public health concern, affecting approximately 10-16% of the population and imposing severe consequences on healthcare expenditures, quality of life, and years of life lost (Kovesdy, 2020). Adequate knowledge of CKD management is essential in mitigating its growing prevalence and associated burden (Kovesdy, 2020; Ulasi et al., 2023).

Management strategies for CKD are primarily directed at treating the underlying conditions, including hypertension, cardiovascular diseases, and diabetes. Knowledge and awareness among patients and healthcare workers play a significant role in the successful implementation of CKD management programs (Ahmed et al., 2018). Nurse-led interactive and multidimensional educational interventions have been shown to enhance patient knowledge, self-management, and overall health outcomes (Ayat Ali et al., 2021). Healthcare providers' knowledge of CKD risk factors such as diabetes and hypertension are instrumental in preventing or delaying disease progression (Ulasi et al., 2023). CKD prevention programs focus on raising awareness about modifiable risk factors, offering health education, and building the capacities of both patients and healthcare professionals for early detection and treatment. However, a significant challenge in CKD control is the low level of public awareness and insufficient knowledge among healthcare providers (Alobaidi, 2021).

Nurses play a vital role in disease prevention, early detection, and management, serving as the first point of contact for individuals requiring healthcare services (Gapira et al., 2020). Given their crucial role, it is imperative for nurses to possess comprehensive knowledge of CKD and its management to deliver effective care to at-risk populations. Specialist nephrology nurses work primarily with patients in stages 4 and 5 of CKD. However, the global shortage of nephrology nurses, exacerbated by the COVID-19 pandemic and projected to reach 900,000 by 2030,

particularly in primary and secondary healthcare settings in developing countries, underscores the necessity of enhancing non-nephrology nurses' knowledge of CKD detection, management, and prevention (Briggs et al., 2023).

Improving patient knowledge significantly enhances self-management and disease prognosis. Poor healthcare provider knowledge, particularly among nurses, contributes to delayed diagnosis, suboptimal management outcomes, accelerated disease progression, and increased mortality (Okoro et al., 2020). Therefore, strengthening nurses' capacity in CKD management through targeted educational programs is imperative (Gapira et al., 2020; Hernandez, 2019). Adequate knowledge of CKD management guidelines among healthcare professionals facilitates early detection, improved management outcomes, and a reduced likelihood of progression to end-stage renal disease (ESRD), thereby lowering the risk of cardiovascular complications and premature deaths (KDIGO).

Nurse-led management programs have been demonstrated to yield positive outcomes in CKD patients, reducing avoidable hospital readmissions, improving overall health status, and decreasing healthcare costs (Stolpe et al., 2021). Studies indicate that nurse-led educational interventions effectively enhance non-nephrology nurses' knowledge and skills in managing hypertension, diabetes, and CKD (Kovesdy, 2020). According to Shobha et al. (2023), pretest knowledge scores among nurses increased from 40.42 to 62.52, with standard deviations shifting from ±4.09 to ±4.29 in posttest assessments, demonstrating the efficacy of nurse-led educational interventions in CKD management. Similarly, a study by Ahmed et al. (2022) revealed that 51.5% of respondents lacked knowledge about CKD medications, while 62.4% (n = 292) were unaware of nephrotoxic drugs that could impair kidney function.

Findings indicate that nurses' knowledge of chronic kidney disease (CKD) management is generally low, particularly among non-nephrology nurses in both developed and developing countries. Studies have reported significant deficiencies in CKD-related knowledge, including disease definition, staging, risk factors, nephrotoxic medications, and management strategies (Adejumo et al., 2019). In Nigeria, only 6% of nurses assessed had good knowledge of CKD (Adejumo et al., 2019), while in Rwanda, only 17.6% of nurses had adequate knowledge of CKD dietary management (Gapira et al., 2020). Similarly, a study in Tanzania reported that only 13%

of nurses demonstrated good knowledge of CKD (Stanifer et al., 2016), and in Saudi Arabia, only 27.3% of 440 participants exhibited sufficient understanding (Assiry et al., 2022).

Poor knowledge among nurses is concerning, as they are the primary healthcare providers in CKD management and are responsible for patient education, symptom monitoring, and treatment adherence. Nurses' knowledge directly influences the quality of care, patient outcomes, and hospital admission rates (Borg et al., 2023). Mismanagement accelerates disease progression to end-stage renal disease (ESRD), increases morbidity and mortality, and places a financial and emotional burden on patients and healthcare systems (Gapira et al., 2020). Effective CKD management involves comprehensive interventions, including blood pressure and glycaemic control, dietary management, medication adherence, and patient education on self-care and lifestyle modifications (KDIGO, 2012; Okoro et al., 2020). Interventions aimed at improving nurses' knowledge have yielded positive results. Hernandez (2019) found that pretest-posttest educational interventions significantly improved nurses' knowledge, supporting the need for structured training programs. Mignott (2022) reported that nurses who attended a four-hour CKD seminar showed significant improvement in memory recall, with posttest scores rising from 46.76% to 59.38%. Similarly, a nurse-led management programme was found to reduce hospital readmissions, improve health status, and lower care costs for CKD patients (Savini et al., 2021).

Educational interventions significantly enhance nurses' knowledge, patient interaction, performance, and decision-making in chronic kidney disease (CKD) management (Tariq et al., 2022). Effective teaching strategies, including self-study modules, discussions, and web-based training, improve nurses' competence and sustain positive outcomes for up to a year. Despite the benefits, nurses often lack adequate in-service training, necessitating structured educational programmes to enhance care quality (Gapira et al., 2020). Multidisciplinary approaches, particularly involving pharmacists, contribute to better clinical outcomes such as improved blood pressure control, reduced cardiovascular risk, and increased medication adherence. However, significant variability exists among trials, with evidence quality ranging from low to moderate. Nonetheless, interdisciplinary interventions are crucial for improving patient outcomes in CKD management.

CKD disrupts multiple physiological functions, necessitating continuous monitoring of blood urea, electrolytes, and haemoglobin to alleviate symptoms and slow progression (Naber &

Purohit, 2021). However, self-reported confidence among primary care professionals in CKD management remains low, reinforcing the need for evidence-based training to enhance nurses' competence. This study aimed to bridge the gap in literature to assess the effect of an educational intervention for improving knowledge of management of chronic kidney disease among nurses in secondary healthcare facilities in Osun State. The specific objectives are to assess the mean score of pre- and post-intervention knowledge of chronic kidney disease (CKD) among nurses in secondary healthcare facilities in Osun State and to evaluate the mean score of pre- and post-intervention knowledge of nursing management of CKD among these nurses.

Two research hypotheses were formulated for this study.

H_o1: There is no significant difference between the pre - and post-intervention knowledge of CKD among nurses in secondary healthcare facilities in Osun State Nigeria.

H_o2: There is no significant difference between the pre - and post-intervention knowledge of nursing management of CKD among nurses in secondary healthcare facilities in Osun State Nigeria.

Methodology

This study employed a quasi-experimental design using a pretest-posttest method to assess the effectiveness of an educational intervention on nurses' knowledge of chronic kidney disease (CKD) management. The study was conducted among registered nurses working in secondary healthcare facilities in Osun State, Nigeria. The total population consisted of 175 nurses across nine State hospitals and five General hospitals under the Osun State Hospitals Management Board. The inclusion criteria encompassed registered nurses employed in these hospitals who were available and consented to participate. Nurses on leave or those who declined participation were excluded. A total enumeration sampling technique was used, considering the relatively small population size. This approach, supported by Ballance (2023) and Marjah (2018), ensures the study captures data from all eligible individuals within the target group. The method is particularly useful for finite populations with unique characteristics, such as nurses registered with the Nursing and Midwifery Council of Nigeria. Although 175 nurses were eligible, only 135 met the inclusion criteria and participated in the study. The distribution of nurses across hospitals

varied, with the highest number (79 nurses, 45%) from State Hospital, Osogbo, while the lowest (one nurse, 1%) was from State Hospitals in Ipetu Ijesa and Ifetedo.

The study utilised a self-structured questionnaire developed from an extensive literature review and validated by the researcher's supervisor and experts in Medical-Surgical Nursing. The questionnaire comprised three sections. Section A collected sociodemographic data, including gender, age, experience, educational level, cadre, and nephrology seminar/training experience, using nominal responses. Section B assessed CKD knowledge through 30 true-or-false questions covering definition, epidemiology, causes, risk factors, stages, clinical features, treatment, and complications. Each correct response earned one point, with a maximum score of 30. Knowledge levels were categorized as good (23–30 points; 75–100%), fair (15–22 points; 50–74%), and poor (<15 points; <50%). Section C evaluated knowledge of CKD nursing management, including monitoring, medications, dietary and fluid therapy, and complication management, through 10 true-or-false questions. Each correct answer earned one point, with a maximum score of 10. Scores of 8–10 (75–100%) indicated high knowledge, 5–7 (50–74%) represented average knowledge, and <5 (<50%) reflected low knowledge. The overall score summed all items, with higher scores indicating better knowledge.

The instrument's validity was assessed by academic and clinical experts who reviewed content relevance and difficulty. A pilot test was conducted in a secondary hospital in Oyo State to ensure reliability. The knowledge of CKD section had a Cronbach’s alpha of 0.771 (30 items), while the nursing management section had 0.864, indicating strong reliability. The pilot study population had similar characteristics to the main study sample but was excluded from the final study.

Data collection involved administering pre-test questionnaires (O1) to establish baseline knowledge, followed by an educational intervention using PowerPoint presentations and physical demonstrations (X). Post-test questionnaires were administered immediately after the intervention (O2) and repeated six weeks later (O3) to measure knowledge retention. The entire study spanned 15 weeks, including ethical clearance, intervention, data collection, and analysis. Data analysis was conducted using IBM-SPSS version 25. Descriptive statistics, including frequency, percentages, mean scores, and standard deviations, summarised demographic data and research objectives. Inferential statistics, including paired t-tests and repeated measures ANOVA, were applied to compare pre-test, immediate post-test, and six-week post-test scores, testing

hypotheses at a 0.05 significance level. Ethical considerations were strictly adhered to. Ethical approval was obtained from the Osun State Hospitals Management Board/Ministry of Health (OSHREC/PRS/569T/787). Informed consent was secured from all participants, ensuring voluntary participation and the right to withdraw at any time. Confidentiality was maintained by anonymising data, coding questionnaires, and restricting access to collected data, ensuring participants' privacy and data security.

Results

Table 1: ***Sociodemographic Characteristics of Study Participants***

Variables	n (%)
Age-group (Years)	
20-29 years	34 (25.2)
30-39 years	52 (38.5)
40-49 years	29 (21.5)
50 years and above	20 (14.8)
Gender	
Male	37 (27.4)
Female	98 (72.6)
Education Level	
Diploma	19 (14.1)
Bachelor	89 (65.9)
Master	27 (20.0)
Years of nursing experience	
Less than 5 years	39 (28.9)
5-10 years	21 (15.6)
10-20 years	58 (43.0)
More than 20 years	17 (12.6)
Nursing Cadre	
Junior (Nursing Officer II and Nursing Officer I)	31 (23.0)
Intermediate (Senior Nursing Officer and Principal Nursing Officer)	33 (24.4)
Senior (Chief Nursing Officer and above)	71 (52.6)
Training/Seminar attendance on chronic disease care (last 3 years)	
Never	51 (37.8)
Once	47 (34.8)
Twice	20 (14.8)
Thrice	17 (12.6)

(Source: Field Survey, 2024)

Table 1 presents the sociodemographic characteristics of the participants. The age distribution revealed that the majority were between 30-39 years, comprising 52(38.5%) of participants. The sample was predominantly female, with 98(72.6%) participants. Regarding educational

qualifications, most nurses held bachelor's degrees at 89(65.9%). In terms of professional experience, the largest group had 10-20 years of nursing experience at 58(43.0%). The distribution of nursing cadres showed that senior positions (Chief Nursing Officer and above) dominated the sample at 71(52.6%). Concerning professional development, a significant portion of the nurses reported limited exposure to chronic disease care training. Specifically, 51(37.8%) had never attended such training in the past three years, while 47(34.8%) had attended once.

Table 2: ***Pre- and Post-Intervention General Knowledge of CKD among Nurses in Secondary Healthcare Facilities in Osun State***

Items	Preintervention		Post intervention		Six weeks post-test	
	Correct n(%)	Incorrect n(%)	Correct n(%)	Incorrect n(%)	Correct n(%)	Incorrect n(%)
Chronic kidney disease is defined as abnormalities of kidney structure or function, present for a minimum of three months, with implications for health. [TRUE]	130 (96.3)	5 (3.7)	127 (94.1)	8 (5.9)	132 (97.8)	3 (2.2)
Chronic kidney disease affects 10% of the global population. [TRUE]	120 (88.9)	15 (11.1)	131 (97.0)	4 (3.0)	133 (98.5)	2 (1.5)
The kidneys help in the production of blood. [TRUE]	75 (55.6)	60 (44.4)	105 (77.8)	30 (22.2)	110 (81.5)	25 (18.5)
The kidneys help to retain nitrogenous waste products of metabolism. [FALSE]	56 (41.5)	79 (58.5)	95 (70.4)	40 (29.6)	115 (85.2)	20 (14.8)
The kidneys help in the regulation of blood sugar level. [TRUE]	82 (60.7)	53 (39.3)	92 (68.1)	43 (31.9)	71 (52.6)	64 (47.4)
The kidneys secrete hormones for some bodily processes. [TRUE]	115 (85.2)	20 (14.8)	131 (97.0)	4 (3.0)	129 (95.6)	6 (4.4)
According to the National Kidney Foundation, chronic kidney disease is classified based on cause, Glomerular Filtration Rate (GFR) category (G1-G5), and Albuminuria category (A1-A3). [TRUE]	112 (83.0)	23 (17.0)	126 (93.3)	9 (6.7)	130 (96.3)	5 (3.7)
In the Glomerular Filtration Rate category, chronic kidney disease is classified into five (5) stages. [TRUE]	99 (73.3)	36 (26.7)	129 (95.6)	6 (4.4)	130 (96.3)	5 (3.7)
Chronic kidney disease is classified into three (3) stages using Albuminuria category. [TRUE]	106 (78.5)	29 (21.5)	119 (88.1)	16 (11.9)	122 (90.4)	13 (9.6)
Hypertension is a common cause of chronic kidney disease. [TRUE]	101 (74.8)	34 (25.2)	131 (97.0)	4 (3.0)	130 (96.3)	5 (3.7)
A common cause of chronic kidney disease is Diabetes mellitus. [TRUE]	94 (69.6)	41 (30.4)	117 (86.7)	18 (13.3)	121 (89.6)	14 (10.4)
Obstruction to the urinary tract is not a cause of chronic kidney disease. [FALSE]	67 (49.6)	68 (50.4)	87 (64.4)	48 (35.6)	116 (85.9)	19 (14.1)
Anaemia is a cause of chronic kidney disease. [FALSE]	38 (28.1)	97 (71.9)	47 (34.8)	88 (65.2)	73 (54.1)	62 (45.9)
Hypertension is a clinical feature of chronic kidney disease. [TRUE]	99 (73.3)	36 (26.7)	118 (87.4)	17 (12.6)	123 (91.1)	12 (8.9)
Anaemia is not a clinical feature of chronic kidney disease. [FALSE]	65 (48.1)	70 (51.9)	73 (54.1)	62 (45.9)	81 (60.0)	54 (40.0)
Frothy urine is a sign of chronic kidney disease. [TRUE]	104 (77.0)	31 (23.0)	109 (80.7)	26 (19.3)	126 (93.3)	9 (6.7)
Patients with chronic kidney disease present with easy fatigability. [TRUE]	118 (87.4)	17 (12.6)	127 (94.1)	8 (5.9)	130 (96.3)	5 (3.7)
Clinical features of CKD include body swelling (oedema). [TRUE]	115 (85.2)	20 (14.8)	123 (91.1)	12 (8.9)	120 (88.9)	15 (11.1)
Obesity is not a risk factor of chronic kidney	60 (44.4)	75 (55.6)	88 (65.2)	47 (34.8)	91 (67.4)	44 (32.6)

disease. [FALSE]						
Hypertension is a risk factor for chronic kidney disease. [TRUE]	109 (80.7)	26 (19.3)	122 (90.4)	13 (9.6)	121 (89.6)	14 (10.4)
Diabetes mellitus is a risk factor for chronic kidney disease. [TRUE]	98 (72.6)	37 (27.4)	119 (88.1)	16 (11.9)	128 (94.8)	7 (5.2)
Nephrotoxins constitute risks for chronic kidney disease. [TRUE]	105 (77.8)	30 (22.2)	118 (87.4)	17 (12.6)	118 (87.4)	17 (12.6)
Older age above 65 years is not a risk factor for chronic kidney disease. [FALSE]	82 (60.7)	53 (39.3)	86 (63.7)	49 (36.3)	90 (66.7)	45 (33.3)
Chronic glomerulonephritis is not a risk for chronic kidney disease. [FALSE]	61 (45.2)	74 (54.8)	91 (67.4)	44 (32.6)	87 (64.4)	48 (35.6)
Hyperkalaemia is a complication of chronic kidney disease. [TRUE]	107 (79.3)	28 (20.7)	114 (84.4)	21 (15.6)	119 (88.1)	16 (11.9)
Uraemia is a sign of worsening chronic kidney disease. [TRUE]	101 (74.8)	34 (25.2)	123 (91.1)	12 (8.9)	124 (91.9)	11 (8.1)
Anaemia is a complication of chronic kidney disease. [TRUE]	108 (80.0)	27 (20.0)	121 (89.6)	14 (10.4)	134 (99.3)	1 (0.7)
Urine, blood, and imaging tests are useful screening tests for the diagnosis of CKD. [TRUE]	125 (92.6)	10 (7.4)	128 (94.8)	7 (5.2)	133 (98.5)	2 (1.5)
A normal Glomerular Filtration Rate (GFR) is 90ml/min/m² and above. [TRUE]	**117 (86.7)**	**18 (13.3)**	**127 (94.1)**	**8 (5.9)**	**133 (98.5)**	**2 (1.5)**
Overall Mean Knowledge Score	20.48 ± 3.66		23.74 ± 3.64		25.27 ± 3.38	

The study assessed nurses' knowledge of chronic kidney disease (CKD) before and after an educational intervention, revealing significant improvements in several areas. At baseline, 130 (96.3%) nurses correctly identified CKD, which increased slightly to 132 (97.8%) at six weeks. Awareness of global CKD prevalence improved from 120 (88.9%) to 133 (98.5%), while knowledge of nitrogenous waste management rose sharply from 56 (41.5%) to 115 (85.2%). Nurses' understanding of CKD classification improved considerably, with recognition of the National Kidney Foundation's system increasing from 112 (83.0%) to 130 (96.3%). Knowledge of glomerular filtration rate (GFR) categories also rose from 99 (73.3%) to 130 (96.3%). Hypertension was more widely recognised as a CKD cause, improving from 101 (74.8%) to 130 (96.3%), while knowledge of diabetes mellitus as a cause increased from 94 (69.6%) to 121 (89.6%). Clinical feature recognition improved, with hypertension increasing from 99 (73.3%) to 123 (91.1%) and frothy urine from 104 (77.0%) to 126 (93.3%). Anemia as a CKD complication saw near-universal recognition, rising from 108 (80.0%) to 134 (99.3%). However, knowledge of erythropoietin treatment remained low, improving only from 25 (18.5%) to 49 (36.3%).

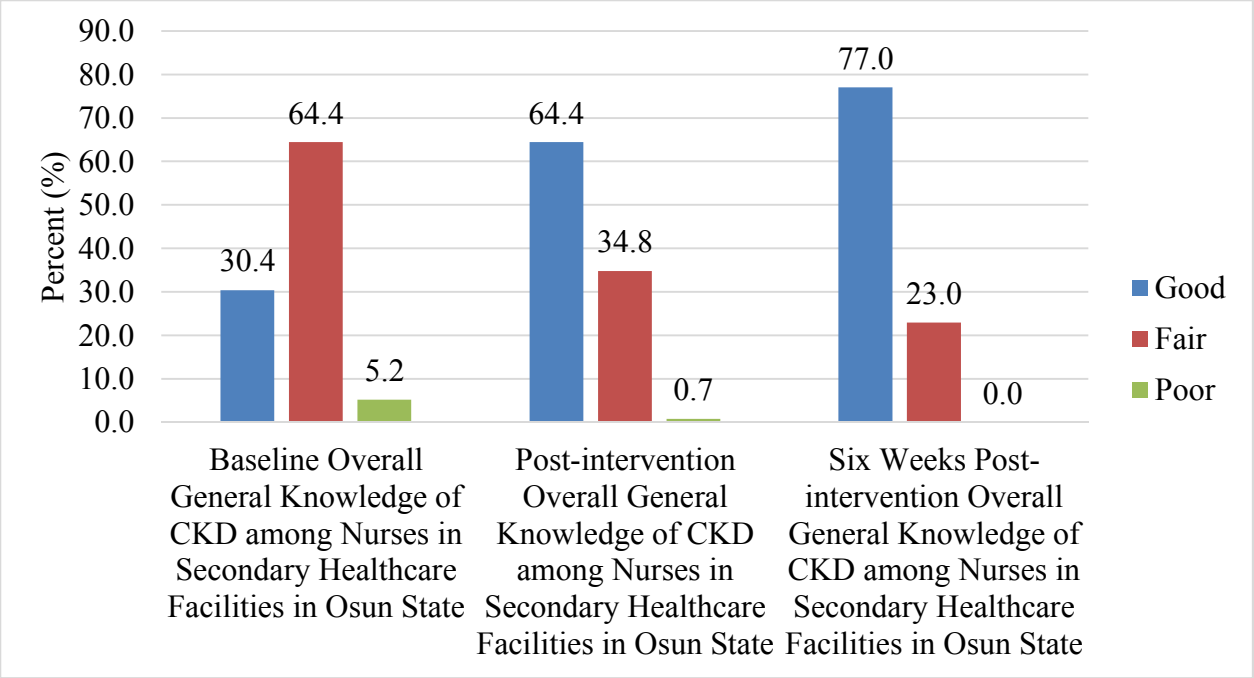

Figure 1: Bar Chart showing the Pre- and Post-Intervention General Knowledge of CKD among Nurses in Secondary Healthcare Facilities in Osun State

The bar graph in Figure 1 illustrates changes in nurses' general knowledge of chronic kidney disease across three time points. At baseline, 64.4% had "Fair" knowledge, 30.4% had "Good" knowledge, and 5.2% had "Poor" knowledge. Post-intervention, "Good" knowledge rose to 64.4%, "Fair" dropped to 34.8%, and "Poor" declined to 0.7%. At six weeks, 77.0% had "Good" knowledge, 23.0% had "Fair," and none had "Poor" knowledge. Scores were based on 30 knowledge-based questions, categorised as ≥75% (Good), 50%-74% (Fair), and <50% (Poor).

Table 3: ***Pre- and Post-intervention Knowledge of Nursing Management of CKD among Nurses in Secondary Healthcare Facilities in Osun State***

Variable Items	Pre-intervention		Post-intervention		Six weeks post-intervention	
	Correct n(%)	Incorrect n(%)	Correct n(%)	Incorrect n(%)	Correct n(%)	Incorrect n(%)
Fluid restriction and monitoring skill is an essential part of CKD management. [TRUE]	95(70.4)	40(29.6)	126(93.3)	9(6.7)	126(93.3)	9(6.7)
Blood pressure and blood sugar monitoring are not essential in caring for patients with chronic kidney disease. [FALSE]	102(75.6)	33(24.4)	119(88.1)	16(11.9)	124(91.9)	11(8.1)
Patients with chronic kidney disease are more susceptible to	112(83.0)	23(17.0)	126(93.3)	9(6.7)	121(89.6)	14(10.4)

infections. [TRUE]						
Plant-based diet will hasten chronic kidney disease progression. [FALSE]	64(47.4)	71(52.6)	79(58.5)	56(41.5)	116(85.9)	19(14.1)
Maintaining fluid balance is not an indicated nursing intervention when caring for patients with chronic kidney disease. [FALSE]	84(62.2)	51(37.8)	109(80.7)	26(19.3)	122(90.4)	13(9.6)
Patients with chronic kidney disease should not engage in physical exercise. [FALSE]	73(54.1)	62(45.9)	99(73.3)	36(26.7)	119(88.1)	16(11.9)
The nurse should teach patients and families on self-care to cure chronic kidney disease. [FALSE]	25(18.5)	110(81.5)	50(37.0)	85(63.0)	73(54.1)	62(45.9)
CKD patients should be advised to undertake moderate-intensity physical activity for a cumulative duration of at least 150 minutes per week, or to a level compatible with their cardiovascular and physical tolerance. [TRUE]	96(71.1)	39(28.9)	122(90.4)	13(9.6)	125(92.6)	10(7.4)
Avoidance of nephrotoxic drugs and herbal preparations constitute elements of secondary prevention in CKD. [TRUE]	97(71.9)	38(28.1)	121(89.6)	14(10.4)	110(81.5)	25(18.5)
When planning for venepuncture in patients with CKD, the veins of the patient's non-dominant arm should be avoided. [TRUE]	88(65.2)	47(34.8)	110(81.5)	25(18.5)	109(80.7)	26(19.3)
Overall Mean Knowledge Score	6.19 ± 1.85		7.86 ± 1.66		8.48 ± 1.41	

In Table 3, the study assessed nurses' knowledge of chronic kidney disease (CKD) management before and after an educational intervention. Pre-intervention, 70.4% of nurses identified fluid restriction as essential in CKD care, increasing to 93.3% post-intervention and remaining stable at six weeks. Awareness that blood pressure and blood sugar monitoring are crucial rose from 75.6% to 88.1% post-intervention, reaching 91.9% at six weeks. Understanding CKD patients' susceptibility to infections improved from 83.0% to 93.3%, slightly declining to 89.6% at six weeks. Knowledge that a plant-based diet does not hasten CKD progression increased from 47.4% to 58.5%, reaching 85.9% at six weeks. The misconception that CKD can be cured, rather than managed, reduced from 18.5% to 37.0%, improving to 54.1% at six weeks. Overall, the mean knowledge score improved significantly from 6.19 ± 1.85 pre-intervention to 7.86 ± 1.66 post-intervention and 8.48 ± 1.41 at six weeks.

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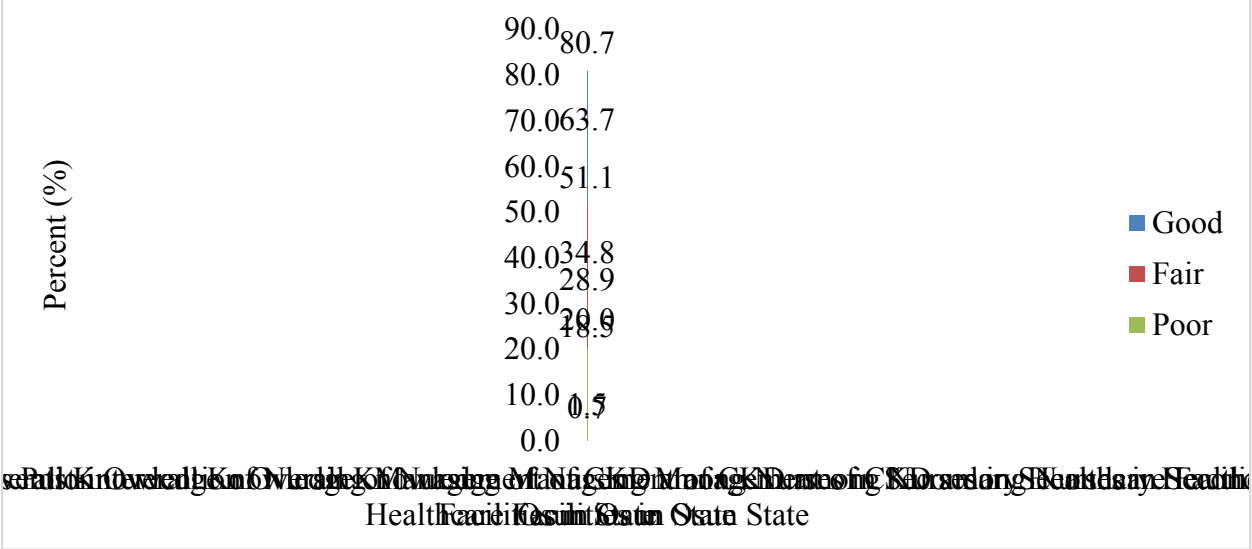

Figure 2: Overall Pre- and Post-intervention Knowledge of Nursing Management of CKD among Nurses in Secondary Healthcare Facilities in Osun State

Figure 2 illustrates changes in nurses' knowledge of CKD management at baseline, post-intervention, and six weeks later. Initially, 51.1% had "Fair" knowledge, 28.9% had "Good," and 20.0% had "Poor." Post-intervention, "Good" knowledge rose significantly to 63.7%, while "Fair" declined to 34.8% and "Poor" dropped to 1.5%. At six weeks, "Good" knowledge further increased to 80.7%, "Fair" declined to 18.5%, and "Poor" was nearly eliminated (0.7%).

Hypotheses Testing

H_o1: There is no significant difference between the pre - and post-intervention knowledge of CKD among nurses in secondary healthcare facilities in Osun State Nigeria.

Table 4: ***Difference Between the Pre - and Post-Intervention General Knowledge of CKD among Nurses in Secondary Healthcare Facilities in Osun State***

Test	Outcome (MeanSD)	*F*	*df*	*p*-value	Partial Eta Squared
Baseline Overall General Knowledge of CKD among Nurses	20.48 ± 3.66	58.801	1.88	P<.001	.305
Post-intervention Overall General Knowledge of CKD among Nurses	23.74 ± 3.64				
Six Weeks Post-intervention General Knowledge of CKD among Nurses	25.27 ± 3.37				

Table 4 presents the analysis of overall general knowledge of chronic kidney disease among nurses in secondary healthcare facilities following the educational intervention. The baseline mean score of general CKD knowledge was 20.48 ± 3.66, which increased substantially to 23.74 ± 3.64 immediately post-intervention, and further improved to 25.27 ± 3.37 at six weeks post-intervention. Using Greenhouse-Geisser correction (due to violated sphericity assumption, p = .013), the repeated measures ANOVA showed a significant effect of the intervention (F (1.88) = 58.801, $p < .001$) with a large effect size (partial $\eta^2 = .305$), indicating that 30.5% of the variance in general knowledge scores was attributable to the intervention. Based on these findings, the null hypothesis (Ho1) is rejected, as there was a statistically significant difference between the pre- and post-intervention knowledge of CKD among nurses.

Table 5: ***Post-Hoc Analysis on the Difference Between the Pre - and Post-Intervention Knowledge of CKD among Nurses***

Time Points	Mean Difference	Standard Error	*p*-value	95% *CI*	Cohen's *d*
Baseline vs Post-intervention	-3.259	0.463	<.001	[-4.382, -2.137]	0.625
Baseline vs Six weeks	-4.793	0.492	<.001	[-5.985, -3.600]	0.867
Post-intervention vs Six weeks	-1.533	0.394	<.001	[-2.487, -0.579]	0.346

For Cohen's d calculation in paired comparisons: d = Mean Difference / (Standard Error × $\sqrt{n}$), where n=135.

Table 5 presents the pairwise comparisons of knowledge of CKD among nurses revealing significant differences between all-time points ($p < .001$). The largest improvement was observed between baseline and six weeks post-intervention (mean difference = -4.793, 95% *CI* [-5.985, -3.600]) with a large effect size (d = 0.867). The immediate intervention effect (baseline to post-intervention) also showed substantial improvement (mean difference=-3.259, 95% *CI* [-4.382, -2.137]) with a medium to large effect size (d = 0.625). The continued improvement from post-intervention to six weeks was smaller but still significant (mean difference=-1.533, 95% *CI* [-2.487, -0.579]) with a small to medium effect size (d = 0.346). These results demonstrate both immediate and sustained improvements in knowledge, with the most substantial gains occurring between baseline and the six-week follow-up.

H_o2: There is no significant difference between the pre - and post-intervention knowledge of nursing management of CKD among nurses in secondary healthcare facilities in Osun State Nigeria.

Table 6: ***Difference Between the Pre- and Post-Intervention Knowledge of Nursing Management of CKD among Nurses***

Test	Outcome (Mean ±*SD*)	*F*	*df*	*p*-value	Partial Eta Squared
Baseline Overall Knowledge of Nursing Management of CKD among Nurses in Secondary Healthcare Facilities in Osun State	6.19 ± 1.85	62.628	1.877	P<.001	.319
Post-intervention Overall Knowledge of Nursing Management of CKD among Nurses in Secondary Healthcare Facilities in Osun State	7.86 ± 1.66				
Six Weeks Post-intervention Overall Knowledge of Nursing Management of CKD among Nurses in Secondary Healthcare Facilities	8.48 ± 1.41				

Table 6 presents the analysis of knowledge of nursing management of CKD revealing significant improvements following the educational intervention. The baseline mean score was 6.19 ± 1.85, which increased substantially to 7.86 ± 1.66 immediately post-intervention, and further improved to 8.48 ± 1.41 at six weeks post-intervention. Using Greenhouse-Geisser correction (due to violated sphericity assumption, $p = .011$), the repeated measures ANOVA showed a significant effect of the intervention (F (1.877) = 62.628, $p < .001$) with a large effect size (partial $\eta^2 = .319$), indicating that 31.9% of the variance in nursing management knowledge scores was attributable to the intervention. Based on these findings, the null hypothesis (Ho2) is rejected, as there was a statistically significant difference between the pre- and post-intervention knowledge of nursing management of CKD among nurses.

Table 7: ***Post-Hoc Analysis on the Difference Between the Pre- and Post-Intervention Knowledge of Nursing Management of CKD among Nurses***

Time Points	Mean Difference	Standard Error	*p*-value	95% *CI*	Cohen's *d*
Baseline vs post-intervention	-1.667	0.235	<.001	[-2.236, -1.097]	0.631
Baseline vs Six weeks	-2.289	0.209	<.001	[-2.795, -1.783]	0.974
Post-intervention vs Six weeks	-0.622	0.188	.004	[-1.079, -0.166]	0.294

Table 7 presents the pairwise comparisons for knowledge of nursing management of CKD revealing significant differences between all-time points. The most substantial improvement was observed between baseline and six weeks post-intervention (mean difference = -2.289, 95% *CI* [-2.795, -1.783]) with a large effect size ($d = 0.974$). The immediate intervention effect (baseline to post-intervention) also showed significant improvement (mean difference = -1.667, 95% *CI* [-2.236, -1.097]) with a medium to large effect size ($d = 0.631$). The continued improvement from post-intervention to six weeks was smaller but still significant (mean difference = -0.622, 95% *CI* [-1.079, -0.166]) with a small effect size ($d = 0.294$). These results demonstrate that the intervention produced both immediate and sustained improvements in nursing management knowledge, with the most substantial gains occurring over the entire study period from baseline to six weeks follow-up.

Discussion of Findings

The findings indicate a significant positive effect of the educational intervention on nurses' knowledge of chronic kidney disease (CKD). At baseline, most nurses had fair knowledge (51.1%), while 28.9% had good knowledge and 20% had poor knowledge. Post-intervention, good knowledge rose significantly to 63.7%, surpassing fair knowledge (34.8%), while poor knowledge declined drastically to 1.5%. By six weeks post-intervention, good knowledge further increased to 80.7%, fair knowledge reduced to 18.5%, and poor knowledge was nearly eliminated (0.7%). A repeated measures ANOVA confirmed a statistically significant intervention effect ($F(1.88) = 58.801$, $p < .001$, partial $\eta^2 = .305$), with pairwise comparisons showing significant differences across all time points ($p < .001$). The greatest improvement

occurred between baseline and six weeks (d = 0.867), demonstrating both immediate and sustained knowledge retention.

These findings align with existing studies in Sub-Saharan Africa, which report low initial CKD knowledge among nurses. Adejumo et al. (2019) found that only 6% of non-nephrology nurses in Nigeria had good CKD knowledge, while Stanifer et al. (2016) reported that just 13% of Tanzanian nurses demonstrated good understanding. Similarly, studies in Nigeria and Rwanda revealed that only 6–15% of non-nephrology nurses had good CKD knowledge, with the majority having moderate knowledge (Gapira et al., 2020). In Tanzania, 72% of nurses had moderate knowledge (Stanifer et al., 2016). However, the present study showed high baseline knowledge of CKD definition (96.3%), possibly due to most participants holding a first-degree certificate, unlike Gapira et al.'s (2020) study, where 60.8% of Rwandan nurses failed to correctly define CKD.

Several studies support the need for enhanced CKD knowledge among nurses. Hernandez (2019) used a pretest-posttest design to stress the necessity of increasing nurse practitioners' awareness due to low reported knowledge levels. Similarly, Wolide et al. (2019) identified a low level of CKD knowledge among their study participants. The present study also revealed specific knowledge gaps at baseline, particularly in CKD causes, staging, and complications like anaemia. Adejumo et al. (2019) similarly found poor knowledge of CKD staging and nephrotoxic medications among non-nephrology nurses in Akure, Nigeria. Borg et al. (2023) also noted that nurses struggled with CKD staging using the Albumin-Creatinine Ratio for prevention and monitoring. These findings highlight the widespread deficit in CKD knowledge and the urgent need for targeted education.

The intervention led to significant improvements in key knowledge areas, particularly in CKD prevalence, staging, and kidney function, such as nitrogenous waste management. This aligns with studies by Shodiya et al. (2023) and Hernandez (2019), which demonstrated that structured educational programs significantly enhance nurses' understanding of CKD risk factors and management. The effectiveness of the intervention in this study, combining audiovisual projections with physical demonstrations, is consistent with ISN-KDIGO recommendations for interactive, multidimensional education. Despite overall improvements, persistent gaps remained

in treatment-specific knowledge, especially erythropoietin administration, where knowledge increased only modestly from 18.5% to 36.3%. Borg et al. (2023) and Assiry et al. (2022) reported similar challenges in complex treatment areas, likely due to limited nephrology training.

The sustained knowledge improvement at six weeks underscores the intervention's effectiveness in knowledge retention, aligning with findings from ISN-KDIGO (2021) and Mignott (2022), which emphasise the role of interactive learning in long-term retention. Given Nigeria's nephrology workforce shortage—only 240 nephrologists and 697 registered dialysis nurses nationwide —such interventions could help address critical gaps in CKD care. This is especially vital given projections that Africa will host 70% of end-stage renal disease patients by 2030 (Ulasi et al., 2022). Improved CKD awareness and early detection, as emphasised by Sotubo et al. (2023), could significantly reduce hospital admissions. However, fluctuating knowledge levels in certain areas, such as the kidney's role in blood sugar regulation, suggest a need for ongoing reinforcement of complex concepts. Gapira et al. (2020) and Singh and Masuku (2014) recommend continuous education to sustain competency. These findings support the National Kidney Foundation's (2021) call for early CKD recognition and management while addressing knowledge gaps in staging and monitoring (Borg et al., 2023).

This study highlights the significant impact of educational intervention on nurses' knowledge of CKD management in secondary healthcare facilities in Osun State. The intervention, incorporating audiovisual presentations and physical demonstrations, led to substantial improvements in knowledge scores. At baseline, most nurses had "Fair" knowledge (51.1%), with 20.0% having "Poor" knowledge. Post-intervention, "Good" knowledge increased to 63.7%, while "Poor" knowledge dropped to 1.5%. At the six-week follow-up, "Good" knowledge further rose to 80.7%, and "Poor" knowledge became almost negligible (0.7%). The mean knowledge score significantly increased from 6.19 ± 1.85 at baseline to 7.86 ± 1.66 post-intervention and 8.48 ± 1.41 at six weeks. Repeated measures ANOVA confirmed the intervention's significant effect ($F(1.877) = 62.628$, $p < .001$) with a large effect size ($\eta^2 = .319$).

The findings aligned with previous research, demonstrating the effectiveness of educational interventions in improving CKD knowledge among nurses. Mignott (2022) and Tariq et al. (2022) reported similar improvements in CKD-related knowledge, clinical decision-making, and

nurse-patient interactions following structured educational programs. This study also supports Gapira et al. (2020), which identified critical knowledge gaps in CKD management, particularly in resource-limited settings. Yeh et al. (2020) highlighted the benefits of experiential learning, reflected in this study's high knowledge retention at six weeks. The intervention effectively addressed key CKD management aspects, including dietary practices (Ikizler et al., 2020; KDOQI, 2021; Mak et al., 2023), fluid balance (Naber & Purohit, 2021), and multidisciplinary care. Notably, knowledge on avoiding nephrotoxic drugs improved, supporting Gapira et al. (2020). The study also tackled misconceptions about CKD's curability, a critical step in fostering realistic patient expectations and self-management (KDIGO, 2023; Ojo et al., 2023). The findings reinforce the need for continuous professional development in CKD management (Gapira et al., 2020; Shobha et al., 2023).

Conclusion

This study confirmed the significant positive impact of an educational intervention on nurses' knowledge of CKD management in secondary healthcare facilities in Osun State. The intervention led to immediate and sustained improvements, with large effect sizes and significant gains maintained at six weeks. These findings emphasised the importance of structured training in enhancing patient care.

Recommendations

1. The government, in collaboration with healthcare institutions, should establish regular in-service training programs focused on chronic kidney disease (CKD) for nurses. These programs should emphasise knowledge retention on CKD pathophysiology, clinical features, complications, and management strategies.
2. The positive impact of the educational intervention on nurses' knowledge of CKD demonstrates its effectiveness. Therefore, this intervention should be integrated into regular in-service training programs for nurses in all secondary healthcare facilities across Osun State
3. To ensure consistent and high-quality care for CKD patients, standardized protocols and resources should be developed and disseminated to all healthcare facilities. These resources

could include clinical practice guidelines for CKD management, patient education materials on CKD, its management, and lifestyle modifications, quick reference guides for nurses on medication administration, monitoring, and patient education.

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