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Knowledge and Its Associated Factors among Nurses Caring Patients with Chronic Kidney Disease (CKD) in Referral Hospital: A Descriptive Cross-Sectional Study

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Abstract

Background: Nursing care based on expert knowledge of patients with chronic kidney disease (CKD) is currently a major clinical concern. Care to CKD patients provided by non-expert nurses has been reported to result in substandard care, increased risk of complications, and prolonged hospitalization. This study described nurses' knowledge of the care of patients with CKD, for possible interventions.

Methods: A quantitative, descriptive cross-sectional design; was used; 200 nurses were enrolled by simple random sampling technique. Data were analysed using SPSS version 25; descriptive analysis was done for demographic characteristics and knowledge responses and a chi-square test was conducted to determine association alpha; $p<0.05$. Also, an ANOVA t-test was done to determine the mean knowledge score difference between the groups of the sociodemographic characteristics p-value < 0.01.

Results: The majority of the participants 72% had moderate and 13% had high knowledge levels. Experience of working in renal ward/unit and attendance in nephrology training were found to significantly contribute to higher mean knowledge scores than not having these experiences [t (198) = -2.26, p=0.025] and [t (198) = -5.24, p<0.01] consecutively. In addition, participants with diplomas, bachelor degree, and masters had higher mean knowledge scores than those with a certificate [F = 17.57, p<0.01].

Conclusion: Knowledge gaps in the care of patients with CKD exist even among nurses working in the highest level of health facilities. Further research may be done to explore nurses' perceptions on caring for patients with CKD without expert/specialized training.

Keywords: nurses; knowledge; chronic kidney disease; ckd; Tanzania

Introduction

Nephrology nursing care based on expert knowledge of patients with kidney disease remains a public and clinical concern in most countries globally [1,2]. Better care may be a product of good knowledge, experiences, staff motivation, and a well-established infrastructure [1,3]. In Tanzania, although there have been improvements in nephrology services which is considered a great success in the country and the health system at large, nephrology services cannot run with only trained nephrologists and a well-established infrastructure. Nephrologists are still very few to address the population's needs for nephrology services [4].

In Tanzania like many other countries in the world, nurses provide care to CKD patients based on shared experiences and basic knowledge acquired during college or university which may pose threat to individual patient care [4,5,6,9]. Few nurses who are working in dialysis units and renal transplant units attended short time courses (2-3months) overseas most in India and some in Pakistan [4]. Also, nurses receive on-job training for a few weeks to a month in established nephrology units mostly at MNH [4].

This informal and short time training may not be adequate hence nurses may be subjected to the passive role due to a lack of the scientific base of their actions and decisions; making them work under the orders of physicians and renal specialists who have more specialized knowledge power to decide the management rather than a shared decision [10]. In addition, providing care without any formal training to update knowledge and skills may result in substandard care which may be associated with poor quality and outcomes of care such as increased cost of care, prolonged hospitalization, and mortality [7,11,12].

Studies that were done to determine knowledge on CKD either involved different professionals, only non-nephrology nurses, based on one unit like only dialysis nurses and others based only on specific aspects like nutrition to CKD patients [5,6,13,16]. In Tanzania, little is known about nurses in the field of nephrology although nurses play a great role in every stage of CKD prevention including primary, secondary, and tertiary prevention [4]. This study described nurses' knowledge of different aspects of care for CKD patients such as; definition, signs and symptoms, indicators of CKD, treatment options, nutritional consideration, and complications for possible interventions from health and education institution.

Materials and methods

Design

This study used a quantitative cross-sectional design to describe nurses' knowledge of care and management of patients with CKD, from 1st December 2020 to 30th January 2021.

Study population

Nurses working at Muhimbili National Hospital Dar es Salaam Tanzania where; nurses working at MNH who consented to the study, working in medical, surgical, renal ward, dialysis, ICU, and renal outpatient clinic were included, and those who were from these departments but not providing direct patient care e.g., nurse leaders were excluded.

Sample size and sampling framework

This study involved nurses with different education levels (Enrolled Nurses, Diploma Nurses, bachelor's degrees, and Master's in Nursing). A total of 200 nurses; sample size calculated using Cochran's formula $n = (Z^2 pq) \div e^2$ [17] using p adopted from a study which was done in Rwanda on Knowledge related to chronic kidney disease (CKD) and perceptions of inpatient management practices among nurses that revealed that only 12% of nurses had good knowledge of CKD [5].

Measurements

Research tool (questionnaire)

Data for this study were collected using a structured English questionnaire was used to assess nurses' knowledge. This tool was developed by adopting questions from validated research questionnaires that were used to assess the knowledge of CKD among internal medicine residents that had a reliability coefficient (Cronbach's alpha) of 0.69 [18]. Also, some questions were added following a review of studies on knowledge and practice guidelines on the management of CKD [6,16,19,22,23] to fit the study purpose. This questionnaire had 2 sections: Section A: 13 demographic characteristics and Section B: 13 knowledge of CKD questions. The responses to the statements were yes if the statement was correct, no if it was wrong and I don't know if the participant was not sure whether the statement was right or wrong.

Statistical Analysis

Data for 200 out of 205 contacted participants with; a response rate of 98% were entered, cleaned, and analysed using a statistical package for social sciences (SPSS) for windows version 25.0. Descriptive statistical analysis was done, Chi-squared (X^2) test was used to determine the association between the demographic/work-related characteristics and participants' level of knowledge; alpha p-value<0.05 was used to determine statistical significance similar to previous studies [5], [6], [16], [20]. Also, an ANOVA t-test was done to determine the difference in the mean knowledge score between the groups of the sociodemographic characteristics where a p-value<0.01 was considered to determine the statistical significance [24]. The total knowledge score calculated to 100% was then categorized into three levels >61%= "high", 41-60= "moderate" and 1-40% as "low" knowledge based on the scale adopted from a study was done in Rwanda to assess nurses'

knowledge related to care/management to CKD patients [5]. Texts, tables, and charts were used to present analysed information.

Validity and reliability

To ensure the validity of the research tool, questions for the questionnaire were adapted from the validated tool (Cronbach Alpha =0.69), and added questions were from published studies on the same topic. The Delphi technique [25] was used to validity where the tool was shared with an expert nephrologist and later a pretesting of the tool was done to assess for clarity and usability of the research tool, and the collected information was used to check for the reliability that revealed acceptable results, Cronbach Alpha = 0.859.

Ethical Consideration

The Ethical approval for this study was obtained from, Xiangya Ethical Review Board (ERB) - Central South University China after successful proposal defense and submission; approval number E202048 and local ethical approval from Muhimbili University of Health and Allied Sciences following institutional review and approval of the study. Furthermore, informed consent to participate in the study was obtained from each participant; two copies of informed consent were signed. Data was kept secure, only the research team had access; confidentiality and research ethics were adhered to throughout the research process.

Results

Sociodemographic characteristics of the study participants

The majority of the participants 105(52.5%) had an age range of 30-40years. Almost half of the study participants were males 101(50.5%). In addition, 93(46.5%) of all participants had a diploma level of education followed by 46% bachelor's degree. Many participants had work experience of fewer than 5 years 116(58%). Furthermore, the majority of participants in this study were from the medical ward and surgical ward, 74(37%) and 55(27.5%) consecutively.

Also, 101(50.1%) of the participants had no experience of working in the renal ward/unit. Moreover, the majority of the participants 157(78.5%) never attended any nephrology-related training, seminar, or course. Among 44 of the participants who had attended nephrology-related training, 18(40.9%) attended a training called operating dialysis machine followed by 14(31.4%) care of dialysis patients. The majority of the participants who had attended seminars, training, or courses related to nephrology 33 (75%), reported that these training were conducted in less than 5 weeks duration (see table 1).

Variable	Frequency (N)	Percent (N %)
Health facility		
MNH-Upanga	137	68.5
MNH-Mloganzila	63	31.5
Age group		
20-30	72	36
30-40	105	52.5
40 and above	23	11.5
Gender		
Male	101	50.5
Female	99	49.5
Highest education level		
Certificate	10	5
Diploma	93	46.5
Degree	92	46
Masters	5	2.5
Working experience		
<5 years	116	58
>5 years	84	42
Current ward/unit		

Medical ward	74	37
Surgical ward	55	27.5
Dialysis unit	33	16.5
Renal clinic	6	3
ICU	32	16
Worked in renal ward/unit		
No	101	50.5
Yes	99	49.5
Attended training related to nephrology		
No	157	78.5
Yes	43	21.5
Duration of nephrology training		
<5 weeks	33	75
>5 weeks	11	25
Nephrology training attended		
Managing patients with CKD	5	11.4
Care of dialysis patients	14	31.4
Operating dialysis machine	18	40.9
ICU care of kidney transplant patients	2	4.5
Kidney transplant short course	1	2.3
NESOT conference	4	9.1

Table 1: Sociodemographic characteristics of the participants (N=200).

Knowledge related to CKD

Knowledge of definition and risk factors

Knowledge on specific questions related to CKD was also analyzed descriptively, which revealed the study participants were knowledgeable in some areas while in others they were not. Only 50% of the participants were able to identify the statement that best defines CKD and state if CKD is classified in five stages. On the risk factors related to CKD majority of the participants were able to correctly identify the factors; age >60 165(82.5%), severe blood loss/hypovolemia 132(66%), severe diseases/infections (malaria, glomerulonephritis) 182(91%), diabetes mellitus 183(91.5%), obesity 152(76%), systemic lupus erythematosus 104(52%), hypertension 187(93.5%), coronary artery disease 140(70%), renal intoxication (over-use of NSAID, local herbs), 190(95%), family history of CKD 139(69.5%) and smoking 144(72%). Also, although the majority of the participants were able to identify the 3 conditions mainly associated with CKD in Tanzania, (diabetes 164(82%), severe diseases/infections like malaria, glomerulonephritis 115(57.5%) and hypertension 147(73.5), most of them also incorrectly mentioned other conditions such as age >60 114(57%), severe blood loss/hypovolemia 117(58.5%), obesity 107(53.5%), systemic lupus erythematosus 106(53%), coronary artery disease 107(53.5%), renal intoxication (over-use of NSAID, local herbs), 145(72.5%), family history of CKD 108(54%) which are not commonly associated (see table 2).

Table 2: Knowledge of definition and risk factors (N=200).

CKD knowledge statements	Correct (N%)	Wrong (N %)
Definition of CKD		
No urine output for 1 month with difficulty in breathing	82(41)	118(59)
GFR>60 with a history of AKI for more than 3 months	80(40)	120(60)
GFR< 60 mL/min/1.73 m2 >3months, ACR >30 mg/g in 2/3 specimens	135(67.5)	65(32.5)
GFR> 60 mL/min/1.73 m2 >3months, ACR <30 mg/g in 2/3 specimens	100(50)	100(50)
Reduced renal function with proteinuria	156(78)	44(22)
Stages of CKD		
Chronic kidney disease can be classified into five (5) stages	100(50)	100(50)
Risk factors of CKD		

Age >60 years	165(82.5)	35(17.5)
Severe blood loss/hypovolemia	132(66)	68(34)
Severe diseases/infections (malaria, glomerulonephritis)	182(91)	18(9)
Diabetes Mellitus	183(91.5)	17(8.5)
Obesity	152(76)	48(24)
Systemic Lupus Erythematosus	104(52)	96(48)
Hypertension	187(93.5)	13(6.5)
Coronary artery disease	140(70)	60(30)
Renal intoxication (over-use of NSAID, local herbs)	190(95)	10(5)
Family history of CKD	139(69.5)	61(30.5)
Smoking	144(72)	56(28)
Three causes of CKD in Tanzania		
Age >60 years	86(43)	114(57)
Severe blood loss/hypovolemia	83(41.5)	117(58.5)
Diabetes Mellitus	164(82)	36(18)
Obesity	93(46.5)	107(53.5)
Severe diseases/infections (malaria, glomerulonephritis)	115(57.5)	85(42.5)
Systemic Lupus Erythematosus	94(47)	106(53)
Hypertension	147(73.5)	53(26.5)
Coronary artery disease	93(46.5)	107(53.5)
Renal intoxication (over-use of NSAID, local herbs)	55(27.5)	145(72.5)
Family history of CKD	92(46)	108(54)

Knowledge of clinical features and complications of CKD

In addition, many of the participants were able to identify anemia 151(75.5%), hypertension 150(75%), body swelling 183(91.5%), and easy fatigability 144(72%) as signs and symptoms of CKD. However, 102(51), and 101(50.1%) participants failed to identify nocturia and frothy urine respectively as clinical features of CKD. On the complications of a patient with CKD secondary to diabetes, on hemodialysis but uncompliant to the treatment regimen, 143(71.5%), 155(77.5%), 144(72%), and 136(68%) correctly identified anemia, severe infection (sepsis), uremic encephalopathy and diabetic complications like retinopathy and neuropathy respectively. However, many participants also failed to identify bone disease 110(65%), coronary artery disease 101(50.5%) stroke 103(51.5%), and malnutrition 115(57.5%) as possible complications (see table 3).

Table 3: Knowledge of clinical features of and complications of CKD (N=200).

CKD knowledge statements	Correct (N %)	Wrong (N %)
Clinical features of CKD		
Anemia	151(75.5)	49(24.5)
Hypertension	150(75)	50(25)
Body Swelling	183(91.5)	17(8.5)
Easy fatigability	144(72)	56(28)
Nocturia	98(49)	102(51)
Frothy Urine	99(49.5)	101(50.5)
Complications of CKD		
Anemia	143(71.5)	57(28.5)
Bone disease	90(45)	110(55)
Severe infection (Sepsis)	155(77.5)	45(22.5)
Uremic encephalopathy	144(72)	56(28)
Coronary artery disease	99(49.5)	101(50.5)
Stroke	97(48.5)	103(51.5)
Malnutrition	85(42.5)	115(57.5)
Diabetic complications like retinopathy and neuropathy	136(68)	64(32)

Knowledge of care and management of CKD patients

On investigations necessary to assess the current functioning of the kidney in patients with CKD, many of the participants were able to correctly choose

blood pressure 119(59.5%), renal function test 187(93.5%), serum electrolytes 160(80%), full blood picture 140(70%), urinalysis 162(81%) and kidney ureters, bladder (KUB) ultrasound 173(86.5%). Also, 131(65.5%) and 154(77%) were able to identify the Estimated glomerular filtration rate and Urine-albumin creatinine ratio respectively as the test to confirm the diagnosis. However, the participants incorrectly chose urine dipstick 128(64%) and ultrasound and 145(72.5%) as confirmatory investigations. In addition, participants in this study demonstrated understanding of the goals of care or management for CKD patients as the majority were able to choose to reduce cardiovascular risk 142(71%), minimize further kidney injury 173(86.5%), slow the rate of CKD progression 170(85%) and help the patient cope with the disease159(79.5%). However, many participants incorrectly choose that care for CKD patients helps the patient continue with their normal lifestyle and habits121 (60.5%).

Regarding renal replacement therapies, many participants correctly identified intermittent hemodialysis 146(73%) peritoneal dialysis 108(54%), continuous renal replacement therapies 107(53.5%), renal transplant 167(83.5%) as options for patients with CKD at late stages. Also, on the definitive treatment of CKD at late stages, 174(87%) participants correctly chose renal transplant. Furthermore, although the majority of the participants identified renal transplant as the definitive treatment for end-stage of CKD 174(83%), they were also wrong to mention hemodialysis and peritoneal dialysis 173(86.5%) and 132(66%) consecutively. On possible interventions that can be used in the management of anemia in patients with CKD, many participants correctly choose blood transfusion 183(91.5%), administration of Erythropoietin (EPO) injection154 (77%), encourage consumption of iron-rich foods173 (86.5%) administration of ferrous sulfate and folic acid 162(81%) (See table 4).

Table 4: Knowledge of care and management to CKD patients (N=200).

CKD knowledge statements	Correct (N%)	Wrong (N %)
Types of renal replacement therapies		
Intermittent hemodialysis	146(73)	54(27)
Peritoneal dialysis	108(54)	92(46)
Continuous renal replacement therapies	107(53.5)	93(46.5)
Renal transplant	167(83.5)	33(16.5)
Definitive treatment of end-stage renal failure		
Hemodialysis	27(13.5)	173(86.5)
Peritoneal dialysis	68(34)	132(66)
Renal transplant	174(87)	26(13)
Use of herbals	167(83.5)	33(16.5)
Treatment of anemia for CKD patient		
Blood transfusion	183(91.5)	17(8.5)
Administration of Erythropoietin (EPO) injection	154(77)	46(23)
Encourage consumption of iron-rich foods	173(86.5)	27(13.5)
Administer ferrous sulfate and folic acid	162(81)	38(19)

Knowledge of diet/nutrition for CKD patients

On statements related to nutrition/diet for CKD patients, the majority of the participants were able to correctly choose that; water intake should not be increased to clear toxins 122 (61%), intake of sodium-containing foods should be reduced/avoided 177(88.5%), intake potassium-rich foods should be reduced 114(57%), the diet of a patient with CKD need special attention; better to be prepared at home174(87%) refined and processed products are not good for the kidney functioning 138(69%) and patient with CKD cannot eat/drink everything if they are on dialysis115(57.5%). However, the majority of participants did not know the role of protein and carbohydrates in CKD as they incorrectly choose protein intake as okay for patients with CKD 122 (61%), and carbohydrate intake should be reduced 112(56%) (See table 5).

Table 5: Knowledge of diet/nutrition to CKD patients (N=200).

CKD knowledge statements	Correct (N%)	Wrong (N%)

Diet/nutrition education for CKD patients		
Increase water intake to clear toxins	122(61)	78(39)
Reduce/avoid intake of sodium-containing foods	177(88.5)	23(11.5)
Intake of potassium-rich foods should be reduced	114(57)	86(43)
Increase intake of carbohydrates	88(44)	112(56)
Protein intake is okay for proper kidney functioning	78(39)	122(61)
The Diet of a patient with CKD needs special attention; prepared at home	174(87)	26(13)
Refined and processed products are not good for the kidney functioning	138(69)	62(31)
Patients with CKD can eat/drink anything if they are on dialysis	115(57.5)	85(42.5)

Knowledge level

In general, the knowledge score related to the care/management of CKD patients was calculated, with a minimum score of 23 and a maximum of 67. The mean, median, and mode of the knowledge score were 48.7, 50, and 44 consecutively. Knowledge level was calculated out of 100% and referring to figure 1 below, the majority of participants 72% had a moderate level of knowledge and 13% had high knowledge (see figure 1).
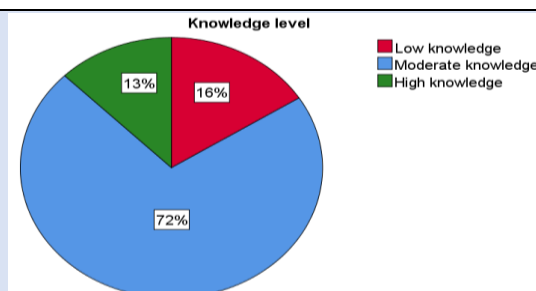

Figure 1: Pie chart of the knowledge level.

Association between demographic/work-related characteristics and knowledge level

Referring to table 2 below, the knowledge level of the study participants was found to associate with many demographic or work-related factors. However, some factors including education level (p-value < 0.01), current working ward/unit (p-value = 0.019), experience of working in renal ward/unit (p-value = 0.007) and attending nephrology related training/short course or seminar (p-value < 0.01) were found to significantly associate with participants' knowledge level (see table 6).

Table 6: Association between demographic/work-related characteristics and knowledge level.

Variables	Knowledge level			p-value
	Low	Moderate	High	
Health facility				
MNH-Upanga	19(13.9)	103(75.2)	15(10.9)	0.235
MNH-Mloganzila	13(20.6)	40(63.5)	10(15.9)	0.382
Age group				
20-30	10(13.9)	52(72.2)	10(13.9)	
30-40	15(14.3)	77(73.3)	13(12.4)	
40 and above	7(30.4)	14(60.9)	2(8.7)	
Gender				
Male	12(11.9)	74(73.3)	15(14.9)	0.206
Female	20(20.2)	69(69.7)	10(10.1)	0.001*
Highest education level				
Certificate	9(90)	1(10)	0(0)	
Diploma	14(15.1)	68(73.1)	11(11.8)	
Degree	9(9.8)	69(75)	14(15.2)	
Masters	0(0)	5(100)	0(0)	0.537
Working experience				

<5 years	16(13.8)	84(72.4)	16(13.8)	
>5 years	16(19)	59(70.2)	9(10.7)	0.019
Current ward/unit				
Medical ward	11(14.9)	56(75.7)	7(9.5)	
Surgical ward	7(12.7)	44(80)	4(7.3)	
Dialysis unit	5(15.2)	18(54.5)	10(30.3)	
Renal clinic	3(50)	3(50)	0(0)	
ICU	6(18.8)	22(68.8)	4(12.5)	0.007
Worked in renal ward/unit				
No	21(20.8)	74(73.3)	6(5.9)	
Yes	11(11.1)	69(69.7)	19(19.2)	0.001*
Attended nephrology training				
No	29(18.5)	119(75.8%)	9(5.7)	
Yes	3(7)	24(55.8)	16(37.2)	

Mean knowledge score difference between the sociodemographic variables

Independent sample t-test analysis revealed statistical significance in the mean knowledge score among participants with experience of working in renal ward/units [t (198) = -2.26, p=0.025]. Participants with experience in the renal ward/unit had a higher mean knowledge score (M=50.34, SD =10.39) compared to those with no experience (M=47.15, SD=9.59). Also attending nephrology-related training/courses had a significant mean knowledge score difference among the study participants [t (198) = -5.24, p<0.01]. Participants that attended nephrology training/seminar/short course had a higher mean knowledge score (M= 55.44, SD=9.77) compared to those who never attend any nephrology-related training (M=46.89, SD=9.41).

In addition, one way ANOVA test showed that education level had a significant mean knowledge score difference among the participants [F = 17.57, p<0.01]. Participants with diplomas (M=49.15, SD=9.57), degree (M=50.36, SD=8.89), and masters (M=51, SD=6.29) had higher mean knowledge scores compared to participants who had certificate level of education (M=28.70, SD= 4.81). There was no statistically significant difference in the mean knowledge score in the other variables (gender, age group, working institution, working experience, and current ward/unit (see table 7).

Table 7: Mean knowledge score difference between the social demographic variables (N=200).

Variable	Mean (SD)	Statistical value	p-value
Gender			
Male	49.91(9.21)	1.68^	0.09
Female	47.53(10.84)	1.33^	0.19
Health facility			
MNH-Upanga	49.37(10.09)		
MNH-Mloganzila	47.33(10.04)		
Working experience			
<5 years	49.08(9.48)	0.57^	0.57
>5 years	48.25(10.93)		
Worked in renal ward/unit			
No	47.15(9.59)	-2.26^	**0.025**
Yes	50.34(10.39)		
Attended nephrology training			
No	46.89(9.41)	-5.24^	**0.001***
Yes	55.44(9.77)		
Age group			
20-30	49.38(9.24)	1.80**	0.167
30-40	49.10(10.06)		
40 and above	45.00(12.30)		
Education			
Certificate	28.70(4.81)	17.57**	**.001***
Diploma	49.15(9.57)		

Degree	50.36(8.89)		
Masters	51.00(6.29)		
Ward/unit			
Medical ward	48.05(9.35)	1.46**	0.216
Surgical ward	48.38(9.08)		
Dialysis unit	51.24(11.93)		
Renal clinic	41.50(12.66)		
ICU	49.66(10.64)		

Discussion

In this study, the majority of the participants had a moderate level of knowledge, few had low knowledge and very few had a high knowledge level on care and management to CKD patients. This was similar to a study that described nurses' knowledge and reported that only 6% of the participants had good, 55% fair and 39% with poor knowledge level [16]. Another study also found a similar finding where just a few of the participants 22.6% had good knowledge of CKD [20]. The level of knowledge found among the study participants, the majority having a moderate level of knowledge and very few with high knowledge like in other previous studies was well explained by Yalcin et al, that only the basic and general education was not enough to make someone's knowledgeable and expert in specialized fields [14]. Likely a study on nurses' experience in care for CKD patients suggested that nurses should improve their literacy through training and repeated courses for better knowledge and quality patient care [26].

Also, this study found that experience of working in a nephrology unit/ward was associated with knowledge level and participants with this experience had a significant mean knowledge score difference from those without experience. Similarly, the study done by Okwuonu et al, also found similar findings where participants who had experience in renal dialysis units had better knowledge with higher mean knowledge scores than others without experience in these units [20]. Evidence suggests that nurses' experience in their working units can help improve their knowledge, reduce burnout and improve patient satisfaction to care [26].

In addition, attending nephrology training, course, and seminars were found to associate with knowledge level and participants who attended training had a significant mean knowledge score difference compared to those who did not. This was a similar finding to a study by Adejumo et al which reported that nurses with nephrology posting during their training had significantly higher mean knowledge scores compared to others [16]. Moreover, another

study also revealed that there was a significant mean knowledge score difference for the nurses who had clinical experience and attended nutrition courses compared to other groups [13]. This may be because experience in these units made the participants interact with other professionals and share knowledge and skills. Also, participants in these units may have a good chance to appreciate and practice directly with the patients' day today compared to others from different units.

In addition, the present study also found that the level of education was associated with the knowledge level of the participants. There was a significant difference in the mean knowledge score between participants with certificate education compared to those with the diploma, bachelor degree, and masters. There was no significant mean knowledge score difference observed between participants with a diploma, degree, and master's levels of education. This was similar to another study which found that there was no statistical significance mean knowledge score difference between participants with diplomas and degrees [20]. Moreover, higher education was also reported to associate and resulted in significant knowledge differences compared to individuals at lower levels [26]. This may be explained by the fact that in both diploma, degree, and master's level of education that is not based on nephrology, curriculums are used to provide the basic knowledge of care to CKD patients during medical/surgical nursing courses which might not be the case for certificate level. The same explanation was provided by other different studies [6,16,20].

Furthermore, the current ward/unit of the participants was found to associate with knowledge level although the mean difference across the units was not significant. Expectedly, nurses from the dialysis unit had a high mean score followed by ICU, medical ward, and surgical ward consecutively. It was surprising to see that nurses from renal clinics had the lowest mean knowledge score compared to other units although this might be due to the reason that just six nurses were from this unit [27]. This was

similar to a study that revealed that the participant department was associated with knowledge level on care to CKD patients [28]. Moreover, this study also found that there was no association between the participants' gender, institution, working experience, age group with knowledge level. It was interesting to find that the duration of experience in the nursing profession was not enough to contribute to good knowledge on care for patients with CKD. Likely, the study that assessed participant knowledge revealed that similar characteristics were not associated with knowledge level [13]. This was different from the study which found that junior and intermediate nurses had better knowledge than higher cadre [16]. The same study found that there was no significant difference in knowledge level based on working experience [16]. Also, other studies that examined the impact of the educational program revealed that junior nurses can have better knowledge than old nurses with many years of experience after training [29,14]. This was best explained by Yalcin et al, who reported that a long time of clinical experience, without specific education in a certain field and without long-term experience of working in that field may not be enough to have good knowledge [14]. This study was aimed at describing nurses' knowledge of the care of patients with chronic kidney disease. Findings showed that the majority of the study participants had a moderate level of knowledge. In agreement with the study [30], work-related factors such as participants' education level, the experience of working in the renal unit, attendance to nephrology training, and current ward/unit were found to associate and significantly contribute to mean knowledge score difference among study participants. However, knowledge level of the study participants and the gaps revealed in this suggests the need for formal training and nephrology specialized programs for quality nephrology nursing services and better patient outcome.

Limitation of the study

This study was done at the highest level of the health facility where nurses' knowledge level may not reflect the situation in other high or lower levels of health institutions that receive patients with kidney problems.

Conclusion

The findings of this study suggest that even in high-level health facilities there are knowledge gaps among nurses providing care to CKD patients. The level of knowledge demonstrated by participants in this study may not be enough for nurses to provide quality care for a better outcome to patients diagnosed with CKD as suggested by Alves et al, nurses must have solid knowledge and skills to use technology to provide expert care to CKD patients [3]. Participants knew some parts but also gaps were revealed that call for short and long-term interventions from different stakeholders including health, education, research institutions, and the nursing council.

Statements of Declaration

Consent for publication
The participants provided consent for this study and permission to publish the findings.

Competing interests
The authors declare no competing interests associated with this study.

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