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# Kidney Disease Knowledge and Its Determinants Among Patients With Chronic Kidney Disease

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**Abstract**

The alarming rise in the incidence of end-stage renal disease in Nigeria is likely to continue if patients with chronic kidney disease (CKD) lack knowledge of this disease, its management, and practices to support effective self-management. The study aimed to assess CKD knowledge and to investigate its predictors. A cross-sectional survey was conducted using a paper-based questionnaire at the medical and nephrology outpatients' clinics of a secondary and tertiary hospital in Maiduguri. The study enrolled 220 patients with CKD stages 1 to 4. Sixty-five percent of the participants had poor CKD knowledge. The patients who had a tertiary level of education were significantly more likely to have higher CKD knowledge compared to those with no formal education (adjusted odds ratio: 2.62, 95% CI: 1.20-5.72). The study shows that the majority of the participants had poor CKD knowledge. Tertiary educational level was the only significant independent predictor of higher CKD knowledge. Therefore, targeted educational interventions are needed among patients with no or low formal education to be able to support them with self-management behaviors.

**Keywords**

chronic kidney disease, end-stage renal disease, knowledge, self-management, Nigeria

## Introduction

Chronic kidney disease (CKD) is a global health problem, with a higher burden in developing countries due to limited resources (1). Chronic kidney disease is defined as a glomerular filtration rate (GFR) <60 mL/min/1.73 $m^2$ or kidney damage or both for at least a period of 3 months (2). In Nigeria, the prevalence of CKD ranges from 8.0% to 45.0% (3–8), whereas 3.6% to 8.0% hospital-based prevalence of end-stage renal disease (ESRD) has been reported (9,10). The alarming rise in the incidence of ESRD in Nigeria; especially in Borno State is likely to continue if patients with CKD lack knowledge of this disease condition and its management. End-stage renal disease is linked with significant morbidity and mortality. Special attention is required to mitigate this growing public health problem in Nigeria.

However, nearly all therapies that help to prevent kidney disease progression and reduce associated complications rely heavily on patients' self-management such as modifications of lifestyle and medication adherence to achieve and maintain optimal blood sugar and blood pressure (BP) levels (11–13), avoidance of further nephrotoxic insults (14), and in advanced stages, maintenance of strict diet control. Knowledge of how action impacts an individual's health, particularly if it involves modification of lifestyle habits, is a prerequisite for behavioral change to occur. Therefore, self-management of chronic disease is a function

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of the knowledge of that disease and its management. Research has shown that patients' knowledge is associated with improved self-management behaviors in patients with CKD (15). Enhancing the patient's CKD knowledge and its management is a crucial strategy to prevent or retard the progression to ESRD.

Although much has been documented about general public CKD knowledge level globally (16–19) and in Nigeria (20,21), there is limited research into the actual CKD knowledge level of patients with the disease worldwide. To our knowledge, no research has been conducted in Nigeria regarding CKD knowledge of patients with this disease condition. The study aimed to assess CKD knowledge and to investigate its predictors.

## Methods

## Study Design and Settings

A cross-sectional hospital-based study was conducted at the medical and nephrology outpatients' clinics of the State Specialist Hospital and the University of Maiduguri Teaching Hospital in Maiduguri. State Specialist Hospital is a 460-bed capacity secondary hospital owned by the Borno state government. It serves as a major referral hospital for Maiduguri metropolis and the entire Borno State. University of Maiduguri Teaching Hospital is a 530-bed capacity federal tertiary teaching hospital with 17 clinical and 14 nonclinical departments, serving a population of over 25 million in north-east zone of the country.

### *Participants*

This study enrolled patients with CKD. All patients who presented to the medical and nephrology clinics of the study hospitals on weekdays during new visits and regular appointments were eligible if aged between 18 and 85 years with confirmed CKD stages 1 to 4 diagnosis. The staging was based on one estimated glomerular filtration rate (eGFR) value ranging from 90 to 15 mL/min/1.73 $m^2$ for 3 months before recruitment. This is because this preliminary study was designed to inform an interventional study with a view to optimize CKD knowledge as one of the measures to help halt or retard CKD progression to stage 5. Other eligibility criteria were willingness to participate in the study and provision of written informed consent and absence of cognitive deficit.

### *Sample Size Calculation*

The sample size was estimated with an online Raosoft sample size calculator, using a CKD prevalence rate of 13.2% in the state (22) with an approximated population size of 6 713 792 people (23), at 5% margin error and 95% CI. The minimum recommended sample size for the study was 177 patients.

### *Study Instrument*

The instrument used for the study was a previously validated CKD knowledge questionnaire (24). The questionnaire was slightly modified to enhance the understanding of the participants and make the filling easier for them. The following areas were slightly modified: (i) don't know option was included for all the questions to avoid forcing the participants to choose an option or leave some questions unanswered, and (ii) the name of the medication (Tyenol) in item number 4 options was changed to paracetamol which is the medication name used for Tyenol in Nigeria.

The 28-item questionnaire contained 3 domains. The 9-item general knowledge domain comprised BP goal, medications important to kidney health, reasons why protein in urine is a problem, medications a person with CKD should avoid, treatment options for kidney failure, the definition of "GFR," knowing there are stages of CKD, understanding increased risk of heart disease, and understanding increased risk of mortality. The 9-item kidney function domain comprised roles in urine production, waste clearance ("cleaning blood"), bone health, hair loss, anemia, BP control, blood glucose control, potassium control, and phosphorus control. The 10-item symptoms of progression or failure domain comprised roles in increased fatigue, shortness of breath, metallic/bad taste, unusual itching, nausea/vomiting, hair loss, difficulty sleeping, weight loss, confusion, and no symptoms at all.

### *Data Collection*

The paper-based study instrument was self-administered to the literate ones in the clinics after consultation with the physicians. However, interviewer assisted format was adopted for those with no formal education and semi-illiterate ones. Data collected included patients' sociodemographics, clinical parameters (BP, comorbidities, and serum creatinine [laboratory parameter]), and kidney disease information.

### *Data Management*

Respondents were categorized into younger than 40 years old, 40 to 64 years old, and 65 years old and above. The eGFR values were determined using the eGFR calculator based on modified diet for renal disease study equation (25). Incorrect/don't know responses were scored zero point, while one point was given for correct response to each question, except for item number 5 that has 2 correct answers (each was scored 0.5 point), giving the highest possible score of 28 points and a least of zero point.

For the domains scores, general knowledge, and kidney function knowledge domains have the highest possible score of 9 points and a least of zero point each, while CKD symptoms knowledge has the highest possible score of 10 and a least of zero point. The sum of correct responses divided by

the total number of questions and multiplying by 100 yielded a percentage knowledge score. Respondents were considered to have an overall good knowledge of CKD if they scored at least the mean score (≥50%) and poor knowledge if below the mean score.

### Data Analysis

The data were initially presented as frequency, percentages, and mean ± standard deviations. Multivariate logistic regression analysis (enter method) was used to identify the significant independent predictors of CKD knowledge. The knowledge level is the independent variable which was coded thus: poor = 0, good = 1. The level of significance was determined at a $P < .05$. All statistical analyses were performed with Statistical Products and Services Solution (SPSS) version 20 (IBM Corp) for Windows.

## Results

Two hundred and twenty patients with CKD participated in the study; completed questionnaires were retrieved from all of them. The mean age of the participants was 52.7 ± 12.4 years. About sixty-two percent (61.8) were females, 84.5% were married, 66.8% were Muslims, and 30.0% and 34.1% had no formal education and tertiary level of education, respectively. Fifty-four percent of the study population had a BP level greater than 130/80 mm Hg. A majority (69.1%) of the participants were at CKD stage 4, while hypertension (69.1%) was the most common comorbidity among them. The detailed demographic and clinical characteristics of the participants are presented in Table 1.

More than one-third (39.5%) of the study participants knew the CKD BP goal. More than half (62.3%) of them did not know the reasons why protein in urine is a problem, while 64 (29.1) got it wrong. Nearly three-quarter (74.1%) of the participants did not know the medication that should be avoided in CKD. Only 6.3% and 5.9% of them knew the treatment options for kidney failure and the definition of GFR, respectively.

More than half (61.4%, 60.9%, and 54.1%, respectively) of them understood the CKD increased risk of mortality, knew that the kidney is responsible for urine production, and the role of the kidney in waste clearance. In contrast, more than half (52.3%, and 54.5%) of the participants did not know the roles of kidney in blood potassium and phosphorus control, respectively. Also, more than half of the participants knew that increased fatigue (68.2%), shortness of breath (51.8%), and metallic/bad taste (55.5%) are symptoms of CKD progression or kidney failure. The detailed CKD knowledge responses are presented in Table 2.

The mean percentage of the overall knowledge score of the participants is 39.5% ± 20.6%. The mean percentage of the knowledge domains score of the participants are 33.8% ± 18.9% for general knowledge, 39.9% ± 30.7% for kidney functions' knowledge, and 44.3% ± 27.0% for CKD symptoms knowledge. Most (64.5%) of the participants had an overall poor CKD knowledge, while 171 (77.7%), 126 (57.3%), and 103 (46.8%) of them had overall poor knowledge in general CKD, kidney function, and CKD symptoms, respectively, as shown in Table 3.

Table 4 shows the multivariate logistic regression analysis results of kidney disease knowledge. After adjusting for the confounding factors, educational level was the only significant independent predictor of kidney disease knowledge. The patients who had tertiary level of education were significantly more likely to have higher knowledge of kidney

**Table 1.** Distribution of the Demographic and Clinical Characteristics of the Participants.[a]

| Variable | Frequency | Percent |
|---|---|---|
| Age group (years) | | |
| <40 | 32 | 14.5 |
| 40-64 | 150 | 68.2 |
| ≥65 | 38 | 17.3 |
| Gender | | |
| Male | 84 | 38.2 |
| Female | 136 | 61.8 |
| Marital status | | |
| Single | 34 | 15.5 |
| Married | 186 | 84.5 |
| Religion | | |
| Islam | 147 | 66.8 |
| Christian | 73 | 33.2 |
| Educational level | | |
| None | 66 | 30 |
| Primary | 40 | 18.2 |
| Secondary | 39 | 17.7 |
| Tertiary | 75 | 34.1 |
| Occupation | | |
| Unemployed | 72 | 32.7 |
| Government employee | 63 | 28.6 |
| Retiree | 43 | 19.5 |
| Self-employed | 36 | 16.4 |
| Student | 6 | 2.7 |
| Blood pressure level (mm Hg) | | |
| ≤130/80 | 101 | 46 |
| >130/80 | 119 | 54 |
| CKD stage | | |
| 1-2 | 11 | 5 |
| 3 | 57 | 25.9 |
| 4 | 152 | 69.1 |
| Comorbidities | | |
| Hypertension | 171 | 77.7 |
| Diabetes mellitus | 7 | 3.2 |
| Asthma | 3 | 1.4 |
| Chronic pyelonephritis | 2 | 0.9 |
| Prostate hyperplasia | 2 | 0.9 |
| Congestive heart failure | 1 | 0.5 |
| Hyperthyroidism | 1 | 0.5 |
| Peptic ulcer disease | 1 | 0.5 |
| Seizure disorder | 1 | 0.5 |
| Sickle cell disease | 1 | 0.5 |

Abbreviation: CKD, chronic kidney disease.
[a]N = 220.

**Table 2.** Respondents' Knowledge of Chronic Kidney Disease.

| Number | Questionnaire Item | Knowledge | | |
|---|---|---|---|---|
| | | Correct, n (%) | Incorrect, n (%) | Don't know, n (%) |
| | General knowledge | | | |
| 1. | Blood pressure goal | 87 (39.5) | 74 (33.6) | 59 (26.8) |
| 2. | Medications that preserve kidney health | 143 (65.0) | 28 (12.7) | 49 (22.3) |
| 3. | Reasons why protein in urine is a problem | 19 (8.6) | 64 (29.1) | 137 (62.3) |
| 4. | Medications a person with CKD should avoid | 24 (10.9) | 33 (15.0) | 163 (74.1) |
| 5.[a] | Treatment options for kidney failure | 14 (6.3) | 1 (0.5) | 160 (72.7) |
| 6. | Definition of "GFR" | 13 (5.9) | 4 (1.8) | 203 (92.3) |
| 7. | Knowing there are stages of CKD | 106 (48.2) | 6 (2.7) | 108 (49.1) |
| 8. | Increased risk of heart disease | 106 (48.2) | 9 (4.1) | 105 (47.7) |
| 9. | Increased mortality risk | 135 (61.4) | 8 (3.6) | 77 (35.0) |
| | Knowledge of kidney functions | | | |
| 10. | Urine production | 134 (60.9) | 24 (10.9) | 62 (28.2) |
| 11. | Role in waste clearance ("cleaning blood") | 119 (54.1) | 19 (8.6) | 82 (37.3) |
| 12. | Role in bone health | 94 (42.7) | 23 (10.5) | 103 (46.8) |
| 13. | Role in hair loss | 32 (14.5) | 64 (29.1) | 124 (56.4) |
| 14. | Role in anemia | 106 (48.2) | 17 (7.7) | 97 (44.1) |
| 15. | Role in BP control | 107 (48.6) | 22 (10.0) | 91 (41.4) |
| 16. | No role in blood glucose control | 19 (8.6) | 93 (42.3) | 108 (49.1) |
| 17. | Role in blood potassium control | 92 (41.8) | 13 (5.9) | 115 (52.3) |
| 18. | Role in blood phosphorus control | 87 (39.5) | 13 (5.9) | 120 (54.5) |
| | Knowledge of symptoms of progression or failure | | | |
| 19. | Increased fatigue | 150 (68.2) | 23 (10.5) | 47 (21.4) |
| 20. | Shortness of breath | 114 (51.8) | 61 (27.7) | 45 (20.5) |
| 21. | Metallic/bad taste | 122 (55.5) | 46 (20.9) | 52 (23.6) |
| 22. | Unusual itching | 93 (42.3) | 75 (34.1) | 52 (23.6) |
| 23. | Nausea/vomiting | 105 (47.7) | 66 (30.0) | 49 (22.3) |
| 24. | Hair loss | 101 (45.9) | 45 (20.5) | 74 (33.6) |
| 25. | Difficulty sleeping | 110 (50.0) | 65 (29.5) | 45 (20.5) |
| 26. | Weight loss | 98 (44.5) | 71 (32.3) | 51 (23.2) |
| 27. | Confusion | 68 (30.9) | 104 (47.3) | 48 (21.8) |
| 28. | No symptoms at all | 14 (6.4) | 150 (68.2) | 56 (25.5) |

Abbreviations: BP, blood pressure; CKD, chronic kidney disease; GFR, glomerular filtration rate.
[a]Partial correct for question number 5 = 45 (20.5).

**Table 3.** Distribution of Kidney Disease Knowledge Domains Scores.

| Knowledge domain | Knowledge category | |
|---|---|---|
| | Poor, n (%) | Good, n (%) |
| Overall knowledge | 142 (64.5) | 78 (35.5) |
| General knowledge | 171 (77.7) | 49 (22.3) |
| Kidney function knowledge | 126 (57.3) | 94 (42.7) |
| CKD symptoms knowledge | 103 (46.8) | 117 (53.2) |

Abbreviation: CKD, chronic kidney disease.

disease compared to those with no formal education (adjusted odds ratio: 2.62, 95% CI: 1.20-5.72).

## Discussion

The study participants had an overall low knowledge of kidney disease. The fact that these patients had inadequate knowledge despite receiving care in the medical and nephrology outpatients' clinics shows that physicians' current education strategies do not meet the needs of the large number of patients with CKD. This finding may reflect a gap in patient–provider communication. It is either that these patients may not be receiving adequate education from the physicians or that they did not understand the information that was provided. Health care professionals' understanding of a patient's level of health literacy is crucial to improving the quality of their communication experience. This finding demonstrates the need for a change of education strategies and the provision of additional resources and health care personnel to support patient education in kidney disease.

With respect to additional health care personnel, it is important that renal care involve the collaboration of other health care professionals such as pharmacists, nurses, dieticians, and clinical psychologists to optimize patient's renal health outcomes, including improved knowledge of the disease and its management. In particular, the role of pharmacists in the provision of patients' information on medication safety in renal diseases cannot be over emphasized. For

**Table 4.** Multivariate Logistic Regression for Predictors of Kidney Disease Knowledge.

| Independent variable | AOR (95% CI) | *P* value |
|---|---|---|
| Age (years) | | |
| <40 | 1.0 | |
| 40-64 | 1.54 (0.61-3.89) | .36 |
| ≥65 | 1.089 (0.35-3.37) | .88 |
| Gender | | |
| Male | 1.0 | |
| Female | 0.78 (0.42-1.45) | .43 |
| Religion | | |
| Islam | | |
| Christianity | 0.74 (0.39-1.43) | .37 |
| Marital status | | |
| Single | 1.0 | |
| Married | 0.58 (0.26-0.26) | .19 |
| Educational level | | |
| None | 1.0 | |
| Primary | 0.95 (0.36-2.45) | .91 |
| Secondary | 2.15 (0.88-5.24) | .09 |
| Tertiary | 2.62 (1.20-5.72) | .02[a] |
| CKD stage | | |
| 1-2 | 1.0 | |
| 3 | 0.36 (0.09-1.48) | .16 |
| 4 | 0.68 (0.18-2.62) | .58 |

Abbreviations: AOR, adjusted odds ratio; CKD, chronic kidney disease.
[a]Statistical significance at *P* value < .05.

instance, a little above one-third of the patients who participated in this survey did not know medications that preserve kidney health, while more than three-quarter similarly were unaware of medications to avoid or use with caution in kidney disease. This poor knowledge may lead to indiscriminate use of prescription and nonprescription drugs as well as herbal products leading to drug therapy problems, which pharmaceutical care is set to address.

Contrary to our findings, previous studies conducted in the United States, the United Kingdom, and Australia had reported moderate knowledge (24–27). This difference could be attributed to wide variations in the operation of the health care system in developing countries compared to the developed ones.

Despite, the overall poor kidney disease knowledge among our study participants, there were some important items on the survey instrument on which they scored fairly well. In particular, the participants had relatively greater knowledge (60% or more) about medications that preserve kidney health, which possibly demonstrates the impact of information given by professionals handling their medications. It is hoped that a stronger synergy of care and/or policy with pharmacists will address the need of patients who still lacked such knowledge. Similar areas with relatively greater knowledge were increased mortality risk of the disease, and fatigue as one of the symptoms of the disease. This finding is comparable to greater knowledge (75% or more correct) reported on the same items by a previous study conducted in the United States (26). Nevertheless, our study recorded low knowledge about stages of CKD, many of the functions, and symptoms of the kidney. This may contribute to worse health outcomes due to the inability to notice a deterioration of kidney function and to seek immediate medical attention. This finding is inconsistent with that of other previous studies conducted elsewhere (24–27).

Our participants had low knowledge on items about the CKD BP goal, kidney function as important for keeping bones healthy, and function items about kidney roles in controlling blood potassium and phosphorus level and symptom items including unusually itching, and confusion. Inadequate knowledge of BP goal in CKD may contribute to poor BP control which may lead to rapid decline in renal function. In agreement with our study findings, a previous study also reported least knowledge about kidney function as important for keeping bones healthy, as well as confusion as a symptom of the disease (26).

Our study participants scored the lowest on 5 additional items: understanding the acronym GFR, treatment options for kidney failure, the effects of proteinuria, kidney function as important for keeping bones healthy, kidney playing no role in keeping blood sugar normal, and whether CKD was associated with symptoms at all. Although these laboratory values are closely monitored in nephrology clinics, these medical terms are complex, and one should not be surprised when patients do not fully understand their meaning or the relationship between GFR and proteinuria in CKD management. Comparable to our finding, a previous study reported participants' poorest knowledge on only two items: understanding the acronym GFR and the effects of proteinuria (26). Similarly, previous studies reported lowest scores on the item about the relationship between proteinuria and poor kidney function (24,27). However, the lack of knowledge about these two clinical terms may reflect low health literacy. These findings challenge physicians to discover how to present information in ways that are comprehensible to all patients. Contrary to our study finding, these two previous studies (24,27) reported more than half correct responses about GFR.

A majority of our study participants did not know that there may be no symptoms as CKD progresses. Similar results have been previously reported elsewhere (24–29). Consistent with our study finding, there was also low knowledge among the US and Australian patients with CKD that the kidney plays no role in keeping blood sugar normal (24,27). Low health literacy is a significant issue in many chronic diseases, including CKD. Chronically ill individuals with low levels of health literacy have little understanding of their condition or its management (30). Health literacy is critical for patients with CKD due to the complex nature of the disease, which requires patients' active involvement and the acquisition of self-management skills (31).

The analysis of predictors of kidney disease knowledge revealed education level as the only significant independent predictor. Patients who had a tertiary level of education had significantly highest odds to have higher knowledge

compared to those with no formal education, primary, and secondary levels of education. This finding is consistent with that of some previous studies (24,26) that reported that people with lower educational status were more likely to have limited CKD knowledge. In contrast, another previous study reported age, marital status, and annual household income as significant independent predictors of knowledge (27). The plausible reason for this difference could be variations in the characteristics of the study population and settings.

### *Limitations*

This study had a few limitations that deserve consideration while interpreting the results. First, it should be noted that the respondents in this study may not be a true representation of the CKD population in Nigeria, especially as the study was conducted in two health care facilities. Second, due to the self-reporting nature of the study, recall and social desirability bias might have also been possible. Third, data of the excluded patients were not collected; therefore, this may have altered the overall results if the data had been collected and analyzed. Fourth, because of the cross-sectional design of the study, respondents were assessed at one-time point; therefore, fluctuations may occur if their knowledge was measured at various times.

## Conclusions

The study shows that a majority of patients with CKD had poor knowledge about CKD. Tertiary educational level was the only significant independent predictor of higher CKD knowledge. Opportunities remain to enhance patients' knowledge about this disease. Knowledge is a critical educational component that drives self-management efforts. Therefore, concerted efforts should be made by renal health care professionals, including clinical pharmacists to increase patients' knowledge about CKD in areas that will best support self-management to help halt or slow CKD progression. Above all, there is a need for targeted educational interventions for patients with no formal education to support effective self-management behaviors among them.

### Author's Note

This publication is approved by all authors. Written informed consents were obtained from those who agreed to participate. Participation was voluntary and no incentives were given to the participants. Participants were assured of the confidentiality of the information provided and the anonymity of their identity. The study protocol was reviewed and approved by the Ethics and Health Research committees of the study hospitals. All the potential participants were briefed about the study objectives during the early morning health talk with the nurses prior to consultations with the physicians.

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