The Seybold Report

ISSN 1533-9211

DOI 10.17605/OSF.IO/XVB8J

# KNOWLEDGE, ATTITUDES, AND PRACTICES TOWARDS PREVENTION AND EARLY DETECTION OF CHRONIC KIDNEY DISEASE IN SUDAN

**OMER AHMED ELRHIMA**

Assistant Professor of Pathology at Jazan University, Faculty of Medicine, Jazan, Saudi Arabia.
*Corresponding Author Email: [1]oelrhima@jazanu.edu.sa

**GHADA ABD ELSALAM AHMED ELDEEB**

Nursing College, Jazan University, Jazan, Saudi Arabia.

**Dr. INSAF HASSAN AHMED MOHAMMED**

Nursing College, Jazan University, Jazan, Saudi Arabia.

**MUDATHIR MOHAMEDAHMED ELTAYEB**

Nursing Department, Collage of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

**MUKHLID ALSHAMMARI**

Collage of Applied Medical Science, University of Hafr Albatin, Saudi Arabia.

**SITELGEEL ALI HAMOUDA BABIKER**

Collage of Applied Medical Science, University of Hafr Albatin, Saudi Arabia.

**Abstract**

This study was carried out to describe the knowledge, attitudes and practices of Sudanese patients with chronic illnesses towards prevention and early detection of chronic kidney disease. Patients with chronic illnesses such as hypertension and diabetes need to adopt healthy attitudes and practices and gain knowledge regarding prevention and early detection of kidney disease to decrease the prevalence of dialysis-related complications and costs. A total of 740 patients were recruited from out-patients clinics in Sudan Knowledge, attitudes and practices about kidney disease prevention and early detection were measured using the chronic kidney disease screening index which was developed by the researcher and tested for validity and reliability. The results revealed that most of the participants have knowledge about kidney disease; however, half of them had wrong information related to signs and symptoms of chronic kidney disease. The majority of the participants were not aware about the importance of discovering health problems at early stages. Conclusion and implications: Improvement in population understanding about chronic kidney disease is needed to advance their awareness and practices to make appropriate decisions towards health promotion and better quality of life.

**Keywords**: Attitudes, Chronic Kidney Disease, Knowledge, Practices, Risk Assessment

## INTRODUCTION

Chronic kidney disease (CKD) is a worldwide epidemic health problem of increasing prevalence and expenditure [1]. It is a major health problem globally casting an enormous burden on healthcare system, a source of psychological distress and is associated with

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

cardiovascular diseases, resulting in a substantial morbidity and mortality [2]. According to the Global Burden of Disease study, CKD was ranked 18th in the list of causes of total number of global deaths in 2010 [3]. However, the prevalence of CKD in the general population in the world is unknown, and it differs across countries and regions [4]. For example, the prevalence of CKD in the USA adult population was 26 million (13%) residents, as reported by the national health and nutrition examination survey [5]. The largest increase in prevalence is reported in developing regions such as the Middle East [6]. In Sudan, there are 954 patients per million population diagnosed with CKD stage five receiving renal replacement, such as hemodialysis and peritoneal dialysis, and this number is expected to increase [7].

A majority of CKD cases were not clinically recognized mainly because of the lack of patients' awareness about CKD risk factors [8]. Ferris and colleagues (2009) examined the extent of diagnosed CKD among 9772 adult patients admitted to a tertiary-care hospital. The results identified that 40–70% of the patients were at risk for developing CKD. Consequently, an international need emerged to initiate screening programs for kidney disease that identify people in the community at increased risk for CKD by using a screening and awareness program such as the Kidney Early Evaluation Program (KEEP) [9].

The worldwide rise in the prevalence of CKD demands changes in the global approach towards the insistent prevention of CKD, mainly by detecting the risk factors [10]. Hypertension and diabetes mellitus are the leading important risk factors for CKD in developing countries [11]. Many studies have confirmed this association due to the fact that these two diseases share risk factors such as smoking and obesity, and promote vascular alterations that increase the risk for developing kidney impairment [12].Globally, the prevalence of hypertension in adults was estimated to be about 26%, most cases (66%) being in developing countries [13]. Similarly, the worldwide prevalence of diabetes is estimated to be 6.4% and is expected to rise to 7.7% by 2030 [14]. Prevalence of CKD in patients with diabetes is known to be high [15]. Janmohamed et al. (2013) interviewed 369 patients with diabetes to assess the prevalence of CKD in Tanzania. The results revealed that 83.7% of the patients had CKD and none was aware of having the disease. Similar results were found in a retrospective study in Netherlands, where the incidence rate of CKD was highest in participants with diabetes, an incidence of 25 000 per 100 000 person-years [16].

Knowledge, attitudes and practices assessment could be an early step forward to assess the extent to which an individual can adopt healthy behaviors [17]. However, patients at risk for CKD were screened using questionnaires based on their socioeconomic status, physical (body mass index) characteristics, personal and family health and lifestyle history, and urinary albumin measurement [18]. Screening programs of patients at risk for CKD using objective measures found that 29% of those patients had CKD, though, only 7% of them were aware of having kidney disease [19]. Clinical indicators of renal dysfunction are imperative for the early detection of patients at risk for CKD; nevertheless, it is of equal importance to increase patients' awareness in order to modify their lifestyle towards preventing the occurrence of the disease [20]. Evidence indicates that screening programs and population education programs regarding CKD have progressed patients' understanding of CKD and medical outcomes [21]. Thus, such

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

programs for patients at risk for CKD would be beneficial in eliminating the medical burden and related costs and may improve the quality of life [22]. The ability of a person with a chronic condition, such as hypertension and diabetes, to follow self-care management process is the key to prevent CKD [23]. This process emphasizes patients' involvement in self-monitoring and developing strategies to manage their own health conditions [24]. CKD can be prevented by influencing patients' knowledge and attitudes towards early detection of the disease [25].

Knowledge is conceptualized as beliefs about specific disease or condition. Patients need to gain knowledge about the kidney and its physiology, signs and symptoms, and risk factors in order to prevent CKD occurrence [26]. Hopefully, this knowledge will help patients in choosing and implementing behaviors that lead to desirable outcomes [27]. Attitudes are either positive or negative feelings about practicing the behavior [28]. For instance, gaining information and holding positive attitudes towards CKD in patients at risk will enhance their adherence to routine check-up of kidney function [28]. A recent study by Lin and colleagues (2013) aimed to develop a self-management education program and to evaluate its effects on self-management behavior and CKD progression among patients with early-stage CKD [29]. The results showed that self-monitoring and observing daily activities by patients at risk can identify factors leading to their health problems and can acquire behaviors to optimize their health status [29]. For the purpose of the present study, the following concepts were examined using defined index subscales: knowledge, attitudes and practices.

The study specific aims were (1) to describe Sudanese patients' knowledge, attitudes and practices towards the prevention and early detection of CKD, (2) to assess the relationship between patients' demographic variables, including age, gender, educational level, employment status, income and marital status and knowledge, attitudes and practices towards the prevention and early detection of CKD, (3) to assess the relationship between patients' clinical variables including presence of comorbidities such as heart disease, hypertension, diabetes, family history of CKD, or diabetes and knowledge, attitudes and practices towards prevention and early detection of CKD, and (4) to examine the predictive power of knowledge and attitudes in behavioral practice regarding CKD prevention and early detection after controlling of demographic and clinical variables.

## Methods

### Design

The study used a descriptive, cross sectional design to identify knowledge, attitudes and practices perceived by Sudanese patients at risk for CKD using a newly developed instrument, the CKD Screening Index.

### Participants

A total of 740 outpatients were recruited from May 2022 to November 2022. Cluster sampling was used to recruit hospitals from various geographical regions in Sudan. These hospitals are located in four major cities from Khartoum, Aljazeera, River Nile, and Kordfan states which account for approximately 60% of the Sudanese population. Seven governmental, one private,

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

and two educational hospitals were included from the mentioned regions. A list of all clinics (diabetic, nephrology, cardiovascular and urology) that follow patients at high risk for CKD at each hospital was obtained. Finally, all patients who fitted the eligibility criteria were recruited from the clinics' admission registry. The eligibility criteria were: (1) aged 18 years and older, (2) able to read or understand Arabic, and (3) had a previous history of at least one of the following: diabetes mellitus, hypertension, and family history of CKD, chronicity with analgesia or aged more than 65 years.

The exclusion criteria were: (1) diagnosed with CKD and (2) diagnosed with mental or severe cerebral vascular diseases that may affect cognitive ability.

**Instrument**

Knowledge, attitudes and practices were measured using the CKD Screening Index questionnaire developed by the authors. The questionnaire has three components which were scored separately. Psychometric properties of the CKD Screening Index have been reported elsewhere. Using Cronbach's α, the internal reliability measurements specific to this study were 0.69 (attitudes) and 0.67 (practices), which are considered adequate, considering that many research assistants were used in the data collection. Content and face validity were confirmed by an expert panel from clinical and academic fields. Then, piloting was conducted to ensure readability and understandability of the items. Significant negative relationships between depressive symptoms and anxiety and the three subscales of CKD Screening Index were evidence for the construct validity of CKD Screening Index. Knowledge was measured on a dichotomous scale. From a list of 24 items regarding definition, risk factors, signs and symptoms and complications of CKD, patients were asked to identify the correct answer. For the analysis purposes, percentage of correct answers was computed. Attitudes and practices were measured using 5- and 4-point Likert-type scale, respectively. The attitudes scale had 15 items which recorded patients' attitudes towards their ability to recognize symptoms and initiate appropriate help-seeking behavior in themselves or someone else with CKD symptoms. Potential scores ranged from 15 to 75. The practices scale had 12 items that recorded patients' healthy practices towards protection from having CKD. Potential scores ranged from 12 to 48.

**Statistical analysis**

Data were analyzed using SPSS software (Statistical Package for the Social Science, version 17.0; SPSS, Inc., Chicago, IL, USA).

Descriptive statistics were presented as mean scores, standard deviations and frequencies to describe the demographic characteristics of the participants along with study variables. The descriptive statistics were used to test the underlying assumption of normality, linearity, homogeneity and independence of observations. In addition, three inferential statistics were used including Pearson correlation coefficient (Pearson r), two sample t test to test the correlation between selected factors and indicators, and hierarchal multiple regression analyses to detect the predictive power of independent variables on health practices towards CKD after controlling for age, gender, monthly income, educational level, presence of hypertension and diabetes and family history of CKD, hypertension and diabetes.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

## RESULTS

A total of 740 participants were recruited. The majority were female ($n$ = 471; 64%), married ($n$ = 609; 82%) and from governmental sectors ($n$ = 458, 62%). The mean sample age was 54.6 ± 12.5 years (range 18–90). The level of education was widely distributed, with 53% having less than high school education, 19.7% having high school education, 12.3% having post high school education, and 14% having college education or college graduate. The majority of participants were unemployed 59.5% ($n$ = 440). Only 7% of the participants were not medically insured. Approximately, 71% ($n$ = 526) of the participants reported having hypertension, while 54% ($n$ = 400) diabetes mellitus, 30% ($n$ = 223) were diagnosed with rheumatic arthritis, and 19.6% ($n$ = 145) had ischemic heart diseases. Eighteen percent ($n$ = 132) had family members with renal disease.

### Knowledge, attitudes and practices behaviors

### Knowledge

Participants' mean scores on the knowledge scale was 19.27 (SD = 2.6) (range 12–24), which when converted to percentage is 80.24 ± 10.4 (50–100%). Overall, Sudanese participants who completed the CKD Screening Index were somewhat knowledgeable about CKD prevention and early detection. However, only 0.4% correctly answered the whole 24 items of the knowledge section, and 50% ($n$ = 370) of the participants achieved more than 80% of the correct scores. Furthermore, only 39% ($n$ = 287) of the participants knew that the kidney releases hormones into the blood to regulate blood pressure, to produce red blood cells and to promote strong bones. Most of the participants did not know that CKD is an irreversible disease. Half of the participants ($n$ = 370) had wrong information related to the CKD signs and symptoms such as itchy and dry skin, muscle cramps and trouble in concentration. However, more than 70% ($n$ = 550) distinguished swollen feet and ankle and puffiness around the eyes as signs and symptoms of CKD. Regarding CKD risk factors, 50% reported that there is no relationship between certain procedures such as cardiac catheterization and computed tomography (CT) scan that require dye injections and getting CKD. Only 34.7% ($n$ = 257) of the participants knew that having family members with CKD increases the risk for CKD. In contrast, smoking, having hyperlipidemia, hypertension, diabetes, obesity and anemia were acknowledged in more than 50% of the participants as risk factors for developing CKD. Around 35% of the participants knew the five stages of CKD, and that each stage needs a different management plan. Additionally, only 44% ($n$ = 323) of the participants knew that the final stage needs dialysis as a lifelong treatment.

### Attitudes

The mean scores on the attitudes scale of the CKD Screening Index was 59 ± 6.1. Table 1 provides frequencies of responses on each of the scale's 15 statements. Generally, participants were more likely to agree or strongly agree over positive attitudes or beliefs towards CKD. Most of the participants agreed or strongly agreed on having a routine check-up to make them less worried about their health. However, 37% ($n$ = 273) of the participants disagreed or were unsure on the need of discovering their health problems at an early stage. Three barriers were

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

identified from the attitudes scale: 'Kidney disease is from Allah (God) and there's nothing I can do about it', 'Preventing kidney disease needs money and efforts', and 'Kidney disease is expensive to diagnose and treat'.

**Table 1: Responses to attitudes scale in the CKD screening index**

| | Strongly disagree | Disagree | Unsure | Agree | Strongly agree |
|---|---|---|---|---|---|
| 1- I will be shocked if I get kidney disease. | 76 (9.1%) | 119 (16.1%) | 138 (18.6%) | 229 (30.9%) | 179 (24.2%) |
| 2- I will talk to my friends about kidney disease. | 30 (4.1%) | 66 (8.9%) | 60 (8.1%) | 424 (57%) | 148 (20%) |
| 3- I will talk to my family about kidney disease. | 19 (2.6%) | 31 (4.2%) | 33 (4.5%) | 375 (50.7%) | 270 (36.5%) |
| 4- I will go to a healthcare provider if I have signs and symptoms of kidney disease. | 13 (1.8%) | 10 (1.4%) | 13 (1.8%) | 289 (39.1%) | 400 (54%) |
| 5- Kidney disease is an expensive to diagnose and treat | 16 (2.2%) | 30 (4.4%) | 156 (21%) | 257 (34.7%) | 267 (36%) |
| 6- Maintaining good health is extremely important. | 6 (0.9%) | 5 (0.7%) | 7 (0.9%) | 187 (25.3%) | 513 (69%) |
| 7- I should search for new information to improve my health. | 10 (1.4%) | 24 (3.2%) | 21 (2.8%) | 299 (40.4%) | 369 (50%) |
| 8- I feel it is important to carry out activities which will improve my health. | 9 (1.2%) | 7 (0.9%) | 30 (4.1%) | 289 (39%) | 390 (53%) |
| 9- Having a routine check-up makes me less worried about my health | 5 (0.7%) | 18 (2.4%) | 21 (2.8%) | 330 (44.6%) | 347 (47%) |
| 10- I want to discover my health problems in the early stages. | 89 (12%) | 184 (25%) | 277 (37.4%) | 120 (16.2%) | 60 (8%) |
| 11- I feel I will get kidney problem in the future. | 111 (15%) | 270 (36.5%) | 49 (6.6%) | 210 (28.4%) | 93 (12.6%) |
| 12- Doctors and nurses should have given me more information about kidney disease | 10 (1.4%) | 20 (2.7%) | 22 (3%) | 381 (51.5%) | 293 (39.6%) |
| 13- Kidney disease is from Allah (God) and there's nothing I can do about it. | 31 (4.2%) | 54 (7.3%) | 29 (3.9%) | 288 (38.9%) | 325 (43.9%) |
| 14- One has an authority over his body and can prevent the occurrence of CKD | 42 (5.7%) | 65 (8.8%) | 199 (27%) | 336 (45.4%) | 86 (11.6%) |
| 15-Preventing kidney disease needs money and efforts. | 24 (3.2%) | 85 (11.5%) | 130 (17.6%) | 386 (52.2%) | 104 (14%) |

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

### Practices

The mean score on the practices scale of the CKD Screening Index was 31 ± 5.1. Table 2 provides frequencies of responses on the scale's 12 statements. Patients with ischemic heart disease adopt positive health practices compared with others (Table 3).

**Table 2: Responses to practices section of chronic kidney disease screening index**

| Items | Not at all | Sometimes | Most of the times | Always |
|---|---|---|---|---|
| I eat well-balanced meals. | 47 (6.4%) | 231 (31.2%) | 310 (42%) | 138 (18.6%) |
| I exercise regularly, such as walking and jogging. | 254 (34.3%) | 241 (32.6%) | 120 (16.2%) | 113 (15.3%) |
| I have regular check-ups even when I'm not sick. | 252 (34%) | 205 (27.7%) | 144 (19.5%) | 131 (17.7%) |
| I keep my weight within normal range. | 143 (19.3%) | 217 (29.3%) | 217 (29.3%) | 156 (21%) |
| I do not smoke. | 590 (79.7%) | 38 (5%) | 21 (2.8%) | 77 (10.4%) |
| I do not drink alcohol. | 691 (93.4%) | 11 (1.5%) | 1 (0.1%) | 7 (0.9%) |
| I take only the medication with prescription. | 20 (2.7%) | 47 (6.4%) | 170 (23%) | 486 (65.7%) |
| I follow my medications regimen. | 17 (2.3%) | 54 (7.3%) | 185 (25%) | 464 (62.7%) |
| I follow my food restrictions, such as low salt diet and diabetic diet. | 77 (10.4%) | 190 (25.7%) | 241 (32.6%) | 219 (29.6%) |
| I recognize abnormal changes related to CKD. | 166 (22.4%) | 212 (28.6%) | 197 (26.6%) | 150 (20.3%) |
| I seek medical help if I notice signs of CKD. | 21 (2.8%) | 73 (9.9%) | 225 (30.4%) | 408 (55%) |
| I get family help and support if I get CKD. | 76 (10.3%) | 85 (11.5%) | 205 (27.7%) | 362 (48.9%) |

### Sociodemographic and clinical factors, attitudes and knowledge associated with practices

Table 3 presents demographic and clinical variables that have impacts on knowledge, attitudes and practices regarding CKD prevention and early detection. Among these variables, getting old, higher monthly income ($r = 0.10$, $P = 0.01$) and no family history of diabetes (30.7 ± 4.8) were significantly associated with better practice scores. Female participants scored lower than males in both attitudes and practices (30.5 ± 4.7 vs. 32.1 ± 5.5), although, there was no difference in the knowledge level between them. It was highly expected that participants with college education or were college graduates have higher knowledge scores than those with high school education only or less. Participants having family history of hypertension had lower attitudes towards CKD prevention and early detection (58.7 ± 6.7 and 58.9 ± 6.5, respectively).

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

**Table 3: The sociodemographic and clinical characteristics of patients by knowledge, attitudes and practices about chronic kidney disease prevention and early detection**

| Characteristics | | Knowledge total score | Attitudes total score | Practices total score |
|---|---|---|---|---|
| Age (n = 737) | | 0.036 | 0.034 | 0.10 |
| Monthly income | | 0.02<br>P = 0.65 | 0.014<br>P = 0.73 | 0.10<br>P = 0.02* |
| Gender | Male (n = 245) | 19.3 ± 2.6 | 59.2 ± 7.2 | 32.1 ± 5.5 |
| | Female (n = 448) | 19.2 ± 2.5<br>P = 0.57 | 58.8 ± 5.4<br>P = 0.007* | 30.5 ± 4.7<br>P = 0.03* |
| Maternal status | Single/divorced/widow (n = 107) | 19.1 ± 2.4 | 58.4 ± 7.2 | 30.5 ± 5.1 |
| | Married (n = 575) | 19.3 ± 2.6 | 59 ± 5.9 | 31.1 ± 5 |
| Employment | Unemployed (n = 586) | 19.3 ± 2.5 | 59 ± 5.7 | 30.8 ± 5 |
| | Employed (n = 101) | 19.2 ± 2.6 | 58.3 ± 7.5 | 32.1 ± 5.1 |
| Education | With high school education or less (n = 508) | 19.2 ± 2.6 | 58.8 ± 5.8 | 30.9 ± 5.0 |
| | College graduate or undergraduate (n = 182) | 19.4 ± 2.3 | 59.6 ± 6.6 | 31.5 ± 5.1 |
| Medical diagnosis | Family history (n = 130) | 19.7 ± 2.4 | 59 ± 6.1 | 30.6 ± 4.7 |
| | Heart failure (n = 100) | 19.4 ± 2.4 | 60 ± 5.3 | 30.6 ± 4.9 |
| | IHD | 19.3 ± 2.5 | 58.7 ± 6.7 | 31.8 ± 5.7 |
| | Hypertension ( n = 503) | 19.4 ± 2.5 | 59 ± 6.5 | 31.1 ± 5.1 |
| | Family history of HTN (n = 472) | 19.4 ± 2.4 | 58.9 ± 6.5 | 31.1 ± 5.0 |
| | Diabetes | 19.2 ± 2.7 | 85.6 ± 6.5 | 31.3 ± 5 |
| | Family history of DM (n = 455) | 19.5 ± 2.4 | 58.7 ± 6.1 | 30.7 ± 4.8 |

Additionally, higher knowledge scores were associated with participants with family history of diabetes, whereas, no association was found with the participants' family history of CKD. Finally, to examine whether knowledge and attitudes were significant predictors of behavioral practices towards CKD prevention and early detection, controlling for age, gender, educational level, income, presence of hypertension and diabetes, and presence of family history of hypertension, diabetes and CKD, two-steps multiple hierarchical regression analysis was performed. Preliminary analyses were conducted to ensure no violation of assumptions of normality, linearity, multicollinearity and homoscedasticity. Demographic variables (age, gender, educational level and income, presence of hypertension and diabetes, and presence of family history of hypertension, diabetes and CKD) were entered at step 1; explaining 22% of variance in total practices scores. After entry of knowledge and attitudes variables at step 2, the total variance explained by the model was 38.6%, $F$ (2564) = 8.9, $P < 0.001$. The variables in step 2 explained an additional 10% of variance in practices after controlling covariates, $R2$ change was 0.10, $F$ change (2, 564) = 33.9, $P < 0.001$. In the final model, being female, with family history of diabetes, low scores on knowledge, and attitudes scales were all statistically

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

significant with the following order based on beta value: family history with diabetes ($\beta = -1.2$, $P = 0.008$), female ($\beta = -1.0$, $P = 0.03$), knowledge ($\beta = 0.47$, $P < 0.001$) and attitudes ($\beta = 0.13$, $P < 0.001$).

## DISCUSSION

As a guiding framework, the Theory of Planned Behavior was used. This study proposed that the constituted attitudes may be positive or negative depending on the internal beliefs and knowledge the individual possesses towards CKD prevention and early detection [30]. Therefore, the idea that participants who did not report knowledge and positive attitudes did not report healthy practices towards prevention and early detection of CKD is important to focus on. The results showed a remarkable level of knowledge (80%) among participants with high risk for CKD in general. However, knowledge scale was scored by true or false responses, which make answers highly susceptible to be correct by chance. Only a few studies screened for early CKD using objective measures such as testing urinary albumin. Based on these measures, only 7–11% of the participants presented with high urinary albumin as an indicator of risk to develop CKD [31]. Statistically and based on TPB, health behaviors were explained by the presence of satisfactory knowledge and attitudes towards CKD prevention and early detection. Thus, educational programs should incorporate the three components so that timely behavior can be initiated when symptoms arise. This work succeeded in evidence on the accuracy of the TPB among Sudanese patients at risk for CKD.

Worldwide, no studies were found assessing knowledge, attitudes and practices of high-risk patients for CKD, though studies that used different populations was conducted and revealed lack of knowledge about CKD screening and diagnosis among healthcare providers. In Pakistan, knowledge, attitudes and practices regarding CKD were assessed in physicians finding that 48% would not refer patients with CKD to nephrologists and continued treating them based on traditional screening methods such as serum creatinine [32]. Likewise, 93% of Nigerian physicians are still using blood urea nitrogen and complete blood count as definite screening measures for CKD [33].Others found that only one-third of American patients diagnosed with CKD were aware of CKD and of the possible treatment modalities [34].

These results are unrivaled with the present study because the populations are different as well as the stage of the disease. Nevertheless, knowledge, attitudes and practice patterns of physicians about CKD probably contribute to the low levels of awareness and concerns of their patients regarding CKD, since many patients look to their physicians as persons with authority. We found that educational level and income are highly associated with low knowledge level and unhealthy behavioral practices. This is comparable with other investigators who found that socio-economic status composed of highest professional position, educational level and income, is significantly associated with renal dysfunction among patients with diabetes [35]. Moreover, the present study found that getting old is highly associated with commitment to healthy behaviors. This finding is consistent with others who found that elderly patients with end-stage renal disease adhere to their dietary restrictions [36]. However, those patients received less information and interventions from healthcare providers because of limited social

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

and financial resources. Based on the TPB, accurate information encourages individuals to act effectively towards better outcomes. However, women showed poor attitudes and practices towards CKD prevention than men, although, their information about this topic is similar. First, this result reflects the gender composition of patients with chronic diseases in Sudan, which is mostly female. Second, Arabic culture combined with poverty make women sacrifice their time, money and efforts towards serving and helping their families, which may reduce their access to health services. This is consistent with beliefs of underserved American women with high risk for cardiovascular disease and Kenyan women with high risk for advanced breast cancer [37]. This result must be taken into consideration when conducting educational programs and developing strategies, which are currently limited in Sudan because of absence of clear guidelines on screening for CKD.

Participants showed poor understanding of CKD risk factors, such as having a family member with a history CKD and those undergoing procedures requiring dye injections. The most identified risk factors were having kidney stones and recurrent urinary tract infection (80%), having diabetes (74.5%), being old (66.6%) and having hypertension (63%).

Based on the present findings, participants' negative attitudes towards the importance of discovering CKD at early stages were mostly based on the fact that most of the participants had misconceptions about the definitions of CKD stages and management plan. The results revealed that more than half of the participants seek medical attention if they notice signs of CKD; unfortunately, lack of knowledge regarding the main signs and symptoms and stages of CKD stands as an obstacle to do so. This finding was applicable in many health diseases and conditions such as breast cancer [38].

In summary, wrong assumptions about CKD risk factors, signs and symptoms, disease stages and related management plan may account for reasons why patients present late to medical help. Therefore, health education about kidney functions, CKD-related risk factors and benefits for early screening should be encouraged. Previous research studies had shown improving on medical outcomes among patients with CKD who receive appropriate educational programs. Thus, interventions aimed at changing misconceptions and improving attitudes enhance practices towards dealing with chronic illnesses such as CKD.

**Limitations**

Several limitations need to be considered when generalizing the results to global population.

Using a Sudanese population from a non-randomized sample might limit the ability to draw conclusions towards applying the findings to different geographical regions with diversity of cultural background. In addition, this study indicated that most of the participants have knowledge about the prevention of CKD. However, it is important to explore qualitatively the perception of patients and to understand their behaviors from their own perspective. Longitudinal studies will also be beneficial in dealing with this topic, mostly across different countries in the world.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

## CONCLUSION

The study achieved the aim of evaluating patients' knowledge, attitudes and practices towards CKD prevention. Although the results indicated that most of the participants have knowledge about CKD, half of them had wrong information related to signs and symptoms of CKD and the majority were not aware about the importance of discovering health problems at early stages. In the future, it will be necessary to structure and refine national screening programs aim to guide in the prevention and early detection of CKD using objective measures. It is also of equal importance to promote educational programs to raise people's awareness and understanding of the routine check-up of kidney function, thus, adopting healthy behaviors that lead to desirable outcomes.

### Implications for health policy development

The nursing discipline is responsible for planning and designing interventional programs that help people at risk to detect health problems such as CKD. An important implication for policy development of this study is engaging in multidisciplinary intervention programs, including nurses and other health professionals. Nursing educators should take into consideration the cultural issues and individual characteristics of people at risk for CKD while planning instructional material. Another application for policy development is to consider the financial status by improving health insurance services to cover the routine check-ups for early detection of CKD. This must be recognized as a priority area for governments globally; consequently, further engagement in self-managing health behaviors in a population with poverty stands as a problem for seeking healthcare services. An important health policy is that all countries should have a targeted screening program for CKD. The nurse should first target patients at risk, such as people diagnosed with hypertension and diabetes. Governments should adopt a public health policy for CKD that supports programs for screening and for improving public awareness for kidney disease prevention.

#### References

1. Alcalde, P.R. and G.M. Kirsztajn, Expenses of the Brazilian Public Healthcare System with chronic kidney disease. Brazilian Journal of Nephrology, 2018. **40**: p. 122-129.
2. Welsh, J., Psychological distress and cardiovascular disease: An investigation into the epidemiological evidence. 2020.
3. Cousin, E., et al., Diabetes mortality and trends before 25 years of age: an analysis of the Global Burden of Disease Study 2019. The Lancet diabetes & endocrinology, 2022. **10**(3): p. 177-192.
4. Yang, C., et al., Ambient ozone pollution and prevalence of chronic kidney disease: A nationwide study based on the China National survey of chronic kidney disease. Chemosphere, 2022. **306**: p. 135603.
5. Moore, J.E.C., Measuring Knowledge of Chronic Kidney Disease (CKD) among Community College Students. 2020, Walden University.
6. Alnuqaydan, A.M., et al., Middle East Respiratory Syndrome (MERS) virus—pathophysiological axis and the current treatment strategies. AAPS PharmSciTech, 2021. **22**(5): p. 173.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

7. Batte, A., et al., Malaria-associated acute kidney injury in African children: prevalence, pathophysiology, impact, and management challenges. International Journal of Nephrology and Renovascular Disease, 2021: p. 235-253.
8. Pattrapornpisut, P., C. Avila-Casado, and H.N. Reich, IgA nephropathy: core curriculum 2021. American Journal of Kidney Diseases, 2021. **78**(3): p. 429-441.
9. Ostermann, M., et al., Controversies in acute kidney injury: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Conference. Kidney international, 2020. **98**(2): p. 294-309.
10. Kornej, J., et al., Epidemiology of atrial fibrillation in the 21st century: novel methods and new insights. Circulation research, 2020. **127**(1): p. 4-20.
11. Alkhaqani, A.L., Clinical characteristics and risk factors of chronic kidney disease among patients attending Al-Sadder Medical Hospital in Al-Najaf City. Turkish J Physiother Rehabil, 2021. **32**(3): p. 15117-15127.
12. Nibali, L., et al., Periodontitis and implant complications in diabetes. Periodontology 2000, 2022. **90**(1): p. 88-105.
13. Singh, A.K. and A. Misra, Impact of COVID-19 and comorbidities on health and economics: Focus on developing countries and India. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2020. **14**(6): p. 1625-1630.
14. Cho, J. and M.S. Petrov, Pancreatitis, pancreatic cancer, and their metabolic sequelae: projected burden to 2050. Clinical and Translational Gastroenterology, 2020. **11**(11).
15. Mithal, A., et al., High prevalence of diabetes and other comorbidities in hospitalized patients with COVID-19 in Delhi, India, and their association with outcomes. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2021. **15**(1): p. 169-175.
16. Kumar, N., et al., Tobacco cessation in low-to middle-income countries: A scoping review of randomized controlled trials. Addictive behaviors, 2021. **112**: p. 106612.
17. Dardas, L.A., et al., Developing an understanding of adolescents' knowledge, attitudes, and practices toward COVID-19. The Journal of School Nursing, 2020. **36**(6): p. 430-441.
18. Molsted, S., et al., The impact of marital and socioeconomic status on quality of life and physical activity in patients with chronic kidney disease. International Urology and Nephrology, 2021: p. 1-6.
19. Tian, X., et al., The comparison of cognitive function and risk of dementia in CKD patients under peritoneal dialysis and hemodialysis: A PRISMA-compliant systematic review and meta-analysis. Medicine, 2019. **98**(6).
20. Kashtan, C.E., Alport syndrome: achieving early diagnosis and treatment. American Journal of Kidney Diseases, 2021. **77**(2): p. 272-279.
21. de Boer, I.H., et al., Executive summary of the 2020 KDIGO Diabetes Management in CKD Guideline: evidence-based advances in monitoring and treatment. Kidney international, 2020. **98**(4): p. 839-848.
22. Willis, M., et al., Cost-effectiveness of canagliflozin added to standard of care for treating diabetic kidney disease (DKD) in patients with type 2 diabetes mellitus (T2DM) in England: Estimates using the CREDEM-DKD model. Diabetes Therapy, 2021. **12**: p. 313-328.
23. Wu, Y., et al., Self-care management importance in kidney illness: a comprehensive and systematic literature review. Network Modeling Analysis in Health Informatics and Bioinformatics, 2020. **9**: p. 1-13.
24. Rai, T., et al., Optimizing a digital intervention for managing blood pressure in stroke patients using a diverse sample: Integrating the person-based approach and patient and public involvement. Health Expectations, 2021. **24**(2): p. 327-340.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/XVB8J

25. Jafar, T.H., et al., Access to CKD Care in Rural Communities of India: a qualitative study exploring the barriers and potential facilitators. BMC nephrology, 2020. **21**: p. 1-12.
26. Hernandez, J., Chronic Kidney Disease: The Need to Increase Nurse Practitioner Awareness. 2019.
27. Lanzolla, G., D. Pesce, and C.L. Tucci, The digital transformation of search and recombination in the innovation function: Tensions and an integrative framework. Journal of Product Innovation Management, 2021. **38**(1): p. 90-113.
28. Offergelt, F., et al., Leader-signaled knowledge hiding: Effects on employees' job attitudes and empowerment. Journal of Organizational Behavior, 2019. **40**(7): p. 819-833.
29. Chuang, L.M., et al., The effects of knowledge and self-management of patients with early-stage chronic kidney disease: Self-efficacy is a mediator. Japan Journal of Nursing Science, 2021. **18**(2): p. e12388.
30. Ahmad, M., et al., Intention-based critical factors affecting willingness to adopt Novel Coronavirus prevention in Pakistan: Implications for future pandemics. International journal of environmental research and public health, 2021. **18**(11): p. 6167.
31. Sumida, K., et al., Conversion of urine protein–creatinine ratio or urine dipstick protein to urine albumin–creatinine ratio for use in chronic kidney disease screening and prognosis: An individual participant–based meta-analysis. Annals of internal medicine, 2020. **173**(6): p. 426-435.
32. Sales, I.A., et al., Public knowledge, attitudes, and practices toward seasonal influenza vaccine in Saudi Arabia: a cross-sectional study. International Journal of Environmental Research and Public Health, 2021. **18**(2): p. 479.
33. Kumela Goro, K., et al., Patient awareness, prevalence, and risk factors of chronic kidney disease among diabetes mellitus and hypertensive patients at Jimma University Medical Center, Ethiopia. BioMed Research International, 2019. **2019**.
34. King, A., et al., Renal replacement knowledge and preferences for African Americans with chronic kidney disease. Journal of renal care, 2020. **46**(3): p. 151-160.
35. Singh, K., et al., Health, psychosocial, and economic impacts of the COVID-19 pandemic on people with chronic conditions in India: a mixed methods study. BMC public health, 2021. **21**: p. 1-15.
36. Gebrie, M.H. and J. Ford, Depressive symptoms and dietary non-adherence among end stage renal disease patients undergoing hemodialysis therapy: Systematic review. BMC nephrology, 2019. **20**(1): p. 1-7.
37. Scott, L., The Double X Economy: The Epic Potential of Empowering Women| A GUARDIAN SCIENCE BOOK OF THE YEAR. 2020: Faber & Faber.
38. Kugbey, N., A. Meyer-Weitz, and K.O. Asante, Access to health information, health literacy and health-related quality of life among women living with breast cancer: Depression and anxiety as mediators. Patient education and counseling, 2019. **102**(7): p. 1357-1363.