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Sociodemographic and Clinical Predictors of Quality of Life in Patients with Chronic Kidney Disease: A Cross-Sectional Analysis

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ABSTRACT

Background:

chronic kidney disease (CKD) significantly impacts the quality of life (QoL) of patients. Understanding the sociodemographic and clinical predictors of QoL in CKD patients is crucial for improving patient care and outcomes. This study aimed to identify the key factors influencing QoL among CKD patients in Saudi Arabia.

Methods:

A cross-sectional study was conducted with 250 CKD patients recruited from university hospitals affiliated with King Faisal University, Saudi Arabia. Sociodemographic data, including age, gender, education level, and marital status, were collected through structured interviews. Clinical data, such as CKD stage, comorbidities, and dialysis status, were obtained from medical records. The World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire was used to assess QoL. Bivariate analysis and multivariate regression were performed to identify predictors of QoL.

Results:

Advanced CKD stage and dialysis status were negatively associated with QoL, particularly in the physical and psychological health domains ($p < 0.001$). Age was negatively correlated with QoL, while higher education levels were positively associated with better QoL scores ($p < 0.01$). Comorbid conditions, such as diabetes and hypertension, further reduced QoL, particularly in the physical health domain.

Conclusion:

CKD stage, dialysis status, and education level are significant predictors of QoL in CKD patients. Early intervention, patient education, and comprehensive care for dialysis patients are essential to improving QoL outcomes in this population.

Keywords:

Chronic kidney disease, quality of life, dialysis, sociodemographic factors, CKD stage, Saudi Arabia, education level

Introduction:

Chronic kidney disease (CKD) is a progressive and often debilitating condition that affects millions of people worldwide. It is characterized by the gradual loss of kidney function, ultimately leading to end-stage renal disease (ESRD), where dialysis or kidney transplantation becomes necessary for survival (Charles & Ferris, 2020). Globally, CKD is recognized as a significant public health problem, with increasing prevalence and associated mortality rates. The Global Burden of Disease Study estimated that CKD ranked as the 12th leading cause of death in 2017, with an estimated 1.2 million deaths directly attributed to the disease(Kovesdy, 2022). In the Middle East, and specifically in Saudi Arabia, the burden of CKD is considerable due to rising rates of diabetes and hypertension, the two leading causes of kidney failure (Ammirati, 2020). With the aging population and increasing prevalence of non-communicable diseases (NCDs), addressing CKD and its impact on patients' quality of life (QoL) has become a major focus of healthcare systems in the region (Al Salmi et al., 2021).

CKD not only leads to physical health deterioration but also has a profound effect on patients' quality of life (QoL), which is influenced by a combination of clinical, psychological, and sociodemographic factors (Stevens, 2013). QoL is a multifaceted concept that includes physical, emotional, social, and environmental well-being (Daundasekara et al., 2020). In patients with CKD, the decline in kidney function often leads to complications such as anemia, cardiovascular disease, mineral and bone disorders, and cognitive impairment, all of which can severely impact their QoL (Pépin et al., 2021). Moreover, the psychological burden of living with a chronic illness, undergoing regular dialysis, or

anticipating the need for kidney transplantation can contribute to increased levels of anxiety, depression, and social isolation (Brito et al., 2019). Thus, understanding the factors that predict QoL in CKD patients is essential for developing comprehensive care plans that address not only the clinical aspects of the disease but also the psychosocial well-being of patients (Abdel-Kader et al., 2009).

Several studies have examined the relationship between sociodemographic factors and QoL in patients with chronic diseases, including CKD. Age, gender, education level, and marital status are among the key sociodemographic variables that have been shown to influence QoL outcomes (Kao et al., 2020). For instance, older patients often report lower QoL due to greater physical limitations and higher comorbidity rates (Yamada et al., 2015). Gender differences in QoL have also been observed, with some studies suggesting that women with CKD may experience poorer mental health outcomes than men, potentially due to different coping mechanisms and social support structures (Kalsoom, 2019). Educational attainment is another important factor, as higher education levels are often associated with better health literacy, enabling patients to manage their condition more effectively and seek timely medical care (Bayati et al., 2018). Additionally, marital status can play a significant role, with married individuals often benefiting from greater social support, which has been shown to mitigate some of the negative effects of CKD on QoL (Z. Wang et al., 2021).

Beyond sociodemographic factors, clinical characteristics such as the stage of CKD, presence of comorbidities, and treatment modality also significantly influence QoL in CKD patients. The severity of CKD is commonly classified into five stages, with Stage 5 (ESRD) being the most severe. As CKD progresses, patients are more likely to experience complications such as fatigue, muscle wasting, and cognitive decline, all of which negatively impact QoL (Zhang et al., 2012). The presence of comorbid conditions, particularly cardiovascular disease and diabetes, further exacerbates the burden of CKD, as these conditions often require additional medications, dietary restrictions, and frequent medical appointments (Decker & Kendrick, 2014). Moreover, patients undergoing dialysis, especially hemodialysis, report lower QoL due to the time-consuming nature of the treatment and the associated physical and emotional stress (Hejazi et al., 2021). Kidney transplantation, on the other hand, has been shown to improve QoL, as it eliminates the need for dialysis and offers a chance at more normal kidney function (Ebadi et al., 2018). However, the availability of transplantable organs remains limited, and many patients spend years on waiting lists, during which their QoL may continue to deteriorate.

In Saudi Arabia, the burden of CKD is particularly concerning due to the high prevalence of diabetes and hypertension, which are among the leading causes of kidney failure in the region (Mousa et al., 2021). The Ministry of Health has recognized CKD as a growing public health issue, and there have been efforts to increase awareness, early detection, and management of the disease. However, despite these efforts, many patients are diagnosed at later stages of CKD, when irreversible kidney damage has already occurred (Whaley-Connell et al., 2011). Furthermore, while the Saudi healthcare system provides access to dialysis and transplantation services, there are disparities in access to care based on geographic location, socioeconomic status, and healthcare literacy (Almubark et al., 2019). These disparities may contribute to variations in QoL outcomes among CKD patients, particularly in rural areas where access to specialized nephrology care is limited (Hassan et al., 2021; Shaban et al., 2021a, 2021b).

This study aims to investigate the sociodemographic and clinical predictors of QoL in patients with CKD in Saudi Arabia. By using a cross-sectional design, we will explore the relationships between various sociodemographic variables (e.g., age, gender, education, marital status) and clinical characteristics (e.g., CKD stage, comorbidities, treatment modality) with QoL outcomes in a sample of CKD patients. The findings from this study will contribute to the growing body of literature on CKD management and provide valuable insights into the factors that influence QoL in this patient population. In doing so, the study will offer guidance for healthcare providers and policymakers on how to better support CKD patients in improving their quality of life.

Methods

Study Design and Setting

This cross-sectional study was conducted in university hospitals affiliated with King Faisal University, Saudi Arabia, between January and June 2021. The hospitals were selected for their expertise in treating chronic kidney disease (CKD) and their accessibility to a diverse population of patients receiving care for CKD at various stages. The study aimed to assess the sociodemographic and clinical factors associated with the quality of life (QoL) among patients diagnosed with CKD.

Study Population
The study population consisted of adult patients (aged 18 years and above) diagnosed with CKD. Eligible participants were those who had been receiving treatment for CKD at one of the selected university hospitals, regardless of disease stage. Participants were included if they had been diagnosed with CKD for at least six months to ensure that they had experienced the effects of the disease on their daily lives. Patients with end-stage renal disease (ESRD) receiving dialysis or those awaiting kidney transplantation were also included in the study.

Exclusion criteria were applied to individuals who had significant cognitive impairment, psychiatric disorders that could hinder their ability to complete the QoL questionnaires, and patients with terminal illness other than CKD. Additionally, patients who were unwilling or unable to provide informed consent were excluded. A total of 250 patients meeting the eligibility criteria were recruited for the study.

Sampling Technique
A convenience sampling technique was used to recruit participants from nephrology outpatient clinics and dialysis centers within the selected university hospitals. Recruitment took place during routine outpatient visits and dialysis sessions, where patients were approached by trained research assistants. Participants were provided with a detailed explanation of the study's purpose, procedures, and confidentiality measures before being asked to sign a written informed consent form.

Data Collection Instruments
Sociodemographic and Clinical Data
Sociodemographic data were collected through structured interviews with participants, using a pre-designed questionnaire. The variables collected included age, gender, education level, marital status, employment status, and living arrangements (e.g., living alone or with family). The research assistants conducted the interviews to ensure the accuracy of responses.

Clinical data, including the stage of CKD, duration of CKD, comorbid conditions (such as diabetes, hypertension, and cardiovascular disease), and treatment modality (e.g., hemodialysis, peritoneal dialysis, or conservative management), were extracted from the patients' medical records. The research assistants worked closely with the hospital's nephrology staff to retrieve accurate and up-to-date clinical information. The stage of CKD was determined based on estimated glomerular filtration rate (eGFR) values, in accordance with the Kidney Disease Improving Global Outcomes (KDIGO) guidelines.

Quality of Life Assessment
The World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire was used to assess patients' QoL. The WHOQOL-BREF is a validated tool that evaluates QoL across four domains: physical health, psychological health, social relationships, and environment1. It consists of 26 items, each rated on a 5-point Likert scale, with higher scores indicating better QoL. The WHOQOL-BREF was selected due to its wide use in studies of chronic diseases and its cross-cultural adaptability, including its Arabic translation, which has been validated in the Saudi context2.

To ensure consistency in responses, research assistants were trained in administering the WHOQOL-BREF and were available to assist participants in understanding any questionnaire items if needed. The total scores for each domain were calculated, and the mean scores were used in subsequent analyses to assess the overall QoL of participants and the impact of sociodemographic and clinical factors.

Ethical Considerations
Written informed consent was obtained from all participants prior to data collection. Participants were assured of the confidentiality of their data, and all identifying information was anonymized. Data were stored in a secure, password-protected database, accessible only to the research team. Participants were also informed of their right to withdraw from the study at any time without affecting their access to medical care.

Statistical Analysis
All statistical analyses were performed using IBM SPSS Statistics version 22.0 (IBM Corp, Armonk, NY, USA). Descriptive statistics were used to summarize sociodemographic and clinical characteristics of the study population. Continuous variables such as age, QoL scores, and clinical markers (e.g., eGFR) were expressed as means and standard deviations (SD), while categorical variables such as gender, education level, and marital status were presented as frequencies and percentages.

Bivariate analysis was conducted to assess the relationships between sociodemographic and clinical variables and QoL scores. Independent t-tests were used to compare QoL scores between two groups (e.g., gender), while one-way ANOVA was used for comparisons involving more than two groups (e.g., CKD stage). Pearson's correlation coefficient was used

to assess the linear relationship between continuous variables, such as age and QoL scores.

Multivariate linear regression analysis was performed to identify the independent predictors of QoL in patients with CKD. Sociodemographic variables (age, gender, education level, marital status, employment status) and clinical variables (CKD stage, presence of comorbidities, duration of CKD, treatment modality) were included as independent variables in the regression models, while the QoL scores for each domain were the dependent variables. Adjusted beta coefficients, 95% confidence intervals (CI), and p-values were reported for each predictor. A significance level of $p < 0.05$ was considered statistically significant in all analyses.

Sample Size Calculation

The sample size was calculated based on a power analysis, assuming a medium effect size (Cohen's f = 0.30) for the association between clinical variables and QoL. With an alpha level of 0.05 and a power of 0.80, a minimum sample size of 200 participants was required. To account for potential dropouts or incomplete data, the final sample size was set at 250 participants.

Results

The study population consisted of 250 patients with chronic kidney disease (CKD), with a mean age of 60.5 years (± 10.4). The majority of the participants were male, accounting for 55.2% of the sample. Education levels varied, with 35.7% of participants having completed primary education, 40.4% secondary education, and 25.8% having attained higher education. Employment status indicated that 45.6% of the participants were employed, and 71.4% were married. These demographic factors provide a baseline understanding of the patient population in the study, as shown in **Table 1**.

Table 1: Sociodemographic Characteristics

Characteristic	**N (%) or Mean ± SD**
Age (years)	60.5 ± 10.4
Gender (Male %)	55.2%
Education Level (Primary %)	35.7%
Education Level (Secondary %)	40.4%
Education Level (Higher %)	25.8%
Employment Status (Employed %)	45.6%
Marital Status (Married %)	71.4%

In terms of clinical characteristics, the average stage of CKD among participants was 3.5 (± 1.2), with the average duration of CKD being 5.2 years (± 2.4). Comorbidities were common among the population, with 50.6% of patients reporting diabetes mellitus, 60.3% having hypertension, and 42.1% having cardiovascular disease. Thirty-two percent of the participants were undergoing dialysis, indicating a significant proportion with advanced CKD. These clinical factors are presented in **Table 2**.

Table 2: Clinical Characteristics

Characteristic	**N (%) or Mean ± SD**
Stage of CKD (Stage 1-5)	3.5
Duration of CKD (years)	5.2 ± 2.4
Diabetes Mellitus (%)	50.6%
Hypertension (%)	60.3%
Cardiovascular Disease (%)	42.1%
Dialysis (Yes %)	32.4%

The quality of life (QoL) among participants was assessed across four domains: physical health, psychological health, social relationships, and environment. The mean scores for the physical health domain were 55.4 (± 10.8), while psychological health scores averaged 60.7 (± 9.8). Social relationships scored the highest, with a mean of 65.1 (± 8.7), and the environment domain had a mean score of 50.6 (± 11.3). These scores indicate that participants rated their social relationships higher than their physical and environmental well-being, suggesting that social support may play a protective role in maintaining QoL. **Table 3** summarizes these results.

Table 3: Quality of Life (QoL) Scores

QoL Domain	Mean ± SD
Physical Health	55.4 ± 10.8
Psychological Health	60.7 ± 9.8
Social Relationships	65.1 ± 8.7
Environment	50.6 ± 11.3

Correlation analysis revealed significant associations between various sociodemographic and clinical characteristics and QoL domains. Age was negatively correlated with physical health (r = -0.42), psychological health (r = -0.31), and environment (r = -0.28), indicating that older participants reported lower QoL scores in these domains. Higher education levels were positively correlated with all QoL domains, especially social relationships (r = 0.45), suggesting that education may enhance coping mechanisms. CKD stage was negatively correlated with physical health (r = -0.49) and psychological health (r = -0.36), highlighting the impact of disease progression on QoL. These findings are detailed in **Table 4**.

Table 4: Correlation Between Sociodemographic/Clinical Characteristics and QoL

Characteristic	Physical Health (r)	Psychological Health (r)	Social Relationships (r)	Environment (r)
Age	-0.42	-0.31	-0.25	-0.28
Gender (Male)	-0.20	-0.15	-0.18	-0.22
Education Level	0.40	0.38	0.45	0.35
Stage of CKD	-0.49	-0.36	-0.30	-0.33
Duration of CKD	-0.30	-0.22	-0.18	-0.25
Diabetes Mellitus	-0.20	-0.18	-0.22	-0.23
Hypertension	-0.25	-0.20	-0.18	-0.21
Dialysis	-0.31	-0.29	-0.28	-0.30

Multivariate regression analysis identified several significant predictors of QoL. CKD stage was a strong negative predictor of physical health ($\beta = -0.50$, $p < 0.001$) and psychological health ($\beta = -0.36$, $p < 0.001$). Age was also a significant predictor, with older age associated with lower physical health scores ($\beta = -0.30$, $p < 0.01$). Higher education levels were positively associated with social relationships ($\beta = 0.40$, $p < 0.01$). Dialysis was negatively associated with all QoL domains, with the strongest effect observed in the physical health domain ($\beta = -0.31$, $p < 0.01$). **Table 5** presents these findings.

Table 5: Multivariate Regression Analysis

Predictor	Beta Coefficient (95% CI)	p-value
Age	-0.30 (-0.35 to -0.25)	0.010
Gender (Male)	0.20 (0.15 to 0.25)	0.015
Education Level	0.40 (0.35 to 0.45)	0.002
Stage of CKD	-0.50 (-0.55 to -0.45)	<0.001
Duration of CKD	-0.10 (-0.15 to -0.05)	0.020
Diabetes Mellitus	-0.20 (-0.25 to -0.15)	0.008
Hypertension	-0.30 (-0.35 to -0.25)	0.005
Dialysis	-0.31 (-0.36 to -0.26)	<0.001

Discussion

This study aimed to explore the sociodemographic and clinical predictors of quality of life (QoL) in patients with chronic kidney disease (CKD) in Saudi Arabia. The findings underscore the multifactorial nature of QoL in CKD patients, with several sociodemographic and clinical variables significantly influencing various QoL domains. In particular, age, education level, CKD stage, and dialysis status were identified as key predictors of QoL, affecting physical, psychological, social, and environmental domains. These findings are consistent with previous research and contribute to the

growing body of evidence emphasizing the need for comprehensive, individualized approaches to CKD management (Levey et al., 2011).

One of the significant findings of this study is the negative association between age and QoL, particularly in the physical and psychological domains. Older patients reported lower QoL scores, which is in line with existing literature indicating that aging is associated with physical decline, increased comorbidities, and a higher burden of CKD-related complications (Y.-N. Wang et al., 2019). As patients age, they experience reduced mobility, fatigue, and cognitive decline, which are known to negatively impact their physical and psychological well-being. Moreover, older CKD patients are more likely to have multiple comorbidities, such as diabetes, hypertension, and cardiovascular disease, which exacerbate the physical limitations imposed by CKD (Akchurin, 2019). The negative impact of age on QoL highlights the need for age-sensitive interventions aimed at improving physical and psychological well-being in older CKD patients (Glassock et al., 2017).

The stage of CKD was another critical predictor of QoL, with more advanced stages of CKD associated with lower physical and psychological health scores. This finding aligns with previous studies showing that as kidney function declines, patients experience increased fatigue, muscle wasting, and other complications that severely impact their physical health (Adair & Bowden, 2020). Additionally, the psychological burden of living with a progressive disease like CKD, especially at later stages, can lead to anxiety and depression, further diminishing QoL (Alshelleh et al., 2022). The significant negative association between CKD stage and QoL underscores the importance of early diagnosis and intervention to slow disease progression and mitigate its impact on patients' overall well-being (Dhondup & Qian, 2017).

Dialysis status emerged as a strong predictor of QoL, with patients undergoing dialysis reporting significantly lower QoL scores across all domains. This finding is consistent with previous research, which has consistently demonstrated that dialysis has a profound negative impact on patients' physical and psychological health (Abraham & Ramachandran, 2012). Dialysis is time-consuming, physically draining, and often associated with a high risk of complications, such as infections and cardiovascular events, all of which contribute to reduced QoL (Himmelfarb et al., 2020). Moreover, the psychological toll of dependency on dialysis, the disruption to daily life, and the uncertainty surrounding long-term outcomes can lead to increased levels of depression and anxiety (Vaden & Elliott, 2016). These findings highlight the need for psychosocial support and rehabilitation programs aimed at improving the QoL of patients on dialysis.

Interestingly, education level was positively associated with QoL, particularly in the social relationships and psychological health domains. Patients with higher levels of education reported better QoL, which is consistent with research suggesting that higher education enhances health literacy and self-management skills (Andrassy, 2013). Educated patients are more likely to understand their condition, adhere to treatment regimens, and actively engage in their care, which can lead to better health outcomes and improved QoL (Bombard et al., 2018). Furthermore, higher education is often associated with greater social support networks and better coping mechanisms, which can buffer the negative effects of CKD on psychological well-being and social functioning (Fishbane & Spinowitz, 2018). The positive relationship between education and QoL underscores the importance of patient education programs to empower CKD patients in managing their condition (Bakarman et al., 2019).

In contrast, the study found that comorbid conditions such as diabetes and hypertension were negatively correlated with QoL, albeit to a lesser extent than CKD stage and dialysis status. This finding aligns with prior research showing that the presence of comorbidities increases the burden of disease and complicates the management of CKD, leading to poorer health outcomes (Cha & Han, 2020). For example, diabetes is associated with a range of complications, including neuropathy and cardiovascular disease, which can exacerbate the symptoms of CKD and contribute to declines in physical functioning (Gluhovschi et al., 2015). Similarly, hypertension, which is both a cause and a consequence of CKD, places additional strain on the cardiovascular system, increasing the risk of heart failure and other life-threatening conditions (Bosevski, 2017). The negative impact of comorbidities on QoL highlights the importance of integrated care approaches that address not only CKD but also its associated comorbid conditions.

The negative correlation between male gender and QoL, though weaker than other predictors, is noteworthy. Some studies have found that men with CKD may report lower QoL scores due to social isolation and lower engagement with healthcare services compared to women14. In contrast, other research suggests that men might experience fewer psychosocial stressors, such as caregiving

responsibilities, which could buffer against declines in QoL (Li et al., 2017). In the context of this study, the observed gender differences may reflect cultural and social factors in Saudi Arabia that shape how men and women experience and cope with chronic illness.

Overall, the findings of this study are consistent with the broader literature on QoL in CKD patients, reinforcing the notion that both sociodemographic and clinical factors play a crucial role in shaping patients' experiences of their disease. However, the specific cultural, social, and healthcare context of Saudi Arabia may influence how these factors interact, suggesting the need for culturally tailored interventions to improve QoL in CKD patients in this setting16.

Implication of the Study

The findings of this study have important implications for healthcare providers, policymakers, and the broader understanding of chronic kidney disease (CKD) management in Saudi Arabia. First, the strong association between CKD stage, dialysis status, and lower quality of life (QoL) highlights the need for early detection and intervention strategies. Healthcare systems should prioritize early screening for CKD and more aggressive management of early-stage disease to prevent progression and its impact on QoL. Moreover, the negative impact of dialysis on patients' QoL emphasizes the need for comprehensive dialysis support programs that address both physical and psychological well-being.

The study also underscores the importance of integrating patient education programs into CKD management. The positive relationship between education level and higher QoL scores indicates that patients with better health literacy can manage their condition more effectively. Developing culturally relevant education programs that empower patients to engage in self-care and disease management can improve outcomes and QoL.

Additionally, the study findings suggest that tailored interventions targeting specific sociodemographic groups (e.g., older patients, those with lower education) could be beneficial in improving QoL. Such interventions could include psychosocial support, rehabilitation programs, and enhanced access to healthcare services, particularly for those on dialysis.

Limitation of the Study

This study has several limitations that should be acknowledged. First, the cross-sectional design prevents the establishment of causal relationships between the variables studied. While significant associations were found between sociodemographic and clinical factors and QoL, longitudinal studies are needed to confirm the direction of these relationships over time. Future research could address this limitation by using a prospective cohort design to monitor changes in QoL as CKD progresses.

Second, the study relied on convenience sampling from university hospitals, which may limit the generalizability of the findings to the broader population of CKD patients in Saudi Arabia. Patients attending university hospitals may have different socioeconomic and clinical characteristics compared to those in rural areas or other healthcare settings. A more diverse sample would provide a more comprehensive understanding of how sociodemographic and clinical factors affect QoL across different populations.

Additionally, while the WHOQOL-BREF questionnaire is a validated tool, it relies on self-reported data, which could be subject to recall bias or social desirability bias. Participants may have underreported or overreported their QoL, which could affect the accuracy of the findings. Future studies could combine self-reported QoL assessments with objective health measures to provide a more balanced view of patient outcomes.

Conclusion

This study provides valuable insights into the sociodemographic and clinical predictors of QoL in patients with chronic kidney disease in Saudi Arabia. The results demonstrate that factors such as age, education level, CKD stage, and dialysis status significantly impact various domains of QoL, particularly physical and psychological health. These findings highlight the importance of early CKD detection, patient education, and comprehensive support for dialysis patients to improve QoL outcomes.

The study also emphasizes the need for culturally tailored interventions that address the unique challenges faced by CKD patients in Saudi Arabia. By understanding the specific predictors of QoL, healthcare providers can develop targeted strategies to enhance patient care and support, ultimately improving the overall well-being of CKD patients. Further research, particularly longitudinal studies, is needed to explore the long-term effects of sociodemographic and clinical factors on QoL and to refine interventions aimed at improving patient outcomes.

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