Quality of life and its predictors among patients with chronic kidney disease: A hospital-based cross sectional study

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Abstract

Introduction

Quality of life (QoL) is increasingly being considered as an important measure of how disease affects patients’ lives, especially for long-term diseases like chronic kidney disease (CKD). Even though there is no statistically significant association between stages of CKD and QoL, it is decreased in patients with early stages of the disease. Hence, this study aimed to assess QoL and its predictors among patients with CKD at Tikur Anbessa Specialized Hospital (TASH).

Methods

A cross sectional study was conducted at the nephrology clinic of TASH. A total of 256 patients were recruited through systematic random sampling. Data were collected using the Medical Outcomes Study Short Form 36-Items (SF-36). The data were entered into Epi Info 7.2.2.2 and analyzed using SPSS version 20.0 statistical software. Descriptive statistics like frequency, percent, mean and standard deviation were used to summarize patients’ baseline characteristics. Student’s unpaired t-test and ANOVA were conducted to compare two groups and more than two groups in the analysis of QoL, respectively. Multivariable linear regression was employed to investigate the potential predictors of QoL.

Results

Quality of life was decreased in all stages of CKD. A reduction in physical functioning (p = 0.03), bodily pain (p = 0.004), vitality (p = 0.019) and social functioning (p = 0.002) was observed progressively across stages of CKD. High income status and greater than 11g/dl hemoglobin level were found to be predictors of all high score SF-36 domains. High family income (β 15.33; 95%CI: 11.33–19.33, p<0.001), higher educational status (β 7.9; 95%CI: 4.10–11.66, p<0.001), and hemoglobin ≥11g/dl (β 8.36; 95%CI: 6.31–10.41, p<0.001) were predictors of better QoL in the physical component summary, whereas absence of CKD...
complications ($\beta$ 2.75; 95%CI: 0.56–4.94, $p = 0.014$), high family income ($\beta$ 10.10; 95%CI: 5.10–15.10, $p < 0.001$) and hemoglobin $\geq$11g/dl ($\beta$ 4.54, 95%CI: 2.01–7.08, $p = 0.001$) were predictors of better QoL in the mental component summary.

Conclusion

In this setting, QoL decreased in CKD patients in the early stages of the disease. Study participants with low income and hemoglobin level were considered to have worse quality of life in both physical and mental component summaries.

Introduction

Chronic kidney disease (CKD) is defined as abnormal kidney structure or function persisting greater than 3 months [1]. This can be determined either by evidence of kidney damage (typically detected by presence of persistent albuminuria) or by decreased glomerular filtration rate (GFR)[2, 3]. CKD is a global public health problem due to the rapid rise of common risk factors such as diabetes and hypertension. Consequently, it will result significance menace to the developing nations with limited resources [2]. Its burden on health care system is becoming immense with increasing prevalence, high costs, and poor outcomes [4]. CKD is associated with increased risks of cardiovascular morbidity, premature mortality, and has severe impact on quality of life (QoL) [4]. Mortality from cardiovascular disease (CVD) is estimated to be at least 8 to 10 fold higher in CKD patients as compared to non-CKD patients [4]. The costs involved in the management CKD co-morbidities are very high, imposing great difficulties on health care systems, predominantly in countries with limited resources [5].

Studies demonstrated that CKD patients living with significant constraints and restrictions might have an impaired normal psychosocial development [6, 7]. QoL is an independent risk factor for mortality in CKD patients particularly in end stage renal disease (ESRD) [8, 9]. Moreover, several factors such as disease related manifestations, side effects of treatments, and patient’s quality of interaction with family members can influence QoL [10, 11]. Low QoL have been the major problems in CKD patients and their occurrence can adversely impact the course of the disease [12, 13]. Patients with CKD have a reduced QoL and an increased frequency and severity of both symptoms and psychological distress, with the magnitude of these changes negatively correlated with GFR [6, 10]. Association of poorer QoL with preventable factors demonstrated that attention should be given to psychosocial and medical interventions to improve QoL in CKD patients [11]. The available data on QoL of patients on conservative treatment and the relationship between the QoL and GFR is limited [12, 13]. Even though patients with advanced renal insufficiency have a reduced QoL, some studies showed that QoL is decreased in the early stages of disease [14].

The incidence of CKD in Ethiopia is rising because of increased risk factors such as hypertension and diabetes mellitus [15]. An extensive study of factors affecting QoL would render valuable perspicacity for the healthcare providers in renal clinic to improve QoL. However, evidence-based research that evaluates QoL and associated factors among patients with CKD in developing countries is scanty [9]. Thus, there should be a continuing need to routinely assess factors affecting QoL among patients with CKD in clinical practice [11, 16]. This is especially important in resource-limited countries like Ethiopia, as the preponderance of economic instability, low literacy level, and restricted access to healthcare facilities, inadequate follow up and co-morbidities might have led to worse QoL. Therefore, this study aimed to evaluate the
quality of life (QoL) of CKD patients at Tikur Anbessa Specialized Hospital and to determine the related factors.

**Methods**

**Study design and settings**

A cross-sectional study was conducted from May to September 2017 at the nephrology clinic of Tikur Anbessa Specialized Hospital (TASH), the largest general public hospital, where tertiary care is being provided in Ethiopia. The Nephrology clinic provides treatment to different types of renal disease and its complications. The renal days are mainly Monday, Tuesday and Thursday; on an average 6, 12 and 12 CKD patients were selected, respectively. Single population proportion formula was used to calculate the sample size [17]

\[
 n = \frac{Z_{\alpha/2}^2 \cdot p(1 - p)}{d^2}
\]

Where;

- \( n \) is desired sample size for population \( > 10,000 \);
- \( Z \) is standard normal distribution usually set as 1.96 (which corresponds to 95% confidence level);
- \( p \) means that we use positive prevalence estimated, to maximize sample size. Negative prevalence \( = 1 - 0.5 = 0.5 \);
- \( d \) = degree of accuracy desired (marginal error is 0.05); then the sample size is

\[
 n = \frac{1.96^2 \cdot 0.5(1 - 0.5)}{(0.05)^2} = 384.16 \approx 384
\]

The expected number of source population in the study period (N), based on the average number of patients coming to the clinic three days in a week with a total of 20 weeks was 600 (20\( \times \)6+20\( \times \)12+20\( \times \)12).

Corrected sample size \( = \frac{n \times N}{n + N} \)

Where \( N \) = source population and \( n \) = estimated sample size for \( N \geq 10,000 \) population.

Corrected sample size \( = \frac{384 \times 600}{384 + 600} = 233 \)

Therefore, the corrected sample size with a 10% contingency provided a final sample size of 256 CKD patients.

**Inclusion criteria**

CKD patients aged 18 years and above and who understood Amharic language were targeted since Amharic is the predominant and national language in the region. However, patients with cognitive, speech or hearing impairment were excluded from the study and only those who signed the informed consent were included in the study.

**Data collection techniques**

Three nurses were recruited as data collectors. Training was given to them regarding appropriate use of the data collection instruments focusing on uniform interpretation of questions,
strict use of study criterion, explanation of study objectives and getting consents from study participants.

Data were collected using structured questionnaire, which contained socio-demographic characteristics, clinical parameters and The Medical Outcomes Study Short Form 36-Item Health Survey (SF-36) (S1 Annex). SF-36 is a generic instrument translated and validated scale in Amharic [18], was utilized to collect information necessary to assess QoL. The 36-item short form questionnaire is a multi-item scale, not specific to any disease or treatment group. The SF-36 is covered by a conceptual model of QoL [19] and includes 36 items that yield an 8-dimension profile on a 100-point scale; a higher score indicates a better perceived health state. The eight dimensions are: Physical function (PF), Role limitations caused by physical problems (RP), Pain (BP), General health (GH), Vitality/energy (VT), Social function (SF), mental health/emotional well-being (MH) and Role limitations caused by emotional problems/mental health (RE). In addition it is used to estimate change in health status over the past year. The data collection instrument was assessed by an expert physician in the field of nephrology for clarity and comprehensiveness of its contents. Pre-testing was done on 5% of the study participants before the start of the actual study. After pre-testing all the necessary modifications and adjustments were done before implementing in the main study.

Data analysis
Data were sorted, cleaned, coded and entered into Epi Info 7.2.2.2 and analyzed using SPSS version 20.0 statistical software. Descriptive statistics such as frequency, percent, mean and standard deviation were used to summarize patients’ baseline socio-demographic data and clinical parameters. Student’s unpaired t-test and one-way ANOVA were conducted to compare two groups and three or more groups in the analysis of QoL, respectively. When t-test & ANOVA result was statistically significant, multivariable linear regression was employed to identify the potential predictors of the physical and mental component summary. P-value < 0.05 considered as statistically significant.

Results
Socio-demographic characteristics
Males comprised 58% of the sex category. Majority of the participants were in the age group of less than 61 years, which accounted for 54.3%. Mean age of the study population was 52.5 (SD = 16.8) years (range 18 to 90 years). Married participants accounted for 69.9% and being retired (25.4%) and government employee (23.4%) accounted for the highest percentage of occupation. Education-wise, 34.4% and 27.7% attended primary and higher education, respectively. Majority of the participants were non-health professionals (97.3%). A significant proportion of the study participants (29.7%) had average level of monthly family income [20] (Table 1).

Disease related characteristics
Overall, patients had been diagnosed with CKD for an average of 4.7 (SD = 3.5) years, ranging from under five years (158, 61.7%) through 5–10 years (75, 29.3%) to above ten years (23, 9%). In stage 5 CKD patients, having more than three co-morbidities (47.5%) and complications (66.7%) were the most prevalent clinical conditions. Fasting blood sugar, serum creatinine and blood urea nitrogen increased, while hemoglobin decreased across the stages (Table 2).
Quality of life SF-36 domains and summary scores

QoL, as evaluated by the means of SF-36 domains, scores in all dimensions were impaired progressively and significantly (p < 0.05) across CKD stages and the lowest scores were found in stage 5 CKD patients except emotional role functioning in stage 4 (p = 0.005). As shown in Table 3, the dimensions showing highest and least scores were emotional role functioning (78 ± 34.7) and bodily pain (59.3 ± 22.6) in stages 1 and 2, social functioning (68 ± 24.6) and physical role functioning (48.6 ± 40.4) in stage 3, mental health (55.6 ± 18.9) and physical role functioning (38.2 ± 40.2) in stage 4 and emotional role functioning (56.1 ± 45.6) physical role functioning (26.6 ± 40.4) in stage 5, respectively (Table 3).
Factors associated with quality of life

The results of the comparative statistical analysis of the QoL domains of CKD patients according to the categorical socio-demographic variables are shown in Table 4. Among the domains that constitute the SF-36 physical and mental component summaries, higher scores in all SF-36 domains were observed in patients ≤ 60 years (p < 0.05) and higher education (p < 0.05) groups. High family income (p < 0.001) groups had higher score in all SF-36 domains except physical functioning, emotional role functioning, and mental health. The present study showed that male patients had escalated QoL in terms of general health (p = 0.034), vitality (p = 0.038), social functioning (p = 0.011) and mental health (p = 0.018). In addition, occupation had statistical significant difference with physical functioning (p = 0.001), physical role functioning (p < 0.001), bodily pain (p = 0.007) and vitality (p = 0.026) (Table 4).

Table 2. Clinical and laboratory parameters according to the stage of chronic kidney disease patients attending the renal clinic of Tikur Anbessa Specialized Hospital.

| Clinical/laboratory parameters | 1 & 2 (n = 50) | 3 (n = 88) | 4 (n = 55) | 5 (n = 63) | Total (n = 256) |
|-------------------------------|----------------|-----------|-----------|-----------|----------------|
| Number of co-morbidities | <= 2 | 43 (20.8) | 77 (37.2) | 46 (22.2) | 41 (19.8) | 207 (100) |
|                               | 3 or more | 4 (10) | 8 (20) | 9 (22.5) | 19 (47.5) | 40 (100) |
| Number of complications | <= 2 | 9 (10.2) | 29 (33) | 23 (26.1) | 27 (30.7) | 88 (100) |
|                               | 3 or more | 0 | 0 | 1 (3.3) | 2 (6.67) | 3 (100) |
| FBS (mg/dl) | 125 ± 46 | 140 ± 46 | 149 ± 69 | 155 ± 57 | 141 ± 36 |
| Scr (mg/dl) | 1.6 ± 0.8 | 2.0 ± 0.8 | 3.5 ± 1.6 | 7.6 ± 3.1 | 3.6 ± 3 |
| BUN (mg/dl) | 41 ± 20 | 56 ± 34 | 93 ± 46 | 136 ± 66 | 80 ± 57 |
| MAP (mmHg) | 104.9 ± 12.2 | 101.7 ± 9.6 | 104.3 ± 14.3 | 103.6 ± 14.3 | 103.4 ± 12.4 |
| GFR (ml/min/1.73m²) | 74.7 ± 15.4 | 65.1 ± 17.5 | 60.8 ± 22.6 | 54.5 ± 25.9 | 51.3 ± 28.1 |
| FBS = fast blood sugar, Scr = serum creatinine, BUN = blood urea nitrogen, Hgb = hemoglobin, MAP = mean arterial pressure and GFR = glomerular filtration rate

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Table 3. Quality of life domains and mean summary scores of patients in different stages of chronic kidney disease patients attending the renal clinic of Tikur Anbessa Specialized Hospital.

| Scales | No of items | Cronbach's α | Stages of CKD |
|--------|-------------|---------------|---------------|
|        | 1 & 2 (n = 50) | 3 (n = 88) | 4 (n = 55) | 5 (n = 63) | Total (n = 256) |
| PF     | 10          | 65.1 ± 17.5 | 60.8 ± 22.6 | 54.5 ± 25.9 | 51.3 ± 28.1 | 57.9 ± 24.4 |
| RP     | 4           | 66.3 ± 37.7 | 48.6 ± 40.4 | 38.2 ± 40.2 | 26.3 ± 40.4 | 44.3 ± 41.9 |
| BP     | 2           | 59.3 ± 22.6 | 58.8 ± 25 | 40.9 ± 23.8 | 35.3 ± 24.1 | 49.3 ± 26.2 |
| GH     | 5           | 61.4 ± 16.2 | 55 ± 17 | 46.4 ± 18.9 | 45.4 ± 18.5 | 52 ± 18.6 |
| VT     | 4           | 66.9 ± 15.4 | 65.1 ± 16.2 | 54.2 ± 19.2 | 52.5 ± 14.5 | 60 ± 17.5 |
| SF     | 2           | 68.6 ± 19.6 | 68 ± 24.6 | 54.7 ± 26.5 | 45.5 ± 22.5 | 59.7 ± 25.4 |
| RE     | 3           | 78 ± 34.7 | 61.4 ± 45.5 | 49.7 ± 42.5 | 56.1 ± 45.6 | 60.8 ± 43.8 |
| MH     | 5           | 67.4 ± 14.4 | 67.7 ± 15.8 | 55.6 ± 18.9 | 54.3 ± 16.8 | 61.8 ± 17.6 |
| PCS    | -           | 42.5 ± 7.5 | 40 ± 8.8 | 36.3 ± 9 | 33.4 ± 10.1 | 38.1 ± 9.5 |
| MCS    | -           | 49.7 ± 6.9 | 48.4 ± 8.9 | 42.6 ± 9.3 | 42.8 ± 8.9 | 46 ± 9.1 |

PF = Physical functioning, RP = Physical role functioning, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social functioning, RE = emotional role functioning, MH = Mental health, PCS = Physical summary scores, MCS = Mental summary scores.

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Table 4. Comparative statistical analysis of mean scores of SF-36 domains among patients with chronic kidney disease, according to the categorical socio-demographic variables.

|                  | PF    | RP    | BP    | GH    | VT    | SF    | RE    | MH    |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| **Sex**          |       |       |       |       |       |       |       |       |
| Female           | 54.9±23 | 41.1±24.2 | 46.6±24 | 49.1±18.7 | 57.3±16 | 55±24.5 | 59.5±44.2 | 58.7±16.9 |
| Male             | 60.1±5.2 | 46.6±41.5 | 51.2±7.6 | 54.1±18.3 | 61.9±8.3 | 63.2±5.6 | 61.8±43.6 | 63.9±7.8  |
| **p-value**      | 0.093 | 0.299 | 0.158 | 0.034 | 0.038 | 0.011 | 0.063 | 0.018 |
| **Age**          |       |       |       |       |       |       |       |       |
| ≤60              | 64.6±21.4 | 56.1±41.4 | 53.6±25.8 | 55.2±17.6 | 63.3±15.9 | 63.6±3.9 | 67.6±42 | 65±14.7  |
| >60              | 50±25.4 | 30.3±38 | 44±25.8 | 48.3±19.1 | 56±18.4 | 55.2±26.5 | 52.7±44.5 | 57.8±20  |
| **p-value**      | <0.001 | <0.001 | 0.004 | 0.003 | 0.001 | 0.008 | 0.006 | 0.001 |
| **Occupation**   |       |       |       |       |       |       |       |       |
| Farmer           | 57.7±24.8 | 39.6±40.3 | 44.2±3.5 | 53.1±9.5 | 60.2±18 | 54.8±17.6 | 62.5±45.4 | 59.8±16.2 |
| Gov’t employee   | 65.3±17.2 | 63.3±37.5 | 56.8±23.4 | 55.1±19 | 65.1±15.4 | 62±22.2 | 71.2±39.5 | 66.7±12.9 |
| Merchant         | 62.6±25.5 | 52.2±43.9 | 53±27.7 | 56.3±16.9 | 64.3±18.1 | 60.5±27.8 | 59.4±42.6 | 65.6±16.7 |
| Daily laborer    | 70.8±22.2 | 51.3±46 | 58.5±27.5 | 60.4±14.4 | 63.4±16.2 | 69.9±24.7 | 68.4±42.3 | 65.7±18.7 |
| Housewife        | 53.6±2.4 | 23.1±34 | 39.1±2.2 | 49.9±16.4 | 54.3±12 | 54.6±23.4 | 63±45 | 58.3±12.7 |
| Retired          | 48.5±27.7 | 32.3±40 | 44.2±28 | 47.2±19.7 | 56.3±19.3 | 58.6±29.6 | 48.7±45.3 | 57.9±22.1 |
| Others           | 57.1±24.6 | 52.7±42.7 | 53.5±26.9 | 49.6±18.7 | 59.1±10.1 | 60.9±27.5 | 58.4±45 | 60.9±19.4 |
| **p-value**      | 0.001 | <0.001 | 0.007 | 0.005 | 0.003 | 0.026 | 0.042 | 0.013 |
| **Education status** |     |       |       |       |       |       |       |       |
| Cannot read & write | 48.2±24.4 | 18.3±30.7 | 41.3±27 | 46.4±18.1 | 53.7±19.1 | 43.5±21 | 48.9±46.1 | 52.7±16.6 |
| Primary          | 57.2±25.9 | 44.3±42.7 | 46.5±26.1 | 51.8±17.6 | 59.5±18.3 | 58.1±24.8 | 61.4±46.4 | 61.2±18.8 |
| Secondary        | 55.4±25.7 | 39.9±42.9 | 48.3±25 | 48.1±18.9 | 57.2±16.7 | 60.9±27.8 | 52.7±43.5 | 59.9±18.2 |
| Higher education | 65.4±18.9 | 59.3±38.1 | 57.2±25.7 | 58.5±18.1 | 65.9±14.7 | 67.6±22.2 | 73.3±36.8 | 67.9±13.7 |
| **p-value**      | 0.006 | <0.001 | 0.017 | 0.002 | 0.003 | <0.001 | 0.015 | <0.001 |
| **Family income status** |     |       |       |       |       |       |       |       |
| Very low         | 40.8±25.8 | 10.6±24.6 | 26.9±19.4 | 40.6±16.4 | 41.1±16.8 | 39.6±24.2 | 42.5±47.1 | 46.1±15.8 |
| Low              | 46.7±22.2 | 22±9.33 | 43.3±25.2 | 46.4±17.2 | 57.8±17.1 | 55±26.1 | 42±42 | 58.8±19.6 |
| Average          | 68.2±21.8 | 58±24.5 | 55.8±24.4 | 55.6±18.4 | 64.6±12.5 | 67.1±22.5 | 70.6±43.9 | 65.7±14.9 |
| Above average    | 69.6±15.5 | 71.3±33.3 | 60.6±22.7 | 60.2±16.1 | 67.8±14.7 | 66.8±21.4 | 83±29.4 | 70.4±12.7 |
| **p-value**      | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |

PF = Physical functioning, RP = Physical role functioning, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social functioning, RE = Emotional role functioning, MH = Mental health

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Comparative statistical analysis of the SF-36 domains of CKD patients according to the clinical & laboratory parameters are shown in Table 5. Among the domains that constitute the SF-36 physical and mental component summaries, lower scores in SF-36 domains were associated with higher CKD stages (p<0.05) except emotional role functioning, on five or more medications (p<0.001), having three or more co-morbidities (p<0.001), presence of CKD complications (p<0.001), having hemoglobin ≤11g/dl level (p<0.001) and being non-adherent to their medications (p<0.05). General health was low in patients having greater than 110 mmHg mean arterial pressure (Table 5).

According to the comparative statistical analysis of categorical socio-demographic variables across composite summary, higher scores in the physical and mental component summary were found among patients who were younger (p<0.001, p<0.05), had higher education (p<0.001, p<0.001) and high family income (p<0.001, p<0.001), respectively of CKD
Table 5. Comparative statistical analysis of the mean scores of SF-36 domains of patients with chronic kidney disease, according to the categorical clinical/laboratory parameters.

| Variables          | PF        | RP        | BP        | GH        | VT        | SF        | RE        | MH        |
|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| CKD stage          |           |           |           |           |           |           |           |           |
| 1 & 2              | 65.1±17.5 | 66±37.7   | 59.3±22.6 | 61.4±16.2 | 66.9±15.4 | 68.6±19.6 | 78±34.7  | 67.4±14.4 |
| 3                  | 60.8±22.6 | 48.6±40.4 | 58.8±25  | 55±17     | 65.1±16.2 | 68.2±24.6 | 61.4±45.5 | 67.2±15.8 |
| 4                  | 54.5±25.9 | 38.2±40.2 | 40.9±23.8| 46.4±18.9 | 54.2±19.2 | 54.7±26.8 | 49.7±42.5 | 55.6±18.9 |
| 5                  | 51.3±28.1 | 26.6±40.4 | 35.3±24.1| 45.4±18.5 | 52.5±14.5 | 45.5±22.5 | 56±45.6  | 54.3±16.8 |
| p-value            | 0.009     | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | 0.007     |
| No of medications  |           |           |           |           |           |           |           |           |
| <3                 | 64.1±21.6 | 51±40.9   | 52.9±26.1| 54.9±17.9 | 62.2±16.1 | 64.2±24.6 | 64.2±42.6 | 64.7±15.7 |
| ≥5                 | 44.1±24.7 | 29.4±40.4 | 41.1±24.7| 45.6±18.5 | 55.1±19.4 | 50.2±24.4 | 46.4±43.2 | 55.1±19.8 |
| p-value            | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | 0.012     |
| Adherence rate     |           |           |           |           |           |           |           |           |
| Non adhered        | 49.3±24.6 | 24.8±36   | 38.1±23  | 43.6±16.9 | 52.8±17.8 | 49.8±24.7 | 52.2±45.5 | 54.9±18.3 |
| Adhered            | 63.3±22.7 | 56.7±40.7 | 56.4±25.6| 57.4±17.6 | 64.5±15.7 | 66±23.9   | 66.3±42.2 | 66.1±15.8 |
| p-value            | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    |
| No of co-morbidity |           |           |           |           |           |           |           |           |
| 0–2                | 62.2±22.1 | 49.5±42.1 | 51.6±25.9| 54.3±17.6 | 61.5±17.3 | 62.7±24.6 | 65.8±43.3 | 64.1±16.8 |
| ≥3                 | 34.6±23.1 | 16.3±26.9 | 36.9±24.6| 40±19.1   | 52±16.2   | 43.6±23.6 | 34.1±36.6 | 49.4±17.1 |
| p-value            | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    |
| Complications      |           |           |           |           |           |           |           |           |
| Present            | 47.1±25   | 29.7±38.9 | 40.1±25.4| 46.2±18.4 | 54±18   | 50.2±25.9 | 46.8±44.7 | 53.7±18.8 |
| Absent             | 63.9±22   | 52.4±41.3 | 54.4±25.3| 55.2±18   | 63.3±16.3| 65.2±23.6 | 68.5±41.4 | 66.2±15.2 |
| p-value            | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    |
| Hemoglobin         |           |           |           |           |           |           |           |           |
| ≤11g/dl            | 40.6±21.7 | 12.1±24.4 | 32.5±21.6| 41.1±16.9 | 50±17.2  | 46.7±25.4 | 36.1±42.5 | 51.9±17.9 |
| >11g/dl            | 70.4±17.6 | 67.4±36.1 | 61.3±22.3| 59.9±15.6 | 67.1±13.8| 69.1±20.9 | 78.6±35.3 | 68.8±13.6 |
| p-value            | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    | <0.001    |
| MAP                |           |           |           |           |           |           |           |           |
| ≤110 mmHg          | 58.2±24.8 | 45.4±41.4 | 50.6±26.2| 53.1±18.8 | 60.6±17.6| 60.2±25.8 | 60.5±43.6 | 62.2±17.7 |
| >110 mmHg          | 56.6±22.6 | 39.2±44.3 | 43.2±25.4| 47±16.6   | 56.9±16.6| 57.6±23.8 | 62.1±45.3 | 59.5±17.1 |
| p-value            | 0.690     | 0.373     | 0.089     | 0.046     | 0.201    | 0.542     | 0.828     | 0.362     |

Pf = Physical functioning, RP = Physical role functioning, BP = Bodily pain, GH = General health, VT = Vitality, SF = Social functioning, RE = Emotional role functioning, MH = Mental health, MAP = mean arterial pressure

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patients. Occupation had also statistically significant mean difference with physical component summary (Table 6).

As per the comparative statistical analysis of clinical & laboratory parameters, lower scores in the physical and mental component summary were found among patients who were on advanced CKD stage (p<0.001, p<0.001), five or more medications (p<0.001, p<0.001), three or more co-morbidities (p<0.001, p<0.001) and had hemoglobin ≤11g/dl level (p<0.001, p<0.001), respectively of CKD patients (Table 7).

After adjustment through multivariable linear regression, higher family income status and greater than 11g/dl hemoglobin level were found to be predictors of all high score SF-36 domains. Being female, presence of complications, advanced stage of CKD, patients with five or more medications and three or more co-morbidities were predictors of low physical functioning. Being adherent to medications and absence of CKD complications were found
Table 6. Comparative statistical analysis of the mean scores of physical and mental composite summaries of patients with chronic kidney disease, according to the categorical socio-demographic variables.

| Variables                | PCS       | p-value | MCS       | p-value |
|--------------------------|-----------|---------|-----------|---------|
| Sex                      |           |         |           |         |
| Female                   | 36.9 ± 9.5| 0.090   | 44.7 ± 9  | 0.051   |
| Male                     | 38.9 ± 9.5|         | 47 ± 9.1  |         |
| Age                      |           |         |           |         |
| <60                      | 40.7 ± 8.9| <0.001  | 47.3 ± 8.1| 0.012   |
| >60                      | 34.9 ± 9.2|         | 44.5 ± 10 |         |
| Occupation               |           |         |           |         |
| Farmer                   | 37.1 ± 9.4| <0.001  | 45.6 ± 8.1| 0.538   |
| Gov’t employee           | 41.7 ± 7.8|         | 47.8 ± 8  |         |
| Merchant                 | 40.5 ± 10.2|        | 46.5 ± 9.3|         |
| Daily laborer            | 42.5 ± 9.5|         | 47.7 ± 8.6|         |
| Housewife                | 33.7 ± 8.5|         | 45.8 ± 7.2|         |
| Retired                  | 34.9 ± 9.7|         | 44.5 ± 11 |         |
| Others                   | 39.3 ± 9  |         | 45.1 ± 10 |         |
| Education status         |           |         |           |         |
| Cannot read and write    | 33.6 ± 9.4| <0.001  | 41.7 ± 8.3| <0.001  |
| Primary                  | 37.6 ± 9.7|         | 45.8 ± 9.5|         |
| Secondary                | 37.2 ± 9.4|         | 44.8 ± 9.6|         |
| Higher Education         | 41.4 ± 8.5|         | 49.3 ± 7.5|         |
| Family income status     |           |         |           |         |
| Very Low                 | 29.7 ± 6.8| <0.001  | 38.8 ± 9.2| <0.001  |
| Low                      | 33.5 ± 8.3|         | 44.3 ± 9.1|         |
| Average                  | 41.7 ± 8.7|         | 48 ± 8.6  |         |
| Above Average            | 43.3 ± 6.7|         | 50.3 ± 6.5|         |
| High                     | 45.1 ± 7  |         | 48.9 ± 6.8|         |

PCS = Physical summary scores, MCS = Mental summary scores
*p < 0.001 compared with cannot read and write
**p = 0.004 compared with very low family income
*p < 0.001 compared with very low family income

predictors of better general health and mental health, respectively. Likewise, advanced CKD was a predictor of worse social functioning, vitality and bodily pain (Table 8). No associations were detected between any other socio-demographic or clinical variables and the scores of the SF-36.

The present study revealed that only high family income, educational status and hemoglobin >11g/dl level were predictors of better QoL in the physical component summary, after adjustments through multivariable linear regression. The independent predictors of higher mental component summary were high family income, hemoglobin >11g/dl level and absence of CKD complications (Table 9).

Discussion

The present study revealed that QoL decreased across all CKD stages, which is similar with various studies [13, 21]. Quality of life domains such as physical functioning, bodily pain, vitality and social functioning were found statistically significant with CKD stages. The domains which make up the physical QoL were more impaired than domains that constitute the mental
Quality of life and its predictors among patients with chronic kidney disease

QoL. This finding is in agreement with the results obtained from previous studies, which demonstrated poorer physical component QoL in relation to mental component QoL in renal patients [5, 13]. This could probably be due to the chronic nature of the disease; patients may adapt not only to the disease and its treatment but also psychologically to their situations that directly affect patients’ QoL over time. The mean score of physical component summary was found to be $38.1 \pm 9.5$. This finding is similar with previous findings in Iran [11], Canada & Denmark [22, 23] and different from other studies in Brazil [13]. On the other hand, mental composite summary was found to be $46.2 \pm 9.1$. This finding is also in accordance with studies conducted in Brazil & Denmark [13, 23] and different from studies conducted in Nigeria & USA [10, 24]. This variation could be attributed to differences in socioeconomic and education status, management approaches between the countries, and sample size between studies.

Socioeconomic status has been implicated in QoL in several studies of renal patients [13, 25]. CKD patients with low socioeconomic status could not afford the prescribed regimens for the management of various illness co-existed and this affects their QoL and adherence [26]. The finding of this study indicated that there were low QoL scores in all stages of CKD, which is associated with low socioeconomic status of the study participants in Ethiopia. Besides, it also demonstrated a significant decrease in QoL progressively in the different stages of renal disease.

### Table 7. Comparative statistical analysis of mean scores of physical and mental composite summaries of patients with chronic kidney disease, according to the categorical clinical & laboratory parameters.

| Variables                  | PCS     | p-value | MCS     | p-value |
|----------------------------|---------|---------|---------|---------|
| **CKD stage**              |         |         |         |         |
| 1 & 2                      | 42.5 ± 7.5 | <0.001 | 49.7 ± 6.9 | <0.001 |
| 3                          | 40 ± 8.8   |         | 48.4 ± 8.9 |         |
| 4                          | 36.3 ± 9⁰  |         | 42.6 ± 9.3⁰|         |
| 5                          | 33.4 ± 10.1⁰|       | 42.8 ± 8.9⁰|         |
| **Number of medications**  |         |         |         |         |
| <5                         | 40 ± 9    | <0.001 | 47.4 ± 8.2 | <0.001 |
| ≥ 5                        | 33.7 ± 9.3 |         | 42.9 ± 10.3 |         |
| **Adherence rate**         |         |         |         |         |
| Non-adhered                | 33.2 ± 8.1 |         | 43.2 ± 9.6 |         |
| Adhered                    | 41.2 ± 9   | <0.001 | 47.8 ± 8.4 | <0.001 |
| **Number of co-morbidity** |         |         |         |         |
| 0–2                        | 39.4 ± 9.1 | <0.001 | 47.1 ± 9   | <0.001 |
| ≥ 3                        | 30.7 ± 8.4 |         | 40.3 ± 8   |         |
| **Complications**          |         |         |         |         |
| Present                    | 34.3 ± 9.2 | <0.001 | 42.2 ± 9.3 | <0.001 |
| Absent                     | 40.1 ± 9   |         | 48.1 ± 8.4 |         |
| **Hemoglobin**             |         |         |         |         |
| Hgb ≤ 11g/dl               | 30.5 ± 6.5 | <0.001 | 41.1 ± 9.1 | <0.001 |
| Hgb > 11g/dl               | 43.5 ± 7.3 |         | 49.5 ± 7.4 |         |
| **MAP**                    |         |         |         |         |
| MAP ≤ 110 mmHg             | 38.5 ± 9.6 | 0.112  | 46.1 ± 9.2 |         |
| MAP > 110 mmHg             | 36 ± 8.9  |         | 45.68 ± 8  | 0.740  |

PCS = Physical summary scores, MCS = Mental summary scores, MAP = mean arterial pressure

* p < 0.001 compared with CKD stage 1 & 2

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### Table 8. Adjusted analysis for predictors of SF-36 domains among chronic kidney disease patients.

| SF-36 domains | Coefficients (95% CI) | p-value |
|---------------|-----------------------|---------|
| **Physical functioning** | | |
| Male | 5.0 [0.28–9.72] | 0.038 |
| Absence of complications | 5.05 [0.16–9.94] | 0.043 |
| ≥ 3 co morbidity | -11.44 [-18.23–(-4.6)] | 0.001 |
| CKD stages | | |
| 1 & 2 | 1.00 |
| 3 | -4.3 [-11.6–(3.0)] | 0.247 |
| 4 | -10.6 [-19.3–(-2.0)] | 0.016 |
| 5 | -13.8 [-22.9–(-4.8)] | 0.003 |
| Family income status | | |
| Very low | 1.00 |
| Low | 4.9 [-4.25–14.14] | 0.289 |
| Average | 27.4 [18.4–36.4] | <0.001 |
| Above average | 28.9 [20.2–37.5] | <0.001 |
| High | 28.7 [15.3–42.0] | <0.001 |
| ≥ 5 medications | -7.9 [-13.27–2.53] | 0.004 |
| Hgb>11g/dl | 21.5 [15.8–27.14] | <0.001 |
| **Role Limitation physical** | | |
| Family income status | | |
| Very low | 1.00 |
| Low | 12.3 [0.5–24.1] | 0.042 |
| Average | 47.6 [33.1–62.1] | <0.001 |
| Above average | 60.5 [47.9–73.0] | <0.001 |
| High | 61.4 [46.6–76.3] | <0.001 |
| Hgb>11g/dl | 37.42 [27.79–47.05] | <0.001 |
| **Bodily pain** | | |
| CKD stages | | |
| 1 & 2 | 1.00 |
| 3 | -0.4 [-8.9–8.0] | 0.098 |
| 4 | -18.3 [-27.3–(-9.3)] | <0.001 |
| 5 | -23.9 [-32.7–(-15.1)] | <0.001 |
| Family income status | | |
| Very low | 1.00 |
| Low | 16.4 [7.3–25.5] | 0.001 |
| Average | 28.9 [20.1–37.8] | <0.001 |
| Above average | 33.8 [24.8–42.7] | <0.001 |
| High | 37.4 [25.5–49.2] | <0.001 |
| Hgb>11g/dl | 16.5 [9.72–23.3] | <0.001 |
| **General health** | | |
| Family income status | | |
| Very low | 1.00 |
| Low | 5.8 [-0.8–12.4] | 0.087 |
| Average | 15.0 [8.1–21.9] | <0.001 |
| Above average | 19.6 [12.8–26.4] | <0.001 |
| High | 21.8 [12.3–31.4] | <0.001 |
| Hgb>11g/dl | 9.99 [4.98–15.00] | <0.001 |
| Adhered | 5.20 [0.68–9.73] | 0.024 |
| **Vitality** | | |
| CKD stages | | |
| 1 & 2 | 1.00 |
| 3 | -1.8 [-7.4–3.8] | 0.528 |
| 4 | -12.7 [-19.5–(-5.9)] | <0.001 |
| 5 | -14.4 [-20.0–(-8.8)] | <0.001 |

(Continued)
based on the mean values of the SF-36 scores, which were below 70 in all dimensions. However, normal healthy populations usually have scores above this level in most studies [19].

On the evaluation of socio-demographic and clinical variables through multivariable linear regression analysis, all SF-36 domains, physical and mental component summary were found

| SF-36 domains | Coefficients (95% CI) | p-value |
|---------------|-----------------------|---------|
| Family income status | Very low 1.00 | |
| | Low 16.7 [10.1–23.4] | <0.001 |
| | Average 23.8 [18.0–28.9] | <0.001 |
| | Above average 26.7 [20.1–33.3] | <0.001 |
| | High 28.3 [19.2–37.4] | <0.001 |
| Hgb>11g/dl | 7.90 [3.26–12.55] | 0.001 |
| Social functioning | | |
| Occupation | | |
| | Farmers 1.00 | |
| | Gov't employee 0.5 [-8.3–9.3] | 0.909 |
| | Merchants -1.0 [-13.5–11.5] | 0.875 |
| | Daily laborer -6.9 [-17.0–3.2] | 0.178 |
| | House wife -2.9 [-13.4–7.6] | 0.585 |
| | Retired -0.6 [-12.7–11.2] | 0.922 |
| | Others* 2.4 [1.2–4.4] | 0.03 |
| CKD stages | | |
| | 1 & 2 1.00 | |
| | 3 -0.6 [-8.6–7.4] | 0.879 |
| | 4 -13.9 [-23.0–(4.8)] | 0.003 |
| | 5 -23.2 [-31.1–(15.2)] | <0.001 |
| Family income status | Very low 1.00 | |
| | Low 15.4 [5.4–25.3] | 0.003 |
| | Average 27.5 [18.6–36.4] | <0.001 |
| | Above average 27.2 [17.7–36.7] | <0.001 |
| | High 33.3 [20.2–46.4] | <0.001 |
| Hgb>11g/dl | 9.15 [2.25–16.06] | 0.01 |
| Role emotional | | |
| Family income status | Very low 1.00 | |
| | Low -0.4 [-17.5–16.7] | 0.963 |
| | Average 28.2 [10.7–45.6] | 0.002 |
| | Above average 40.6 [24.5–56.6] | <0.001 |
| | High 30.2 [5.2–55.3] | 0.019 |
| Mental health | | |
| Absence of complications | 6.19 [2.12–10.26] | 0.003 |
| Family income status | Very low 1.00 | |
| | Low 12.7 [5.5–19.8] | 0.001 |
| | Average 19.6 [13.7–25.5] | <0.001 |
| | Above average 24.3 [18.3–30.2] | <0.001 |
| | High 21.4 [13.2–29.6] | <0.001 |
| Hgb>11g/dl | 7.74 [3.02–12.45] | 0.001 |

CI = confidence interval, CKD = chronic kidney disease, Hgb = hemoglobin

*students, garage, guards, teacher working in private schools

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to be strongly associated with family income and hemoglobin level. In addition, an advanced stage of CKD was found a predictor of worse physical functioning, social functioning, vitality and bodily pain. These findings are in accordance with other studies in Denmark [23], Jordan [27], Saudi [3], Ireland [28], Portugal [7], and showed that socio-economic status was a predictor of QoL score. A prospective study conducted by Braga et al [26] revealed that higher socio-economic level was significantly related to better QoL. Similarly, lower social status, characterized by lower education, worse financial situation, or lack of employment has also been consistently associated with impaired QoL [29]. This could be due to the fact that people with low economic status do not access effective health care due to economic constraints. This might suppress utilization of good QoL, effective health care in developing countries including Ethiopia.

Besides, various studies revealed that hemoglobin \(\geq 11\text{g/dl} \) was associated with better QoL. A study in the US indicated that hemoglobin level was positively associated with QoL [24]. In different literature, the impact of hemoglobin in CKD on QoL is well described [30, 31]. This may be due to the low level of hemoglobin being associated with a greater risk of co-morbidities, which could result in fatigue and reduced physical activities, thus, decreasing QoL.

With regard to education, participants with a higher level of education had better physical component summary than patients with lower education level. This finding is similar to other previous studies which showed that participants with higher educational level have better QoL [32, 33]. This may be due to educated participants have greater access to information about their disease, better economic conditions, and better capacity to evaluate traumatic phenomena. It is also assumed that CKD patients with higher education mainly participate in activities that require more intellectual over those that require greater physical effort. Thus, low educational status may attribute the poor QoL of CKD patients. Presences of CKD complications were found to be strongly associated with low score on mental composite summary in the

### Table 9. Adjusted analysis for predictors of physical and mental component summaries of the Short Form (SF-36) among chronic kidney disease patients.

| SF-36 component summary | Coefficients (95% CI) | p-value* |
|------------------------|-----------------------|----------|
| Physical component summary | | |
| Educational status | | |
| Cannot read & write | Reference |
| Primary | 4.0 [-0.01–9.06] | 0.051 |
| Secondary | 3.6 [-0.49–7.71] | 0.083 |
| Higher education | 7.9 [4.10–11.66] | <0.001 |
| Family income status | | |
| Very low | Reference |
| Low | 3.76 [0.71–6.81] | 0.016 |
| Average | 11.97 [8.83–15.12] | <0.001 |
| Above average | 13.56 [10.68–16.43] | <0.001 |
| High | 15.33 [11.33–19.33] | <0.001 |
| Hgb\(>11\text{g/dl}\) | 8.36 [6.31–10.41] | <0.001 |
| Mental component summary | | |
| Family income status | | |
| Very low | Reference |
| Low | 5.45 [1.87–9.03] | 0.003 |
| Average | 9.15 [5.74–12.56] | <0.001 |
| Above average | 11.50 [8.22–14.79] | <0.001 |
| High | 10.10 [5.10–15.10] | <0.001 |
| Absence of complications | 2.75 [0.56–4.94] | 0.014 |
| Hgb\(>11\text{g/dl}\) | 4.54 [2.01–7.08] | 0.001 |

CI = confidence interval.

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present study. This is comparable to a study by Silverberg et al [34] & Kimel et al [35] where history of CVD and anemia were found to be negatively associated with QoL. The study participants in this study who have different complications scored low QoL. The possible reason for this finding may be due to CKD patients with different complications were more likely on many drugs at the same time and may also be at advanced stage of CKD [36]. All these factors may constitute great burden for the patients and invariably reduce their QoL. In the present study variables like sex, co-morbidity status, CKD stage, occupation and pill burden were not statistically significant associated with QoL, which were predictors of in various studies. This variation may be due to methodological difference and management approaches between studies in different countries.

**Limitation of the study**

The cross-sectional nature of the study did not allow a follow up, which would have provided a better design for identifying the worse quality of life and contributing factors. On the other hand, the quantitative nature of the data could not properly highlight the reasons for low quality of life from the patients’ perspective, which would have been better revealed by conducting in-depth interviews or focus group discussions. The study looked at only a single facility and hence caution should be exercised in extrapolating the results.

**Conclusions**

Quality of life was impaired progressively across the 5 CKD stages. The domains which make up the physical quality of life were more impaired than domains that constitute the mental quality of life. Study participants with low income and hemoglobin level were considered to have worse quality of life in both physical and mental component summaries.

**Ethical approval**

Approval and permission were sought from Ethical Review Board of school of pharmacy and department of internal medicine of Addis Ababa University.

**Supporting information**

S1 Annex. Structured questionnaire and data abstraction format. (DOCX)

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