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ORIGINAL ARTICLE

Assessment of Disability Adjusted Life Years (DALYs) Among the Patients of Chronic Kidney Disease in Nishtar Medical University Hospital, Multan

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ABSTRACT

Background: Mortality statistics alone are insufficient to capture the full burden of illness experienced by individuals across communities. Chronic kidney disease (CKD) presents a rising global health concern, with a global prevalence estimated at 13.4%. In Pakistan, this burden is even higher, with prevalence reaching 16.6%. The use of Disability-Adjusted Life Years (DALYs) offers a more comprehensive assessment by incorporating both morbidity and mortality, thus guiding more effective healthcare resource allocation.

Objectives: This study aims to emphasize the critical need for improved management strategies for CKD in Pakistan and to encourage both governmental and private stakeholders to implement targeted interventions that reduce disability and extend life expectancy in affected patients.

Methods: A cross-sectional comparative study was conducted at the Nephrology Department of Nishtar Medical University Hospital, Multan. Data were collected through a semi-structured questionnaire addressing demographic characteristics, clinical history, and CKD-associated disabilities. Analysis was performed using SPSS version 22.

Results: Among the 110 CKD patients enrolled, 62 (56.4%) were male and 48 (43.6%) were female. The majority were married, with most females being housewives and most males unemployed. Educational attainment was low, with 75.4% having education from illiteracy to matriculation, and only 24.5% having intermediate or higher education. Most patients had a monthly household income between PKR 10,000 and 40,000. A family history of CKD was absent in 70.9% of participants, and 86.4% were non-smokers. Common physical symptoms included swollen ankles/feet (71.8%) and itching, tingling, or numbness of the skin (62.7%).

Conclusion: All CKD patients experienced at least one form of disability. Fatigue and exhaustion were the most frequently reported physical issues, while depression, mood changes, and mental confusion were the most common functional impairments. The majority of patients belonged to lower socioeconomic and educational backgrounds and were diagnosed at later stages of disease progression.

Keywords: Chronic kidney disease, DALYs, Disability, Morbidity, Functional Impairment.

INTRODUCTION

The data on mortality and health in people throughout the world is patchy and unreliable at best. Mortality alone does not provide a clear picture of the illness burden experienced by individuals in various communities. [1] The Global Burden of Disease (GBD) is a methodology that assesses the risks to the population when they are confronted with a disease or injury, such as the effects of death and disability on health systems.[2] The disability-adjusted life year (DALY) is a metric for the total disease burden that is stated as the number of years lost due to illness, disability, or death.[1] The World Bank

commissioned the first Global Burden of Disease (GBD) research in collaboration with the Harvard School of Public Health and the World Health Organization for its World Development Report 1993 (World Bank, 1993). The first GBD study, conducted in 1990, looked at the health effects of over 100 diseases and injuries in eight different countries.[1]

One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition is the sum of the years of life lost due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population.[1]

The total of these two components is used to compute DALYs:

DALY = YLL + YLD

YLD is determined by the number of years disabled weighted by the level of disability caused by a disability or disease. The life expectancy at the moment of death is used by YLL.[3]It's important to note that life expectancies vary with age. Because the Japanese have the longest life expectancies, their figures have long been used as a benchmark for gauging early death.[4] Japan has an 84.3-year life expectancy at birth. Males score 81.5, while females score 86.5. Pakistan has a life expectancy of 65.6 years. Males scored 64.6, while females scored 66.7.[5]

Chronic kidney disease (CKD) is a diverse term used to describe the progressive loss of nephrons caused by any type of kidney disorder. Current guidelines define this condition as a decrease in kidney function, represented by a glomerular filter rate (GFR) of less than 60 mL/min per 1·73 m^2, or markers of kidney damage, or both, for a duration of at least 3 months, irrespective of the underlying cause [6]. Pathogenesis of the disease has many routes all of which lead to the loss of nephrons. The most common causes of CKD are hypertension, diabetes, and cardiovascular disease. In short, any type of Pathology that can cause damage to the Kidneys can lead to CKD[7].

Screening high-risk individuals with routine urine and blood tests enables early CKD detection, slowing progression and preserving quality of life. [8] Treatment is mainly aimed to prevent the progression and complications of the disease. Furthermore, ACEI and ARB are recommended on grounds of their ability to reduce proteinuria.[9] After stage 5 of the disease, dialysis is required to prevent severe complications.[10]

Worldwide CKD has been recognized as a public health problem and has a significant burden on the health care system. The prevalence of CKD is increasing with an estimated global prevalence of 13.4% and the number of patients that require kidney transplants is estimated to be around 4.9 to 7 million.[11] However, in Pakistan, the prevalence was found to be 16.6%.[12] This increased prevalence can be attributed to increasing risk factors in developing countries like Pakistan. Many risk factors have been identified for CKD. Some of the most common include smoking, hypertension, Diabetes mellitus, reduced blood supply to kidneys, and obesity. A family history of CKD is also an indicator of the disease later in life. Excessive alcohol consumption, use of analgesic medicines, and heavy metal exposure can also contribute to the development of disease.[13]

This study underscores DALYs' crucial role in comparing disease burdens and guiding equitable, cost-effective resource allocation. It advocates for strengthened CKD management in Pakistan—urging public and private sectors to reduce disability and extend patient life.

MATERIAL AND METHOD

Study Design and Duration

This study was designed as a cross-sectional comparative analysis to evaluate the burden of disability-adjusted life years (DALYs) among patients diagnosed with chronic kidney disease (CKD). The research was carried out at the Department of Community Medicine, Nishtar Medical University (NMU), Multan. The duration of the study was six months, initiated after obtaining ethical approval and research synopsis clearance from the university's Institutional Review Board. The design was chosen to gather data from different groups of CKD patients at a single point in time to enable assessment and comparison of relevant variables related to disease-related disability.

Study Setting

The study was conducted at Nishtar Medical University Hospital, a tertiary care teaching hospital located in Multan, Pakistan. The hospital serves as a referral center for a wide catchment area, particularly southern Punjab. Data were collected from patients admitted to the nephrology wards as well as those presenting to the nephrology outpatient department during the specified study period.

Sample Size Determination

The sample size was calculated using statistical parameters that included a 95% confidence level, a margin of error of 9%, and an estimated population proportion of 36%. A standard z-score value of 1.96 was used for the 95% confidence interval. Assuming an infinite population size, the sample size calculated was 110 participants. This ensured that the study could achieve sufficient statistical power to generalize findings within ±9% of the true population value at the defined confidence level.

Sampling Method

A non-probability convenience sampling technique was employed to select the participants. This approach allowed the inclusion of patients who were readily available and met the study's eligibility criteria, either through admission in hospital wards or attendance at outpatient clinics. The sampling continued until the required sample size was achieved.

Eligibility Criteria

Inclusion criteria for the study comprised patients who had been diagnosed with CKD and were either admitted to the nephrology ward or attended the outpatient department of NMU Hospital during the study period. All patients who agreed to participate and provided written informed consent were considered eligible, provided they affirmed at least one positive response to the sub-questions included in question 18 of the structured questionnaire, which related to disability assessment. Conversely, patients who refused to participate or denied any disability in all parts of question 18 were excluded from the study.

Ethical Considerations

Prior to initiating the data collection, formal ethical approval was obtained from the Institutional Review Board of Nishtar Medical University, Multan. The study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. Each participant received a detailed explanation of the study's objectives, procedures, and confidentiality assurances. Written informed consent was taken from all participants before enrollment in the study.

Data Collection Instrument and Procedure

Data were collected using a semi-structured, self-developed questionnaire designed specifically for this study. The questionnaire was developed in consultation with subject experts and pretested for clarity and reliability. It comprised sections related to socio-demographic details, clinical history, comorbid conditions, and specific disabilities associated with CKD. Particular focus was given to question 18, which assessed multiple domains of physical and functional disabilities. Eligible patients were approached individually, and interviews were conducted in a quiet environment to maintain privacy. Assistance was provided for patients who were illiterate or fatigued. For patients who had died during the course of treatment, demographic and clinical data were obtained from hospital records, specifically to estimate years of life lost (YLL), if applicable.

Data Analysis

All collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22. Descriptive statistics were applied to compute means, standard deviations, frequencies, and percentages for quantitative and qualitative variables. The calculation of DALYs was based on the standard formula: DALY = YLL + YLD, where YLL denotes years of life lost due to premature mortality, and YLD represents years lived with disability. In this study, as no patient deaths were recorded during the study period, YLL was zero, and the DALY score was equivalent to the calculated YLD. Pearson's correlation test was used to explore associations between age at onset of disability, academic background, and the duration of specific physical and functional disabilities. Scatter plots were also generated to visually represent correlations and trends between the studied variables.

RESULTS

Demographic Profile of the Study Population

The present study included a total of 110 patients with chronic kidney disease (CKD). Of these, 62 patients (56.4%) were male and 48 (43.6%) were female (Table 1). Most of the participants were married, while a minority were unmarried or widowed, suggesting that familial responsibilities may influence healthcare access and stress levels (Figure 1). Occupational data indicated that most women were housewives, while a significant proportion of men were unemployed (Figure 2), reflecting potential economic vulnerability among this group.

Most patients came from lower socioeconomic strata, with 10,000–40,000 PKR/month being the most common income bracket. A smaller number earned between 40,000–60,000 PKR or above 60,000 PKR/month (Figure 3). Education levels revealed that 75.4% of patients had not studied beyond matriculation, and only 24.5% had completed intermediate or higher education. This educational disparity has implications for health literacy and disease management.

Table 1: Frequency Distribution of Gender

Gender	Frequency	Percentage
Male	62	56.4%
Female	48	43.6%
Total	**110**	**100.0%**

Family History and Lifestyle Factors

A family history of CKD was positive in only 29.1% of participants (Table 2), suggesting that lifestyle and environmental factors may play a more prominent role in this population. Regarding smoking status, 86.4% of the patients were non-smokers (Table 3), aligning with findings that smoking is a modifiable risk factor but not a dominant contributor in all CKD populations.

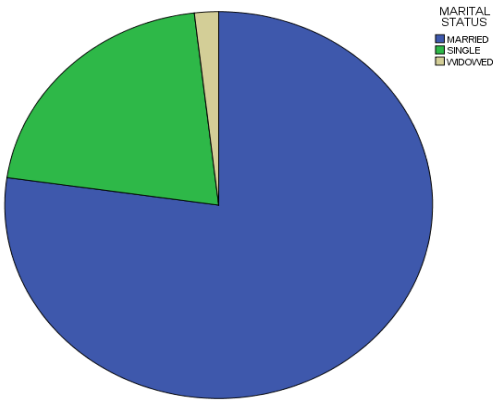

Figure 1: Figure of Marital Status

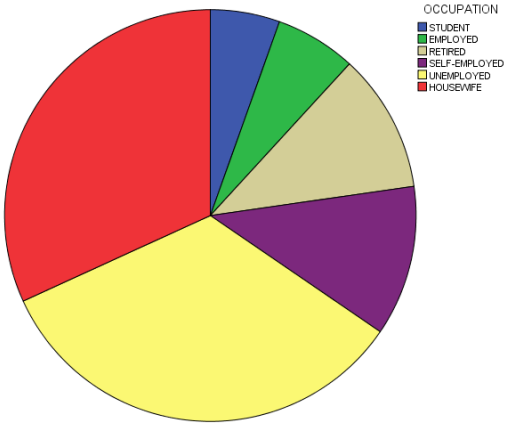

Figure 2: Figure of Occupation

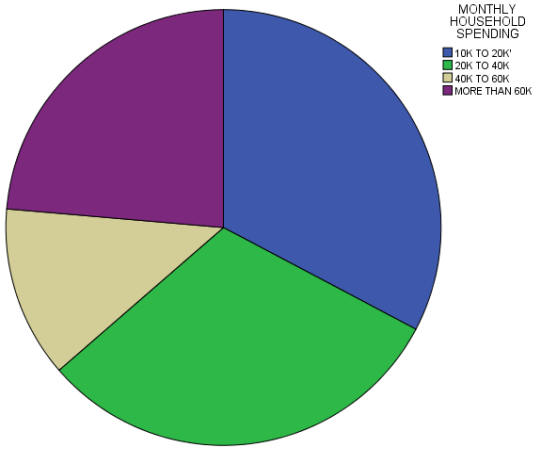

Figure 3: Figure of Monthly Household Spending

Table 2: Family History of CKD

Family History	Frequency	Percentage
Yes	32	29.1%
No	78	70.9%
Total	**110**	**100.0%**

Table 3: Smoking Status

Smoking Status	Frequency	Percentage
Yes	15	13.6%
No	95	86.4%
Total	**110**	**100.0%**

Prevalence of Physical Disabilities

Fatigue and exhaustion was the most common physical disability among CKD patients, affecting 88.2% of the sample (Table 4). This finding is consistent with CKD literature, which highlights fatigue as a hallmark symptom due to anemia, uremia, and muscle catabolism (Perlman et al., 2005) . Bone pain and muscle cramps affected 79.1% of patients, followed by weight loss (70.9%), swollen ankles and feet (71.8%), and itching/tingling/numbness (62.7%). The least reported symptom was skin pigmentation (40.9%).

Table 4: Frequency of Physical Disabilities in CKD Patients

Symptom	Frequency (%)
Fatigue and Exhaustion	88.2%
Bone Ache and Muscle Cramping	79.1%
Swollen Ankles and Feet	71.8%
Loss of Weight	70.9%
Itching, Tingling, Numbness	62.7%
Skin Pigmentation	40.9%

Functional Disabilities and Limitations

Depression, mood changes, and mental confusion were the most common functional impairments, affecting 70% of patients (Table 5). Repeated hospitalizations were reported by 47.3% of participants, and 35.5% experienced loss of employment. Bedridden state was seen in 26.4% of patients, and 30.9% were unable to walk without assistance. Only 2.7% were unable to eat or drink unassisted, the lowest recorded functional disability. These findings mirror studies linking poor functional status to reduced quality of life and increased healthcare utilization.

Table 5: Functional Disabilities in CKD Patients

Functional Impairment	Frequency (%)
Depression/Mood Fluctuation/Mental Confusion	70.0%
Repeated Hospitalizations	47.3%
Loss of Job	35.5%
Bedridden State	26.4%
Unable to Walk Unassisted	30.9%
Unable to Eat/Drink Unassisted	2.7%

Descriptive Statistics: Age, Duration of Disease, and Disability

The average age of the patients participating in the study was 40.6 years, with the youngest being 15 and the oldest

73 years, indicating a wide age range that includes both adolescent and geriatric patients. This suggests that CKD is not only a disease of old age but can affect individuals early in life as well. The standard deviation of 13.37 shows moderate variability within the study population.

The average number of family members per household was 6.4, with some families as small as one person and others as large as fourteen. This reflects the typical extended family structure common in South Asian societies and highlights the potential support system available to patients, which can influence disease management and caregiving dynamics.

The mean age at CKD diagnosis was 33.6 years, and the mean age at the onset of disability was 35.9 years, suggesting a rapid transition from diagnosis to functional impairment within two to three years. This rapid progression may be attributed to late-stage presentation, lack of early screening, or poor disease awareness.

Patients reported living with disability for an average of 4.67 years, with a maximum reported duration of 30 years, highlighting the chronic and long-lasting nature of disability due to CKD. The large standard deviation (4.29) indicates that the impact of disability varies widely across the population.

Regarding specific physical symptoms, fatigue and exhaustion had a mean duration of 3.45 years, closely followed by swollen ankles and feet (3.44 years), weight loss (3.42 years), and itching, tingling, or numbness of the skin (3.28 years). These symptoms are typical of long-standing CKD and severely affect daily life. Bone aches and muscle cramps persisted for an average of 3.01 years, while skin pigmentation, the least frequent physical issue, had the shortest mean duration of 2.24 years.

Among the functional disabilities, depression, mood fluctuation, and mental confusion lasted on average 3.83 years, while repeated hospitalizations lasted the longest at 3.85 years, with some patients reporting up to 30 years of recurrent admissions. These statistics indicate a significant psychological and systemic burden on patients and the healthcare system alike.

Loss of employment was also notably long-lasting at 3.64 years, which underscores the economic consequences of CKD. Bedridden states had a shorter mean duration of 1.85 years, whereas mobility impairment (inability to walk unassisted) lasted 1.56 years. The least reported and shortest-lived functional disability was inability to eat or drink unassisted, with a mean duration of just 0.38 years, affecting only three patients in total.

Lastly, household activity limitations, such as inability to perform chores, had a mean duration of 2.31 years, suggesting that even basic daily functions are significantly affected in a considerable portion of this population.

Table 6: Summary Statistics of Patient Demographics and Disability Durations

Variable	N	Min	Max	Mean	Std. Dev.
Age (years)	110	15.00	73.00	40.62	13.37
Number of Family Members	110	1	14	6.40	2.52
Age at Diagnosis of CKD (years)	109	8.00	65.00	33.63	12.86
Age at Start of Disability (years)	110	8.00	71.00	35.92	13.43
Current Total Time Span of Disability (years)	110	0.02	30.00	4.67	4.29
Duration of Swollen Ankles and Feet (years)	80	0.00	15.00	3.44	3.16
Duration of Itching, Tingling, and Numbness of Skin (years)	69	0.08	15.00	3.28	3.34
Duration of Skin Pigmentation (years)	45	0.01	13.00	2.25	2.19
Duration of Loss of Weight (years)	78	0.08	13.00	3.42	2.87
Duration of Fatigue and Exhaustion (years)	96	0.03	15.00	3.45	3.07
Duration of Boneache and Muscle Cramping (years)	87	0.01	15.00	3.01	2.95
Duration of Bedridden State (years)	29	0.03	9.00	1.85	2.04
Duration of Loss of Job (years)	40	0.08	16.00	3.64	3.50
Duration of Depression, Mood Confusion, and Mental Confusion (years)	78	0.42	13.00	3.83	2.68
Duration of Repeated Hospitalizations (years)	53	0.00	30.00	3.85	4.82
Duration of Unable to Eat & Drink Unassisted (years)	3	0.25	0.50	0.38	0.13
Duration of Unable to Walk Unassisted (years)	34	0.03	15.00	1.56	2.57
Duration of Unable to Perform Household Chores (years)	50	0.03	15.00	2.31	3.00

Mortality and DALY Calculations

No patient deaths were recorded during the six-month study period, therefore Years of Life Lost (YLL) was zero. The average Years Lived with Disability (YLD) was 4.6691 years. Accordingly, the Disability Adjusted Life Years (DALYs) was calculated using the standard WHO formula:

DALY = YLL + YLD = 0 + 4.6691 = 4.6691

This figure reflects a substantial disease burden in the CKD population at NMU, Multan. Comparable global

estimates suggest rising DALY trends in CKD from 1990 to 2019, with CKD climbing from the 29th to the 18th leading cause of DALYs.

Correlation Analysis and Interpretation

Pearson correlation showed a significant negative relationship between age at onset of disability and the duration of specific symptoms such as swollen feet, bedridden state, and inability to perform household chores. These trends are visualized in Figures 4, figure 5 and figure 6. The correlations indicate that earlier onset of disability is associated with a longer duration of impairment, further emphasizing the chronic and debilitating nature of CKD in younger patients.

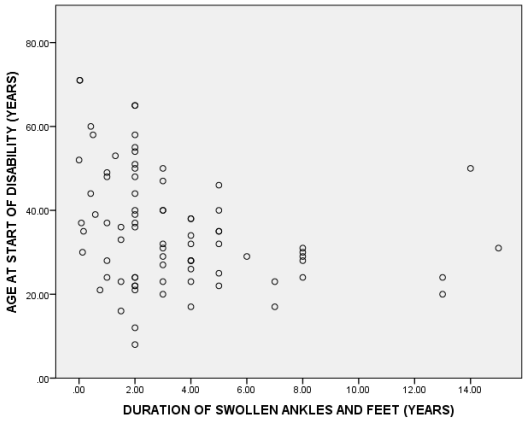

Figure 4:

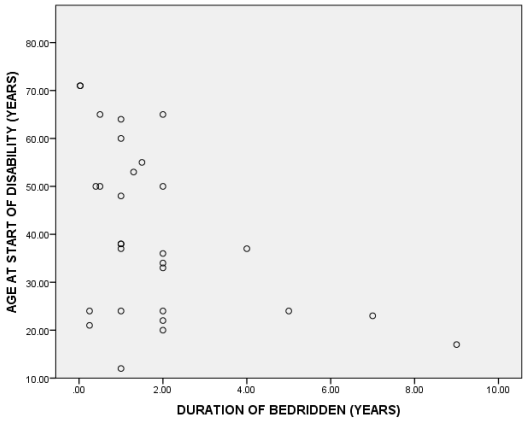

Figure 5:

Correlation is significant at the 0.01 level. It shows negative correlation as with the increase in age at start of disability, there is decrease in duration of swollen ankles and feet. There was no proper line of best fit. So, it gives direction of significance but not strength.

Correlation is significant at the 0.05 level. It shows negative correlation as with the increase in age at start of disability, there is decrease in duration of being bedridden. There was no proper line of best fit. So, it gives direction of significance but not strength.

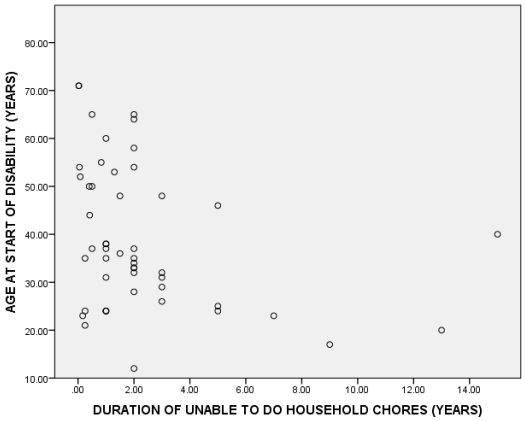

Figure 6:

Correlation is significant at the 0.05 level. It shows negative correlation as with the increase in age at start of disability, there is decrease in duration of inability to do household chores. There was no proper line of best fit. So, it gives direction of significance but not strength.

DISCUSSION

From 2002 to 2016, data collected from different states of US in a global study revealed an increasing burden of CKD and an overall increased rate of DALYs, representing a 35.9% increase.[17] A study in 2017 stated that global prevalence of CKD was 9.1% and CKD resulted in 35.8 million disability-adjusted life years (DALYs). And diabetic kidney disease was the leading cause of CKD DALYS, accounting for 30.7% of the total. “The DALY rate for impaired kidney function was higher than that for drug use, unsafe sanitation, low physical activity, second-hand smoke and several dietary risk factors”.[18]

GBD data suggested, while DALYs are declining for other non-communicable diseases but both death rates and DALY rates due to CKD are increasing. It may be possible that this is partly due to new data becoming available or different coding behavior over time, including greater specificity of coding. However, although some feel there is evidence of over diagnosis, it seems clear that in many countries and regions CKD is a growing public health problem and in some of them ranks very high as a cause of YLL and DALYs.[19]

According to the Global Burden of Disease (GBD) study, disability-adjusted life-years (DALYs) for CKD has risen from 29th in 1990 to 18th in 2019.[20] Some studies conducted in Pakistan showed overall prevalence of CKD

as 21.2%.[21] Highest prevalence was reported as 29.9%.[22] and lowest was reported as 12.5%.[23] Difference among these two findings might be due to use of different equations to find CKD. Another study based specially on patients receiving hemodialysis used quality of life index and showed that intensity of pruritus was significantly associated with poor quality of life among patients on hemodialysis having CKD-associated pruritus.[24]

In the study we conducted, disability is found to be quite common in the patients of chronic kidney disease in NMU, Multan since all the patients had one or more of disabilities as mentioned in question 16 and 17 of the questionnaire. There were zero deaths of patients during the 6months of the study. DALYs is 4.6691 in the patients of chronic kidney disease in NMU, Multan. Total time span of disability is significantly correlated with low academic background. This may be due to the fact that with higher academic background, patients were more health conscious and aware of the disease. Age at the start of a disability is significantly correlated with duration of particular disability. With late onset, duration of disability was low. Depression. Mood fluctuations and mental confusion was the most frequent functional disability (70%). Fatigue and exhaustion is the most common physical disability (88.2%) followed by bone ache and muscle cramps. Only 13.6% patients were smokers. There was no significant family history of CKD.

Limitations: This hospital-based observational study was conducted at a single tertiary care center, limiting the generalizability of results to the wider population. The use of a self-designed questionnaire introduced the possibility of recall bias. Most participants were of low socioeconomic status, which may have influenced outcomes. Time constraints restricted the depth of data collection, and many patients were fatigued or irritable, affecting the accuracy and completeness of responses. Despite these limitations, the study offers important insights into the burden of disability among CKD patients.

Future Directions

Future research should focus on multicenter, population-based studies to enhance the generalizability of findings and capture a broader spectrum of chronic kidney disease (CKD) patients, including those in rural and primary care settings. Standardized and validated tools for disability assessment should be employed to minimize bias and improve data accuracy. Longitudinal studies are also needed to monitor the progression of disability over time and evaluate the effectiveness of early interventions, rehabilitation strategies, and psychosocial support. Additionally, integrating mental health and nutritional assessments into routine CKD management may provide a more holistic understanding of patient needs and improve long-term outcomes.

CONLUSION

Results demonstrate significant disability associated with Chronic Kidney Disease. All the patients had at least one disability associated with the disease as mentioned in the question 16 and 17 of questionnaire. Fatigue and exhaustion was the most common physical disability and Depression mood fluctuation and mental confusion was the most frequent functional disability. Majority of the patients were of low socioeconomic status and low academic background. Mean age of diagnosis is quite close to mean age of patients which shows that patients were diagnosed in late stages.

DECLARATION

Ethical Approval and Consent to Participate

This study was approved by the Institutional Review Board (IRB) of Nishtar Medical University, Multan. Written informed consent was obtained from all participants prior to their inclusion in the study. All procedures were conducted in accordance with the ethical standards of the Helsinki Declaration.

Consent for Publication

Not applicable. No individual personal data (images, videos, identifiable information) is included in this article.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

All authors contributed equally and significantly to the study. All authors reviewed and approved the final version of the manuscript.

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