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Determinants of Repeated Hospital Admission in Dialysis-Dependent Chronic Kidney Disease Patients

Saqib Khan[1*], Muhammad Feroz Khan[1], Sehrish Saeed[2] and Amer Azhar[1]

[1]Department of Nephrology, Khyber Teaching Hospital, Peshawar, Pakistan
[2]Department of Cardiology, Peshawar Institute of Medical Sciences, Peshawar, Pakistan

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Corresponding Author:
Saqib Khan
Department of Nephrology, Khyber Teaching Hospital, Peshawar, Pakistan
saqibkhan1010@gmail.com

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ABSTRACT

Studies evaluating the factors leading to repeated hospital admissions in dialysis-dependent CKD patients are scarce in the context of local settings. Results of the study would benefit clinicians and patients in reducing hospitalization burden and health care costs by prompt management of potential factors leading to hospitalization. **Objective:** To determine the frequency of factors leading to repeated hospitalization in dialysis-dependent chronic kidney disease patients. **Methods:** The descriptive study was conducted at the Department of Nephrology, Khyber Teaching Hospital, Peshawar, during the period 11th May 2025 to 10th September 2025. A total of 176 male and female patients diagnosed with chronic kidney disease and receiving maintenance hemodialysis were enrolled. The patients were evaluated for factors leading to repeated hospitalization, including the presence of heart failure, anemia, mode of vascular access, and low serum albumin. **Results:** The mean age of patients was 58.68±6.73 years. 89 patients (50.6%) were female. Repeated hospitalization was recorded in 87 patients (49.0%). Factors of repeated hospitalization revealed heart failure in 82 patients (46.6%), anemia in 30 (17.0%), low albumin in 118 (67.0%), and AV fistula in 82 patients (46.6%) as a mode of vascular access. Female patients had more frequent repeated hospitalization (n = 45, 50.6%), p value 0.762. **Conclusions:** Heart failure, AV fistula usage, and low albumin were the most common variables associated with frequent hospitalization. A connection between hospitalization, duration, and cause of CKD was observed, but did not reach statistical significance.

INTRODUCTION

Through the preceding decade or so, persistent renal failure that requires dialysis has become a major global public health concern [1]. Because of its numerous medical concurrent conditions (such as hypertension, diabetes, low blood hemoglobin, cardiovascular conditions like cerebrovascular accidents, and peripheral vascular disease. Chronic kidney disease (CKD) leads to a relatively substantial medical care stress raised admission to the hospital and increased mortality. It additionally results in more extensive consumption of outpatient, emergency, and inpatient services [2]. Hospitalizations and rehospitalizations, particularly an increase in frequency and severity as the illness worsens, are the biggest strain on patients with advanced renal disease. ESRD patients have a significant load of multiple medical conditions, according to observational studies [3]. Hospitalization may be less likely in individuals with end-stage renal disease (ESRD) if the potential of readmission is identified early [4]. Research has shown that the frequency and reason of hospitalizations influence the prognosis for ESKD, and that there is a positive correlation between hospitalization rate and patient state in patients with ESRD.[5] Poorer quality of life, increased morbidity, and death are linked to hospitalization. When compared to patients without CKD, those who were diagnosed with the disease had a 1.4-fold increased risk of dying in the hospital and a 1.2-fold

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increased risk of being admitted again after being discharged [6]. Kidney failure patients were three times more likely to die in the hospital and 1.8 times more likely to be admitted. Most hospitalizations and fatalities among patients with CKD and renal failure are caused by circulating illnesses and infections [7]. In one study, 58 (37.7%) of the 154 participants receiving maintenance hemodialysis experienced a 30-day readmission to the hospital. Re-admission diagnoses for these patients included HD vascular access, such as fistula 26 (44.8%) or catheter 19 (36.5%), low serum albumin 36 (62.1%), anemia 12 (20.7%), and precipitation of heart failure 14 (24.1%) [1].

There were few studies examining the causes of recurrent hospitalizations in dialysis-dependent CKD patients in local contexts. Furthermore, it was not possible to generalize the findings of international studies. Therefore, the study was designed to fill the research void. The study findings would help patients and clinicians manage potential hospitalization risk factors promptly and lower hospitalization burden and health care costs. The study aimed to determine the frequency of factors leading to repeated hospitalization in dialysis-dependent chronic kidney disease patients.

METHODS

The descriptive study was conducted at the department of Nephrology, Khyber Teaching Hospital, Peshawar, during the period 11th May 2025 to 10th September 2025. Approval for the conduct of the study was granted vide no. 134/DME/KMC. A total of 176 male and female patients diagnosed with chronic kidney disease and receiving maintenance hemodialysis were enrolled. Patients taking immunosuppressive medications, post-renal transplant patients, concurrent medical conditions like chronic liver failure and endocrine disorders, and acute kidney injury patients were excluded. CKD was defined as mentioned in the 2024 KDIGO guidelines by imaging findings (shrunken kidneys on ultrasound, i.e., size less than 8cm) and eGFR <60ml/min/1.73m2 calculated on the Cockroft Gault Formula. Repeated hospital admission was defined as hospital admission for more than 24 hours within 30 days of prior hospitalization. The patients were assessed for factors of hospitalization in terms of 1) Heart failure was defined ESC 2021 guidelines as patients with ejection fraction <40% on ECHO and brain natriuretic peptide (BNP) >100pg/ml 2) Anemia: Blood hemoglobin level <12gm/dl for men and <11gm/dl for women 3) Low serum albumin: Serum albumin: Normal serum albumin ranges from 3.5 to 5.5gm/dl. Serum albumin level < 3.5 g/dl was called low serum albumin and 4). Mode of vascular access: through AV fistula or catheter, confirmed clinically and by medical record examination. Sample size was calculated using the WHO sample size formula (n = Z2. p (1-p)2/E2), where n = sample size, Z = 1.96 at 95% confidence interval, p = expected prevalence value, and E = margin of error = 6%. Sample size was 176, taking the anticipated frequency of anemia in patients with repeated hospitalization among CKD patients on maintenance hemodialysis (p) = 20.7%, 6% margin of error (E) [1]. Participants were enrolled using non probability consecutive sampling technique. Patients who met the recruitment parameters were admitted from the hospital's indoor department following permission from the CPSP and the hospital's research review board. All enrolled participants gave their informed consent after being fully informed about the study's goals, risks, and rewards. Demographic data such as age and gender were recorded from the patient's national identity card, while weight and height were measured using a weighing scale and a stadiometer, respectively. The duration of hemodialysis and etiology of CKD were confirmed from the medical record. Other parameters recorded were patient education, occupation, and SE status (classified using the Modified Kappaswamy scale, taking a score more than 10 as fair and 10 or below as poor). At the time of discharge from the index hospitalization, a thorough medical examination and history were taken. For the following 30 days, patients were monitored. According to operational criteria, hospitalization during the follow-up period was recorded, and patients were divided into those who had and did not experience repeated hospitalization. A 10-cc blood sample was taken from a main vein in the antecubital fossa of the patient's non-dominant arm after they had been comfortably seated on the chair. The sample was sent to the hospital lab after being evenly divided (05cc) in EDTA and gel tube. Anemia was assessed by measuring blood hemoglobin level using Nihon Kohden® Celltac G+ (MEK-9200) automated hematology analyzer, and serum albumin was measured with the dye-binding technique using Roche Cobas® 4000 biochemistry analyzer. Vascular access mode was observed. ECHO was done with Logiq E10, and the BNP level (measured using standardized chemiluminescent immunoassay Siemens Advia BNP Assay®) was used to diagnose heart failure.

Data were analyzed using the statistical analysis program IBM SPSS version 26. Means ± SD or median (IQR) was recorded for quantitative data like age, BMI, Hb, serum albumin and duration of hemodialysis after checking the normality of the data with Shapiro wilk test while frequencies and percentages were recorded for qualitative data like gender, residence, education, profession, SE status, cause of CKD, presence or absence of repeated hospitalization and factors leading to repeated hospitalization. Factors (anemia, heart failure, vascular access, and low serum albumin) were compared between those with and without repeated hospitalization using chi

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square of fisher exact test at 5% level of significance. Repeated hospitalization was stratified by age, gender, BMI, duration of hemodialysis, and cause of CKD to control effect modifiers. Post-stratification chi-square or fisher exact test was applied. p-value ≤0.05 was considered statistically significant.

RESULTS

The mean age of the participants was 58.68 ± 6.73 years, the mean BMI was 24.99 ± 1.054 kg/m^2, and the mean duration of CKD was 7.72 ± 0.24 years as reported in table 1.

Table 1: Descriptive Statistics of Study Participants (n=176)

Parameters	Mean ± SD
Age (Years)	58.68 ± 6.734
BMI (kg/m^2)	24.990 ± 1.054
Duration of CKD (Years)	7.72 ± 2.247

Participants aged more than 55 years were 119 (67.6%), while gender wise distribution was equivalent, with 89 female participants (50.6%). 113 patients (64.2%) had a BMI of 25.0 kg/m^2 or below. 107 patients (60.8%) belonged to rural areas. CKD duration more than 7 years was recorded in 94 participants (53.4%), while 96 participants (54.5%) had diabetes as the underlying cause of CKD, as shown in Table 2.

Table 2: Baseline Characteristics of Study Participants (n=176)

Parameters	Subgroups	n (%)
Age (Years)	55 or below	57 (32.4%)
	More Than 55	119 (67.6%)
Gender	Male	87 (49.4%)
	Female	89 (50.6%)
BMI (kg/m^2)	25.0 or below	113 (64.2%)
	More Than 25.0	63 (35.8%)
Residence	Rural	107 (60.8%)
	Urban	69 (39.2%)
Education	No Formal Schooling	42 (23.9%)
	Matric or below	66 (37.5%)
	Above Matric	68 (38.6%)
Profession	Salaried	85 (48.3%)
	Business	91 (51.7%)
SE Status	Fair	46 (26.1%)
	Poor	130 (73.9%)
CKD Duration (Years)	7 or below	82 (46.6%)
	More Than 7	94 (53.4%)
CKD Cause	Dm	96 (54.5%)
	Others	80 (45.5%)

Repeated hospitalization was recorded in 87 patients (49.0%), as shown in figure 1.

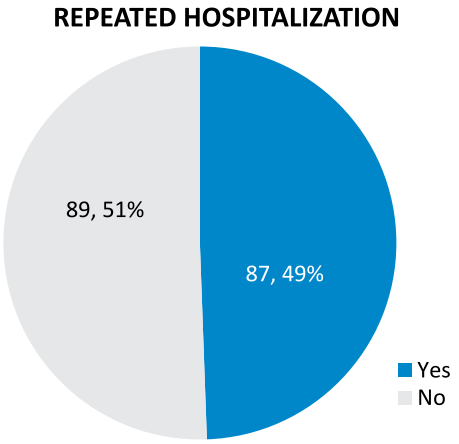

Figure 1: Distribution of Patients According to Repeated Hospitalization (n=176)

Analysis of factors of repeated hospitalization revealed heart failure in 82 patients (46.6%), anemia in 30 (17.0%), low albumin in 118 (67.0%), and AV fistula in 82 patients (46.6%) as a mode of vascular access, as reported in Table 3.

Table 3: Distribution of Factors of Repeated Hospitalization among Study Participants (n=176)

Factors of Repeated Hospitalization		n (%)
Heart Failure	Yes	82 (46.6%)
	No	94 (53.4%)
Anemia	Yes	30 (17.0%)
	No	146 (83.0%)
Low Albumin	Yes	118 (67.0%)
	No	58 (33.0%)
Vascular Access	AV fistula	82 (46.6%)
	Catheter	94 (53.4%)

Analysis of factors among patients with and without repeated hospitalization showed anemia in 18 patients (60.0%) with repeated hospitalization versus 12 (40.0%) without repeated hospitalization. The p-value for the difference in distribution was 0.204. Similarly, heart disease was more prevalent among patients with repeated hospitalization (n=45, 54.9%), p-value 0.177. 36 patients (43.9%) with AV fistula had repeated hospitalization compared to 51 (54.3%) with catheter access, p-value 0.171, as shown in table 4.

Table 4: Comparison of Factors of Repeated Hospitalization Among Patients with and without Repeated Hospitalization (n=176)

Factors of Repeated Hospitalization		Repeated Hospitalization		Total, n (%)	p-value
		Yes = 87, n (%)	No = 89, n (%)		
Anemia	Yes	18 (60.0%)	12 (40.0%)	30 (100.0%)	0.204
	No	69 (47.3%)	77 (52.7%)	146 (100.0%)	
Heart Failure	Yes	45 (54.9%)	37 (45.1%)	82 (100.0%)	0.177
	No	42 (44.7%)	52 (55.3%)	94 (100.0%)	

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Low Albumin	Yes	57 (48.3%)	61 (51.7%)	118 (100.0%)	0.670
	No	30 (51.7%)	28 (48.3%)	58 (100.0%)	
Vascular Access	AV fistula	36 (43.9%)	46 (56.1%)	82 (100.0%)	0.171
	Catheter	51 (54.3%)	43 (45.7%)	94 (100.0%)	

Repeated hospitalization was more common in patients aged more than 55 years (n=63, 52.9%), p-value 0.178. Female patients had more frequent repeated hospitalization (n=45, 50.6%) compared to males (n=42, 48.3%), p-value 0.762. The p-value for the difference in distribution of repeated hospitalization with respect to BMI was 0.559, while the respective p-values for distribution with respect to CKD duration and cause of CKD were 0.177 and 0.099, respectively, as reported in table 5.

Table 5: Stratification of Repeated Hospitalization with Various Parameters (n=176)

Baseline Parameters		Repeated Hospitalization		Total, n (%)	p-value
		Yes = 87, n (%)	No = 89, n (%)		
Age (Years)	55 or below	24 (42.1%)	33 (57.9%)	57 (100.0%)	0.178
	More Than 55	63 (52.9%)	56 (47.1%)	119 (100.0%)	
Gender	Male	42 (48.3%)	45 (51.7%)	87 (100.0%)	0.762
	Female	45 (50.6%)	44 (49.4%)	89 (100.0%)	
BMI (kg/m^2)	25.0 or below	54 (47.8%)	59 (52.2%)	113 (100.0%)	0.559
	More Than 25.0	33 (52.4%)	30 (47.6%)	63 (100.0%)	
CKD Duration (Years)	7 or below	45 (54.9%)	37 (45.1%)	82 (100.0%)	0.177
	More Than 7	42 (44.7%)	52 (55.3%)	94 (100.0%)	
Cause of CKD	DM	42 (43.8%)	54 (56.3%)	96 (100.0%)	0.099
	Others	45 (56.3%)	35 (43.8%)	80 (100.0%)	

DISCUSSION

The distinctive characteristics of repeated hospital admission across chronic kidney failure patients have never been examined before, as far as we are aware. Heart failure and low albumin constituted the most prevalent factors of repeated hospitalization among the studied variables in this study. Hospitalization occurred on multiple occasions a year. Risk factors for several hospitalizations annually, where the main kidney illness was diabetic renal disease, the comorbidity of coronary heart disease, or the catheter mode of vascular access. Mode of vascular access, cardiac conditions such as heart failure, and declining level of serum albumin and concurrent or sequelae of CKD, such as anemia, were prevalent in our study, but in a report, a significant proportion of hospitalizations occurred due to these reasons [8]. Access-related infections were the most common cause of hospitalization for PD patients according to Swedish research, while they were fewer in the HD group and rare in the dialysis population overall [9]. Neither Sweden nor the United States reported that the creation of dialysis access was the most common reason for hospitalization. Septicemia was the most prevalent clinical condition among the top ten most common reasons for hospitalizations in the United States. Regarding cardiovascular diseases, the United States had a significantly higher rate of admissions to hospitals for high blood pressure, coronary heart disease, and congestive heart failure (CHD) than China. In the USA, diabetes-related admissions were likewise extremely high [8]. Similarly, in Sweden, hospitalizations attributable to diabetes accounted for 6.4% and cardiovascular disorders for 19.8% [9]. The observed discrepancies may be the result of variations in the patient groups with respect to clinical practice, concomitant diseases, etiology of ESKD, and demographics (particularly age). First, the percentage of dialysis patients who were old varied by nation [10]. According to the reports, the largest percentage of dialysis patients in China belonged to the subgroup of people aged 45 to 64 years. The average age was higher in China and the USA compared to our findings [11, 12]. Similarly, our mean age was also lower than that reported in Sweden [9]. In comparison to children and adolescents, elderly individuals receiving dialysis might exhibit higher rates of age-associated concurrent medical conditions, such as insulin resistance and plaque buildup, as well as a greater likelihood of vulnerability and inadequate nutrition, and a greater probability of impaired mental behavior [13, 14]. These factors could lead to decreased physical wellness and clinical consequences [15, 16]. Second, the most prevalent cause of ESKD in China was glomerulonephritis, whereas in the United States, Europe, and certain other Asian countries had higher rates of high blood pressure and diabetes [17-19]. Prior research revealed that diabetic dialysis patients had a high incidence of cardiovascular and diabetic complications [20, 21]. From a reduction in kidney function to the need for renal replacement treatment, the circulatory system and heart may experience various structural and functional alterations [22, 23]. Dialysis patients may develop heart and vascular disease more quickly, particularly if they have cardiovascular risk factors like diabetes or high blood pressure. Patients receiving dialysis were at a greater risk, and almost half of the patients experienced numerous hospitalizations in this study. Prior research on hospital readmissions has mostly concentrated on thirty-day readmissions between patients receiving in-center hemodialysis and home-based peritoneal dialysis; however, dialysis is only provided in hospital settings in our country, hence no comparison can be drawn in this regard. A study reported that the 30-day unscheduled readmission rate was greater in the peritoneal dialysis population than in the hemodialysis population [8]. Peritoneal dialysis patients had a higher 30-day readmission rate than hemodialysis patients, according to a population-based study [24]. Nonetheless, some research produced contradictory findings,

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indicating that there were no or negligible variations in readmission risks among dialysis modalities [25]. The belief that readmissions after thirty days might reveal healthcare inadequacies throughout follow-up with patients from the hospital to the outpatient environment, however, remained constant. Clinical practice discrepancies between hemodialysis and peritoneal dialysis may contribute to variations in the performance of several hospitalizations.

The research has limitations in that it is a single-center and descriptive study design that does not allow generalizing the results and faces the causal limitation to make statements about the risk factors that lead to re-hospitalization. Moreover, the preoccupation with in-hospital dialysis in a particular country setting complicates the process of direct comparison of the national statistics about dialysis modalities and those found abroad. Future studies ought to be based on multicenter, longitudinal studies involving larger and more varied cohorts to further define the predictors of readmission to the hospital. Comparative analyses of various models of healthcare delivery and dialysis modalities and specific cost-effectiveness studies should also be conducted to guide ideal and patient-centered care trajectories to manage chronic kidney failure.

CONCLUSIONS

Although the connections were not statistically significant, the study found that recurrent hospitalization was prevalent among participants, especially among females and those over 55 years of age. Heart failure, AV fistula usage, and low albumin were the most common variables associated with frequent hospitalization. Although patterns indicated a potential correlation between hospitalization rates and the duration and cause of CKD, the findings did not reach statistical significance. To lower the frequency of hospitalizations in this population, our findings emphasize the necessity of focused care of modifiable risk factors, such as cardiovascular health and nutritional status. Larger sample sizes in future research might assist in shedding light on the tendencies that have been noticed.

Authors' Contribution

Conceptualization: SK
Methodology: SK, MFK
Formal analysis: SK, SS
Writing and Drafting: SK, MFK, SS, AA
Review and Editing: SK, MFK, SS, AA

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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