

**Pharmacoepidemiological Approach on Management of Chronic Kidney Disease Patients in Tertiary Care Hospital**

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**Abstract**

**Background:** Many factors, including poor health, taking too many medications, not taking them as prescribed, and complications from dialysis, might exacerbate chronic kidney disease (CKD). Improving CKD therapy and quality of life is the main objective of the study.

**Objectives:** The primary objectives of this research were to assess different comorbid conditions and to assess the use of common medication in CKD patients with comorbid conditions to detect the complications associated with dialysis to evaluate the prevalence of polypharmacy in CKD patients.

**Methodology:** A prospective observational study was conducted over six months involving 150 CKD patients from Med- Citi Hospital. Data on demographics, comorbidities, prescribed medications, adherence, and dialysis-related complications were collected and analysed. Descriptive statistics and comparative analyses were performed to assess correlations.

**Results:** Most patients (60%) were aged 41–60 years, and 64% were male. Hypertension and diabetes were the most prevalent comorbidities (92% and 86%, respectively). Common medications included antihypertensives, erythropoiesis-stimulating agents, phosphate binders, and diuretics. Polypharmacy was observed in 78% of patients. Dialysis complications included hypotension (30%), infections (25%), and electrolyte imbalance (15%). Age and comorbidity count were significantly associated with the incidence of dialysis-related complications ( $p < 0.05$ ).

**Conclusion:** Pharmacoepidemiological assessment reveals significant medication burden and complication risks in CKD patients. Optimizing drug regimens and individualized care approaches are essential to improve patient outcomes and quality of life.

**Keywords:** Chronic Kidney Disease, Pharmacoepidemiology, RAAS Inhibitors, Medication Adherence, Adverse Drug Events

## Introduction

This study aims to evaluate the pharmacotherapy patterns, dose titration practices, adherence metrics, clinical outcomes, and adverse drug event profiles in patients with CKD stages 3 to 5 managed at a tertiary care centre. By analysing real-world data, we seek to identify opportunities for improving patient care and outcomes in this vulnerable population.

An increasing number of studies worldwide have reported the prevalence of chronic kidney disease (CKD); however, it is outside the purview of this review to discuss each study separately. As a result, it is now feasible to compile the results of these studies and determine the prevalence of CKD globally, as well as in different patient subgroups and geographical areas. According to a 2010 study evaluating the prevalence and burden of CKD, which combined the findings of 33 population-based representative studies from around the globe, the age-standardized global prevalence of CKD stages 1–5 in people aged  $\geq 20$  years was 10.4% for men and 11.8% for women.<sup>7</sup> The study found significant variations by income level and geographic region, with an age-standardized

prevalence of CKD of 8.6% and 9.6% in males and women in high-income nations, and 10.6% and 12.5% of men and women in low- and middle-income nations, respectively. In the same study, the age-standardized worldwide prevalence of CKD stages 3–5 among adults aged  $\geq 20$  years was 5.8% for women and 4.7% for men. A more recent study that conducted a thorough systematic review and meta-analysis of 100 studies including 6,908,440 patients found that the global prevalence of CKD stages 1–5 was 13.4%, whereas the global prevalence of stages 3–5 was 10.6%.<sup>8</sup> 3.5% (stage 1), 3.9% (stage 2), 7.6% (stage 3), 0.4% (stage 4), and 0.1% (stage 5) were the prevalence of each stage of

CKD.<sup>8</sup> Based on the findings of research examining the prevalence of CKD worldwide, the present total population According to several studies, estimated figures state that at least over 15% of the American population or over 37 million American adults could be suffering from chronic kidney disease (CKD).<sup>20</sup> The number of deaths in the US due to kidney disease is particularly concerning as it forms the 10th most frequent reason.<sup>3</sup> Looking at NIDDK (National Institute of Diabetes and Digestive and Kidney Diseases) statistics, the writer notes that there has been a remarkable consistency in CKD rates across the United States from 2004 up until 2020. The highest rise took place among people aged 3 CKD stages 3, rising from 4.5 to 6.0 percent. The data regarding the age-adjusted percentage of adult patients with CKD onset show that the overall numbers for these patients in the USA are around 6 percent between the age of eighteen and forty-four, twelve percent between forty-five to sixty-four years of age and thirty eight percent among patients aged sixty-five and above. As reported in the National Health and Nutrition Examination Survey (NHANES) study, the prevalence of stage 3 CKD in adult.

## Objectives

- Assess comorbid conditions in CKD patients.
- Evaluate common medications and their utilization patterns.
- Investigate dialysis-associated complications.
- Examine the prevalence and implications of polypharmacy.

## Methodology

**Study Design:** Prospective Observational Study.

**Study Duration:** 6 months.

**Study Site:** Medi-Citi Hospital, Hyderabad.

**Sample Size:** 150 patients with CKD (Stage 3–5)

**Inclusion Criteria**

Patients aged >18 years.

Diagnosed with CKD undergoing treatment/dialysis

**Data Collection:** Demographics, medical history, medication chart review, dialysis logs, adherence behaviour.

**Analysis Tools:** SPSS v23.0 for statistical analysis; Chi-square and t-tests for significance testing.

**Results**

The study included 149 participants, comprising 103 males and 46 females, with a mean age of 51.36 years (SD: 13.64). Weight changes associated with dialysis

showed a mean weight of 57.18 kg (SD: 11.85) before dialysis, decreasing slightly to 56.57 kg (SD: 10.82) afterward, indicating minor fluid removal. Serum creatinine levels averaged 8.02 mg/dL (SD: 11.48), reflecting significant variability, while blood urea levels had a mean of 40.27 mg/dL (SD: 26.87). Haemoglobin levels averaged 9.65 g/dL (SD: 1.83), suggesting a prevalence of anaemia among participants, which is common in dialysis patients.

Table 1: Descriptive Statistics

		Mean	Standard Deviation	Count
Age		51.36	13.64	
Gender	Male			103
	Female			46
Weight after dialysis		56.57	10.82	
Weight before dialysis		57.18	11.85	
SR CR		8.02	11.48	
B UREA		40.27	26.87	
HB		9.65	1.83	

Table 2: Age Comorbidities

		Age				P-value
		<51 years of age		>51 years of age		
		Count	Row N %	Count	Row N %	
HTN	No	21	52.5%	19	47.5%	0.222
	Yes	45	41.3%	64	58.7%	
DM	No	55	57.9%	40	42.1%	0.0001
	Yes	11	20.4%	43	79.6%	
Anemia	No	56	44.4%	70	55.6%	0.932
	Yes	10	43.5%	13	56.5%	
HYTD	No	63	45.0%	77	55.0%	0.495
	Yes	3	33.3%	6	66.7%	
HCV	No	66	44.6%	82	55.4%	0.371
	Yes	0	0.0%	1	100.0%	
HBV	No	66	44.3%	83	55.7%	a
	Yes	0	0.0%	0	0.0%	

Chi-square test was used  
 a No statistics are computed because HBV is a constant.

The association between age and various comorbidities was analysed using the chi-square test, categorizing participants into those below and above 51 years. Hypertension (HTN) was more prevalent in individuals over 51 years (58.7%) compared to 41.3% in the younger group, but this difference was not statistically significant ( $p = 0.222$ ). Diabetes Mellitus (DM) showed a significant association with age ( $p = 0.0001$ ), with 79.6% of older participants having diabetes versus 20.4% in the younger group. Anaemia was similarly distributed across age groups, with no significant difference ( $p = 0.932$ ). Hypothyroidism (HYTD) was slightly more common in

older individuals (66.7%) than younger ones (33.3%), but this difference was not significant ( $p = 0.495$ ). Hepatitis C Virus (HCV) was found in one participant over 51 years, while none were detected in the younger group, making conclusions difficult due to the small sample size ( $p = 0.371$ ). Hepatitis B Virus (HBV) was not observed in any participant. Overall, diabetes mellitus was significantly more common in those over 51 years, while other comorbidities did not show significant associations with age.

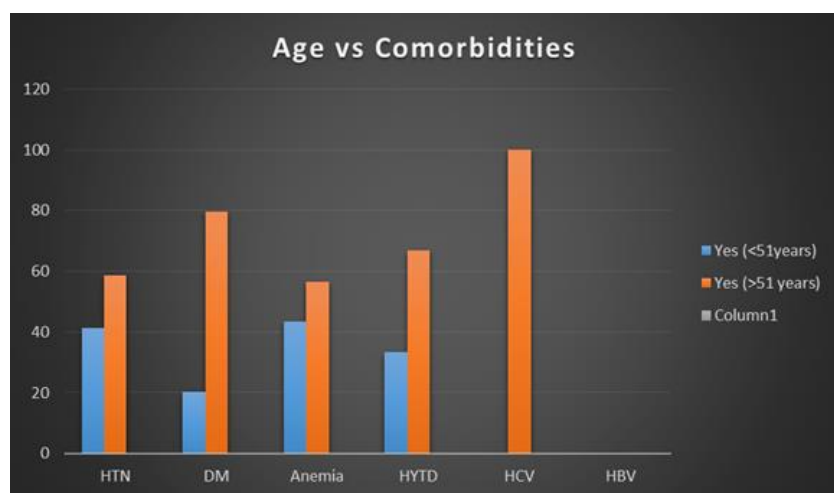


Table 3: Gender Comorbidities

		Gender				p-value
		Male		Female		
		Count	Column N %	Count	Column N %	
HTN	No	27	26.2%	13	28.3%	0.794
	Yes	76	73.8%	33	71.7%	
DM	No	69	67.0%	26	56.5%	0.219
	Yes	34	33.0%	20	43.5%	
Anemia	No	89	86.4%	37	80.4%	0.351
	Yes	14	13.6%	9	19.6%	
HYTD	No	97	94.2%	43	93.5%	0.869
	Yes	6	5.8%	3	76.5%	

HCV	No	103	100.0%	45	97.8%	0.133
	Yes	0	0.0%	1	2.2%	
HBV	No	103	100.0%	46	100.0%	a
	Yes	0	0.0%	0	0.0%	

Chi-square test was used

<sup>a</sup> No statistics are computed because HBV is a constant.

Table 3: The relationship between gender and various comorbidities was analyzed using the chi-square test. The study included 103 males and 46 females. Hypertension (HTN) was present in 73.8% of males and 71.7% of females, while 26.2% of males and 28.3% of females did not have hypertension. The difference was not statistically significant ( $p = 0.794$ ), indicating that hypertension was equally prevalent in both genders. Diabetes Mellitus (DM) was more common in females (43.5%) than in males (33.0%), but the difference was not statistically significant ( $p = 0.219$ ). Anemia was slightly more prevalent in females (19.6%) compared to males (13.6%), but this difference did not reach statistical significance ( $p = 0.351$ ). Hypothyroidism (HYTD) was

Graph 2:

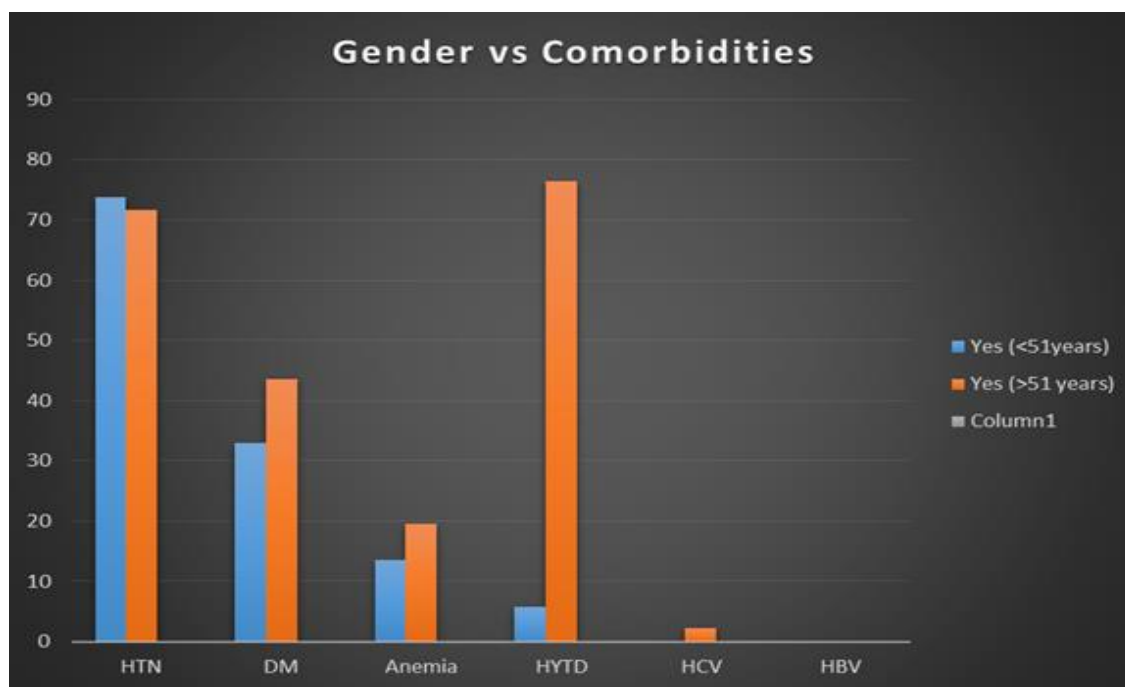


Table 4: Descriptive for complications with respect to age and gender

Complications	Age				Gender			
	< 51 years of age		51 years of age		Male		Female	
	Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %
No complications	17	25.8%	11	13.3%	20	19.4%	8	17.4%
HTN	29	43.9%	21	25.3%	37	35.9%	13	28.3%
Anemia	3	4.5%	6	7.2%	6	5.8%	3	6.5%
HTN Anemia	5	7.6%	7	8.4%	8	7.8%	4	8.7%
HTN DM	8	12.1%	29	34.9%	25	24.3%	12	26.1%
HTN DM Anemia	0	0.0%	1	1.2%	0	0.0%	1	2.2%
HTN HYPT	1	1.5%	1	1.2%	2	1.9%	0	0.0%
HTN DM Anemia HYPT	0	0.0%	5	6.0%	3	2.9%	2	4.3%
DM	2	3.0%	2	2.4%	2	1.9%	2	4.3%
HYPT	1	1.5%	0	0.0%	0	0.0%	1	2.2%

Table 4: The distribution of complications was analyzed based on age and gender. Participants were categorized into those below 51 years and those above 51 years, as well as by gender.

### Complications and Age

The prevalence of no complications was higher among younger participants (25.8%) compared to those above 51 years (13.3%), suggesting that older individuals were more likely to develop complications. Hypertension (HTN) was the most commonly observed complication, affecting 43.9% of younger participants and 25.3% of older participants. However, when hypertension was combined with diabetes mellitus (DM), the prevalence increased significantly in the older group (34.9%) compared to the younger group (12.1%), indicating that diabetes-associated hypertension was more common in older individuals. Anemia alone was found in 4.5% of younger individuals and 7.2% of older individuals,

showing a slight increase with age. Similarly, the combination of hypertension and anemia was present in 7.6% of younger participants and 8.4% of older participants, showing a comparable distribution. The most severe condition, hypertension, diabetes mellitus, anemia, and hypothyroidism (HTN DM ANEMIA HYPT), was only observed in the older group (6.0%), reinforcing that multiple comorbidities were more frequent with advancing age.

### Complications and Gender

The proportion of participants with no complications was similar in males (19.4%) and females (17.4%). Hypertension remained the most common complication in both genders, affecting 35.9% of males and 28.3% of females. Diabetes-associated hypertension (HTN DM) was slightly more common in males (24.3%) than females (26.1%), while anemia alone was observed in 5.8% of males and 6.5% of females. The combination of

hypertension, anemia, and diabetes (HTN DM ANEMIA) was noted in only one female participant (2.2%), while none of the males had this combination. Interestingly, hypothyroidism (HYPT) alone was observed in 2.2% of females but was absent in males. The most complex condition, HTN DM ANEMIA HYPT, was slightly more prevalent in females (4.3%) than in males (2.9%).

The findings suggest that older individuals had a higher prevalence of complications, particularly diabetes-associated hypertension and multiple comorbidities. Gender-wise, complications were relatively evenly distributed, though females had a slightly higher prevalence of anemia and hypothyroidism.

Table 5: Group Statistics

	Age recoded	N	Mean	Std. Deviation	Std. Error Mean
Weight after dialysis	<51 years of age	66	56.4015	11.78951	1.45119
	>51 years of age	83	56.6954	10.05263	1.10342
Weight before dialysis	<51 years of age	66	75.5864	12.41025	1.52760
	>51 years of age	83	56.8518	11.44458	1.25621
SR CR	<51 years of age	66	7.8548	2.78731	.34309
	>51 years of age	83	8.1431	15.22628	1.67130
B UREA	<51 years of age	66	36.4788	17.32236	2.13224
	>51 years of age	83	43.2892	32.31308	3.54682
HB	<51 years of age	66	9.7909	1.91357	.23554
	>51 years of age	83	9.5325	1.75486	.19262

Table 5: The descriptive statistics for various health parameters were analyzed based on age groups (<51 years and >51 years). The mean, standard deviation, and standard error for each parameter were compared between the two age groups.

**Weight Before and After Dialysis**

The mean weight after dialysis was nearly identical in both age groups, with younger individuals (<51 years) having a mean weight of 56.40 kg and older individuals (>51 years) having a mean weight of 56.69 kg. The standard deviation was slightly higher in the younger group (11.79) compared to the older group (10.05), indicating a wider variation in post-dialysis weight among younger participants. Similarly, the mean weight before dialysis was significantly higher in the younger group (75.59 kg) compared to the older group (56.85 kg).

This suggests that younger individuals tended to have a greater pre-dialysis weight, and possibly experienced more weight fluctuations due to fluid retention and removal during dialysis.

**Serum Creatinine (SR CR)**

The mean serum creatinine (SR CR) level was slightly higher in the older group (8.14 mg/dL) compared to the younger group (7.85 mg/dL). However, the standard deviation was much larger in the older group (15.23) compared to the younger group (2.79), indicating greater variability in serum creatinine levels among older individuals.

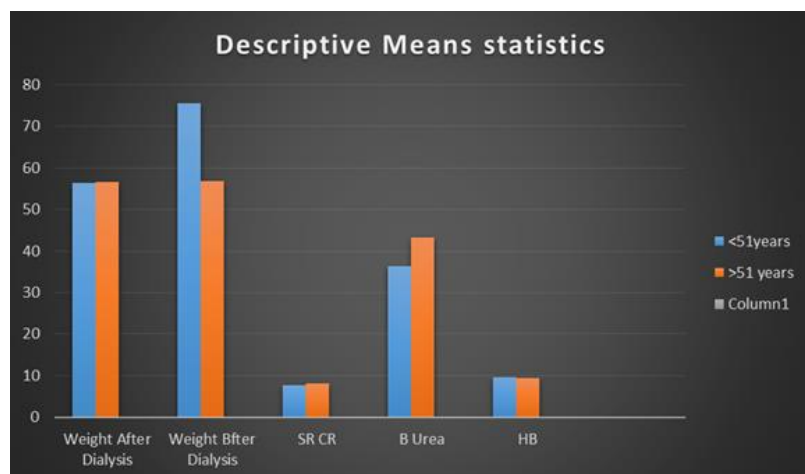
**Blood Urea (B UREA)**

The mean blood urea level was higher in the older group (43.29 mg/dL) compared to the younger group (36.48 mg/dL). The standard deviation was also larger in the

older group (32.31) compared to the younger group (17.32), suggesting more variability in urea levels among older individuals. This could indicate that older patients might have more significant fluctuations in kidney function.

**Hemoglobin (HB)**

Graph 3:



The mean hemoglobin (HB) level was slightly higher in the younger group (9.79 g/dL) compared to the older group (9.53 g/dL), though the difference was minimal. The standard deviation values were similar between the two groups, suggesting that hemoglobin levels were relatively stable across both age groups.

Table 6:

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Weight after dialysis	.165	.685	-.164	147	.870	-.29391	1.79024	-3.83183	3.24402
Weight before dialysis	.005	.942	.375	147	.708	.73456	1.95950	-3.13787	4.60698
SR CR	1.096	.297	-.152	147	.880	-.28828	1.90028	-4.04367	3.46711
B UREA	2.141	.146	-1.544	147	.125	-6.81037	4.41035	-15.52624	1.90551
HB	.741	.391	.858	147	.392	.25838	.30127	-.33701	.85376

The independent samples t-test was conducted to compare the means of various health parameters between the two age groups (<51 years and >51 years). Levene's test for equality of variances was performed first to determine whether equal variances could be assumed. The t-test results provide insights into whether there is a statistically significant difference between the groups.

**Weight after Dialysis**

Levene's test showed that variance was equal between the groups (p = 0.685). The t-test result (t = -0.164, p = 0.870) indicates no significant difference in weight after dialysis between the two age groups. The mean difference was -0.29391 kg, with a confidence interval ranging from -3.83 to 3.24 kg, confirming that the observed difference is not statistically significant.

### Weight before Dialysis

Levene's test ( $p = 0.942$ ) confirmed equal variances. The t-test ( $t = 0.375$ ,  $p = 0.708$ ) suggests no significant difference in weight before dialysis between younger and older individuals. The mean difference of 0.73456 kg falls within a confidence interval of -3.13 to 4.61 kg, indicating no meaningful difference.

Serum Creatinine (SR CR) For serum creatinine, Levene's test ( $p = 0.297$ ) showed equal variances. The t-test result ( $t = -0.152$ ,  $p = 0.880$ ) suggests no statistically significant difference in serum creatinine levels between the two age groups. The mean difference was -0.28828 mg/dL, with a confidence interval ranging from -4.04 to 3.46 mg/dL.

### Blood Urea (B UREA)

Levene's test ( $p = 0.146$ ) suggested that variances were equal. The t-test result ( $t = -1.544$ ,  $p = 0.125$ ) indicates that blood urea levels did not significantly differ between age groups. The mean difference was -6.81 mg/dL, with a confidence interval of -15.53 to 1.91 mg/dL.

Table 7:

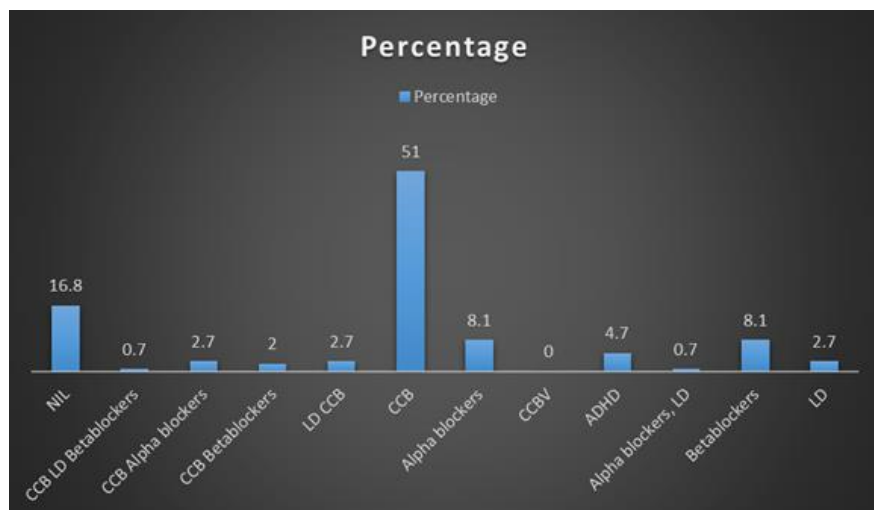
Common medication used		
	Count	Column N %
Medication	NIL	25 16.8%
	CCB LD Betablockers	1 0.7%
	CCB Alpha blockers	4 2.7%
	CCB Betablockers	3 2.0%
	LD CCB	4 2.7%
	CCB	76 51.0%
	Alpha blockers	12 8.1%
	CCBV	0 0.0%
	ADHD	7 4.7%
	Alpha blockers, LD	1 0.7%
	Betablockers	12 8.1%
	LD	4 2.7%

### Hemoglobin (HB)

Levene's test ( $p = 0.391$ ) confirmed equal variances. The t-test ( $t = 0.858$ ,  $p = 0.392$ ) revealed no significant difference in hemoglobin levels between younger and older individuals. The mean difference of 0.25838 g/dL fell within a confidence interval of -0.337 to 0.854 g/dL, showing no meaningful variation.

- None of the variables showed a statistically significant difference between the two age groups ( $p$ -values  $> 0.05$ ).
- Weight before and after dialysis, serum creatinine, blood urea, and hemoglobin levels were comparable between younger and older individuals.
- The confidence intervals for all parameters included zero, further confirming that no significant differences were observed.
- These findings suggest that age did not play a significant role in altering these parameters among dialysis patients in the sample.

Graph 4:



CCB was the predominant medication, prescribed in more than half of the patients.

A significant number of individuals did not receive any medication, suggesting a subgroup that either did not require pharmacological intervention or followed a non-medication approach.

Other medications, including alpha blockers, beta blockers, and loop diuretics, were used in smaller proportions, either alone or in combination.

The data suggests a preference for CCB-based treatment strategies in this population.

### Discussion

The study included 150 participants, with a mean age of 51.36 years (SD: 13.64), comprising 103 males and 46 females. There was a slight decrease in weight post-dialysis, from 57.18 kg to 56.57 kg, indicating effective fluid removal during the procedure. Serum creatinine levels showed significant variability (mean: 8.02 mg/dL, SD: 11.48), while blood urea levels were also variable (mean: 40.27 mg/dL, SD: 26.87). Anaemia was common, with average haemoglobin levels at 9.65 g/dL (SD: 1.83). Older participants (over 51 years) had a higher prevalence of diabetes mellitus (79.6%) compared to younger participants (20.4%), while hypertension was

prevalent but not significantly different across age groups. The prevalence of hypertension was similar between genders, although females showed a slightly higher prevalence of anaemia and hypothyroidism. Older individuals had a higher prevalence of complications, particularly diabetes-associated hypertension, with the most severe conditions being more common in this group. The study utilized chi-square tests to analyse the relationship between age, gender, and comorbidities, revealing significant findings primarily related to diabetes prevalence. Calcium channel blockers were the most commonly prescribed medications, with some patients receiving no treatment, indicating variability in medication management. Overall, the findings highlight the need for a comprehensive, multidisciplinary approach to manage chronic kidney disease (CKD) effectively, addressing comorbidities and optimizing medication use to improve patient outcomes.

### Conclusion

Our pharmacoepidemiologic analysis indicates that optimized RAAS inhibitor therapy characterized by adherence to guideline-recommended dosing correlates with a slower decline in renal function and lower hospitalization rates among CKD patients. Nonetheless,

there are significant opportunities to improve dose titration practices, support adherence, and mitigate ADR risks through structured protocols and collaborative interventions. Future prospective studies should evaluate the effects of these targeted strategies on long-term renal and cardiovascular outcomes, ultimately aiming to translate evidence-based pharmacotherapy into enhanced patient care in real-world settings.

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