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Prescription Audit of CKD Patients in Nephrology Department of a Tertiary Care Hospital: An Observational Prospective Study

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ABSTRACT

Background: A major global health concern that is linked to a considerable morbidity, mortality, and financial burden is chronic kidney disease. In addition to discussing risk factors, management techniques, stages, causes, and pharmaceutical concerns, this study offers a succinct summary of chronic kidney disease. In addition to highlighting the gradual progression of CKD and its wide range of contributing factors, such as diabetes, hypertension, genetic susceptibility, and drug toxicity, the review emphasizes the significance of early identification and intervention. Modest lifestyle changes, medication-assisted therapies, and routine patient monitoring are all components of successful management regimens. A thorough grasp of CKD enables cooperative efforts to lessen its effects on public health and supports well-informed decision-making.

MATERIALS AND METHODS: This study was designed as a prospective observational study. Our inclusion criteria include Patients of both sexes, Patients willing to participate in the study and provide written and dated informed consent, patients diagnosed with chronic kidney disease (CKD),patients aged above 25 years. Exclusion Criteria: Patients unwilling to participate or unwilling to provide informed consent, patients aged below 25 years.

All collected data were systematically compiled, tabulated, and subjected to statistical analysis. Various graphical representations, including tables, figures, and charts, were employed to summarize and present the results effectively.

The Chi-square test was applied for statistical analysis to determine the significance of associationns within the data.

Result: A study of 150 CKD patients found the highest prevalence in ages 51-60. Common comorbidities were diabetes (31%) and hypertension (27%). Antibiotics were prescribed to all. Drug interactions occurred in 28.7% of cases, and prescription errors included dose (16%) and frequency (6.7%). Only 4.7% lacked a doctor's signature.

Keywords: *Chronic kidney disease, prescription audit, drug utilization, medication errors, pharmacotherapy, nephrology, drug interactions, patient safety.*

1. INTRODUCTION

Drug utilization studies critically assess the marketing, distribution, prescription, and consumption of pharmaceutical agents, with a focus on their health, societal, and economic implications[1]. These studies play a pivotal role in promoting the rational use of medications, which is essential for informed healthcare decision-making[2]. Among various patient populations, prescription pattern analysis is particularly crucial for individuals with chronic kidney disease (CKD) due to their dynamic pharmacotherapeutic requirements. Systematic monitoring of prescriptions facilitates the identification of potential prescribing errors and enhances awareness among healthcare providers, ultimately improving patient outcomes[3]. CKD is a significant global health burden, characterized by high mortality rates, prolonged hospitalizations, and substantial treatment costs. This burden is particularly pronounced in low- and middle-income countries such as India, where affordability poses

a major challenge. Patients undergoing chronic hemodialysis require multiple pharmacological interventions, predisposing them to a heightened risk of adverse drug reactions (ADRs) and drug-related complications. Despite the clinical importance of optimizing pharmacotherapy in this patient cohort, there remains a paucity of data on drug utilization patterns, dosages, and associated outcomes among Asian hemodialysis patients[4-5].

Epidemiology and Progression

Disease progression elevates the risk of end-stage kidney disease (ESKD), cardiovascular morbidity, and mortality. Hence, early detection and risk-based management strategies are imperative for mitigating adverse outcomes and improving patient survival[6-7].

Classification: CKD is classified into five stages based on GFR8-9: Stage 1 (GFR >90 mL/min/1.73 m²): Kidney damage is present, but renal function remains within the normal or high range. Patients are usually asymptomatic. Stage 2 (GFR 60-89 mL/min/1.73 m²): Mild decline in kidney function may occur, sometimes accompanied by nonspecific symptoms like fatigue. Stage 3 (GFR 30-59 mL/min/1.73 m²): Moderate reduction in kidney function, further classified into Stage 3a (GFR 45-59) and Stage 3b (GFR 30-44). Possible symptoms include swelling, anemia, and metabolic abnormalities. Stage 4 (GFR 15-29 mL/min/1.73 m²): Significant impairment in kidney function, leading to complications such as fluid retention, electrolyte imbalances, and an increased risk of cardiovascular issues. Stage 5 (GFR <15 mL/min/1.73 m²): End-stage kidney disease (ESKD), requiring dialysis or kidney transplantation to sustain life.Early diagnosis and intervention are essential to slow disease progression and improve patients' quality of life.

Etiology: The etiological factors contributing to CKD include9-11: Diabetes Mellitus, Hypertension, Glomerulonephritis-Polycystic Kidney Disease (PKD), Obstructive Uropathy: Recurrent Kidney Infections,Autoimmune Disorders, Conditions such as systemic lupus erythematosus can cause immune-mediated nephritis, Congenital Anomalies, Nephrotoxicity, Aging.

Assessment and Management of Glomerular Filtration Rate (GFR): GFR serves as the primary indicator of renal function, reflecting the filtration capacity of nephrons. In healthy individuals, GFR ranges between 90 and 125 mL/min/1.73 m². A decline in GFR indicates progressive renal dysfunction, while elevated GFR may signify hyperfiltration, often observed in early diabetic nephropathy[12]. Since direct GFR measurement is impractical, estimated GFR (eGFR) is commonly utilized. The most accurate methods involve the clearance of exogenous filtration markers such as iohexol, iothalamate, 51Cr-EDTA, and 99mTc-DTPA, replacing the historically used but cumbersome inulin clearance method[13].

Risk Factors and Prevention Strategies: CKD risk factors encompass genetic, environmental, and behavioral determinants. Key modifiable risk factors include diabetes mellitus, hypertension, obesity, smoking, and nephrotoxic drug exposure. Non-modifiable factors such as aging, genetic predisposition, and ethnicity also influence disease susceptibility. Implementing preventive strategies, including lifestyle modifications and routine screening, can significantly reduce CKD incidence and progression[14].

Management Strategies: A multidisciplinary approach is essential for CKD management, encompassing pharmacological and non-pharmacological interventions[16-19]: Blood Pressure Regulation: Lifestyle interventions (e.g., sodium restriction, physical activity) and antihypertensive agents (e.g., ACE inhibitors, ARBs) mitigate disease progression. Glycemic Control: Optimal glucose management through dietary modifications and antidiabetic medications is crucial for diabetic nephropathy prevention. Dietary Adjustments: A renal-specific diet restricts sodium, phosphorus, and potassium intake while ensuring adequate protein consumption. Lifestyle Modifications: Smoking cessation, stress management, and alcohol limitation contribute to improved renal outcomes. Regular Monitoring: Routine assessment of renal function, blood pressure, and metabolic parameters facilitates early therapeutic adjustments. Specialist Referral: Advanced CKD cases necessitate nephrology consultation, dialysis initiation, or renal transplantation.

Pharmacological Considerations: A vital part of treating Chronic Kidney Disease (CKD) is pharmacological treatment, which aims to manage symptoms, decrease the disease's course, and treat related consequences. Antihypertensive drugs are commonly used to lower blood pressure and lessen kidney damage[20]. Examples of these drugs include angiotensin II receptor blockers (ARBs) and angiotensin-converting enzyme (ACE) inhibitors. Diuretics, especially loop diuretics, aid in the management of fluid retention which is typical in later stages of chronic kidney disease. Erythropoiesis-stimulating agents (ESAs), such as erythropoietin, promote the synthesis of red blood cells, hence addressing the common CKD consequence of anemia[21-22]. Phosphate binders, which are frequently either calcium- or non-calcium-based, control blood phosphorus levels and lower the risk of cardiovascular problems and bone disease. Supplements of vitamin D are given to compensate for shortages and preserve bone health. Statins are used to reduce cardiovascular risk, which is a major issue in patients with chronic kidney disease, and cholesterol levels[23-24]. In addition, blood clot formation is prevented and the risk of stroke or heart attack is decreased by the prescription of anticoagulants and antiplatelet medicines. Using specific drugs to treat side effects such as hyperkalemia, metabolic acidosis, and secondary hyperparathyroidism is another aspect of pharmacological management. For best results, pharmacological treatment must be closely monitored, taking into account renal function and any interactions, and emphasizing patient education and adherence[25-26].

2. MATERIALS AND METHODS

This prospective study looked into the effects of chronic kidney disease (CKD) on patients 25 years of age and beyond. It was carried out at the Parul Sevashram Hospital in Vadodara, Gujarat, India. The Parul Sevashram Hospital's Institutional Ethical Committee granted ethical approval, and 150 individuals were enrolled following the acquisition of signed informed consent. The Medical Record Department provided information during a six-month period, including treatment records, medical history, and demographic data. Patients under 25 years old or unwilling to cooperate were not included. The gathered data were subjected to statistical analysis using the Chi-square method in order to evaluate several CKD-related factors. Figures, tables, and graphs were used to summarize the results. The demographic and clinical aspects of CKD are better understood thanks to this study, that gives important insights for future.

The study protocol was reviewed and approved by the Institutional Ethical Committee. The ethical approval number assigned to this study is PUIECHR/PIMSR/00/081734/6509. Prior to commencement, the study underwent peer review and assessment by the ethics committee, ensuring compliance with ethical guidelines.

A specially designed and validated patient data collection form was developed for the study. This form, detailed in ANNEXURE – I, was utilized to systematically collect relevant information from the medical record department. The form included demographic details (age, sex, date of admission, date of discharge), reason for admission, medical history, social history, treatment history (dose, route, frequency), and other pertinent clinical information.

All collected data were systematically compiled, tabulated, and subjected to statistical analysis. Various graphical representations, including tables, figures, and charts, were employed to summarize and present the results effectively. Statistical Analysis The Chi-square test was applied for statistical analysis to determine the significance of associationns within the data.

Results:

GENDER WISE DISTRIBUTION: In this study, total number of 150 patients were studied during a period of 6 months. Out of 150 patients, 101 (67%) were males and 49 (33%) were females. The findings are summarized in Table 1.

TABLE 1: GENDER WISE DISTRIBUTION

Gender	Number of patients	Percentage (%)
Male	101	67
Female	49	33

AGE WISE DISTRIBUTION: Based on the result obtained, out of 150 patients, it was found that the age group of 51-60 years, i.e., 55 patients constituting 36.7 % had a high frequency of chronic kidney disease compared to other age groups. The age group 81-90 years age group had fewest patients, with 3 patients, accounting for 2% of overall patient population. The findings are summarized in Table 2.

TABLE 2: AGE WISE DISTRIBUTION

Age group (In years)	Number of patients	Percentage (%)
30-40	12	8%
41-50	33	22%
51 -60	55	36.7%
61-70	41	27.3%
71 – 80	6	4%
81-90	3	2%

DISTRIBUTION ACCORDING TO C0-MORBIDITY: Other medical conditions were also diagnosed in CKD patients. We found 31% of patients with diabetes mellitus, followed by 27% with hypertension, 25% with anemia, 14% with heart disease and 3% with liver disease.the findings are summarized in Table 3.

TABLE 3: DISTRIBUTION ACCORDING TO C0-MORBIDITY

Co-morbidity	Number of patient	Percentage (%)
DM	47	31%
HEART DISEASE	20	14%
ANEMIA	37	25%
HTN	41	27%
LIVER DISEASE	5	3%

PERCENTAGE DISTRIBUTION OF DIFFERENT CLASSES OF DRUG IN PATIENTS: In this study data, the most commonly prescribed class was antibiotic 100%, followed by antianemic 82%, antihypertension 70%, alkylating agents 68%, antihyperglycemic agents 31%, diuretics 27% and fewest patients prescribed antihyperuracemic 19%. The findings are summarized in Table 4.

TABLE 4: PERCENTAGE DISTRIBUTION OF DIFFERENT CLASSES OF DRUG IN PATIENTS

Drug classes	Total number of patients	Number of patients	Percentage (%)
Diuretics	150	41	27%
Antihypertension	150	106	70%
Alkylating agents	150	102	68%
Antihyperurecemic	150	29	19%
Antianemic	150	123	82%
Antihyperglycemic agents	150	47	31%
Antibiotic	150	150	100%

PERCENTAGE 0F DEGREE OF LEGIBILITY: Below graph illustrate that, out of 150 prescriptions, 134 prescriptions were found legible. While, 16 prescriptions were found illegible.The findings are summarized in Table 5 and Figure 1.

TABLE 5: PERCENTAGE 0F DEGREE OF LEGIBILITY

Percentage of degree legibility	Number of patients	Percentage (%)
legibility with easy	116	77.3%
legibility with difficulty	18	12%
illegible	16	10.7%

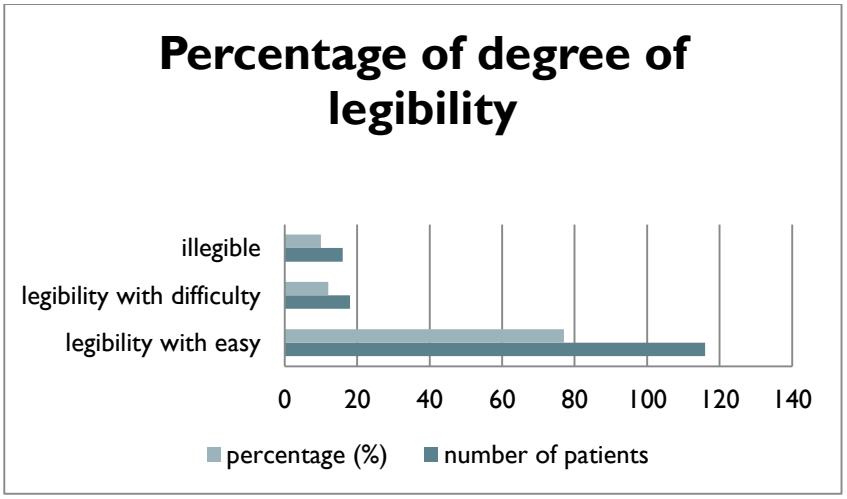

FIGURE 1: PERCENTAGE 0F DEGREE OF LEGIBILITY

PERCENTAGE OF DRUG INTERACTION FOUND: Below chart shows, total number of 150 patients were studied during a period of 6 months. Out of 150 patients, 107 (71.30%) were not found any drug interaction and 43 (28.70%) were found drug interaction. Most common potential drug-drug interaction in this study, such as bisoprolol + nifedipine, bisoprolol + torsemide, sodium bicarbonate + moxifloxacin, sodium bicarbonate + iron supplement, sodium bicarbonate + bisoprolo, metoprolol + clonidine and aspirin + bisoprolol. The findings are summarized in Table 6 and Figure 2.

TABLE 6: PERCENTAGE OF DRUG INTERACTION FOUND

Drug interaction	Number of patient	Percentage%
YES	43	28.70%
NO	107	71.30%

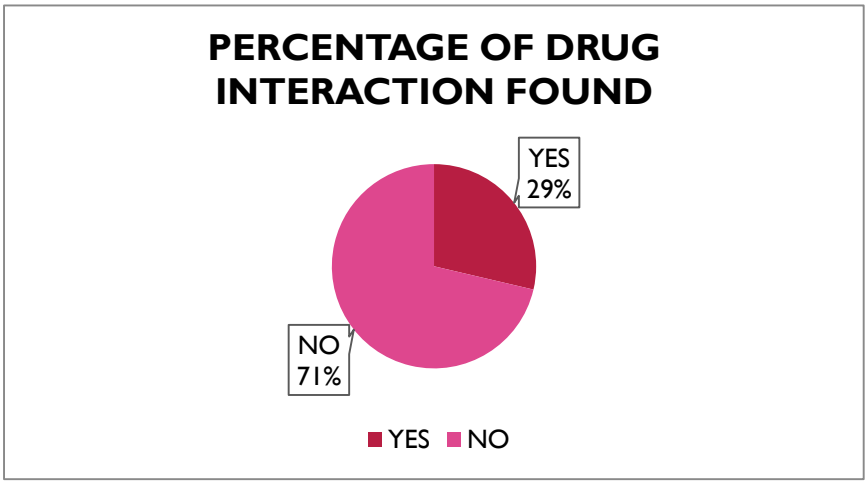

FIGURE2: PERCENTAGE OF DRUG INTERACTION FOUND

PERCENTAGE OF ERRORS IN FREQUENCY: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 10 (6.70%) were found errors in frequency and 140 (93.30%) were not found any errors in frequency. The findings are summarized in Table 7 and Figure 3.

TABLE 7: PERCENTAGE OF ERRORS IN FREQUENCY:

Errors in frequency	Number of patient	Percentage%
YES	10	6.70%
NO	140	93.30%

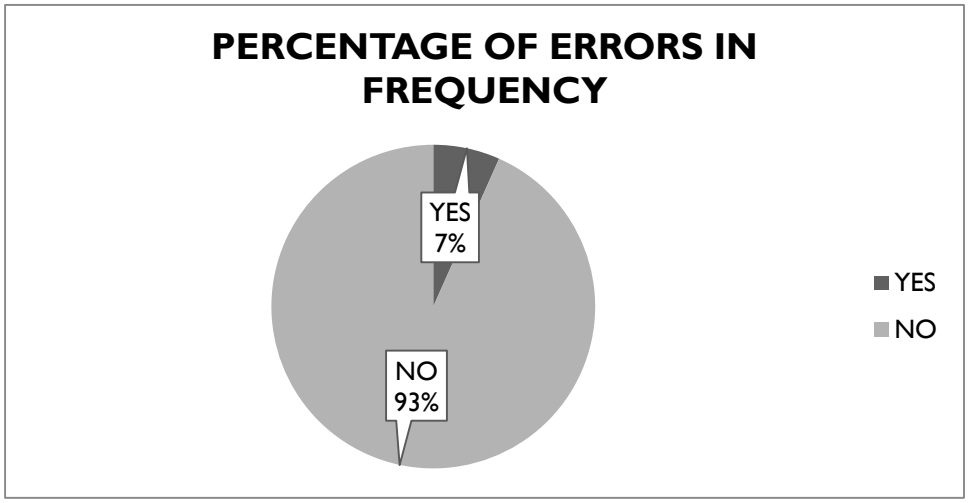

FIGURE 3: PERCENTAGE OF ERRORS IN FREQUENCY

PERCENTAGE OF ERRORS IN DOSE: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 24 (16.00%) were found errors in dose and 126 (84.00%) were not found any errors in dose. The findings are summarized in Table 8 and Figure 4.

TABLE 8: PERCENTAGE OF ERRORS IN DOSE:

Errors in dose	Number of patient	Percentage%
Yes	24	16.00%
No	126	84.00%

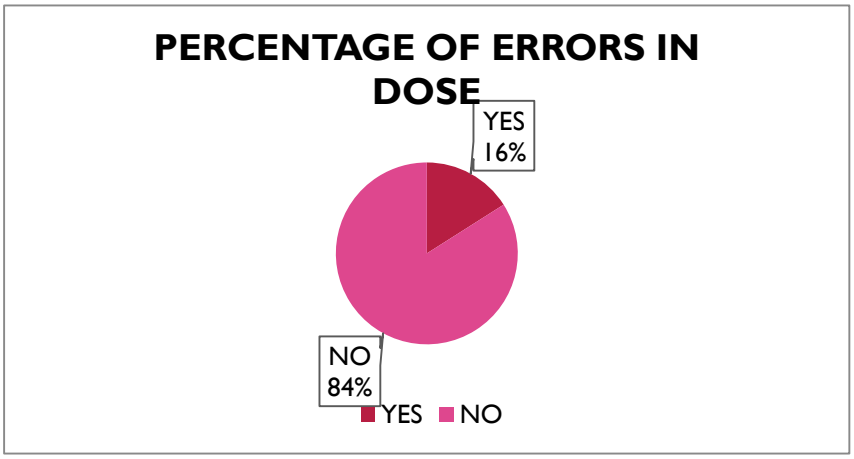

FIGURE 4: PERCENTAGE OF ERRORS IN DOSE

PERCENTAGE OF ERRORS IN ROUTE OF ADMINISTRATION: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 4 (2.70%) were found errors in route of administration and 146 (97.30%) were not found any errors inroute of administration. The findings are summarized in Table 9 and Figure 5.

TABLE 9: PERCENTAGE OF ERRORS IN ROUTE OF ADMINISTRATION:

Errors in route of administration	Number of patient	Percentage%
YES	4	2.70%
NO	146	97.30%

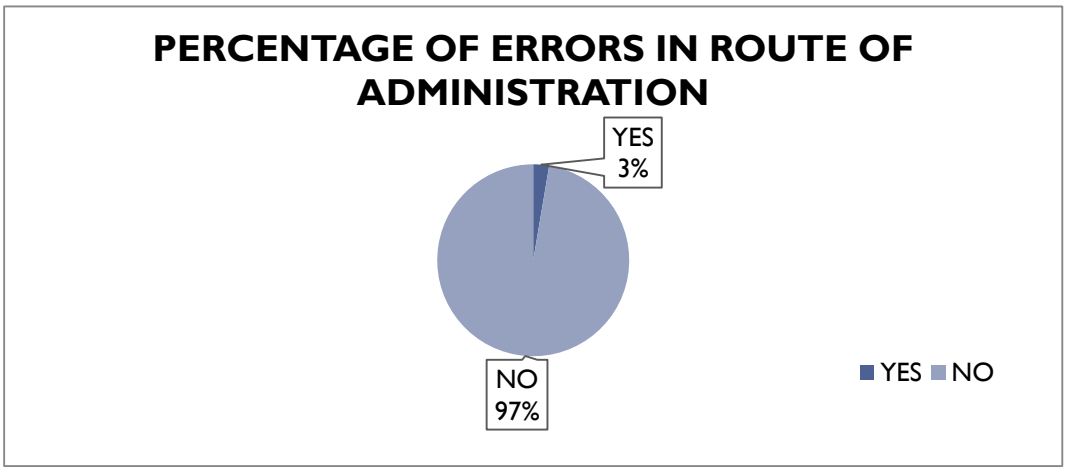

FIGURE 5: PERCENTAGE OF ERRORS IN ROUTE OF ADMINISTRATION

PERCENTAGE OFCAPITALISATION IN PRESCRIPTION: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 17 (11.30%) were found capitalisation and 133 (88.70%) were not found any capitalisation. The findings are summarized in Table 10 and Figure 6.

TABLE 10: PERCENTAGE OF CAPITALISATION IN PRESCRIPTION:

Capitalisation	Number of patient	Percentage%
YES	17	11.30%
NO	133	88.70%

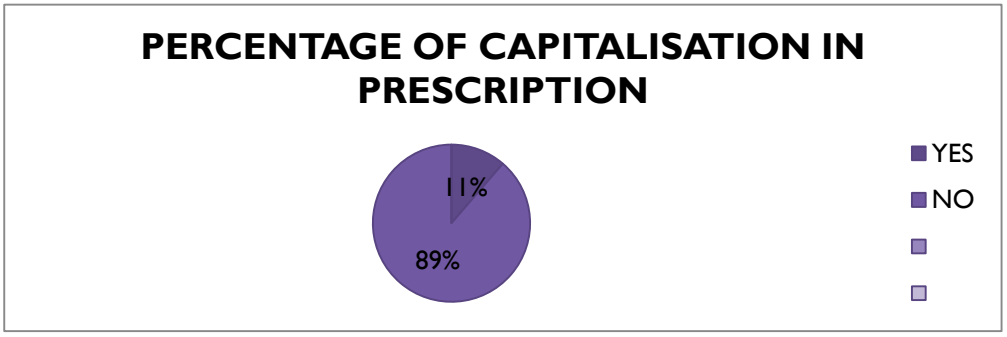

FIGURE 6: PERCENTAGE OF CAPITALISATION IN PRESCRIPTION

PERCENTAGE OF CAPITALISATION IN PRESCRIPTION: Below chart shows, total number of 150 patients were studied. Out of 150 patients, 0 (0%) were found duplication in prescription and 150 (100%) were not found anyduplication in prescription. The findings are summarized in Table 11.

TABLE 11: PERCENTAGE OF THERAPEUTIC DUPLICATION IN PRESCRIPTION:

Therapeutic duplication in prescription	Number of patient	Percentage%
YES	0	0.00%
NO	150	100.00%

PERCENTAGE OFDRUG-FOOD INTERACTION: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 13 (8.70%) were found drug-food interaction and 137 (91.30%) were not found any drug- food interaction. The findings are summarized in Table 12.

TABLE 12: PERCENTAGE OF DRUG-FOOD INTERACTION:

Drug-food interaction	Number of patient	Percentage%
YES	13	8.70%
NO	137	91.30%

PERCENTAGE OFPRESCRIPTION WITH DOCTOR SIGNATURE: Below chart shows, total number of 150 patients were studied. Out of 150 patients, only 7 (4.70%) were found without doctor signature and 143 (95.30%) were found with doctor signature. The findings are summarized in Table 13 and Figure 7.

TABLE 13: PERCENTAGE OF PRESCRIPTION WITH DOCTOR SIGNATURE:

Doctor signature	Number of patient	Percentage%
YES	143	95.30%
NO	7	4.70%

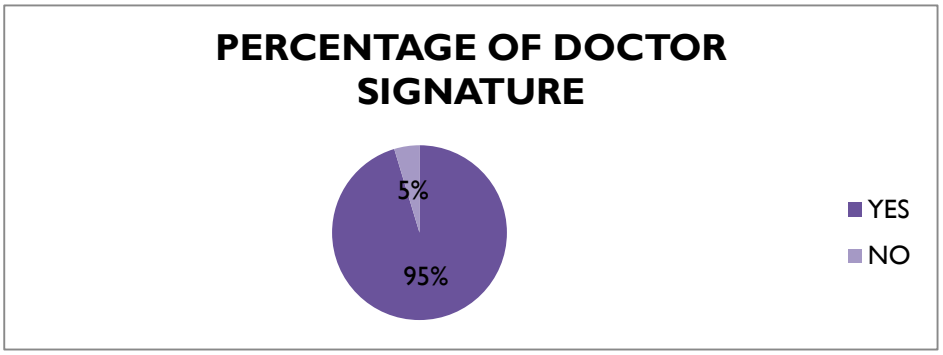

FIGURE 7: PERCENTAGE OF PRESCRIPTION WITH DOCTOR SIGNATURE

Statistic calculation for parameters based on chi-square:

Parameters	**Yes**	**No**	**TOTAL**
Degree of legibility	16	134	150
Drug interactions	43	107	150
Errors in frequency	10	140	150
Errors in dose	24	126	150
Errors in ROA	4	146	150
Capitalization in prescription	17	133	150
Duplication in prescription	0	150	150
Drug food interaction	13	137	150
Prescription with doctor signature	143	7	150
TOTAL	**270**	**1080**	**1350**

Calculation based on observed and expected values:

EXPECTED VALUES - 1	**EXPECTED VLES - 2**	**(O - E) * (O - E) - 1**	**(O - E) * (O - E) - 2**	**[(O - E) * (O - E)] / E - 1**	**[(O - E) * (O - E)] / E - 2**
30.00	120.00	196	196	6.53	1.63
30.00	120.00	169	169	5.63	1.41
30.00	120	400	400	13.33	3.33
30.00	120	36	36	1.20	0.30
30.00	120	676	676	22.53	5.63
30.00	120	169	169	5.63	1.41

30.00	120	900	900	30.00	7.50
30.00	120	289	289	9.63	2.41
30.00	120	12769	12769	425.63	106.41
				520.13	130.03
Chi square total				**650.17**	

3. DISCUSSION

In this study, a prescription audit to assess the prescription management and errors in prescription for patients who suffered from chronic kidney disease (CKD). Prescription surveys are considered among the most cost effective methods for examining medication management. The aim of this study is to "Evaluate prescription of patients affected by chronic kidney disease (CKD) in a tertiary care hospital". Over the period of our six-month study, we thoroughly examined 150 patients in order to look into our issue of interest. We found that 67% of this group's members were men and 33% were women, providing a baseline demographic profile for our investigation. It is evident that, those between the ages of 51 and 60 accounted for the largest percentage of instances of chronic kidney disease 55 out of 150, or 36.7% of all cases. Conversely, the age range of 81-90 constituted only 3 patients, or two percent of the whole cohort, and had the fewest cases. According to the research review, patients also had various medical issues in addition to chronic kidney disease (CKD). In particular, 31% had been diagnosed with diabetes mellitus, followed by hypertension (27%), anemia (25%), heart disease (14%), and liver disease (3%). All patients received antibiotics, which were the most commonly recommended drugs, according to a summary of the study. After that, 82% of patients received antianemic medication, while 70% received prescriptions for antihypertensive drugs. Of the group, 68% received alkylating drugs and 31% received antihyperglycemic medications. Antihyperuricemic drugs were prescribed to the fewest patients (19%), followed by diuretics (27%). After looking over the study, out of the 150 prescriptions that were looked at, 134 were found to be legible and 16 to be illegible. In addition, percentage of 28.70% of patients did show signs of drug interactions. Significantly, the investigation revealed a number of typical possible drug-drug interactions, including aspirin and bisoprolol, metoprolol and clonidine, sodium bicarbonate and moxifloxacin, sodium bicarbonate and iron supplement, and bisoprolol and sodium bicarbonate. These results emphasize how important it is to carefully monitor drug dosage in order to reduce patient risks. Out of total patients, a small percentage, or 10 patients (6.70%), had frequency error. On the other hand, the majority, or 140 patients (93.30%), did not have any frequency errors. In addition, 24 patients (16.00%) had dose error, while the remaining 126 patients (84.0%) had no errors in their prescribed doses. Moreover, out of the total patients examined only 4 patients (2.70%) had errors in their prescribed routes of administration, whereas 146 patients (97.30%) did not have any errors in their prescribed routes of administration. Only 17 patients (11.30%) had capitalization in prescription, whereas 133 patients (88.70%) did not have any capitalization in prescription. Additionally, there were zero instances of therapeutic duplication. Notably, no therapeutic duplication in any of the 150 patients (100%) that were part of the study. Furthermore, just 8.70% (13 patients) of the 150 patients that were evaluated experienced drug food interactions, whereas the great majority (91.30%) (137 patients) did not. We find that, out of the 150 patients we looked at, a small percentage of 4.70% (7 people) did not have a signature from a doctor in prescription, while the majority, or 95.30% (143 patients), had prescription with a signature from a doctor.

4. CONCLUSION

A comprehensive audit of prescriptions for 150 patients with chronic kidney disease (CKD) yielded key findings. The prevalence of CKD was higher in men (67%) compared to women (33%), with the age group of 51-60 years representing the largest proportion (36.7%). Coexisting conditions, such as diabetes mellitus (31%) and hypertension (27%), further complicate management of these patients.

The most commonly prescribed medications included antibiotics, followed by antihypertensive and antianemic drugs. Notably, 28.7% of patients showed signs of drug interactions, underscoring the importance of vigilant monitoring. Prescription accuracy was generally high, with 89.3% of prescriptions having no frequency errors and only 10.7% containing

frequency errors. Dose errors were present in 16% of cases, but errors in modes of administration were minimal (2.7%).

Prescription capitalization was rare (11.3%), and no therapeutic duplication was found, reflecting a high standard of prescription accuracy. Drug-food interactions were also limited (8.7%). Importantly, only 4.7% of prescriptions lacked a doctor's signature, highlighting the need to adhere to legal requirements in pharmaceutical practices.

In conclusion, prescription practices at the tertiary care hospital for CKD patients are generally effective, though improvements are needed to minimize medication errors and enhance prescription clarity. Ongoing attention to drug interactions and prescription quality will be essential for maintaining treatment safety and efficacy in this patient population.

REFERENCES

[1] Shalini S, Ravichandran V, Mohanty BK, Dhanaraj SK, Saraswathi R. Drug utilization studiesAn overview. International Journal of Pharmaceutical Sciences and Nanotechnology. 2010;3:803- 10.

[2] Sonika Niraj Motan, Anusha Vohra, & Mohammed Shoaib. (2023). PRESCRIPTION PATTERN OF MEDICINES IN CHRONIC KIDNEY DISEASE PATIENTS IN NEPHROLOGY DEPARTMENT OF A TERTIARY CARE TEACHING HOSPITAL: AN OBSERVATIONAL STUDY. *Journal of Population Therapeutics and Clinical Pharmacology*, *30*(16), 753-760. https://doi.org/10.53555/jptcp.v30i16.1933

[3] Chakraborty S, Ghosh S, Banerjea A, De RR, Hazra A, Mandal SK. Prescribing patterns of medicines in chronic kidney disease patients on maintenance hemodialysis. Indian J Pharmacol. 2016 Sep-Oct;48(5):586-590. doi: 10.4103/0253-7613.190760. PMID: 27721548; PMCID: PMC5051256.

[4] Nelms CL, Shaw V, Greenbaum LA, Anderson C, Desloovere A, Haffner D, Oosterveld MJ, Paglialonga F, Polderman N, Qizalbash L, Rees L. Assessment of nutritional status in children with kidney diseases—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce. Pediatric Nephrology. 2021 Apr;36:995-1010.

[5] Haffner D. Strategies for optimizing growth in children with chronic kidney disease. Frontiers in pediatrics. 2020 Jul 30;8:399.

[6] Hundemer GL, Tangri N, Sood MM, Ramsay T, Bugeja A, Brown PA, Clark EG, Biyani M, White CA, Akbari A. Performance of the kidney failure risk equation by disease etiology in advanced CKD. Clinical Journal of the American Society of Nephrology. 2020 Oct 1;15(10):1424-32.

[7] Kidney T (1952) Structure and function in health and disease. Postgrad Med J 28(317):191–192 Shannon JA, Smith HW (1935) The excretion of inulin, xylose and urea by normal and phlorizinized man. J Clin Invest 14(4):393–401

[8] Heinze M, Schell M, Nägele FL, Cheng B, Flottmann F, Fiehler J, Schmidt-Lauber C, Thomalla G. Kidney dysfunction predicts 90 days mortality after stroke thrombectomy independent of cardiovascular risk factors and chronic kidney disease. European Stroke Journal. 2024 Jan 9:23969873231224200.

[9] Davison SN, Tupala B, Wasylynuk BA, Siu V, Sinnarajah A, Triscott J. Recommendations for the care of patients receiving conservative kidney management: focus on management of CKD and symptoms. Clinical Journal of the American Society of Nephrology. 2019 Apr 1;14(4):626-34.

[10] Muntner P, Anderson A, Charleston J, Chen Z, Ford V, Makos G, O'Connor A, Perumal K, Rahman M, Steigerwalt S, Teal V, Townsend R, Weir M, Wright JT Jr; Chronic Renal Insufficiency Cohort (CRIC) Study Investigators: Hypertension awareness, treatment, and control in adults with CKD: Results from the Chronic Renal Insufficiency Cohort (CRIC) study. Am J Kidney Dis 55: 441–451, 2010

[11] Debella YT, Giduma HD, Light RP, Agarwal R: Chronic kidney disease as a coronary disease equivalent--a comparison with diabetes over a decade. Clin J Am Soc Nephrol 6: 1385–1392, 2011

[12] Tauro CM, Kamath JV, Mishal M, Hateefa Z. Assessment of Prescribing Patterns of Drugs in Chronic Kidney Disease Patients in a Tertiary Care Hospital. Indian Journal of Pharmacy Practice.

[13] Sonoda A, Kondo Y, Iwashita Y, Nakao S, Ishida K, Irie T, Ishitsuka Y. In-hospital prescription checking system for hospitalized patients with decreased glomerular filtration rate.

[14] Nafih A, Mateti UV, Shenoy P, Shivaprasad S, Moorthy J. A study on prescribing patterns in hemodialysis and renal transplantation patients. Egyptian Pharmaceutical Journal.

[15] Meenakshi R, Selvaraj N, Anandabaskar N, Dhamodharan A, Badrinath AK, Rajamohammad MA. Prescription audit of a teaching hospital in South India using World Health Organization core prescribing indicators–A cross-sectional study. Perspectives in Clinical Research.

[16] Jamaluddin J, Yassin MS, Jamil SN, Kamel MA, Yusof MY. A clinical audit of the diagnosis and management of chronic kidney disease in a primary care clinic. Malaysian family physician: the official journal of the

Academy of Family Physicians of Malaysia.

[17] Beg MA, Dutta S, Varma A, Kant R, Bawa S, Anjoom M. Study on drug prescribing pattern in hypertensive patients in a tertiary care teaching hospital at Dehradun, Uttarakhand. Int J Med Sci Public Health.

[18] Sinha AD, Agarwal R. Clinical pharmacology of antihypertensive therapy for the treatment of hypertension in CKD. Clinical Journal of the American Society of Nephrology. 2019 May 1;14(5):757-64.

[19] Rebecca Noble, Maarten W. Taal, Epidemiology and causes of chronic kidney disease, Medicine,Volume 47, Issue 9,2019,Pages 562-566,ISSN 1357-3039,https://doi.org/10.1016/j.mpmed.2019.06.010.

[20] Awdishu L, Coates CR, Lyddane A, Tran K, Daniels CE, Lee J, El-Kareh R. The impact of real-time alerting on appropriate prescribing in kidney disease: a cluster randomized controlled trial. Journal of the American Medical Informatics Association.

[21] Phillips M, Wilson JA, Aly A, Wood M, Poyah P, Drost S, Hiltz A, Carver H. An evaluation of medication reconciliation in an outpatient nephrology clinic.

[22] Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004;351(13):1296–305.

[23] Navadia KP, Patel CR, Patel JM, Pandya SK. Evaluation of Medication Errors by Prescription Audit at a Tertiary Care Teaching Hospital. Journal of Pharmacology and Pharmacotherapeutics.

[24] Mallamaci F, Tripepi G. Risk Factors of Chronic Kidney Disease Progression: Between Old and New Concepts. Journal of Clinical Medicine. 2024 Jan 24;13(3):678

[25] Schena FP. Management of patients with chronic kidney disease. Internal and emergency medicine. 2011 Oct;6:77-83.

[26] Walther CP, Nambi V, Hanania NA, Navaneethan SD. Diagnosis and management of pulmonary hypertension in patients with CKD. American Journal of Kidney Diseases. 2020 Jun 1;75(6):935-45. the American College of Gastroenterology| ACG. 2018 Nov 1;113(11):1581.