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Original Article

# Prospective Observational Study of Chronic Kidney Disease, its Prescription Pattern and Risk Factors in Patients with Pre-Existing Comorbidities in Tertiary Care Hospital

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## ABSTRACT

**Objectives:** Chronic Kidney Disease (CKD) is one of the major health concerns all over the world. Our study provides a clarified view for epidemiology in hospital settings identifies risk factors associated with Pre-existing co-morbidities and studies the prescribing pattern of chronic kidney disease. **Materials and Methods:** A prospective observational study was conducted in the inpatient general medicine department of a tertiary care hospital. Total 210 patients were studied over period of 6 months for epidemiological studies of Chronic Kidney Disease (CKD) and existing comorbidities, the prescribing pattern of CKD and risk factors associated with comorbidities. The prescription pattern was assessed using KIDGO guidelines for the treatment of CKD and drugs are classified by ATC classification. **Results:** The study included 210 patients of chronic kidney disease with comorbidities reported 62% male and 38% female. Socio-epidemiological studies show more prevalence in urban than rural and the most commonly observed risk factors associated were hyper-tension and diabetes. Laboratory reports analyzed showed fluctuation levels throughout the stages. Complications include diabetic nephropathy and hypertensive nephropathy and mostly anemia is a major concern. The total prescription contains 3360 drugs out of which 2308 were from the WHO essential drug list. The average drug prescribed to patients was 16-17 drugs. And antimicrobial drugs per prescription were found to be 3-4. In renal transplantation analysis recurrence of CKD is observed. **Conclusion:** The results were significant and provide a precise view of the prevalence and risk factors associated with chronic kidney disease. Prescriptions pattern quantifies use of the high potential drugs.

**Keywords:** Chronic kidney disease, Complications, Prevalence of CKD, Renal replacement, Risk factors of CKD, Prescription pattern.

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## INTRODUCTION

Chronic kidney disease has been emerging as a prominent cause of death. The progressive condition affects >10% population worldwide, which contributes to about >800 million people over the world. Most prevalently seen in men, women and people with pre-existing co-morbidities like diabetes and hypertension.[1] According to a recent study in India roughly calculated that the age-adjusted incidence rate of ESRD in India was found to be 229 per million and more than 1lakh appears renal replacement.[2] There is no sufficient information available on the incidence rate of Chronic Kidney Disease in low-middle-income countries like India. Chronic kidney disease is associated with varying degrees of seriousness. Condition usually gets worse over time; though proper pharmacotherapy; management slows the progression. If left untreated, CKD may be a precursor to kidney failure and early cardiovascular events. Necessarily every kidney disease patient may not progress to kidney failure. To help for prevention and lowering the risk of kidney failure, early detection and proper treatment gives a notable impact on the betterment of patients.[3]

Chronic kidney disease has come out to be one of the most prominent causes of death in the 21st century. The number of patients suffering with CKD has also been increasing, an estimated 843.6 million individuals worldwide in 2016.[4] Diabetes mellitus and hypertension records over 2/3rd of cases of CKD. The US has spotted a 30% increase in the prevalence of CKD in the last decade.[5] Chronic Kidney Disease has its prevalence in different groups such as geriatrics, women, racial minorities and in people with Diabetes Mellitus (DM) and hypertension. CKD represents a huge burden in low- and middle-income countries and appeared as a leading cause of mortality worldwide.[4] Type 1 or type 2 diabetes mellitus, high blood pressure, glomerulonephritis, interstitial nephritis, polycystic kidney, prolonged obstructions of the urinary tract, from conditions such as enlarged prostate,

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kidney stone or cancer, vesicoureteral reflux, a condition that causes urine reflux back to the kidney, pyelonephritis (recurrent UTI, kidney infection) are some of the common co-morbidities that trigger kidney impairment.[6] Some of the studies in the US have also suggested CKD to be genetic and monogenic causes of CKD can be identified by broad gene panels.[7]

CKD is a condition in which the kidneys are injured and lose the ability to filter blood which eventually leads to excess fluid and waste that remains in the body that might root other health problems, such as heart disease and stroke.[8] Conditions such as diabetes and hypertension destroy kidney function by the accumulation of blood glucose in the glomerulus and capillaries making them thick and hard (causing calcification or plaque) which leads to scarring of kidney tissues.[9] Chronic Kidney Disease (CKD) can have a variety of different demonstrations relying on the stage of the disease and its cause, as well as patient factors such as age.

Patients having control over diabetes and hypertension have shown the delay and slowing progression of chronic kidney disease or renal failure.[10] Controlling blood sugar level and cholesterol levels is a prime management. In addition to lowering hypertension, this medication also helps reduce protein in urea which is a risk factor for CKD.[10,11] The clinical management of patients with CKD focuses on:

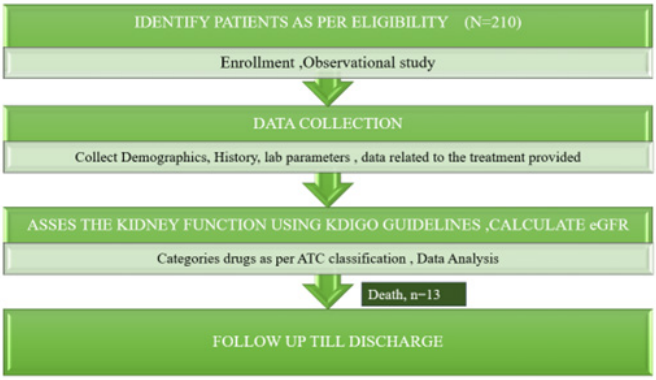
- Delaying or faltering the progression of CKD.
- Diagnosing and treating the pathologic expressions of CKD.
- Conveniently planning for long-term renal replacement therapy.[12]

People with multi-morbidities probably have a number of medications that cause polypharmacy which eventually affects the quality of lives of patients with Chronic Kidney Disease (CKD) due to significant drug-related problems. This study objectives include identifying factors that are associated with CKD progression and development of renal failure in patients with comorbidities and provide a detailed view of the complications and prescription pattern of CKD patients. It also identifies the prevalence of recurrent primary disease post-renal replacement therapy. This study also focuses on the prescribing pattern of Chronic Kidney Disease (CKD) by KIDGO guidelines and ATC classification of drugs and quantifies the use of high-potential drugs to provide a precise view.

## MATERIALS AND METHODS

The study was a prospective observational study carried out in a tertiary care hospital over a period of six months in both critical (ICU and Private wards) and non-critical (General ward) areas. Patients having an active and a past history of chronic kidney disease with co-morbidities were identified for inclusion. Subjective details, objective laboratory data and prescription drugs data were collected. The kidney function was assessed by use of KDIGO (Kidney Disease Improving Global Outcomes) Clinical Practice Guidelines. The drugs prescribed were analyzed and categorized as per the ATC (Anatomic and Therapeutic Classification).

### Methodology flow chart




### Estimated eGFR using MDRD equation

$$GFR\ (mL/min/1.73\ m^2) = 186.3 \times (S.\ Cr)^{-1.154} \times (Age)^{-0.203} \times (0.742 \text{ if female})$$

### Study design and duration

Prospective, observational study was conducted for 6 months in a tertiary care hospital. Recruitment of patients was done as per the inclusion criteria.

### Sample size

The sample size was 210 patients.

### Study Criteria

#### *Inclusion*

- Inpatients of either gender (Age≥18 years) having CKD and existing comorbidities such as diabetes, hypertension and cardiovascular disorders.
- Patients having an active and a past history of chronic kidney disease were included.
- Patients admitted in both critical as well as non-critical were included in the study.

#### *Exclusion*

- Pregnant women, breast feeding women's and pediatric patients (Age <18 years) were excluded from the study.
- Outpatients visiting the out-patient department were also excluded.

## Statistical Analysis

Data was collected in paper format as per the data collection form and transferred electronically and stored in MS EXCEL. Microsoft Excel sheet was designed as per the data collection form containing the various elements required to generate the results, store the data and data validation was performed. Statistical methods such as student *t*-test or ANOVA were used. Mean and standard deviation was used to represent continuous data. Softwares like MS Excel and MS Word were used for the graphical representation of data and to pick up various types of graphs and figures required for result interpretation. *p* (probability)<0.05 was considered significant as per the statistical considerations.

## RESULTS

An observational, prospective study was performed in a tertiary care hospital to study the epidemiology, risk factors and prescription pattern in CKD patients having co-morbidities. The study contained 210 patients recruited as per the inclusion criteria in tertiary care hospital. Out of 210 patients, 130 were male and 80 were female (Figure 1). Patients included in the study were having age >18 years with existing comorbidities such as diabetes, hypertension and cardiovascular disorders with estimated Glomerular Filtration Rate (eGFR) by MDRD equation of GFR (mL/min/1.73 $m^2$)=175×(S. Cr)$^{-1.154}$×(Age)$^{-0.203}$×(0.742 if female). The highest number of patients presented in Stage G5 had an incidence rate of 42% Male and 48% Female population. Followed by 30% of the study population in Stage G4; 19% in Stage G3 whereas 6% population was observed to be in Stage G2 and Stage G1 (Figure 2). Socio-demographic details of the study participants are presented in Table 1. The total mean average ages of patients having CKD are 60.93, the mean value of the age of females was 60.98 and for male was 61.53. The average length of hospital stay of patients is about 8 days approximately.

Diabetes mellitus and high blood pressure are the most commonly seen risk factors of CKD in adults. The risk factors were divided into three groups as shown in Table 2. according to age which shows the advancement in the factors as the age progresses. The laboratory data were analyzed during the research in each patient with chronic kidney disease. Biochemical characteristics of the patient population showed varied levels of fluctuations as per the staging. Mostly serum creatinine one of the most commonly used marker to assess kidney function shows an increase as the stage gradually increases determining decreased GFR, which signifies kidney damage There was a notable increase in values of creatinine, uric acid, serum urea and albumin creatinine ratio. PTH (Parathyroid Hormone) showed an increasing graph in patients with chronic kidney disease. Serum electrolytes have also shown little fluctuation in the concentration values. Albumin Creatine Ratio (ACR) was determined which showed an increase in values. In the case of GFR which is a majorly used parameter was shown a decrease in the eGFR of the patient. Chronic kidney disease leads to an increase in the risk of anemia as the main component erythropoietin hormone- a precursor for RBCs production is not released in proportionate amount due to altered kidney function; the laboratory results show decreased values of minerals and essential vitamins such as Ferritin, vitamin

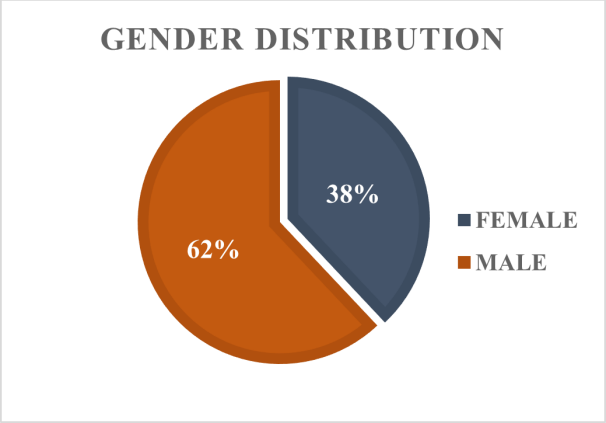



**Figure 1:** Distribution of CKD Population as per Gender.

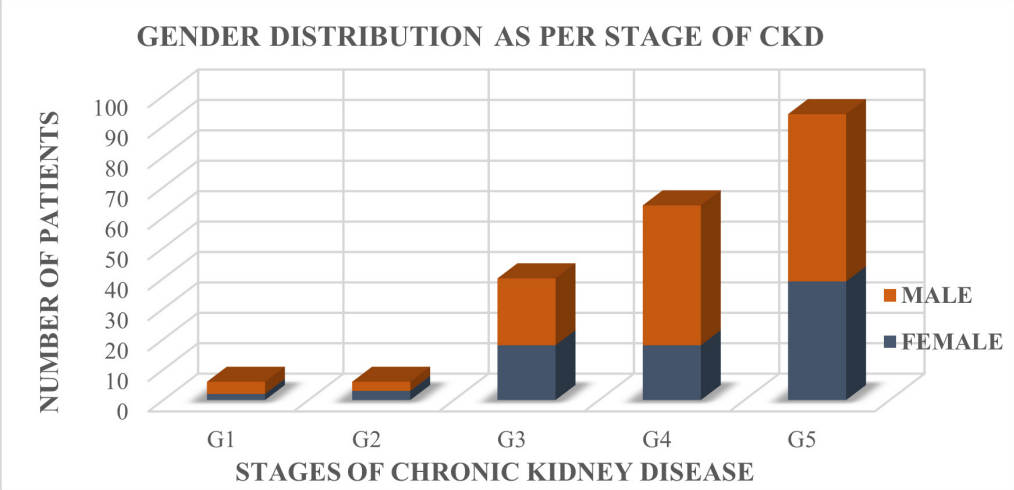



**Figure 2:** Gender Distribution of Study Population Describing the Stages of CKD.

**Table 1: Socio-demographic characteristics of patients suffering from chronic kidney disease.**

| Characteristics | Male | Female | Total | *p* value |
|---|---|---|---|---|
| No. of patients (N) | 130 | 80 | 210 | 0.05 |
| Age (years) | 61.53±15.31 | 60.98±15.43 | 60.93±15.41 | 0.105 |
| Height (cm) | 159.64±9.29 | 159.83±9.08 | 159.68±9.29 | 0.63 |
| Weight (kg) | 64.62±12.46 | 64.79±12.01 | 64.62±12.23 | 0.11 |
| **BMI (kg/m²)** | | | | |
| Underweight (<25) | 74 | 30 | 104 | 0.17 |
| Normal (=25) | 21 | 5 | 26 | 0.03 |
| Overweight (>25) | 45 | 35 | 80 | 0.09 |
| **Place of residence** | | | | |
| Rural | 25 | 20 | 45 | 0.04 |
| Urban | 105 | 60 | 165 | 0.57 |
| **Social habits** | | | | |
| Alcohol | 15 | 2 | 17 | 0.02 |
| Tobacco | 10 | 5 | 15 | 0.02 |
| **Ward category** | | | | |
| ICU | 46 | 20 | 66 | 0.07 |
| General | 38 | 38 | 76 | 0.08 |
| Semiprivate | 20 | 8 | 28 | 0.03 |
| Private | 26 | 14 | 40 | 0.04 |
| Average length of hospital stays | 7.69 | 7.68 | 7.66 | 0.02 |

Data presented as N which refers to no. of patients except for age, height and weight presented as mean±standard deviation.

**Table 2: Risk factors associated with CKD patients.**

| Risk factors | Total (*n*=615), *n* (%) | < 40 years (*n*=52), n (%) | 40-60 years (*n*=157), n (%) | > 60 years (*n*=406), n (%) |
|---|---|---|---|---|
| Hypertension | 190 (31) | 26 (50) | 55 (35) | 109 (27) |
| Diabetes mellitus | 135 (22) | 4 (8) | 38 (24) | 93 (23) |
| History of AKI | 54 (9) | 1 (2) | 15 (10) | 38 (9) |
| Drugs (NSAIDS) | 9 (1) | 0 | 1 (1) | 8 (2) |
| Cardiovascular disorders | 85 (14) | 4 (8) | 14 (9) | 67 (17) |
| Stroke | 2(0.3) | 0 | 0 | 2 (0.6) |
| Myocardial Infarction | 1(0.3) | 0 | 0 | 1 (0.4) |
| Hypothyroidism | 36 (6) | 4 (8) | 10 (6) | 22 (5) |
| History of COVID-19 disease | 27 (4) | 3 (6) | 3 (2) | 21 (5) |
| Liver disease | 29 (5) | 1 (2) | 4 (3) | 24 (6) |
| History of renal calculi | 31 (5) | 6 (12) | 7 (4) | 18 (4) |
| HIV | 1 (0.3) | 0 | 1 (1) | 0 |
| HBV/HCV | 15 (2) | 3 (6) | 9 (6) | 3 (1) |

Data presented as total number of patients 'n" and percentage n (%).**AKI:** Acute Kidney Injury; **MI:** Myocardial Infarction; **HIV:** Human Immunodeficiency Virus; **HBV:** Hepatitis B Virus; **HCV:** Hepatitis C Virus.

**Table 3: Biochemical Characteristics of Study Population**

| LAB Parameters | Overall (*n*=210) | G1 (*n*=6) | G2 (*n*=6) | G3 (*n*=40) | G4 (*n*=64) | G5 (*n*=94) | *P* value |
|---|---|---|---|---|---|---|---|
| SBP (mmHg) | 143 ±26.9 | 136.67 ±18.56 | 133.6 ±9.8 | 136.15 ±20.9 | 139 ±29.1 | 148 ±27.2 | 0.05 |
| DBP (mmHg) | 83.5 ±14.8 | 81.66 ±10.67 | 82.1 ±3.9 | 81.1 ±10.6 | 83.34 ±13.6 | 85 ±16.1 | 0.69 |
| Haemoglobin (g/dL), | 9.75 ±2.1 | 12.16 ±2.03 | 10.4 ±1.5 | 9.8±2.05 | 9.9 ±2.0 | 9.39 ±2.0 | 0.08 |
| S. Creatinine (mg/dL) | 4.38 ±2.7 | 0.93 ±0.3 | 1.75 ±0.9 | 2.09 ±1.0 | 3.53 ±1.2 | 7.11 ± 2.1 | 0.05 |
| S. Albumin (g/dL) | 2.2 ±1.5 | 2.4 ±1.7 | 2.6 ±0.5 | 3.23 ±0.6 | 1.89 ±0.16 | 2.72 ±1.1 | 0.05 |
| S. Total protein (g/dL) | 4.66 ±3.5 | 4.58 ±3.4 | 4.66 ±1.9 | 6.58 ±0.8 | 4.80 ±0.4 | 6.12 ±0.83 | 0.06 |
| S. Sodium (mmoL/L) | 131.1 ±24.9 | 136 ±2.7 | 138.33 ±4.1 | 135 ±6.2 | 132 ±17.6 | 136 ±4.2 | 0.06 |
| S. Potassium (mmoL/L) | 7.25 ±5.01 | 3.85 ±0.2 | 3.95 ±0.3 | 4.2 ±0.8 | 5.0 ±0.5 | 5.7 ±0.99 | 0.06 |
| S. Chloride (mmoL/L) | 96.77 ±7.8 | 101.3 ±1.8 | 105.66 ±4.8 | 98.7 ±18.7 | 107.7 ±39.2 | 103.9 ±10.9 | 0.32 |
| S. Urea (mg/dl) | 73.35 ±5.5 | 23.16 ±13.6 | 25.66 ±10.3 | 58.60 ±40.8 | 70.28 ±40.7 | 96.40 ±16.6 | 0.72 |
| S. Uric acid (mg/dL) | 8.35 ±3.06 | 3.6 ±1.8 | 2.36 ±2.0 | 5.84 ±1.5 | 4.65 ±1.4 | 7.42 ±2.6 | 0.06 |
| PTH (pg/mL) | 433.6 ±37.7 | 36.8 | 243.4 ±87.64 | 131.4 ± 15.2 | 82.62 ±2.12 | 605.08 ±54.2 | 0.08 |
| ACR (mg/g) | 2035.5 ±26.5 | 266.52 | - | 347.1 ± 151.3 | 296.78 ±13.9 | 2039 ±23.7 | 0.07 |
| EGFR, mL/min/1.73 m2 | 23.1 ± 19.04 | 80.38 ±31.9 | 62.1 ±26.9 | 37.3 ±8.44 | 21.37 ±4.6 | 10.14 ±3.8 | 0.37 |
| S. Calcium (mg/dL) | 8.28 ±1.15 | 8.8 ±0.8 | 8.82 ±0.4 | 8.67 ± 0.6 | 3.2 ± 0.41 | 8.08 ±1.2 | 0.07 |
| S. Phosphorous (mg/dL) | 4.81 ±1.99 | 3.35 ±1.25 | 4.32 ±1.1 | 3.78 ±0.8 | 2.07 ±1.2 | 5.61 ±2.2 | 0.06 |
| $HbA_{1c}$ (%) | 7.10 ±1.58 | 5.7 | 8 | 5.17 ±3.2 | 3.11 ±1.6 | 7.1 ±1.4 | 0.06 |
| S. Vit d3 (20ng/mL) | 16.07 ±7.05 | - | - | 3.2 | 22 ±8.5 | 17 | 0.08 |
| S. Vit b12 (pg/mL) | 758.7 ±11.5 | - | 1015.3 ±0.84 | 1235.5 ±52.4 | 337 | 1901 | 0.01 |
| BSL (mg/dL) | 181.72 ±98.3 | 125.33 ±33.7 | - | 208.4 ±11.0 | 106.5 ±6.4 | 169 ±8.8 | 0.18 |
| S. Iron (mcg/dL) | 69.47 ±6.05 | - | 21 | 50.15 ±22.5 | 34.46 ±5.1 | 70.4 ± 5.9 | 0.4 |
| S. Tibc (mcg/dL) | 197 ±81.5 | - | 91 | 222 ±11.4 | 47.65 ±8.1 | 203 ± 50.5 | 0.27 |
| S. Uibc (mcg/dL) | 112.30 ±82.6 | - | 70 | 132.8 ±87 | 19 ±1.3 | 122.77 ±61 | 0.87 |
| S. Ferritin (ng/mL) | 1255.1 ± 89.1 | - | - | 1269.91 ±73 | 550 ±81.5 | 812.9 ±48.8 | 0.03 |
| Hbsag | | | | | | | - |
| Positive | 12 | 1 | - | 3 | 4 | 4 | - |
| Negative | 91 | 3 | 2 | 11 | 29 | 46 | - |
| Not available | 107 | 2 | 4 | 26 | 31 | 44 | - |
| Anti- HCV | | | | | | | - |
| Positive | 4 | - | - | - | 2 | 2 | - |
| Negative | 99 | 4 | 2 | 14 | 31 | 48 | - |
| Not available | 107 | 2 | 4 | 26 | 31 | 44 | - |
| HIV | | | | | | | - |
| Positive | 1 | - | - | - | 1 | - | - |
| Negative | 102 | 4 | 2 | 14 | 32 | 50 | - |
| Not available | 107 | 2 | 4 | 26 | 31 | 44 | - |

**Table 4: Complications related to CKD among study population.**

| Complications | Total (*n*=260), n (%) | <40 years (*n*=39), n (%) | 40-60 Years (*n*=78), n (%) | >60 Years (*n*=143), n (%) |
|---|---|---|---|---|
| Diabetic Nephropathy | 43 (17) | 0 | 9 (12) | 34 (24) |
| Hypertensive Nephropathy | 7 (3) | 1 (3) | 4 (5) | 2 (1) |
| Diabetic Retinopathy | 6 (2) | 0 | 6 (8) | 0 |
| Anemia | 173 (68) | 21 (62) | 51 (66) | 101 (71) |
| Mild | 43 (25) | 6 (14) | 32 (74) | 5 (12) |
| Moderate | 77 (45) | 11(14) | 21 (27) | 45 (58) |
| Severe | 53 (30) | 4 (8) | 15 (28) | 34 (64) |
| CRF | 16 (6) | 7 (21) | 3 (4) | 6 (4) |
| Renal Transplantation | 9 (4) | 4 (15) | 5 (5) | 0 |

$D_3$, serum iron and vitamin $B_{12}$. Decreased levels of hemoglobin are observed in many cases suggesting anemia as one of the major complications of CKD (Table 3).

The observational study from collected data significantly showed several complications associated with CKD such as CRF, anemia and nephropathy (Table 4). Anemia accounts greater than the rest of the complications associated with chronic kidney disease. The other most common complication is diabetic nephropathy and chronic renal failure observed followed by 4% of patients underwent renal transplantation with CKD.

In this study, a significant major finding was observed for patients with a history of renal transplant had a risk of recurrence of primary chronic kidney disease. This data is presented in the form of a double bar graph (Figure 3) according to patient's age, year required for recurrence of CKD and grade in which they appeared. As per the data collected, this study included 9 patients (with complete clinical data available) with a history of renal transplant and presenting recurrence of CKD after a certain time span in different stages. Among that 1 patient presented in the G5 stage who died due to chronic allograft dysfunction with antibody-mediated rejection within a year after transplantation.

Remarkably, a total of 210 prescriptions were analyzed, manifesting one prescription containing at least 16-17 drugs. Out of a total of 3360 drugs, 68% of medications belong to WHO essential drug list (Table 5). The treatment regimen for CKD included diuretics, dietary supplements, nutrition and bone marrow stimulants. Medications prescribed in CKD patients comprise different classes of drugs are described in Table 6. The most common prescription includes cardiovascular drugs, antimicrobials and drugs for GIT, analgesic, hematopoietic agents, antidiabetic drugs, xanthin oxidase inhibitors and phosphate binders. The prescription for Vitamin D, sodium bicarbonate, calcium supplements and protein powder were also high. On the other hand, the use of antidepressants, antiepileptics, mucolytic agents and herbal/ miscellaneous drugs is very low (Table 6).

In the case of the use of antimicrobials or antibiotics, mainly while using higher antibiotics in patients with renal damage dose adjustment is required and the use should be specific and limited. Some of the antibiotics are contraindicated in CKD. In this study, we signified the amount and type of antimicrobial drugs prescribed to patients with CKD. The above pie chart gives an idea of the uses of antibiotics for CKD patients. The majority of prescriptions were observed for the cephalosporin class of antibiotics followed by the maximum utility of carbapenems from the high-alert antibiotics list (Figure 4).

## DISCUSSION

This paper provides a comprehensive description of observation of patients with mild-to-moderate CKD from a developing area. The enrolled subjects are the general Indian population as regards of age, sex ratio, representation of the rural population, other socio-economic characteristics, laboratory data, risk factors and comorbidities present in patients with CKD. Kumar *et al.*[13] ICKD study also concluded that the prevalence of CKD found in males was larger as compared to females which is similar to our study which observed 68% were males and 38% females in which almost the same numbers of both genders appeared in stage 4-5 CKD. Discussing the urban-to-rural ratio of prevalence of CKD was found more in urban people than rural people. We have observed some patients with smoking and alcohol habits also have a risk of developing CKD. As per the research, Smoking can respectively elevate the risk in CKD through a proinflammatory state, oxidative stress, prothrombotic shift and tubular atrophy. Titze *et al.*[14] GCKD study reported a remarkable unpredictability about the underlying causes of CKD, an inflated prevalence of co morbidities and insufficient blood pressure control in many patients. In this study, they have stated that comorbidities like diabetes are an important contributor to CKD patients, in long-term existence cause diabetic nephropathy. In our study, we found about 22% of total patients had diabetes and the most prevalence of diabetes has seen in the age group between 40-60

**Table 5: Analysis of prescription in chronic kidney disease.**

| Details | Number (N) |
|---|---|
| Prescription analyzed | 210 |
| Total no. of drugs prescribed | 3360 |
| Average no. of drugs prescribed | 16.07 |
| Number of drugs prescribed by generic name | 0 |
| Number of drugs from who essential drug list out of total no. of drugs | 2308 (68%) |

WHO=World Health Organization.

**Table 6: Drug utilisation pattern of drugs prescribed in patients suffering from chronic kidney disease.**

| Drug class | ATC code | No of prescribed drugs N (%) |
|---|---|---|
| Cardiovascular drugs | | 753 (22%) |
| Calcium channel blockers | C08CA | 120 |
| Diuretics | C03CA | 165 |
| Alpha-blockers | C02CA | 58 |
| ACE Inhibitors | C09CA | 6 |
| ARBs | C09CA | 1 |
| Beta-blockers | C07AB | 88 |
| Vasodilators | C04A | 92 |
| Cardiac glycosides | C01A | 5 |
| Anti-Platelet agent | B01AC | 60 |
| Anticoagulants | B01 | 39 |
| Antihyperlipidemic agents | C10A | 66 |
| Anti-platelet + Antihyperlipidemic agent | | 53 |
| Drugs for GIT | | 670 (20%) |
| PPI | A02BC | 197 |
| H2 blockers | A02BA | 2 |
| Sodium bicarbonate | B05CB04 | 137 |
| Antacid and Preprobiotics | | 115 |
| Laxatives | | 58 |
| Anti-emetic | A04 | 161 |
| Analgesic | | 109 (3%) |
| Mild analgesic | | 54 |
| Opioids | N02AX | 33 |
| Neuropathic pain | | 22 |
| Antidiabetic drugs | | 152 (5%) |
| Insulin | A10A | 100 |
| Oral hypoglycaemic agents | A10B | 52 |
| Hematopoietic agents | | 128 (4%) |
| Iron | B03A | 37 |
| Folic Acid | B03B | 30 |
| Erythropoietin | B03XA01 | 61 |
| Phosphate Binder | | 151 (4%) |
| Calcium carbonate | A02AA04 | 75 |
| Calcium acetate | A12AA12 | 30 |
| Sevelamer hydrochloride | V03AE02 | 16 |
| Calcium gluconate | D11AX03 | 17 |
| Calcium polystyrene sulphonate | V03AE01 | 13 |
| Vitamins and Minerals | | 423 (13%) |
| Vitamin D3 | A11HA | 10 |
| Calcitriol | A11CC04 | 63 |
| MV and minerals | A11AA | 210 |
| Vitamin B12 | B03BA01 | 37 |
| Protein Powders | | 61 |
| Electrolyte supplement | | 22 |
| Amino acid infusion | | 20 |
| Xanthine oxidase inhibitor | M04AA | 52 (2%) |
| Antimicrobials | J01 | 249 (7%) |
| Cephalosporins | J01D | 123 |
| Penicillin | J01C | 17 |
| Fluro-quinolone | J01M | 10 |
| Tetracycline | J01A | 12 |
| Macrolide | J01FA | 3 |
| Carbapenems | J01DH | 52 |
| Glycopeptide | J01X | 18 |
| Polypeptide | D06A | 11 |
| Oxazolidine | N03AC | 3 |
| Antiprotozoal agents | P01 | 11 (1%) |
| Antiviral | J05 | 31 (1%) |
| Immune-suppressants | L04 | 120 (4%) |
| Corticosteroids | | 66 |
| Chemotherapy agents | L01 | 54 |
| Anti-depressants | N06AB | 39 (1%) |
| Antiepileptics | N03 | 53 (2%) |
| Mucolytic agents | | 126 (4%) |
| Antifungal agents | D01AE | 40 (1%) |
| Dermatological drugs | | 23 (1%) |
| Herbal drugs | | 13 (1%) |
| Miscellaneous | | 217 (6%) |

years which was 55%. US National Health and Nutritional Examination Survey (NHANES), suggests that the high frequency of hypertension in all categories is larger in the CKD population. Similarly, we observed a total of 190 (31%) of total subjects suffered from hypertension higher in the age group >60 years. NSAIDs do not harm patients not having renal diseases and co morbidities. However, because of it is dose-dependency, caution should be considered during its chronic usage of these drugs, as it increases the chances of developing toxicity and morbidity. J Bras Nefrol[15] Zhang *et al.*[16] The results of the meta-analysis revealed that current exposure to NSAIDs was connected with an approximately 1.5-fold rise in the odds of developing AKI in the general population and people with CKD. Similarly in our research, we have found 9 patients using NSAIDs for a certain period shown occurrence of AKI and CKD.

Kovesdy *et al.*[4] had similar results with decreased eGFR to report on CKD stages 1-5 patients. Whereas other studies have reported combined albuminuria (typically defined as an albumin-to-creatinine ratio of >30 mg/g) has significantly increased in 1-5 stages of CKD. Correspondingly, our study showed a significant increase in the albumin creatine ratio in different stages. The overall estimation of ACR was 2035.5±26.5 approximately. Provenzano *et al.*[17] estimated the lab values parallel to our research; they concluded that constant fluctuation in serum urea, serum creatinine and serum albumin.[18] Many studies have shown that there is a gradual decrease in serum ferritin and serum iron in chronic kidney disease. AK Bello *et al.*[19] elaborated on complications associated with CKD, he stated that raised blood phosphate levels, vitamin D deficiency and secondary hyperparathyroidism are seen and treated which

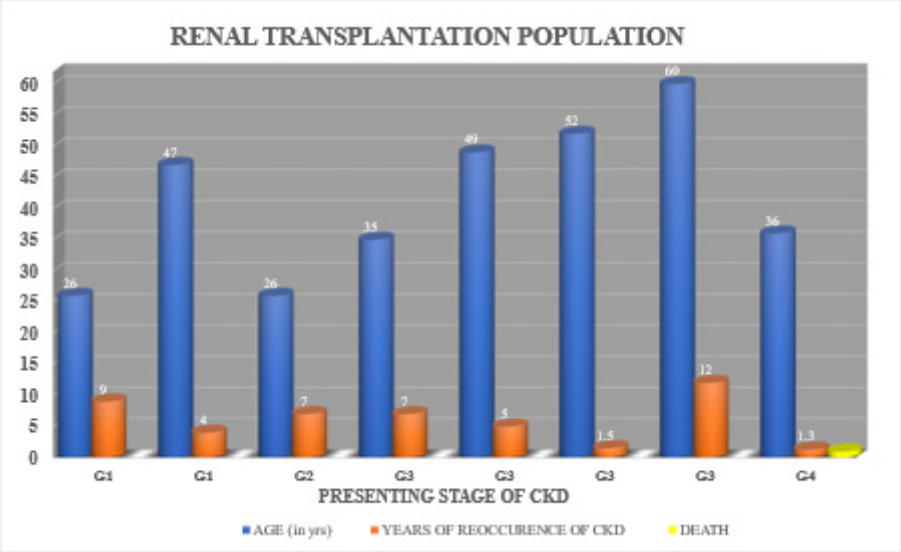



**Figure 3:** Renal transplantation population.

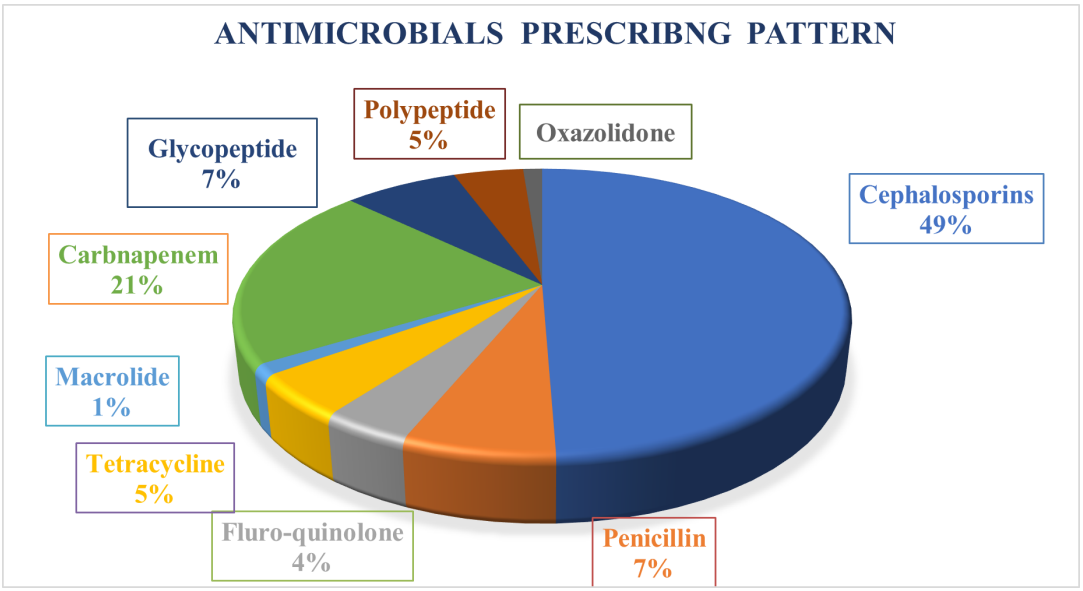



**Figure 4:** Prescribing pattern of antimicrobials.

may cause bone destruction in patients. As our study report shows several vitamins and minerals, most of the patients had a vitamin D and vitamin B12 deficiency. Along with vitamins and minerals, the average number of ferritin and iron is also reduced, which leads to the occurrence of anemia.[20] The pathogenesis of diabetic nephropathy involves metabolic, hemodynamic, growth and inflammatory and fibrotic factors. AKI plays avital role which triggers the progression of kidney disease in patients with diabetes. According to the data found in our study, diabetic nephropathy was seen in patients, another observed data showed hypertensive nephropathy and CKD associated with the history of AKI.

Chronic Kidney Disease management includes a few evidence-based approaches both nonpharmacologic and pharmacologic treatment essential to slow down the progression of kidney disease and prevent or treat CKD-associated complications. Hence physicians add on the prescription with several drugs as per the symptoms that lead to polypharmacy. Multiple medications to treat co-morbidities eventually trigger building rational drug prescription an arduous task and an invitation of a majority of interactions and greater risk of medication-related problems. Sourav Chakraborty *et al.*[21] the study reported, Total of 1098 drugs were prescribed for these 100 patients. The median number of drugs per prescription was 10. According to our study, the total drug prescribed in 210 patients was 3360 and the average number of drugs prescribed in one patient was 16-17. Most of which were cardiovascular drugs and drugs used for GIT, there is significant use of antidiabetics and antimicrobials has been seen in prescription. The frequently prescribed drugs among the Cardiovascular class were Diuretics (22%) followed by Calcium channel blockers (17%) which resemble other studies reported. Fahimi F *et al*,[22] reported the average number of antibiotics prescribed to a patient in the ICU and general ward were 7-8. In our findings in a single prescription, nearly about 3-4 antibiotics are prescribed including combinational therapy. The quantified number of antimicrobials prescribed in our study constitutes 8% of the total drugs analyzed. Out of which majority of them constitute cephalosporin class (47%) and consumption of high-alert antibiotics was found to be 35% comprising utilization of carbapenems to a greater extent.

A number of studies have shown that about 10-20% of patients with a glomerular disease develop re-occurrence after renal transplantation and 50% of them resulted in a graft loss on long-term follow-up.[24] Recurrence, relapse of primary chronic kidney disease is an important risk factor for allograft dysfunction for patients with renal failure due to glomerulonephritis. Briganti *et al.*[23] get hold of 1505 patients with native and graft biopsies, evidencing that recurrent disease is the third most common and general cause of graft failure 10 years after renal transplantation, whereas death with a functioning graft and Chronic Rejection (CR) is the first and the second cause, respectively and acute rejection the fourth. In our study, it was found that 4% of the total population had End Stage Renal Disease and underwent Renal transplantation and reoccurred at the nephrology department, mean age of the patient population was 45 yrs mostly presented in stage 4 and stage 5. One of them was found dead due the chronic allograft dysfunction mediated by antibody rejection and three of them had acute allograft dysfunction post-renal transplantation.

### Limitations

- Presenting study contains limited number of subjects.
- It does not include neonates.
- In some patients included in the study, information was not available or found to be inadequate.
- This study does not include dose-adjusting parameters for drugs.

### Future Scope

This study can be carried out on a larger scale to get more epidemiological knowledge of chronic kidney disease to help prevent CKD. The study should be done for evacuating more knowledge about risk factors and complications linked with CKD.

This study does not provide dose adjustment of drugs and information related to nephrotoxic drugs. A study should be carried out for getting more information about drug use and dose adjustment in chronic kidney disease.

Another study could be done on drug effect and dose adjustment of drugs during dialysis.

## CONCLUSION

The study concludes prevalence of CKD was more in male patients than in the female population. Sociodemographic factors establish an outcome, showing the incidence of CKD is more in urban as compared to rural. CKD contributes to multiple risk factors out of which some are modifiable whereas others are non-modifiable. The study reports Diabetes and hypertension as one of the crucial causes of chronic kidney disease. Objective findings are performed to assess kidney function; laboratory reports, serum urea, serum creatinine and serum uric acid are important parameters that show significant increases in blood levels at different stages of CKD. Although ferritin and iron are not directly associated with CKD, they are affected and found to be decreased eventually causing anemia. Complications related to CKD comprise fluid retention and diabetic nephropathy. Our study focused on the overall prescription pattern of CKD patients which revealed the use of Cardiovascular drugs and antimicrobials is higher, most of them prescribed from the essential list of WHO. Antimicrobial drugs used included higher

antibiotics and combinational drug therapy. The observations of the study also conclude complacency of renal replacement therapy with an incidence of reoccurrence of CKD.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ABBREVIATIONS

**CKD:** Chronic kidney disease; **SBP:** Systolic blood pressure; **DBP:** Diastolic blood pressure; **PTH:** Intact parathyroid hormone; **ACR:** Albumin / Creatinine ratio; **eGFR:** Estimated glomerular filtration rate; **HbA1C:** Glycosylated haemoglobin; **BSL:** Blood sugar level; **TIBC:** Total iron binding capacity; **UIBC:** Unsaturated iron binding capacity; **HBsAg:** Hepatitis b surface antigen; **Anti-HCV:** anti hepatitis C virus; **HIV:** Human immunodefficiency virus; **AKI:** Acute kidney injury; **NSAIDs:** Non-Steroidal Anti-inflammatory Drugs; **MI:** Myocardial infarction; **COVID-19:** Corona virus-2019; **HIV:** Human immunodeficiency virus; **HBV:** Hepatitis B virus; **HCV:** Hepatitis C virus; **CRF:** Chronic renal failure; **ATC:** Anatomic therapeutic chemical; **ACE:** Angiotensin converting enzyme; **ARB:** Angiotensin receptor blocker; **PB:** Phosphate binder; **GIT:** Gastrointestinal tract; **PPI:** Proton pump inhibitors.

## SUMMARY

This study emphasizes Chronic kidney disease as the major health concern and has outcome to be one of the prominent cause of death. We have focused on the patients with pre-existing co-morbidities which are on multiple medications. This study is a observational study that provides information about the risk factors, complications and a detailed view of prescribing pattern of various medications used in CKD patients. The standard preferred for GFR calculation used was MDRD equation and KDIGO guidelines were used as a standard reference. The study would help to understand the unique challenges considered during the medication management in CKD

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