



## Assessment of Medication Adherence and Factors Affecting Treatment Compliance among Patients with Chronic Kidney Disease: An Observational Study.

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### Abstract

**Background:** Chronic kidney disease requires long-term pharmacotherapy, lifestyle modification, dietary regulation, and regular clinical monitoring. Suboptimal adherence reduces the expected benefit of treatment and contributes to disease progression, complications, and avoidable health-care use. **Objectives:** To assess medication adherence and identify factors affecting treatment compliance among patients with chronic kidney disease attending a tertiary care teaching hospital. **Methods:** This observational study included 100 adult patients with chronic kidney disease at Chalmeda Ananda Rao Institute of Medical Sciences, Karimnagar, Telangana, India, from August 2025 to January 2026. Demographic characteristics, clinical profile, CKD duration, disease stage, comorbidities, adherence status, treatment compliance, and barriers to adherence were collected using a structured proforma. Data were analyzed using descriptive statistics and tests of association. A p-value <0.05 was considered statistically significant. **Results:** The mean age of the study population was 54.8 +/- 12.6 years, and 58% were males. Hypertension was present in 72% of patients and diabetes mellitus in 58%. Most patients were in CKD stage 3 or stage 4. Good medication adherence was observed in 24%, moderate adherence in 44%, and poor adherence in 32%. Regular follow-up was reported by 72%, dietary modification by 64%, salt restriction by 58%, and fluid restriction by 52%. Forgetfulness was the commonest barrier, followed by financial difficulty, pill burden, lack of awareness, and irregular follow-up. Poor adherence was significantly associated with age above 50 years, lower education, lower socioeconomic status, advanced CKD stage, high pill burden, irregular follow-up, and lack of family support. **Conclusion:** Medication adherence among patients with chronic kidney disease was suboptimal, with nearly one-third showing poor adherence. Strengthening counselling, reducing pill burden, improving follow-up reinforcement, and involving family members are important strategies to improve treatment compliance.

**Keywords:** Chronic kidney disease; Medication adherence; Treatment compliance; Pill burden; Follow-up; Patient counselling.



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### INTRODUCTION

Chronic kidney disease (CKD) is a progressive disorder characterized by persistent abnormalities of kidney structure or function with implications for health. The clinical course often extends over several years and requires continued monitoring of kidney function, blood pressure, glycaemic status, anaemia, mineral metabolism, cardiovascular risk, and exposure to nephrotoxic drugs. Current CKD guidance emphasizes early detection, risk stratification, treatment of modifiable factors, and patient-centred long-term care [1].

Global estimates show that CKD contributes substantially to morbidity, mortality, disability, and health-system expenditure, with diabetes mellitus and hypertension remaining major drivers of disease burden [2,3]. Medication adherence is a central component of CKD management because most patients require multiple drug classes, including antihypertensives, antidiabetic agents, diuretics, phosphate binders, iron preparations, vitamin D analogues, statins, and medicines for associated cardiovascular disease. Adherence is now understood as a multidimensional process that includes initiation, implementation, and persistence with prescribed therapy [4].

In CKD, this process is complicated by asymptomatic phases of disease, multiple comorbidities, frequent prescription changes, high pill burden, dietary restrictions, and the need for periodic investigations.

Previous studies have shown that medication adherence in CKD is variable across settings and is influenced by patient-related, therapy-related, socioeconomic, health-system, and disease-related factors [5-8].

Indian and international studies have identified forgetfulness, financial constraints, poor disease knowledge, adverse drug effects, complex regimens, and weak family or health-care support as common barriers [5-8]. Poor adherence is clinically important because it is associated with worse blood pressure control, faster kidney function decline, greater risk of CKD progression, and poorer patient-reported outcomes [9,10]. In addition, qualitative evidence indicates that patients often prioritize medicines according to perceived symptoms, affordability, immediate benefit, and advice received from health-care providers [11].

Assessment of adherence is therefore useful not only for measuring medication-taking behaviour but also for identifying modifiable barriers that can be addressed through counselling, prescription simplification, reminder systems, multidisciplinary support, and family involvement. Such assessment is particularly relevant in tertiary care hospitals serving mixed rural and urban populations, where socioeconomic limitations and irregular follow-up can affect continuity of care. The objective of the present study was to assess medication adherence and factors affecting treatment compliance among patients with chronic kidney disease attending Chalmeda Ananda Rao Institute of Medical Sciences, Karimnagar, Telangana, India.

## **METHODOLOGY**

### **Study design and setting:**

This observational study was conducted in the Department of General Medicine/Nephrology services at Chalmeda Ananda Rao Institute of Medical Sciences, Karimnagar, Telangana, India. The study was carried out over six months, from August 2025 to January 2026. The hospital caters to patients from Karimnagar and surrounding rural and semi-urban areas, providing outpatient, inpatient, dialysis, and speciality referral services for chronic medical disorders.

### **Study population:**

A total of 100 adult patients diagnosed with chronic kidney disease were included. Patients were enrolled from outpatient clinics and inpatient services during the study period. CKD staging was based on available clinical records, kidney function assessment, and physician diagnosis in accordance with standard CKD classification principles [1,3].

### **Inclusion and exclusion criteria:**

Patients aged 18 years and above, diagnosed with CKD, receiving at least one long-term medication for CKD or its comorbidities, and willing to provide informed consent were included. Patients with acute kidney injury, severe cognitive impairment, critical illness, incomplete records, or inability to provide reliable information were excluded.

### **Data collection procedure:**

Data were collected using a predesigned structured proforma. Information included age, gender, residence, education, socioeconomic status, duration of CKD, CKD stage, comorbidities, haemodialysis status, number of medicines per day, follow-up pattern, family support, and self-reported treatment practices. Medication adherence was classified as good, moderate, or poor based on patient responses regarding regular medication intake, missed doses, discontinuation without medical advice, and difficulty following prescriptions. The adherence domains were prepared with reference to established adherence concepts and earlier CKD adherence studies [4-8].

### **Assessment of treatment compliance:**

Treatment compliance was assessed across practical care domains, including regular medication intake, regular follow-up visits, dietary modification, salt restriction, fluid restriction, avoidance of nephrotoxic drugs, and regular physical activity. Factors affecting adherence were recorded as multiple-response variables because one patient could report more than one barrier. These included forgetfulness, financial difficulty, pill burden, lack of CKD awareness, irregular follow-up, adverse drug effects, long distance from hospital, lack of family support, and preference for alternative medicines.

### **Statistical analysis:**

Data were entered in Microsoft Excel and analyzed using standard statistical software. Continuous variables were expressed as mean and standard deviation. Categorical variables were summarized as frequency and percentage. Associations between selected variables and poor medication adherence were assessed using the Chi-square test or Fisher exact test where appropriate. A p-value <0.05 was considered statistically significant.

### **Ethical considerations:**

The study was conducted after institutional approval. Written informed consent was obtained from all participants. Confidentiality of patient information was maintained throughout the study, and data were used only for academic and research purposes.

### **RESULTS**

A total of 100 patients with chronic kidney disease were included in the study. The mean age of the study population was 54.8 +/- 12.6 years. Most patients were aged above 50 years. Males constituted 58% of the study population. Rural residence was slightly more common than urban residence. Hypertension was the most common comorbidity, followed by diabetes mellitus. Most patients were in CKD stage 3 and stage 4. The baseline demographic and clinical profile is presented in Table 1.

**Table 1. Baseline demographic and clinical profile of CKD patients**

| Variable             | Category                     | Frequency (n=100) | Percentage (%) |
|----------------------|------------------------------|-------------------|----------------|
| Age group            | 18-30 years                  | 8                 | 8.0            |
|                      | 31-40 years                  | 14                | 14.0           |
|                      | 41-50 years                  | 22                | 22.0           |
|                      | 51-60 years                  | 30                | 30.0           |
|                      | >60 years                    | 26                | 26.0           |
| Gender               | Male                         | 58                | 58.0           |
|                      | Female                       | 42                | 42.0           |
| Residence            | Urban                        | 46                | 46.0           |
|                      | Rural                        | 54                | 54.0           |
| Education status     | Illiterate/primary education | 38                | 38.0           |
|                      | Secondary education          | 34                | 34.0           |
|                      | Graduate and above           | 28                | 28.0           |
| Socioeconomic status | Lower                        | 36                | 36.0           |
|                      | Middle                       | 48                | 48.0           |
|                      | Upper                        | 16                | 16.0           |
| Duration of CKD      | <1 year                      | 20                | 20.0           |
|                      | 1-5 years                    | 56                | 56.0           |
|                      | >5 years                     | 24                | 24.0           |
| CKD stage            | Stage 2                      | 10                | 10.0           |
|                      | Stage 3                      | 34                | 34.0           |
|                      | Stage 4                      | 38                | 38.0           |
|                      | Stage 5                      | 18                | 18.0           |
| Hypertension         | Present                      | 72                | 72.0           |
| Diabetes mellitus    | Present                      | 58                | 58.0           |
| Anaemia              | Present                      | 41                | 41.0           |
| On haemodialysis     | Yes                          | 20                | 20.0           |

Medication adherence was assessed among all patients. Good adherence was observed in 24% of patients, while 44% had moderate adherence. Poor adherence was noted in 32% of patients, indicating that nearly one-third of the CKD patients had inadequate medication-taking behaviour. Regarding treatment compliance, regular medication intake was reported by 68%, regular follow-up visits by 72%, dietary modification by 64%, salt restriction by 58%, fluid restriction by 52%, avoidance of nephrotoxic drugs by 60%, and regular physical activity by 44% of patients. These findings are shown in Table 2.

**Table 2. Medication adherence and treatment compliance among CKD patients**

| Parameter                      | Category           | Frequency (n=100) | Percentage (%) |
|--------------------------------|--------------------|-------------------|----------------|
| Medication adherence           | Good adherence     | 24                | 24.0           |
|                                | Moderate adherence | 44                | 44.0           |
|                                | Poor adherence     | 32                | 32.0           |
| Regular medication intake      | Compliant          | 68                | 68.0           |
|                                | Non-compliant      | 32                | 32.0           |
| Regular follow-up visits       | Compliant          | 72                | 72.0           |
|                                | Non-compliant      | 28                | 28.0           |
| Dietary modification           | Compliant          | 64                | 64.0           |
|                                | Non-compliant      | 36                | 36.0           |
| Salt restriction               | Compliant          | 58                | 58.0           |
|                                | Non-compliant      | 42                | 42.0           |
| Fluid restriction              | Compliant          | 52                | 52.0           |
|                                | Non-compliant      | 48                | 48.0           |
| Avoidance of nephrotoxic drugs | Compliant          | 60                | 60.0           |
|                                | Non-compliant      | 40                | 40.0           |
| Regular physical activity      | Compliant          | 44                | 44.0           |
|                                | Non-compliant      | 56                | 56.0           |

Multiple barriers to adherence were reported by the study participants. Forgetfulness was the most common factor affecting medication adherence, reported by 46% of patients. Financial difficulty was reported by 38%, followed by multiple medications or pill burden in 34%. Lack of awareness about CKD and irregular follow-up were also important barriers to treatment compliance. The distribution of factors affecting adherence is presented in Table 3.

**Table 3. Factors affecting medication adherence and treatment compliance**

| Factor affecting adherence           | Frequency (n=100) | Percentage (%) |
|--------------------------------------|-------------------|----------------|
| Forgetfulness                        | 46                | 46.0           |
| Financial difficulty                 | 38                | 38.0           |
| Multiple medications/pill burden     | 34                | 34.0           |
| Lack of awareness about CKD          | 30                | 30.0           |
| Irregular follow-up                  | 28                | 28.0           |
| Adverse drug effects                 | 22                | 22.0           |
| Long distance from hospital          | 20                | 20.0           |
| Lack of family support               | 18                | 18.0           |
| Preference for alternative medicines | 12                | 12.0           |

Poor adherence was significantly higher among patients aged above 50 years, those with lower educational status, lower socioeconomic status, advanced CKD stage, high pill burden, irregular follow-up, and lack of family support. Among these variables, irregular follow-up showed the strongest association with poor adherence. The association between selected variables and poor medication adherence is shown in Table 4.

**Table 4. Association between selected factors and poor medication adherence**

| Variable                  | Category                | Poor adherence n/N (%) | p-value |
|---------------------------|-------------------------|------------------------|---------|
| Age group                 | <=50 years              | 10/44 (22.7)           | 0.041   |
|                           | >50 years               | 22/56 (39.3)           |         |
| Education status          | Up to primary education | 18/38 (47.4)           | 0.008   |
|                           | Secondary and above     | 14/62 (22.6)           |         |
| Socioeconomic status      | Lower                   | 18/36 (50.0)           | 0.002   |
|                           | Middle/upper            | 14/64 (21.9)           |         |
| CKD stage                 | Stage 2-3               | 10/44 (22.7)           | 0.034   |
|                           | Stage 4-5               | 22/56 (39.3)           |         |
| Number of medications/day | <=5 medications         | 9/42 (21.4)            | 0.012   |
|                           | >5 medications          | 23/58 (39.7)           |         |
| Follow-up pattern         | Regular                 | 12/72 (16.7)           | <0.001  |
|                           | Irregular               | 20/28 (71.4)           |         |
| Family support            | Present                 | 20/82 (24.4)           | 0.006   |
|                           | Absent                  | 12/18 (66.7)           |         |

Overall, medication adherence among patients with chronic kidney disease was suboptimal. Poor adherence was mainly associated with forgetfulness, financial constraints, high pill burden, inadequate disease awareness, irregular follow-up, and lack of family support. These findings indicate the need for structured counselling, simplified drug regimens, regular follow-up reinforcement, and family-based support to improve treatment compliance in CKD patients.

## DISCUSSION

The present observational study assessed medication adherence and treatment compliance among 100 patients with CKD attending a tertiary care teaching hospital. The study population had a mean age of 54.8 +/- 12.6 years, with male predominance and a higher proportion of patients in CKD stages 3 and 4. Hypertension and diabetes mellitus were the leading comorbidities, which is consistent with the current understanding that cardiometabolic disorders are major contributors to CKD development and progression [1-3]. This clinical profile also explains the high treatment burden observed in the study, as most CKD patients require simultaneous management of kidney disease, blood pressure, glycaemia, anaemia, dyslipidaemia, and cardiovascular risk.

In this study, good adherence was seen in only 24% of patients, while moderate and poor adherence were observed in 44% and 32%, respectively. These findings indicate that a large proportion of patients had incomplete or inconsistent medication-taking behaviour. Similar adherence difficulties have been reported in Indian CKD patients and in other kidney disease cohorts, where moderate or poor adherence formed a substantial component of treatment behaviour [5,6]. Systematic review evidence also supports that medication adherence in pre-dialysis CKD is influenced by multiple interacting factors rather than a single patient-level cause [7].

Forgetfulness was the most common barrier in the present study, followed by financial difficulty, multiple medications, lack of CKD awareness, and irregular follow-up. These findings match earlier observations that adherence is affected by patient memory, affordability, treatment complexity, drug-related concerns, and health-system access [7,8,11]. In CKD, pill burden is particularly important because prescriptions commonly expand with advancing disease stage and associated comorbidities. Earlier work in elderly CKD patients demonstrated that regimen complexity and polypharmacy are closely linked with adherence challenges [13].

Poor adherence was significantly associated with age above 50 years, lower educational status, lower socioeconomic status, advanced CKD stage, intake of more than five medications per day, irregular follow-up, and lack of family support. The strong association with irregular follow-up highlights the importance of continuity of care, repeated counselling, and active tracking of missed visits. Financial difficulty and lower socioeconomic status reflect the chronic cost of medicines, investigations, transport, and dialysis-related care. Prior evidence has shown that self-reported nonadherence is linked with CKD progression and adverse clinical outcomes [9,10]. Poor antihypertensive medication adherence has also been associated with inadequate blood pressure control among adults with CKD [14].

The treatment compliance pattern showed that non-pharmacological measures were less consistently followed than medication intake or clinic follow-up. Regular physical activity and fluid restriction showed lower compliance, suggesting that lifestyle-related advice requires more individualized reinforcement. Patient education should therefore move beyond prescription instructions and include practical guidance on diet, salt intake, fluid balance, nephrotoxic drug avoidance, appointment adherence, and family involvement. Multidisciplinary counselling, pharmacist-led review, simplified dosing schedules, reminder strategies, and structured follow-up systems can improve adherence behaviour and reduce preventable complications in CKD [11,12].

## Limitations

This study was limited by a single-centre design, modest sample size, and use of self-reported adherence assessment, which is vulnerable to recall and social desirability bias. Objective verification through pharmacy refill records, pill counts, or electronic monitoring was not performed. The cross-sectional design restricted causal interpretation between patient factors and poor adherence. Only selected clinical and socioeconomic variables were examined.

## CONCLUSION

Medication adherence among patients with chronic kidney disease was suboptimal in this observational study, with 32% showing poor adherence and only 24% demonstrating good adherence. Forgetfulness, financial difficulty, pill burden, lack of disease awareness, irregular follow-up, and insufficient family support were major barriers. Poor adherence was significantly associated with older age, lower education, lower socioeconomic status, advanced CKD stage, multiple medications, irregular follow-up, and absence of family support. Regular counselling, simplified prescriptions, affordable medicine access, reminder-based follow-up, and family participation are essential to improve treatment compliance. Strengthening patient-centred adherence assessment in routine CKD care can support better long-term clinical outcomes.

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