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Frequency of Treatment Patterns of Kidney Protective Therapies among Patients with Chronic Kidney Disease at Tertiary Care Hospital, Karachi.

Sana Moin, Sonia Yaqub

ABSTRACT

Objective: To determine the frequency and treatment patterns of kidney-protective therapies, including ACE inhibitors, ARBs, and SGLT2 inhibitors, among patients with chronic kidney disease (CKD) at a tertiary care hospital in Karachi.

Study Design and Setting: This cross-sectional study was conducted in the Department of Nephrology, Aga Khan University Hospital, Karachi, from 12TH May 2025 to 10th October 2025.

Methodology: A non-probability consecutive sampling was used to recruit 133 clinically confirmed CKD patients aged 40-80 years. Demographic information, clinical features, lifestyle, and kidney-protective drugs were documented using a structured proforma. Anthropometric measurements were made following standard procedures and the status of smoking and physical activity was determined by interviewing the patients. Prescriptions and comorbidities were proven by medical records. The data were analyzed using SPSS version 22 descriptive statistics and chi-square/Fisher exact test, $p<0.05$ was significant.

Results: Of the 133 patients, 68.4% were aged 61–80 years, and 51.1% were female. ACE inhibitors were prescribed to 39.8% of patients, ARBs to 15%, and SGLT2 inhibitors to 34.6%. The use of ACE inhibitors was significantly higher among patients with diabetic nephropathy and those with a shorter duration of disease. SGLT2 inhibitor prescriptions were more common in younger and urban populations and among diabetic patients, suggesting awareness of newer therapeutic options.

Conclusion: Patients with CKD were undertreated with key kidney-protective therapies, particularly ARBs and SGLT2 inhibitors. Younger, diabetic, and urban patients were more likely to receive evidence-based treatments, indicating gaps in guideline adherence and inequitable access.

Keywords: Angiotensin-Converting Enzyme Inhibitors; Angiotensin Receptor

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INTRODUCTION

Chronic kidney disease (CKD) is a condition characterized by renal structural or functional abnormality for at least 3 months with implications affecting the glomerular filtration rate (GFR) which can potentially lead to progressive decline in kidney function. It is a serious public health problem worldwide because of its growing prevalence, relationship with diverse comorbidities and high risk to progress to end-stage kidney diseases. CKD causes not only high morbidity and mortality, but also carries a substantial economic burden on the health systems worldwide.[1]

In the last few decades, CKD has increasingly been acknowledged as an alarming public health problem especially in developing countries. The burden is expected to rise dramatically in Asia where more than 60% of the global population resides, primarily due to increasing prevalence of diabetes, hypertension and an aging demographic.[2] In light of the anticipated rise in prevalence of CKD in Asian countries, there is an urgent call for measures to prevent and treat this disease in order to reduce long-term complications.[3]

CKD treatment is multi-factorial and involves both drug- and non-drug-based strategies. Following the diagnosis, the main objectives are to slow disease progression and reduce complications and cardiovascular morbidity and mortality.[4] Lifestyle changes, dietary changes and optimal control of risk factors like hypertension and diabetes are crucial toward attaining these goals. Pharmacotherapy continues to be an important piece in the care of CKD, and therapeutic categories have shown some efficacy in slowing disease progression. Renin–angiotensin system inhibitors (RASIs), such as an angiotensin-converting enzyme inhibitor (ACEI) or an angiotensin receptor blocker (ARB), are the mainstay of treatment in most patients with CKD.5 These

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agents exert effects by lowering intraglomerular pressure and proteinuria, which result in the preservation of renal function and cardiovascular risk reduction.[6] The Reno protective role of these drugs has been repeatedly demonstrated in clinical trials, such as the "classic" trials showing a substantial decrease in progression to kidney disease and mortality rates among patients receiving RAS blockade.

Despite these established advantages, underuse of RAS blockade still represents a common problem in clinical practice.[8] Observational data demonstrate that a significant proportion of diabetic patients with CKD are not initiated or do not have an up-titration during the earliest stages of the disease.? These differences may reflect differences in physician knowledge, economic constraints, patient compliance and regional variation in treatment patterns. Identifying such treatment gaps is important for increasing the adherence to evidence-based quality standards, ultimately leading to improved patient outcomes.

During the last years, SGLT2 inhibitors have represented a revolutionary advancement in the treatment of CKD. Originally used as hypoglycemic agents, these drugs have shown major Reno protection and cardio protection regardless of glucose levels. Findings from both large-scale randomized trials and real-world studies have shown that SGLT2 inhibitors decrease the risk of CKD progression, hospitalization, and death in patients with or without diabetes.[6] Their effects are more than glycemic and include lowering intraglomerular pressure, bettering tubuloglomerular feedback, as well as decreasing inflammation and oxidative stress.8

Nonetheless, the utilization of SGLT2 inhibitors in clinical practice is limited worldwide when compared with classical Reno protective agents.[2] Real-world prescribing patterns studies show that the number of CKD patients prescribed SGLT2 inhibitors is low, and prescription rates for ACEIs/ARBs are higher. [2] This phenomenon represents a combination of clinical inertia and the friction that new therapies face when they are introduced into practice. Regular monitoring of treatment use patterns can enable the identification of facilitators and barriers to implementation and optimization of newer guidelines for CKD care.4

Drug utilization studies are the key contributors which help in identifying prescribing, dispensing and use of drugs in clinical practice.[1°] Analyzing adherence can evaluate how planning in treatment decision based on guidance is and be able to become a good referring point for intervention.[11] These studies also reflect the level of rational drug use, polypharmacy and compliance with the WHO prescribing indicators—an important aspect in treating CKD patients who are frequently prescribed multiple medications and more likely to experience adverse drug reactions.[12] Prescription pattern analysis assists in ascertaining current trends in practice and identifies potential areas for clinician- or system-level focused intervention.[1°]

In addition, evaluating drug prescribing patterns in various populations and health care facilities is important to assess the pragmatic effects of guidelines.[11] They went on to say: "For a better plan of health management, there is a need to design strategies toward improving the therapeutic results and decreasing variability in CKD care; and therefore, determination of prevalence of use and predictors for prescription is important. Through analyzing the prevalence and pattern of kidney-protective therapies, investigators can find gaps in treatment deployment and compare whether any interventions of novel treatments have been well employed.

In summary, chronic kidney disease continues to be an emerging public health crisis and a multimodal approach including lifestyle and pharmacological approaches is required for management.[1,12] Pharmacologic "fine-tuning" including use of submaximal ACEI, ARB and SGLT2 inhibitors may represent a promising option for enhancing renal and cardiovascular outcomes. Evaluating treatment patterns is not only a reflection of the realities of clinical practice, but also provides useful information for updating.[12] guidelines, rational use of drugs and ultimately the quality of care offered to CKD patients. In line with its objectives, the present study focuses exclusively on lifestyle-related factors and pharmacological treatment patterns among patients with CKD, and does not evaluate other non-pharmacological or multidisciplinary management strategies.

METHODOLOGY

It was a descriptive cross-sectional study, which was carried out in the Department of Nephrology, Aga Khan University hospital (AKUH), Karachi over a period of six months (April 2025 -September 2025), following a six-month exemption granted by the ethical review committee at Aga Khan University (ERC # 2025-10772-34517 dated May 11th, 2025). The aim was to evaluate the prescribing rates of kidney-protective medications, especially reninangiotensin system inhibitors (RASIs) and sodium-glucose co-transporter-2 (SGLT2) inhibitors, among patients with CKD.

A sample of 133 patients with CKD was recruited through non-probability consecutive sampling technique, i.e. all the eligible patients who came forward in the process were recruited to get to the required sample size. The sample size was calculated by the WHO sample size calculator basing on a previous reported 53.4% rate of Losartan usage by CKD patients with a margin of error of 8% and power of 95%. This gave the minimum required sample size of 133 participants to be used in establishing sufficient precision in estimating the patterns of treatment utilization. Inclusion criteria were set to ensure a sample with homogeneity, male and female patients aged 40 to 80 years with clinically established CKD by a nephrologist or with laboratory data

were included. The exclusion criteria included people with concomitant conditions that may affect the therapeutic plan or results including malignancy, those on hemodialysis, intravenous drug abuse, pregnant, asthma, recent myocardial infarction (MI), congestive cardiac failure (CCF), chronic liver disease (CLD), chronic obstructive pulmonary disease (COPD) and cerebrovascular accident. Patients who did not want to make an informed consent were also excluded.

Each qualified participant was informed about the aim and objectives of the study before enrolment. Written informed consent was taken after an assurance of confidentiality and voluntary participation. All the ethical standards were observed in full following the Declaration of Helsinki. A structured and pretested proforma specifically designed to address the study was used to collect data, comprised of sociodemographic characteristics, clinical profile and treatment history. Demographic variables (age, sex and place of residence) were noted and clinical variables (duration of CKD, disease stage and comorbid diabetes mellitus and hypertension). Data on antihypertensive/antidiabetic treatment, classes of Reno-protective medications was recorded.

The anthropometric measurements were done through the standard procedures. The weight was measured to the nearest 0.1 kg with the participants being loosely dressed and with bare feet weighing them with a calibrated digital weighing scale. The measurement of height was taken to the closest 0.1 cm using a wall-mounted stadiometer in the Frankfort plane to the upright stance of the participant. Body mass index (BMI) was determined as the weight divides by the height in terms of meters squared (kg/m^2) and the participants were classified as underweight, normal, overweight or obese based on traditional parameters. The data on the lifestyle was collected via interviews with the participants. The question on physical activity was on the basis of whether the patients had any form of regular physical activity (yes/no), and in the event of yes, whether the activity was light, moderate or vigorous, depending on their own self-concept, which then allowed the categorization on the basis of routine practice. The smoking status was measured by asking the respondents whether they were present smokers, former smokers or had not smoked at all and smoking status was operationalized as current smoking (any cigarette use during the last 30 days), former smokers(previously smokes but no more during the last 30 days) or never smokes. Medical records were also cross checked with all responses where there was a comparison. The comorbidities such as hypertension (BP 140/90mmHg or taking antihypertensive medication) and diabetes mellitus (fasting plasma glucose 126mg/dl or taking antidiabetic medication) were classified using operational definitions. Medical prescriptions were used to affirm the use of kidney-protective medications (ACE inhibitors, ARBs and SGLT2 inhibitors).

All the data collected were inputted and were analyzed by use of SPSS (Statistical Package for the Social Sciences) software version 22. Univariate analysis was done to describe data. The quantitative variables like age, BMI and the duration of the disease were displayed as mean SD when data had a normal distribution or median with interquartile range (IQR) when data were non-normal. Frequencies and percentages were used to report categorical variables such as sex, comorbidities and medication use. The post-stratification analyses were conducted to test associations between patient factors and treatment utilization. Categorical variables were compared using chi-square or fisher exact tests and the p-value of less than 0.05 was taken to be significant in all tests.

RESULTS

A total of 133 patients with chronic kidney disease (CKD) were enrolled. The mean age was 66.2 ± 8.4 years, and the majority (68.4%) were between 61 and 80 years old. Gender distribution was almost equal, with 48.9% males and 51.1% females. Most participants (88%) resided in urban areas, while 12% were from rural regions. More than two-thirds (70.7%) had CKD for over 2.5 years, reflecting a chronic disease burden (Table 1).

Regarding comorbidities, 24.8% had type II diabetes mellitus and 45.9% had hypertension. Lifestyle-related factors showed that 36.8% were smokers, and 45.1% engaged in regular physical activity. Socioeconomic data revealed that 45.9% reported a monthly household income =50,000 PKR, while 60.2% were unemployed. Educational attainment varied, with 9.8% illiterate, 39.8% with primary education, 26.3% with secondary, and 24.1% with higher education (Table 2).

Table 3 presents the relationship between patient characteristics and the prescription of kidney-protective therapies, including ACE inhibitors, ARBs, and SGLT2 inhibitors. Younger patients (40–60 years) showed a higher likelihood of receiving SGLT2 inhibitors, with a statistically significant association (p=0.01), whereas age was not significantly associated with ACE inhibitor or ARB use. Urban residents were more frequently prescribed SGLT2 inhibitors compared to rural residents (38.5% vs. 6.2%, p=0.01), and a similar but non-significant trend was observed for ACE inhibitor use. Patients with a shorter CKD duration (=2.5 years) were more often prescribed ACE inhibitors (p=0.03), although CKD duration did not show an association with ARB or SGLT2 inhibitor use.

Diabetic patients were significantly more likely to receive ACE inhibitors (p=0.04) and SGLT2 inhibitors

(p=0.05), reflecting their established role in this population. Education level showed a significant association only with ARB use (p=0.01), with higher utilization among illiterate participants. In contrast, smoking status, physical activity, and hypertension did not demonstrate statistically significant associations with any of the treatment categories.

DISCUSSION

Prescription pattern and utilization of kidney-protective agents among CKD patients: A study at tertiary care hospital in Karachi. Angiotensin converting enzyme (ACE) inhibitors were prescribed in less than half and angiotensin receptor blockers (ARBs) in only few patients, while nearly one-third of participants received SGLT2 inhibitors. These findings indicate a wide discrepancy between evidence-based guidelines and the actual clinical practice, despite the Reno protective and cardio protective effects of these therapeutic drugs are well documented.

The low usage of ACE inhibitors and SGLT2 inhibitors in this population mirrors that seen in studies from other middle-income countries. The same trends had been observed in South Asian and Latin American countries that all have an uneven access to RASIs and SGLT2 inhibitors (13). In Colombia, SGLT2 inhibitors were least commonly used in places apart from the largest cities and differences across socio-economic status particularly impacted prescribing. Our findings are consistent with these observations, as urban patients were also more likely to be prescribed SGLT2 inhibitors compared rural ones. Availability of care, affordability and lack of familiarity with new drug classes are important barriers to CKD management in LMICs Management of CKD in developing countries has been characterized by unavailability, high cost for treatment and tremulous experience of newer drug types.

Our findings are in agreement with those of Indian studies as well, which have reported high prevalence of antihypertensive drug usage especially among CKD patients but very low use of ACE inhibitors and ARBs. In India, common prescription patterns were reported for diuretics and calcium channel blockers, ACE inhibitors and ARBs use remained low especially in advanced CKD stages. These trends were also observed in cross-sectional surveys of prescribing practices among tertiary care hospitals, with practitioners being less likely to recommend ACE inhibitors or ARBs out of fear for hyperkalemia or an exacerbation in renal function. These tendencies may also account for the underuse seen among our

Table 1. Demographic Characteristics of Patients with Chronic Kidney Disease (n = 133)

Variable	Categories	n (%) / Mean ± SD
Age (years)		66.2 ± 8.4
	40–60	42 (31.6)
	61–80	91 (68.4)
Gender	Male	65 (48.9)
	Female	68 (51.1)
Residence	Urban	117 (88.0)
	Rural	16 (12.0)
Duration of CKD	=2.5 years	39 (29.3)
	>2.5 years	94 (70.7)

Table 2. Comorbidities, Lifestyle, and Socioeconomic Profile

Variable	Categories	N (%)
Comorbidities	Type II Diabetes Mellitus	33 (24.8)
	Hypertension	61 (45.9)
Lifestyle Factors	Smoker	49 (36.8)
	Physically Active	60 (45.1)
Socioeconomic Indicators	Family income =50,000 PKR	61 (45.9)
	Unemployed	80 (60.2)
Education Level	Illiterate	13 (9.8)
	Primary	53 (39.8)
	Secondary	35 (26.3)
	Higher	32 (24.1)

Figure 1. Distribution of Kidney-Protective Therapy Prescriptions among CKD Patients

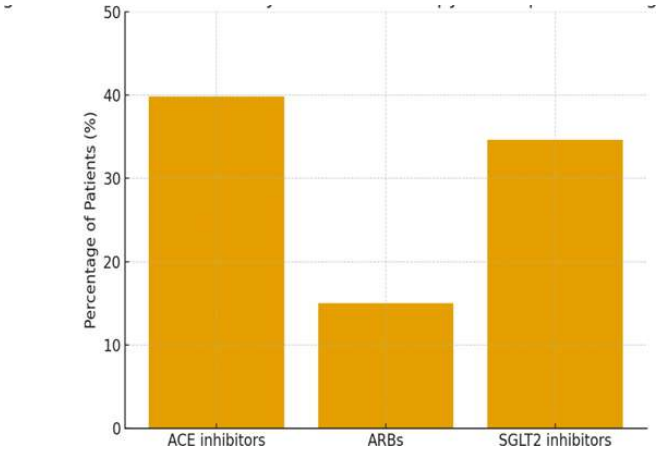

Table 3. Distribution of Kidney-Protective Therapies and Significant Associations

Variable	ACE Inhibitor Use (%)	ARB Use (%)	SGLT2 Inhibitor Use (%)	p-value (ACE / ARB / SGLT2)
Age (40–60 vs. 61–80 years)	50.0 vs. 35.2	13.0 vs. 16.5	50.0 vs. 27.5	0.10 / 0.60 / 0.01
Residence (Urban vs. Rural)	42.7 vs. 18.8	14.5 vs. 18.8	38.5 vs. 6.2	0.06 / 0.70 / 0.01
Duration of CKD (=2.5 vs. >2.5 years)	53.8 vs. 34.0	12.8 vs. 15.9	33.3 vs. 35.1	0.03 / 0.68 / 0.84
Diabetes Status (Yes vs. No)	54.5 vs. 35.0	18.2 vs. 14.0	48.5 vs. 30.0	0.04 / 0.60 / 0.05
Education Level (Illiterate vs. others)	41.0	30.8	32.0	0.30 / 0.01 / 0.28
Smoking Status (Yes vs. No)	40.8 vs. 39.3	16.3 vs. 14.1	36.7 vs. 33.3	0.85 / 0.79 / 0.72
Physical Activity (Active vs. Inactive)	41.7 vs. 38.0	18.3 vs. 12.7	36.7 vs. 32.4	0.68 / 0.40 / 0.62
Hypertension (Yes vs. No)	41.0 vs. 38.0	16.4 vs. 13.4	36.1 vs. 32.4	0.74 / 0.64 / 0.65

study population, where patients with advanced disease or numerous comorbidities are particularly prevalent.

In the present study, diabetics and those with less advanced CKD were more likely to be prescribed ACE inhibitors. This is congruent with prior research demonstrating higher probability of RASI use in patients with diabetes or albuminuria.[13] In the current analyses, patients with diabetes appeared more likely to receive guideline-directed therapy: thus comorbidity profiles exert important effects on prescribing practices. These findings were consistent with the results of previous studies, which reported that renoprotective drugs were more frequently used among milder disease stage patients and less likely used in advanced to ESRD stages due to concerns for further decline of renal function and hyperkalemia.[14]

The apparently low rate of prescription of ARBs in this group is interesting, and may be representative of local prescribing patterns, financial considerations or a preference to keep ARBs as second line drugs for patients who are intolerant to ACE inhibitors. These results are consistent with those of studies in South Asia and Africa that also report this preference.[15 1 6] In Kenyan study, the prevalence and treatment control of hypertension among CKD patients was poor, there were substantial disparities in patient access to guideline-based medications driven mainly by cost-related and supply related factors. [17] These findings cumulatively emphasize that cost, availability and clinical conservatism still drive practice rather than evidence based guidelines in various LMIC's.

In the present analysis, younger patients and those living in urban areas were also significantly more likely to be dispensed SGLT2 inhibitors. This is consistent with international trends where newer agents are usually introduced in urban tertiary referral centers, which have better healthcare resources and access to specialists. The 653-fold ratio of diabetes to SGLT2 inhibitor exposure in our cohort underlines again the redundancy these antihyperglycemic agents are considered for therapy rather than renoprotective agents. While the glucose-lowering benefit of these drugs is well established, new evidence indicates that SGLT2i offer significant renal and CV protection in a broad range of patients with kidney disease, even those without diabetes.[18?1?]

Recent meta-analyses have shown a significant reduction in risk for progression of CKD, hospitalization due to heart failure, and all-cause mortality with use of SGLT2 inhibitors among diabetic as well as non-diabetic CKD populations.[18] These have resulted in substantial changes to clinical practice guidelines, most notably by the 2023 UK Kidney Association guideline where SGLT2 inhibitors have moved into pole position as first line therapy for adults with CKD regardless of diabetic status.[1?] Moreover, meta-analysis data have shown that in combination with RASIs, SGLT2 inhibitors are able to provide additional renal benefits as well as anti-inflammatory and glomerular hyper filtration protection.[2°] This changing paradigm, which Emerging evidence suggests that SGLT-2 inhibitionation should not be restricted to glycemic control but rather viewed as an important renoprotective therapeutic strategy within the CKD management algorithm.

The renal effect of SGLT-2 inhibitors is not only due to the glucose control mechanism. They decrease intraglomerular pressure mechanistically, ameliorate dysfunctional tubuloglomerular feedback, and inhibit cytokine pro-inflammatory-mediated pathways.[21] Other than their beneficial renal effects, they are presumably safe and have a potential renal protective effect even in patients with chronic dialysis therapy as the follow-up studies especially among peritoneal dialysis populations were reported recently.[22] Such data continue to support the case for wider availability of SGLT2 inhibitors as well as greater physician experience across a range of CKD phenotypes.

Although our research involved the correlation of the outcome with the place of residence of the patients (urban versus rural), some of the studies with which we compared our results analyzed outcomes obtained in hospitals situated in an urban environment. This is a contextual incompatibility, since the location of hospitals is not always indicative of the residential features or exposure history of the patient population. Interpretations should therefore be made with respect to the fact that urban based hospitals could be serving urban based as well as rural citizens and this is likely to water down the real residential effects. In order to enhance the contextual relevance we analyzed local evidence and the literature already in Pakistan has revealed significant differences in presentation patterns and health-seeking behavior between urban and rural population, which justify the need to assess the differences in residence based disparities in our context.[4]

While these benefits are powerful, our study results underscore an ongoing challenge in closing the evidence- to-practice gap. The documented underuse of ACE inhibitors, ARBs and SGLT2 inhibitors points to barriers at clinician and system levels. Barriers at clinician-level may stem from lack of knowledge regarding updated guidelines, and inexperience with new agents, as well perception of potential side-effects. At the system level, costs, restricted drug availability, lack of standardized treatment pathways and absence of electronic prescribing reminders all contribute to this inequity. To fill this space, comprehensive interventions are necessary. Continuing medical education programmes, incorporation of evidence-based prescribing guidelines into electronic health record systems and national procurement or subsidy policies all have the potential to maximize access to, and adherence with optimal therapeutic regimens.

In summary, the use of ACE and ARB therapy among patients with CKD in this tertiary care cohort was much lower than anticipated, suggesting a significant evidence-practice discordance. Sociodemographic and clinical characteristics determined the uptake of therapy, being more likely to be prescribed in younger, diabetic and urban individuals. Tackling the obstacles to deliver GP-based access and prescription in line with guidelines is still essential to enhance renal and cardiovascular outcomes among patients with CKD.

There are several limitations in the study, which must be considered. It was performed in a single tertiary care hospital and it can be difficult to generalize these findings to other health care settings. It is also worth noting that the study did not assess drug adherence,

and contraindications in the reason given by rheumatologists for non-prescription, which may influence the differential patterns observed here. Nevertheless, the results provide an important snapshot of practice at the time and identify key areas for improvement in CKD care.

CONCLUSION

In this study, we observed that patients with CKD in a tertiary care hospital of Karachi were undertreated for kidney protective therapies. We found that younger patients, as well as those with diabetes and in urban areas, were more likely to be prescribed with ACE inhibitors and SGLT2 inhibitors compared to ARB use which remained notably low. These patterns indicate areas of shortfall in guideline adherence and inequities in access, highlighting the importance of targeted interventions to improve prescribing practices, and for broader dissemination of effective treatments.

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Authors Contribution:
Sana Moin: Study conception, design, data collection, statistical analysis, and manuscript drafting.
Sonia Yaqub: Critical review of the manuscript, supervision, and final approval for submission.

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