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Original Research Article

Prescribing patterns and health-related quality of life in patients with chronic kidney disease: a cross-sectional study

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ABSTRACT

Background: Chronic kidney disease (CKD) is associated with multimorbidity, polypharmacy, and impaired health-related quality of life (HRQoL). This study evaluated prescribing patterns using World Health Organization (WHO) core prescribing indicators and HRQoL using the RAND 36-item health survey 1.0 among patients with CKD.
Methods: A cross-sectional observational study was conducted among 162 adults with CKD in India. Prescribing patterns were assessed using WHO core prescribing indicators, and HRQoL was evaluated using the RAND-36 questionnaire. Associations between prescribing burden, patient characteristics, and physical component summary (PCS) and mental component summary (MCS) scores were analysed.
Results: The mean number of drugs per encounter was 12.77±3.68. Generic prescribing (38.64%) and essential medicines list (EML) adherence (61.57%) were below WHO benchmarks, while injection prescribing (29.23%) exceeded recommendations. Cardiovascular agents were the most frequently prescribed drug class (34.26%). HRQoL was impaired across all domains (PCS: 30.23±6.57; MCS: 35.30±5.30). Advancing CKD stage was associated with lower PCS and MCS (both $p<0.001$). Older age was associated with lower PCS ($p<0.001$), whereas higher medication burden was associated with lower MCS ($p=0.034$). Medication burden was also associated with greater comorbidity burden ($p=0.007$) and longer hospitalisation ($p<0.001$).
Conclusions: Patients with CKD experienced substantial polypharmacy, suboptimal adherence to WHO prescribing indicators, and impaired HRQoL. These findings highlight the need for rational prescribing, medication review, and routine patient-reported outcome assessment.

Keywords: Chronic kidney disease, Drug prescribing, Polypharmacy, Health-related quality of life, RAND-36

INTRODUCTION

Chronic kidney disease (CKD) refers to the presence of abnormalities of structure and/or function of the kidney for more than 3 months with health consequences. CKD is among the most serious global public health issues, and in recent decades, the number of cases of this condition, their mortality, and prevalence of disability associated with CKD have increased significantly. An early assessment of the condition, stratification of risks, and comprehensive treatment for delaying the progression of CKD and improving the patient's outcomes are critical in the new KDIGO guideline of 2024.[1,2]

Multimorbidity and polypharmacy are often characteristic of patients with CKD. As a result of a large number of drugs being influenced by reduced kidney function, there may be changes in the pharmacodynamics and pharmacokinetics of such drugs, which can be expressed in the change in effectiveness and safety of medications and the development of medication-related problems. Therefore, rational prescription of medications and periodic drug review, as well as the adjustment of doses

depending on the state of kidney function, are significant in terms of managing CKD safely and effectively. WHO core prescribing indicators provide a standardized framework for evaluating prescribing practices and identifying opportunities to improve the rational use of medicines in health-care settings.[3,4]

HRQoL is negatively impacted by CKD. With the progression of CKD, HRQoL decreases gradually, with impairment noted in physical, mental, and social well-being, particularly among CKD patients closer to the dialysis period.[5] The RAND 36-Item Health Survey 1.0 (RAND-36) questionnaire is one of the most commonly used standardized questionnaires to measure the HRQoL of patients in various health domains, which has been widely used among CKD patients.[6]

There is ample literature on prescription practices and HRQoL separately among CKD patients; however, literature comparing both outcomes simultaneously among Indian tertiary care patients is scarce. Concurrent evaluation of prescribing patterns and HRQoL may help identify opportunities to optimise pharmacotherapy and improve comprehensive CKD care. This will help in identifying gaps in CKD pharmacotherapy. Hence, the purpose of the current study was to evaluate prescribing patterns using WHO prescribing indicators and HRQoL among CKD patients using the RAND-36 questionnaire.

METHODS

Study design and setting

The current study is a cross-sectional observational study conducted in the Department of General Medicine at a tertiary care hospital in India. Data was collected for a period of six months from April 2025 to September 2025. The study aimed to evaluate prescribing patterns in patients with CKD along with their HRQoL.

Study participants

Adults (≥18 years) with a confirmed diagnosis of CKD were eligible for inclusion, attending the study site during the study period, and both genders were eligible for selection. These patients were selected by a consecutive sampling technique, and written informed consent was taken from each participant.

Those participants who had a history of acute kidney injury, renal calculi, autoimmune renal disease, kidney transplant, pregnancy/breastfeeding, and discharge against medical advice were excluded from the study.

The minimum number of samples (n) required was calculated to be 113 participants with 95% confidence level and 5% margin of error, as per the formula for a single population proportion. Eventually, 162 participants were included in the study.

Data collection and study variables

Methods of patient interviews and review of the patients' records (patient profile and medicine chart), through a predesigned case record form, were employed for data collection. Data included demographic information, clinical background information, parameters of CKD, comorbidity information, medication, and laboratory data.

Prescribing patterns and quality of life were the main outcomes in this study. Prescribed number of medications per patient per encounter, percentage of prescribed medications by their generic names, percentage of encounters where at least one antibiotic was prescribed, percentage of encounters where at least one injectable drug was prescribed, and percentage of drugs prescribed from the EML were assessed as indicators of prescribing patterns, according to WHO core prescribing indicators.

HRQoL was measured using the RAND 36-item health survey 1.0 (RAND-36).[6] This validated test measures the HRQoL and includes eight health dimensions: Physical functioning, role limitations due to physical health, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. The eight RAND-36 domain scores and the PCS and MCS scores were calculated according to the RAND 36-item health survey 1.0 scoring algorithm.

Bias

Consecutive eligible patients were selected during the study period to minimize selection bias. Data was collected using a standardized data collection form, medical record review, and the validated RAND-36 questionnaire. Information bias was minimized using the above methodology.

Statistical analysis

Data were entered into Microsoft excel and analyzed by means of IBM SPSS Statistics (version 27.0; IBM Corp., Armonk, NY, USA). Quantitative variables were presented as mean±SD, while qualitative data were presented as frequencies and percentages.

Chi-square test/ Fisher's exact test was used for analyzing distribution of CKD stages with regard to both demographic factors, prescription criteria, and patient-related factors. Independent-samples t test and the Welch's one-way ANOVA were applied to analyze differences in PCS and MCS with regard to patients' characteristics, depending on normality and homogeneity of variances of data. All statistical analyses were performed in 2-tailed mode with criterion for significance $p<0.05$.

Ethical considerations

Before the study, the study protocol was reviewed and approved by the institutional ethics committee. All the

subjects gave their informed consent before participating in the study, and confidentiality of patient information was maintained during the whole study in accordance with institutional ethical guidelines and declaration of Helsinki.

RESULTS

A total of 162 CKD patients were taken for this study. The predominance was male patients (62.96%). Age category 54-60 years was the most frequent age category among the subjects (26.54%). CKD stage 4 and 5 were the most prevalent stage categories (29.01% and 27.78%, respectively). The majority of the cases (58.64%) were found to have 1 to 4 comorbidities. The most prevalent comorbid conditions were hypertension (88.27%) and type 2 diabetes mellitus (75.93%), followed by anaemia (39.51%), diabetic kidney disease (39.51%), and ischaemic heart disease (26.54%) (Table 1).

A total of 2,078 medications were prescribed to 162 patients. Most of the patients were prescribed 10-14 medications (50.62%), and 27.78% were prescribed 15-19 medications. Cardiovascular agents were the most frequently prescribed therapeutic class, accounting for 34.26% of all prescribed medications and being prescribed to 98.15% of patients. Other therapeutic classes were gastrointestinal medications (16.94%), anti-diabetes medications (10.11%), and antibiotics (9.87%). Respiratory medications were 7.51% of total medications prescribed, and other therapeutic classes made up less than 5% of medication prescriptions (Table 2).

The total number of drugs prescribed to 162 patients was 2,078. A majority of the patients received 10-14 drugs (50.62%), while 27.78% of patients received 15-19 drugs. Among cardiovascular agents, diuretics were the most frequently prescribed subclass (21.91%), followed by calcium-channel blockers, antiplatelet agents, and HMG-CoA reductase inhibitors.

For the gastrointestinal drugs, the most frequently prescribed subclass is proton-pump inhibitors (41.19%), while insulin (57.14%) is the most frequent antidiabetic drug subclass. As for antibiotics, the most frequently prescribed subclasses were penicillin/β-lactamase inhibitor combinations (25.85%) and cephalosporins (23.41%) (Table 3).

The mean number of drugs prescribed per encounter was 12.77±3.68. The percentage of prescriptions of drugs by generic names was 38.64%±13.66%. On other hand, a total of 61.57%±14.60% of prescribed medicines were from the EML. Prescribed antibiotics were 9.67%±9.75% of encounters, and 29.23%±14.53% of encounters (Table 4).

Mean RAND-36 domain scores ranged from 25.00±19.10 for role limitations due to physical health to 45.11±14.05 for emotional well-being. PCS score had a mean of 30.23±6.57, and MCS had a mean of 35.3±5.30 (Table 5).

The number of prescribed medications was significantly associated with the number of comorbidities (p=0.007) and duration of hospitalisation (p<0.001). PCS scores were significantly correlated with age (p<0.001) and CKD stages (p<0.001), while MCS scores were significantly correlated with CKD stages (p<0.001) and the frequency of prescription of the medications (p=0.034). There were no other significant correlations (Table 6).

Table 1: Demographic and clinical characteristics of the study population.

Variables	Category	N	Percentage (%)
Gender	Male	102	62.96
	Female	60	37.04
	Total	162	100.00
Age group (in years)	33-39	7	4.32
	40-46	18	11.11
	47-53	23	14.20
	54-60	43	26.54
	61-67	32	19.75
	68-74	20	12.35
	75-81	14	8.64
	82-88	5	3.09
	Total	162	100.00
CKD stage	Stage 2	6	3.70
	Stage 3a	22	13.58
	Stage 3b	42	25.93
	Stage 4	47	29.01
	Stage 5	45	27.78
	Total	162	100.00
Number of comorbidities	1-4	95	58.64
	5-8	67	41.36
	Total	162	100.00

Continued.

Variables	Category	N	Percentage (%)
Major comorbidities	Hypertension	143	88.27
	Type 2 diabetes mellitus	123	75.93
	Anaemia	64	39.51
	Diabetic kidney disease	64	39.51
	Ischaemic heart disease	43	26.54

Table 2: Overall medication burden and therapeutic category-wise prescribing pattern.

Components	Category	Number of patients	Percentage (%)	Number of drugs	Percentage (%)
Number of drugs prescribed per patient	5-9 drugs	31	19.14	-	-
	10-14 drugs	82	50.62	-	-
	15-19 drugs	45	27.78	-	-
	20-24 drugs	4	2.47	-	-
	Total	162	100.00	-	-
Therapeutic category	Cardiovascular agents	159	98.15	712	34.26
	Gastrointestinal agents	151	93.20	352	16.94
	Antidiabetic agents	113	69.75	210	10.11
	Antibiotics	109	67.28	205	9.87
	Respiratory agents	73	45.06	156	7.51
	Vitamins and minerals	70	43.20	85	4.09
	Analgesics	64	39.50	77	3.71
	CNS agents	44	27.16	60	2.89
	Anti-infective agents	35	21.60	40	1.92
	Enzyme modulators	32	19.75	32	1.54
	Thyroid drugs	25	15.43	25	1.20
	Autacoids and related drugs	22	13.58	24	1.15
	Hematinics	21	12.96	21	1.01
	Corticosteroids	18	11.11	19	0.91
	Other supportive therapies	42	25.92	60	2.87
	Total drugs prescribed	-	-	2,078	100.00

Table 3: Prescribing pattern of major drug subclasses within the predominant therapeutic categories.

Therapeutic category	Major drug subclass	N	Within-category percentage (%)
Cardiovascular agents	Diuretics	156	21.91
	Calcium-channel blockers	113	15.87
	Antiplatelet agents	100	14.04
	HMG-CoA reductase inhibitors	94	13.20
Gastrointestinal agents	Proton-pump inhibitors	145	41.19
	Serotonin antagonists	104	29.55
	Laxatives	41	11.65
	Antacids	28	7.95
Antidiabetic agents	Insulin	120	57.14
	SGLT2 inhibitors	41	19.52
	DPP-4 inhibitors	29	13.81
	Biguanides	14	6.67
Antibiotics	Penicillin/β-lactamase inhibitor combinations	53	25.85
	Cephalosporins	48	23.41
	Carbapenems	24	11.71
	Lincomycins	15	7.32

Table 4: WHO core drug-use prescribing indicators.

Prescribing indicators	Observed mean	SD	WHO reference value
Average number of drugs per encounter	12.77	3.68	1.6-1.8
Drugs prescribed by generic name (%)	38.64	13.66	100%

Continued.

Prescribing indicators	Observed mean	SD	WHO reference value
Encounters with antibiotics prescribed (%)	9.67	9.75	20-26.8%
Encounters with injections prescribed (%)	29.23	14.53	13.4-24.1%
Drugs prescribed from the essential drug list (%)	61.57	14.60	100%

Table 5: RAND-36 health-related quality-of-life domain and summary scores.

RAND-36 domains	Mean	Standard deviation
Physical functioning	33.24	19.99
Role limitation due to physical health	25.00	19.10
Bodily pain	34.86	14.23
General health	29.07	13.56
Vitality	33.67	13.67
Social functioning	33.45	15.10
Role limitation due to emotional problems	29.82	23.67
Emotional well-being	45.11	14.05
PCS	30.23	6.57
MCS	35.30	5.30

Table 6: Association of patient-related factors with prescribing burden, PCS, and MCS.

Patient-related factors	Number of drugs prescribed p value	PCS p value	MCS p value
Age (in years)	0.969	<0.001	0.781
Gender	0.391	0.580	0.187
Number of comorbidities	0.007	0.857	0.078
Duration of hospital stay	<0.001	0.121	0.099
CKD stage	0.447	<0.001	<0.001
Number of drugs prescribed	Not applicable	0.650	0.034

DISCUSSION

This cross-sectional observational study aimed to assess the prescribing practices using the WHO core prescribing indicators and HRQoL on the basis of the RAND-36 questionnaire in 162 CKD patients attending the tertiary care hospital in India. The key findings were: the mean drug burden per encounter was significantly higher than normal (12.77±3.68); generic prescribing was suboptimal (38.64%), and adherence to the EML was suboptimal (61.57%); antibiotic prescribing was below the WHO reference range; and the prescription rate for injections exceeded the upper limit of the WHO reference range. HRQOL was significantly affected in all of the RAND-36 domains, especially in the physical health domain, compared to mental health. There was a significant relationship between the PCS scores and the increasing age and CKD stage, and a significant relationship between the MCS scores and the number of drugs prescribed and the CKD stage. These results point to key opportunities to optimize pharmacotherapy and enhance patient-centred outcomes within this population.

The mean number of drugs prescribed per encounter (12.77±3.68) was well above the value used as a reference by WHO/INRUD (1.6-1.8 medicines per encounter), which was derived from primary health-care practice.[4,7] A similar pattern has been reported in South Asian tertiary care settings, with a mean drug burden of 6.47 drugs per patient diagnosed with diabetic nephropathy reported by Seetharaman et al.[8] This finding of increased drug burden in our cohort may be due to the more advanced stage of CKD (stages 4-5) and high prevalence of hypertension, diabetes, and ischaemic heart disease. In most cases, the optimal management of these conditions involves the use of several concurrent medications.[9,10]

The most commonly prescribed drug class was the cardiovascular agents, which were used in 98.15% of patients (34.26%), and are used in the treatment of CKD, which has a high cardiovascular risk, as per guidelines.[2] Cardiovascular drugs were most prevalent (21.91%) and included diuretics, commonly used in managing hypertension and volume overload, as well as antiplatelet agents (14.04%) and statins (13.20%), which are used for cardiovascular risk reduction in suitable patients. Insulin was the most common antidiabetic medication (57.14%), which aligns with the high prevalence of insulin use in advanced CKD, where adjustment of the doses of certain glucose-lowering medications is required, and others are not suitable for reduced kidney function.[2] The medicines in the SGLT2 inhibitors (19.52%) had a proven renoprotective effect. Newen et al conducted a systematic review and meta-analysis that found SGLT2 inhibitors significantly lowered the risk of kidney failure, defined as dialysis, kidney transplant, or death from kidney failure (RR 0.67, 95% CI=0.52-0.86).[11]

The percentage of medicines prescribed by their nonproprietary (generic) name (38.64%) was far below WHO's recommended target of 100%.[4] Likewise, 61.57% of the prescribed medicines were from the EML, which is below the WHO-recommended percentage of 100%.[4]

The proportion of encounters with antibiotic prescription (9.67%) was below the WHO/INRUD reference range, while the proportion with injectable medications (29.23%) was above the recommended range. These indicators, however, were created for primary health-care environments and are affected by case mix and should not be compared directly to those in specialised inpatient services. Thus, the results of the measurements should be read with care if they are outside of the WHO/INRUD reference ranges and, as such, do not necessarily constitute irrational prescribing.[4]

This group had significantly lower HRQoL in all 8 RAND-36 domains. Role limitations due to physical health (25.00±19.10), general health perception (29.07±13.56), and emotional well-being (45.11±14.05) were the least impaired domains, respectively. This finding, with the physical health dimensions more negatively impacted than the mental health dimensions, is consistent with the findings of Pagels et al who examined 535 CKD patients in stages 2 to 5 in a cross-sectional study, finding the greatest between-group differences in physical health dimensions, smaller differences in mental health dimensions, and pain dimensions.[5] The mean PCS score in the present study (30.23±6.57) was also lower than the normative population means of 50, and similar to PCS scores obtained in the dialysis populations in the Fletcher et al systematic review and meta-analysis (pooled RAND-36 PCS 35.5 in dialysis patients), indicating a similar degree of HRQoL impairment in our advanced non-dialysis population to that of dialysis patient populations. This finding is consistent with the predominance of advanced CKD (stages 4 and 5) in the present cohort. Although significantly lower than the normative mean, the mean MCS score (35.30±5.30) was less affected compared to PCS, which is also consistent with CKD literature.[5,12]

The negative correlation between the score of each HRQoL domain and advancing CKD stage (PCS both $p<0.001$ and MCS both $p<0.001$) is similar to the findings in studies that have previously investigated this relationship between HRQoL and stage of CKD. Similarly, Pagels et al. reported progressive deterioration in HRQoL across advancing CKD stages, with the largest declines observed in physical functioning, role physical, general health, and PCS, while mental health domains were comparatively less affected.[5] Similarly, the international systematic review by Fletcher et al showed decreased HRQoL in dialysis patients compared to those not undergoing renal replacement therapy and suggested that HRQoL decreased as disease severity increased.[12]

The significant association between older age and lower PCS ($p<0.001$) but not MCS, is also in line with the previous data showing that older age is mostly associated with physical rather than mental HRQoL dimensions in CKD patients. This also aligns with the results of the NURTuRE-CKD cohort, which demonstrated that age was an important covariate when assessing determinants of HRQoL in non-dialysis CKD patients.[13]

In this study, a significant association was found between high drug burden and low MCS ($p=0.034$), which is consistent with previous studies in the CKD population. In a cross-sectional study where the authors (Adjeroh et al) used the medical expenditure panel survey (MEPS) with 649 non-dialysis CKD patients, they found that hyperpolypharmacy (≥10 medication classes) and major polypharmacy (≥5 medication classes) were independently associated with worse MCS scores. In the same way, Phillips et al (NURTuRE-CKD) cohort study of 2,996 individuals with non-dialysis CKD in the United Kingdom found that the use of 10 or more medications was an independent predictor of poor overall HRQoL after multivariable adjustment.[13,14] However, due to its cross-sectional design, the present study cannot infer causality regarding this association, and prospective longitudinal studies are needed to account for the direction and underlying mechanisms.

There are several strengths to this study. Consecutive patient recruitment was used to minimise selection bias. Concurrently assessing prescribing indicators with HRQoL in the same cohort and in a single study is quite unusual in the Indian tertiary care setting, where the assessment of prescribing patterns or HRQoL has been conducted in isolation. Standardised instruments, validated with WHO core prescribing indicators and RAND-36, are used, which helps to allow comparisons with published literature. Some restrictions need to be recognised. Due to the cross-sectional design, the findings do not allow for causal inferences to be made about the associations found between the prescribing patterns and the HRQoL, for example, to conclude that drug burden causes a reduction in MCS. Given the single-centre design, the results of this study may not be generalized to other Indian and international populations of CKD. Prescribing indicator benchmarks from WHO were created for primary care outpatient settings and should be interpreted with caution in the tertiary care hospital setting of this study. In associative analyses, disease progression was not assessed, nor were the eGFR trajectory data; this limits the ability to characterise disease progression and adjust fully for the severity of CKD in adherence analyses.

These findings have important clinical implications. The suboptimal rates of generic prescribing and EML adherence highlight opportunities to strengthen rational prescribing in tertiary care practice. In CKD, pharmacist-led interventions that are delivered by a multidisciplinary team have been demonstrated to enhance medication adherence and select clinical outcomes, and therefore are recommended to be included in routine care.[15] In addition, the relationship between increased medication burden and

decreased MCS highlights the need for periodic medication reviews. The significant reduction in HRQoL also justifies the regular application of PROMs in the management of CKD in line with the KDIGO 2024 Clinical Practice Guideline.[2] Further longitudinal analyses should assess the association of prescribing quality, medication burden, and HRQoL.

CONCLUSION

The medication burden and suboptimal prescribing of both generic and EML drugs were high in this study, while HRQoL was significantly impaired in CKD patients treated at a tertiary hospital. Poor physical and mental HRQoL was associated with advancing CKD stage, and higher medication burden was associated with poorer mental health. The results highlight the need for rational prescribing and frequent review of medication use and routine evaluation of patient-reported outcomes in the context of good clinical management of CKD. Further multicentre longitudinal studies are warranted to explore the benefits of optimisation of prescribing practices and multi-disciplinary medication management, in terms of improving prescribing quality and patient-centred outcomes.

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