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Evaluation of Prescribing Pattern and Impact of Polypharmacy in Geriatric Patients with Chronic Kidney Disease

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ABSTRACT
Chronic Kidney Disease (CKD) is a progressive condition affecting about 10% of the global adult population and is projected to become the fifth leading cause of death by 2040. Geriatric CKD patients are highly susceptible to polypharmacy due to multiple comorbidities such as hypertension and diabetes, increasing the risk of potentially inappropriate medications (PIMs), drug interactions, and adverse effects. This prospective observational study evaluated prescribing patterns, polypharmacy prevalence, and PIM use among 80 geriatric CKD patients in a tertiary care hospital using the 2023 AGS Beers Criteria. Males constituted 71.25% of participants, and most were aged 65–74 years. Hypertension (75%) and diabetes mellitus (68.75%) were the leading comorbidities. Over half of the prescriptions (51.25%) included at least one PIM, with aspirin, clonidine, prazosin, and enoxaparin being most frequent. Polypharmacy was common, with many patients receiving more than ten drugs. Despite short hospital stays (2–4 days), inappropriate prescribing remained high, mainly due to lack of renal dose adjustment. The study emphasizes the need for rational prescribing, regular medication audits, and clinical pharmacist involvement to minimize PIMs and improve therapeutic outcomes in elderly CKD patients.

Keywords: CKD, Geriatric, Polypharmacy, Beers Criteria, PIMs, Prescribing Pattern.

INTRODUCTION:

Chronic Kidney Disease (CKD) is a progressive condition where the kidneys gradually lose their ability to function effectively due to various causes. It is defined by a sustained reduction in kidney function—an estimated glomerular filtration rate (eGFR) below 60 mL/min/1.73 m²—or evidence of kidney damage, such as albuminuria, lasting at least three months. Diabetes and hypertension are the leading causes worldwide, while genetics, ethnicity, and socioeconomic factors also influence disease progression. Early stages often go unnoticed, as symptoms like fatigue, itching, and loss of appetite are non-specific. CKD is typically detected incidentally during routine investigations or when symptoms worsen.

CKD is classified into five stages based on kidney function—from mild damage in stage 1 to complete kidney failure in stage 5, where dialysis or transplantation becomes necessary. This staging helps guide

treatment and monitor disease progression. Globally, CKD affects about 10% of adults and causes over 1.2 million deaths annually. By 2040, it is projected to be the fifth leading cause of death. Older adults are especially at risk because of comorbidities such as diabetes, hypertension, and dyslipidemia, which increase the likelihood of cardiovascular complications. As kidney function declines, toxins accumulate, leading to uremic symptoms and systemic complications. The main goal of management is to slow progression, prevent complications, and maintain quality of life.

Polypharmacy and Its Challenges in CKD

Polypharmacy—commonly defined as the use of five or more medications daily—is prevalent among CKD patients due to multiple comorbid conditions. While necessary for disease control, it increases the risk of drug–drug interactions, adverse effects, and medication errors. Older adults with CKD are particularly vulnerable because of impaired drug clearance and altered pharmacodynamics. These issues heighten the risk of medication-related harm, hospital readmissions, and healthcare costs, underscoring the need for careful medication review and rational prescribing.

Beers Criteria: Origin and Purpose

To address inappropriate medication use in older adults, several screening tools have been developed, with the Beers Criteria being one of the most recognized. Introduced in 1991 by Dr. Mark Beers, it initially targeted nursing home residents but was later expanded to all elderly patients. Over successive updates in 1997, 2003, 2012, 2015, and 2019, the list became more evidence-based and clinically relevant. The American Geriatrics Society (AGS) assumed responsibility for updates in 2010. The 2019 revision introduced renal-specific dose adjustments—an important addition for CKD management.

The latest **2023 AGS Beers Criteria** organizes medications into five categories:

1. Drugs generally inappropriate for older adults.
2. Drugs inappropriate in specific diseases or conditions.
3. Drugs requiring caution.
4. Potentially harmful drug–drug interactions.
5. Drugs needing dose adjustment based on kidney function.

These recommendations, grounded in the latest research, are designed to guide—not restrict—clinicians, promoting safer, individualized prescribing practices.

Clinical Importance in CKD

In elderly CKD patients, applying the Beers Criteria is critical due to the high risk of drug-related problems. Many prescriptions remain inappropriate because renal dose adjustments are overlooked or outdated regimens persist. Integrating the Beers Criteria into clinical routines—during admissions, medication reviews, or new prescriptions—helps identify potentially inappropriate medications (PIMs), enabling safer substitutions or dosage modifications.

Role of Clinical Pharmacists and Rational Prescribing

Clinical pharmacists play a pivotal role in enhancing medication safety. They review prescriptions, detect drug interactions, and ensure renal dose adjustments are made appropriately. Evidence shows that pharmacist-led interventions reduce inappropriate prescriptions and improve therapeutic outcomes. Regular medication audits, prescriber education, and patient counseling further strengthen rational drug use. In addition to the Beers Criteria, tools such as KDIGO guidelines, the Kidney Failure Risk Equation, and the Dialysis Transition Mortality Prediction Score assist in individualized, evidence-based care planning.

Despite clear guidelines, inappropriate prescribing in elderly CKD patients remains a significant issue, particularly in resource-limited settings. Contributing factors include limited awareness, insufficient pharmacist involvement, and the complexity of CKD management. This study therefore aims to evaluate prescribing patterns and the prevalence of polypharmacy among geriatric CKD patients using the 2023 AGS Beers Criteria. It will identify commonly prescribed PIMs, explore factors contributing to their use, and assess the impact of pharmacist interventions on improving medication safety.

In conclusion, CKD poses a growing global health burden, especially among older adults with multiple comorbidities. Polypharmacy, though often necessary, elevates the risk of medication-related complications. The Beers Criteria offers an essential framework for identifying and avoiding inappropriate drug use. Incorporating clinical pharmacists, enforcing prescription audits, and tailoring doses to kidney function are crucial for optimizing therapy. Promoting rational, evidence-based prescribing ultimately enhances safety, outcomes, and quality of life in elderly patients with CKD.

OBJECTIVES:

- To evaluate the appropriateness in prescribing medications in geriatric CKD patients using Beer's criteria.
- To assess the impact of polypharmacy on drug related problems in geriatric CKD patients.
- To evaluate the impact of polypharmacy on clinical outcomes and to improve safety and efficacy geriatric CKD patients.

MATERIALS AND METHODS

The study was conducted in the Nephrology Department of Sri Ramakrishna Multi-Specialty Hospital, Coimbatore. It followed a prospective observational design over 10 months, involving 80 geriatric patients aged 65 years and above diagnosed with chronic kidney disease (CKD) and receiving polypharmacy. The sample size was determined using a 95% confidence interval with a 5% margin of error, and data were analyzed using the Chi-square test.

Inclusion criteria included patients aged above 65 years with CKD and prescriptions showing polypharmacy who consented to participate. Exclusion criteria involved critically ill patients, those unwilling to participate, or with insufficient data.

A literature survey was conducted to understand inappropriate medication use, prescribing trends, and quality-of-life impacts in CKD. Data collection tools included a Patient Information Form, Informed Consent Form (in English and Tamil), and a Data Entry Form capturing demographic, clinical, and laboratory details.

Eligible participants were enrolled after obtaining consent, and data were collected from medical records, treatment charts, and direct interviews with patients, caregivers, and healthcare staff. Drug therapy was regularly monitored to identify drug-related problems such as inappropriate medication use, drug interactions, adverse reactions, and noncompliance. Necessary permissions were obtained from the Medical Director (EC/2025/0302/CR-13) and departmental heads. The study aimed to assess prescribing patterns, evaluate medication safety, and promote rational drug use among geriatric CKD patients to optimize therapeutic outcomes.

RESULTS:

The study was done in the Nephrology department of a tertiary care teaching hospital. Based on the incl-

usion and exclusion 80 patients were included in our study. The study is currently being conducted under the phase II as per the proposed methodology so far, there were 80 cases collected and the following result was given.

GENDER –WISE CATEGORIZATION:

In this study out of 80 patients, (57) 71.25% of the patients were males and (23) 28.75% were females.

TABLE 1: GENDER WISE DISTRIBUTION OF STUDY PARTICIPANTS (n= 80)

GENDER	NO OF PARTICIPANTS	PERCENTAGE
MALE	46	60.52%
FEMALE	30	39.47%

TABLE 2: AGE –WISE DISTRIBUTION: (n= 80)

Age distributions of the patients were analysed and it was found that out of 80 patients 62.5% between were 65-74 years (50), followed by 32.5%between 75-84 years (26), and 5%were between 85-94 years (4).

Age in years	No of patients	Percentage
65-74 years	50	62.5%
75-84 years	26	32.5%
85-94 years	4	5%

TABLE 3: NUMBER OF DAYS PATIENTS STAYED IN HOSPITAL

Among the study participants, the majority of patients 53 (66.25%) had a total hospital stay of 2–4 days. A shorter duration was followed by 22 patients (27.5%) who stayed for 5–7 days, while only 5 patients (6.25%) required hospitalization for 8–10 days.

TOTAL HOSPITAL STAY	No. of Patients (N=20)	Percentage (%)
2-4	**53**	**66.25%**
5-7	**22**	**27.5%**
8-10	**5**	**6.25%**

TABLE 4: DETAILS OF NUMBER OF DRUGS PRESCRIBED PER PRESCRIPTION

In the study population, 30 patients were prescribed (5–10) medications, while 39 patients received (11–15) medications, making this the most common range. Additionally, 11 patients were found to be on (16–20) medications, indicating a considerable prevalence of polypharmacy among the participants.

S.NO	No. of Medications	No of patients
1	**5-10**	**30**
2	**11-15**	**39**
3	**16-20**	**11**

TABLE 5: NUMBER OF COMORBIDITIES (n= 80)

Hypertension 60 (75%) and diabetes mellitus 55 (68.75%) were the most common comorbidities, followed by coronary artery disease 21 (26.25%) and Anemia 13 (16.25%). Cerebrovascular accidents, hypothyroidism, and dyslipidemia were less frequent, while respiratory, musculoskeletal, renal, and other conditions occurred in smaller proportions, highlighting cardiovascular and metabolic disorders as predominant among patients.

COMORBIDITY	NO. OF PATIENTS	PERCENTAGE (%)
Hypertension	60	75%
Diabetes Mellitus	55	68.75%
Coronary Artery Disease	21	26.25%
Anemia	13	16.25%
CVA	9	11.25%
Hypothyroidism	7	8.75%
Dsylipidemia	4	5%
IHD	3	3.75%
Pulmonary edema	3	3.75%
Bronchitis	3	3.75%
Osteoarthritis	2	2.5%
COPD	2	2.5%
UTI	2	2.5%
Renal stone disease	2	2.5%
CCF	2	2.5%
Asthma	1	1.25%
Renal Failure	1	1.25%
Rheumatoid arthritis	1	1.25%

TABLE 6: CLASSIFICATION OF DRUGS

Among the total 562 drugs used, antihypertensive drugs were the most commonly prescribed 112 (19.92%), followed by anti diabetic agents 78 (13.87%) and drugs acting on the gastrointestinal system

57 (10.14%). Antimicrobial drugs 60 (10.67%) and cardiovascular agents 56 (9.96%) were also frequently used. This distribution highlights a predominance of medications used for managing chronic conditions such as hypertension, diabetes, and cardiovascular disorders among the study population.

S.NO	CLASSES OF DRUGS	NO.OF DRUG (n=562)	PERCENTAGE
1.	Drugs acting on Cardiovascular system	56	9.96%
2.	Drugs acting on Gastrointestinal system	57	10.14%
3.	Antihypertensive drugs	112	19.92%
4.	Anti-diabetic drugs	78	13.87%
5.	Drugs acting on central nervous system	30	5.33%
6.	Drugs acting on blood and blood forming agents	21	3.73%
7.	Antimicrobial drugs	60	10.67%
8.	Drugs acting on respiratory system	35	6.22%
9.	Drugs acting on CVA	25	4.44%
10.	Analgesics	28	4.98%
11.	Anti emetic drugs	20	3.55%
12.	Drugs for Anemia	10	1.77%
13.	Drugs for Osteoarthritis	5	0.88%
14.	Antacids	9	1.60%
15.	Corticosteroids	8	1.42%
16.	Anti gout drugs	8	1.42%

EVALUATION OF PRESCRIPTION USING BEERS CRITERIA

Total of 80 geriatric patients who were admitted in Nephrology medicine department were incorporated in the study. The patients were allocated according to age and gender. By using BEER'S CRITERIA commonly prescribed drugs are evaluated and are classified as appropriate prescription and inappropriate prescription.

TABLE 7: CATEGORIZATION OF PRESCRIPTION USING BEERS CRITERIA

Category of prescription	No. of prescription	Percentage
Inappropriate prescription	41	51.25%
Appropriate prescription	39	48.75%

Figure no.1

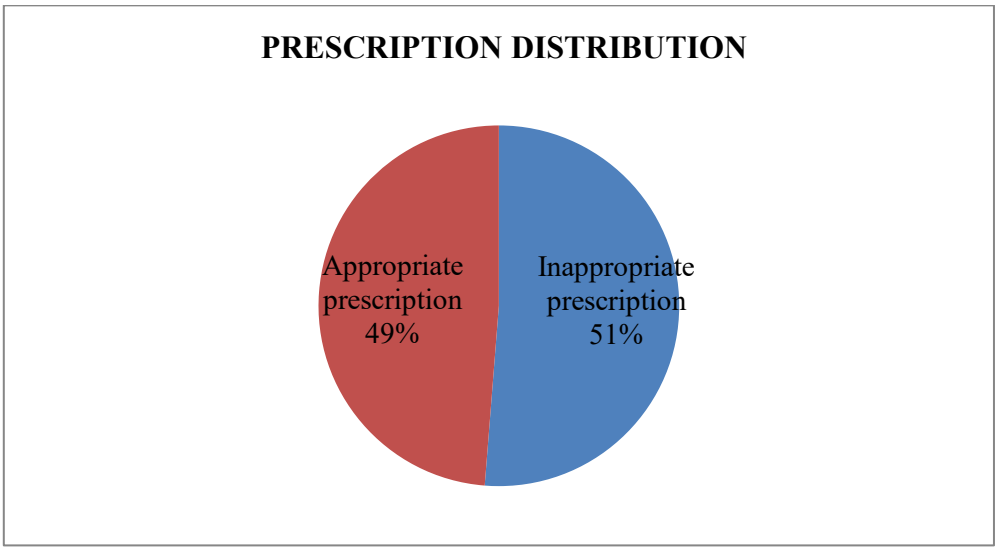

TABLE 8: List of Potentially Inappropriate Medications (PIMs) prescribed in the study population using Updated Beers Criteria 2023 (n=41)

According to Beers Criteria, a total of 54 potentially inappropriate medications (PIMs) were identified. The most common were Aspirin (16 cases), followed by Clonidine and Prazosin (7 each), Enoxaparin (6), Hydroxyzine (3), Clobazam and Clonazepam (2 each), and several others with single incidences.

S.NO	NAME OF THE PIM AS PER BEER'S CRITERIA	NO OF INCIDENCE
1.	Aspirin	16
2.	Clonidine	7
3.	Prazosin	7
4.	Enoxaparin	6
5.	Hydroxyzine	3
6.	Clobazam	2
7.	Clonazepam	2
8.	Glimepiride	2
9.	Gliclizide	2
10.	Nifedipine	1
11.	Alprazolam	1
12.	Tolterodine	1
13.	Colchicine	1
14.	Phenobarbital	1
15.	Diclofenac	1

16.	Chlorzaxazone	1

TABLE 9: Potentially Inappropriate Medications (PIMs) According to Beers Criteria: Classification and Rationale

According to Beers Criteria classification, most identified drugs such as Aspirin, Nifedipine, Clonidine, Gliclazide, Alprazolam, Glimepiride, Clonazepam, Phenobarbital, Diclofenac, Chlorzoxazone, and Clobazam belong to **Class 1**, indicating they are potentially inappropriate medications. **Prazosin** falls under **Class 2**, being inappropriate in specific diseases, while **Enoxaparin, Tolterodine, Colchicine,** and **Hydroxyzine** belong to **Class 5**, requiring dosage adjustment based on renal function.

S.NO	NAME OF THE PIM AS PER BEER'S CRITERIA	CLASSIFICATION CATEGORIES IN BEER'S CRITERIA	RATIONALE
1.	Aspirin Nifedipine Clonidine Gliclizide Alprozolam Glimepiride Clonazepam Phenobartital Diclofenac Chlorzaxazone Clobazam	CLASS 1	Medications considered as potentially inappropriate
2.	Prazosin	CLASS 2	Medications potentially inappropriate in patients with certain diseases or syndromes
3.	Enoxaparin Tolterodine Colchicine Hydroxyzine	CLASS 5	Medications whose dosages should be adjusted based on renal function

TABLE 10: ERRORS IDENTIFIED IN PRESCRIPTIONS USING BEERS CRITERIA (n=41)

Errors identified in prescriptions using Beers Criteria include the use of potentially inappropriate medications (PIMs) in elderly patients. These errors highlight the need for careful drug selection and dose adjustment in older adults to avoid adverse effects.

S.No	**DRUGS UNDER BEERS CRITERIA**	**OBSERVATION**	**RECOMMENDATIONS**
1.	Aspirin	Increased risk of GI bleeding/peptic	Avoid chronic use, unless

		ulcer(325mg/day),>75years/Taking anticoagulants/antiplatelet agents	other alternatives are not effective and patient can take proton-Pump Inhibitor.
2.	Clonidine	High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension.	Avoid clonidine as first-line treatment for hypertension.
3.	Prazosin	High risk of orthostatic hypotension and associated harms, especially in older adults; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile.	Avoid use as an antihypertensive.
4.	Enoxaparin	30 Crcl, Increased risk of bleeding	Reduce dose
5.	Hydroxyzine	Use of diphenhydramine in situations such as acute treatment of severe allergic reactions may be appropriate.	Avoid
6.	Clobazam	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; the continued use of benzodiazepines may lead to clinically significant physical dependence.	Avoid
7.	Clonazepam	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; the continued use of benzodiazepines may lead to clinically significant physical dependence..	Avoid
8.	Glimepiride	Among sulfonylureas, long-acting agents (e.g.,glyburide, glimepiride) confer a higher risk of prolonged hypoglycemia than short-acting agents (e.g., glipizide)	If a sulfonylurea is used, choose short-acting agents (e.g., glipizide) over long-acting agents (e.g., glyburide,glimepiride).
9.	Gliclizide	Sulfonylureas have a higher risk of cardiovascular events, all-cause mortality, and hypoglycemia than alternative agents. Sulfonylureas may increase the risk of cardiovascular death and ischemic stroke.	Avoid sulfonylureas as first- or second-line monotherapy or add-on therapy unless there are substantial barriers to the use of safer and more effective agents.
10.	Nifedipine	Potential for hypotension; risk of precipitating myocardial ischemia	Avoid

11.	Alprazolam	The use of benzodiazepines exposes users to risks of abuse, misuse, and addiction. Concomitant use of opioids may result in profound sedation, respiratory depression, coma, and death	Avoid
12.	Tolterodine	Use of more than one medication with anticholinergic properties increases the risk of cognitive decline, delirium, and falls or fractures.	Avoid; minimize the number of anticholinergic drugs
13.	Colchicine	Crcl<30 GI, neuromuscular, and bone marrow toxicity	Reduce dose; monitor for adverse effects.
14.	Phenobarbital	High rate of physical dependence, tolerance to sleep benefits, greater risk of overdose at low dosages.	Avoid
15.	Diclofenac	Increased risk of GI bleeding or peptic ulcer disease in high-risk groups, including those >75 years old or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents; use of proton-pump inhibitor or misoprostol reduces but does not eliminate	Avoid chronic use unless other alternatives are not effective and the patient can take a gastroprotective agent
16.	Chlorzoxazone	Muscle relaxants typically used to treat musculoskeletal complaints are poorly tolerated by older adults due to anticholinergic adverse effects, sedation, and increased risk of fractures; effectiveness at dosages tolerated by older adults is questionable.	Avoid

DISCUSSIONS:

The present study evaluated prescribing patterns, comorbidities, and the prevalence of potentially inappropriate medications (PIMs) among geriatric patients with chronic kidney disease (CKD) admitted to a tertiary care nephrology department. The findings highlight major challenges in geriatric pharmacotherapy, including polypharmacy, drug–drug interactions, and high PIM prevalence.

Among 80 patients, males constituted 71.25%, with most aged 65–74 years, consistent with global CKD demographics. Polypharmacy was a significant concern, as nearly half the patients received 11–15 medications. This increases the risk of adverse events, poor adherence, and complex drug interactions. Comparable results were observed in a Turkish study, where 33% of elderly patients met polypharmacy criteria and 63.5% used PIMs. Hypertension (75%) and diabetes mellitus (68.75%) were the most common comorbidities, paralleling national and international CKD trends.

Using the Beers Criteria, 51.25% of prescriptions contained at least one PIM, similar to findings from Turkey (63.5%) and China (66.3%). Frequently prescribed PIMs included aspirin, clonidine, and

prazosin, which may cause gastrointestinal bleeding or orthostatic hypotension. The high prevalence suggests limited awareness of geriatric pharmacology principles and a lack of regular prescription review.

Evidence from other studies shows that pharmacist-led medication reviews and tools such as the Beers criteria effectively reduce PIM use. Considering CKD patients' susceptibility to adverse effects, renal dose adjustments and prescription auditing are crucial. The study emphasizes the importance of multidisciplinary collaboration, clinical decision-support systems, and continuous education to promote rational prescribing and improve medication safety in elderly CKD patients.

CONCLUSION:

This study evaluated prescribing patterns, comorbidities, and potentially inappropriate medications (PIMs) among geriatric chronic kidney disease (CKD) patients admitted to a tertiary care hospital. Among 80 participants, 71.25% were males, and most were aged 65–74 years. Polypharmacy was highly prevalent, with nearly half receiving 11–15 drugs. Hypertension (75%) and diabetes mellitus (68.75%) were the most frequent comorbidities. Using Beers Criteria, 51.25% of prescriptions contained at least one PIM, commonly aspirin, clonidine, and prazosin. These findings reveal significant prescribing challenges and highlight the need for regular prescription audits, renal dose adjustments, and pharmacist-led interventions to improve medication safety and therapeutic outcomes in elderly CKD patients**.**

FUTURE OUTLOOK:

The findings of this study emphasize the need for improved strategies in managing geriatric patients with chronic kidney disease (CKD). With an ageing population and rising CKD prevalence, pharmacotherapy in older adults is becoming increasingly complex. Future research should focus on structured interventions to minimize polypharmacy and inappropriate medication use. Pharmacist-led medication reviews and interdisciplinary prescribing models have proven effective globally and should be adapted to Indian healthcare settings. Integrating electronic prescribing systems with decision-support tools for renal dose adjustments, drug interactions, and Beers Criteria alerts can further enhance safety. Large, multi-center interventional studies are needed to evaluate the long-term impact of rational prescribing on morbidity, mortality, and quality of life. Patient education on adherence and lifestyle changes can also improve outcomes. Overall, a multidisciplinary, evidence-based, and technology-driven approach—supported by stronger clinical pharmacy involvement and prescriber awareness—will be key to optimizing medication safety in elderly CKD management.

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