Original Article

A Study on Prescribing Patterns of Drugs in Geriatric Patients in a Tertiary Care Hospital: A Cross-sectional Study

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ABSTRACT

Background: Rational drug use plays even more significant role in case of geriatrics as they are the majority of drug consumers compared to the rest of the population. **Objectives:** The main objectives of this study were to determine the prevalence of PIMs in geriatric prescriptions and to determine the association between number of PIMs prescribed with total number of drugs prescribed, number of comorbidities and age. **Materials and Methods:** The data of 110 patients who were all above 60 years of age were collected. And analysed and interpreted using google forms and IBM SPSS Statistics 28.0 version. In this study, prevalence of PIMs and the association between number of PIMs prescribed with total number of drugs prescribed, number of comorbidities and age will be determined. **Results:** Most prescriptions that is 22.7% prescriptions had 4 PIMs present. The correlation between number of drugs prescribed and number of PIMs is having medium positive correlation as R = 0.570 and correlation between number of PIMs and Age is having low positive correlation as R = 0.262 and correlation between number of PIMs and number of comorbidities is having medium positive correlation as R = 0.317. **Conclusion:** The study revealed that the prescribing patterns in the hospital was irrational as there was at least one PIM present in each prescription that was studied. This study accentuates the fact that physicians and pharmacists must be made aware of guidelines or criteria like the Beers criteria to practise safer prescribing patterns in elderly.

Keywords: Beers criteria, Geriatrics, Potentially inappropriate medications (PIMs), Rational drug use, Polypharmacy.

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INTRODUCTION

Rational drug use starts with ensuring rational drug prescribing.[1] Rational drug use plays even more a significant role in case of geriatrics as they are the majority of drug consumers compared to the rest of the population.[2] Geriatrics is the term used to refer to elderly patients older than 60 years of age. Geriatric drug prescribing is a rising concern in healthcare discussions in the present day because of the rising prevalence of pathological health conditions and chronic diseases in the elderly.[3]

The response of elderly patients towards medications differs from that of the younger adults.[4,5] This is because of the changes in their pharmacokinetics that occurs with time.[4,5] Moreover older patients maybe more or less sensitive to certain drug types.[4,5] These drugs especially include drugs that act on the central nervous system like benzodiazepines and these drugs are known to be related to ADRs like postural sway and risk of falls.[5]

Apart from this, due to the existence of multiple comorbidities in the elderly, they are exposed to polypharmacy. Polypharmacy is

defined as the usage of 5 or more drugs and is ubiquitous in patients aged 65 years or older.[6] Increase in the number of drugs will make way for ADEs and drug interactions.[4-6] This higher risk of ADRs and DDIs due to polypharmacy can eventually lead to problematic prescribing avalanche and result in ineffective treatment and can result in prolonged hospitalization and high cost of treatment.[4]

To prevent the aforementioned quandaries, drug prescribing for elderly must be done with utmost care and caution. While prescribing drugs for the elderly, certain principles must be followed regarding:

i. Questions to be asked during admission.

ii. Avoiding unnecessary polypharmacy.

iii. Safe prescribing habits.

iv. Adverse events.

v. Review of medications during discharge.[7]

There are certain criteria that can be used for safe drug prescribing in geriatrics and to avoid the use of PIMs. Among those criteria, Beers criteria are the most commonly used criteria and this study focuses mainly on the use of these criteria.[8]

The Beers Criteria were first developed in 1991 by Mark H. Beers, MD, it was developed to decrease the use of inappropriate prescribing and prevent ADRs and to identify medications to be avoided in geriatrics.[6]

These are a unique set of evidence-based recommendations customized distinctively for geriatrics in all care settings, except hospice or palliative care.[4] It is basically a list of PIMs that has to be avoided in geriatric patients.[4] It provides guidance on how to optimize medication selection in the elderly.[4] The criteria is used as a tool to refer to before beginning, raising, or changing medications, or when conducting a thorough review of medications for older patients.[4]

According to Beers Criteria PIMs are categorized into 3 groups

Category A: Drugs to be avoided in geriatrics.[9]

Category B: Drugs which can exacerbate the disease or syndrome due to Drug disease or drug syndrome interaction.[9]

Category C: Drugs to be used with Caution in geriatrics.[9]

It also includes list of DDIs to be avoided in geriatrics and drugs to be avoided or reduce dose according to Kidney Function Test.[9]

As mentioned before, it is observed that even though geriatrics are the major consumers of modern drug therapy, they are more susceptible to or are at a higher risk of suffering from ADRs and drug interactions.[2] In fact, the prevalence of ADRs in the elderly is designated as " a major modern epidemic".[2] Therefore to reduce these issues, it is important to follow certain rules like the Beer's criteria for safe geriatric drug prescribing.

The main objectives of this study were to evaluate the prescribing patterns in geriatrics and if the prescribing was based on Beers criteria and to determine the correlation between potentially inappropriate medications and parameters like age, total number of drugs prescribed and number of comorbidities.

MATERIALS AND METHODS

A cross-sectional observational study was conducted for six months (July 2020–December 2020) in Mallige Hospital in Bangalore, Karnataka. A sample size of 110 was obtained and taken for the study which was determined using the convenience sampling method.

Study site

This study was conducted at Mallige hospital. Mallige hospital is a multispecialty tertiary care hospital with over 126 beds conveniently located in the heart of Bengaluru, the capital of Karnataka state of India. Mallige Hospital consists of many departments like Nephrology, Cardiology, Radiology, General Medicine, Surgical, Paediatrics, Obstetrics and Gynaecology, etc.

Ethical consideration

Before commencing data collection, approval for the study from the Institutional Review Board (IRB) of Mallige hospital was acquired and a verbal informed consent was obtained from the participants of the study as recommended by IRB.

Objectives of the study

Primary objective

- To evaluate the Prescribing Patterns in Geriatrics and to determine if Beers criteria is considered while prescribing drugs for geriatrics.

Secondary objective

- To determine the prevalence of potentially Inappropriate Medications (PIMs) in Geriatric Prescriptions.

- To determine the most used PIM in geriatric prescriptions.
- To determine the association between number of PIMs prescribed with total number of drugs prescribed, number of comorbidities and age.

Tools used

- Patient data collection form.
- Patient informed consent form.
- Beer's criteria PIM list.

Study criteria

Inclusion criteria

- Patients of 60 years of age and above.
- Geriatric patients prescribed more than three drugs.
- Geriatric patients with co-morbidities.

Exclusion criteria

- Patients below 60 years of age.
- Patients undergone surgery within in the last 6 months until data collection.
- Geriatric patients prescribed less than 3 drugs.

Data collection and study procedure

For this study, the data collection form was designed using google forms and the form included questions regarding the patient's age, gender, medical history, final diagnosis, and medications prescribed and it also included the PIMs checklist included in Beers criteria. Data of patients were collected prospectively or from the medical record department of the hospital. Data of 110 patients were collected from the inpatient department of the hospital which included the female ward, male ward, general ward, and the intensive care unit. Subsequently the data was analysed and interpreted using google forms and IBM SPSS STATISTICS 28.0 VERSION. In this study, prevalence of Potentially Inappropriate Medications (PIMs) and the association between number of PIMs prescribed with total number of drugs prescribed, number of comorbidities and age will be determined.

Statistical Analysis

In this study, prevalence of Potentially Inappropriate Medications (PIMs) and the association between number of PIMs prescribed with total number of drugs prescribed, number of comorbidities and age was determined using statistical analysis. Statistical analysis was performed using IBM SPSS STATISTICS 28.0 VERSION and the result was determined using Pearson correlation coefficient and determining the '*p*' value. "*p*" value indicates the significance of the correlation obtained.

RESULTS

Patient characteristics

More than half of the patients included in this study were males i.e., 57.3% of them were males and the rest 42.7% were females. Patients whose cases were studied for this project belonged to age group between 60-98 years. Out of the 110 patients, most of them were aged 70years old i.e., 8.2% of patients were 70 years of age. Maximum no. of patients i.e., 63.6% of the patients were admitted to the general medicine department. The second highest no. of patients (10.9%) were admitted to neurology. The third highest no. of patients (7.3%) were admitted to pulmonology. 73.6% of patients were suffering from hypertension making it the most common ailment seen in the study sample. 66.4% suffered from Type 2 Diabetes Mellitus and 31.8% suffered from Ischaemic heart disease. Patient characteristics are summarized in Table 1. Graphical representation of gender distribution observed in the study is shown in Figure 1, and number of patients admitted to various departments is shown in Figure 2.

Drugs prescribed per patient

The patients included in the study were prescribed at least 4 drugs. The most observed no. of drugs that were prescribed were 12 i.e., 10.9% of prescriptions had 12 drugs prescribed. Number of drugs prescribed per patient is summarized in Table 2 and graphical representation is shown in Figure 3.

PIMs prescribed per patient

Most prescriptions i.e., 22.7% prescriptions had 4 PIMs present. Most commonly prescribed PIM was Pantoprazole; 88.1% patients were prescribed pantoprazole. Next most prescribed PIMs were diuretics; 44.5% patients were prescribed diuretics with Furosemide being the most common diuretic that was prescribed. Number of PIMs prescribed per patient is summarized in Table 3 and graphical representation is shown in Figure 4.

Table 1: Patient characteristics.

Variables	Patients (*n*=110)
Gender	
Male, n (%)	63 (57.3%)
Female, n (%)	47 (42.7%)
Age distribution (years), n (%)	
60-70	54 (49.1%)
70-80	37 (33.64%)
80-90	13 (11.81%)
90-98	6 (5.45%)
Department, n (%)	
General Medicine	70 (63.6%)
Neurology	12 (10.9%)
Pulmonology	8 (7.3%)
Gastroenterology	7 (6.4%)
Haematology	4 (3.6%)
Oncology	4 (3.6%)
Diabetology	2 (1.8%)
Nephrology	1 (0.9%)
General surgery	1 (0.9%)
Orthopaedics	1 (0.9%)
Medical history, n (%)	
Hypertension	81 (73.6%)
Diabetes Mellitus	73 (66.4%)
Ischaemic heart disease	35 (31.8%)
Cerebrovascular accident	9 (8.2%)
Thyroid disorder	16 (14.5%)
COPD/Bronchitis/Asthma	16 (14.5%)
Kidney disease	11 (10%)
Liver disease	4 (3.6%)
Seizure disorder	4 (3.6%)

N = Total number of patients, n = number of patients.

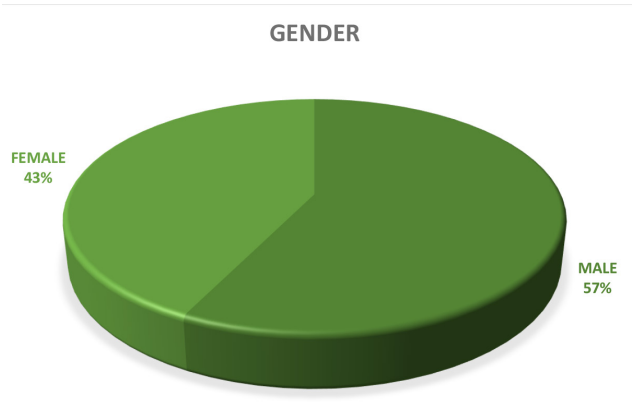

Figure 1: Gender distribution observed in the study.

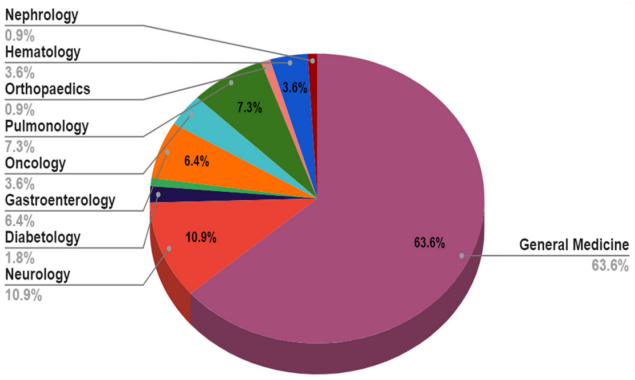

Figure 2: Number of patients admitted to various departments.

Table 2: Drugs prescribed per patient.

Number of drugs	Number of patients
1-5	2
6-10	24
11-15	38
16-20	17
21-25	22
25-30	5
31-35	2

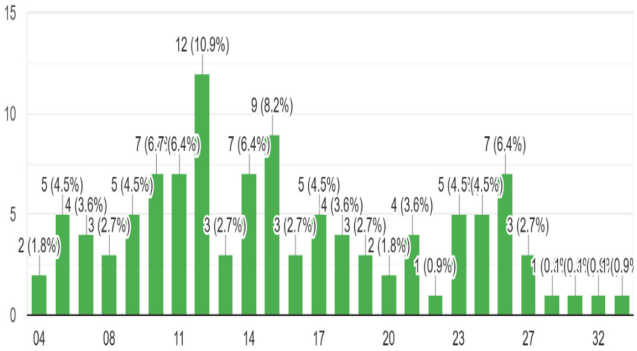

Figure 3: Number of drugs prescribed per patient.

Table 3: PIMs prescribed per patient.

Number of PIMs	Number of patients [n, (%)]
0	1 (0.9%)
1	14 (12.7%)
2	12 (10.9%)
3	22 (20%)
4	25 (22.7%)
5	17 (15.5%)
6	8 (7.3%)
7	6 (5.5%)
8	3 (2.7%)
9	2 (1.8%)

n = number of patients, PIMs-Potentially inappropriate medications.

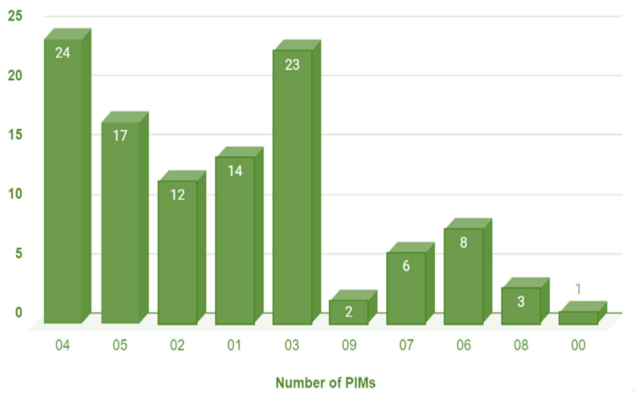

Figure 4: Number of PIMs prescribed.

Table 4: Correlation between number of drugs prescribed per patient and total number of PIMs.

Correlations			
		Number of drugs prescribed	Number of PIMs
Number of drugs prescribed	Pearson Correlation	1	.570**
	Sig. (2-tailed)		<.001
	N	110	110
Number of PIMs	Pearson Correlation	.570**	1
	Sig. (2-tailed)	<.001	
	N	110	110

**. Correlation is significant at the 0.01 level (2-tailed).
N = Total number of patients, PIMs-Potentially inappropriate medications.

Table 5: Correlation between age and number of PIMs.

Correlations			
		Number of PIMs	Age
Number of PIMs	Pearson Correlation	1	.262**
	Sig. (2-tailed)		.006
	N	110	110
Age	Pearson Correlation	.262**	1
	Sig. (2-tailed)	.006	
	N	110	110

**. Correlation is significant at the 0.01 level (2-tailed).
N = Total number of patients, PIMs-Potentially inappropriate medications.

Table 6: Correlation between number of comorbidities and total number of PIMs.

Correlations			
		Number of PIMs	Number of comorbidities
Number of PIMs	Pearson Correlation	1	.317**
	Sig. (2-tailed)		<.001
	N	110	110
Number of comorbidities	Pearson Correlation	.317**	1
	Sig. (2-tailed)	<.001	
	N	110	110

**. Correlation is significant at the 0.01 level (2-tailed).
N = Total number of patients, PIMs-Potentially inappropriate medications.

Statistical analysis

Correlation between number of drugs prescribed per patient and total number of PIMs

As we can see in Table 4, the correlation between number of drugs prescribed and number of PIMs is having medium positive correlation as R= 0.570 and it is proved that correlation is significant at 0.01 level as the *p* value obtained by 2 tailed test is <.001. (If the *p* value is <0.05 it is said to be significant). The correlation between number of drugs prescribed per patient and total number of PIMs is shown in Table 4.

Correlation between age and total number of PIMs

As we can see in Table 5, the correlation between Number of PIMs and Age is having low positive correlation as R= 0.262. And it is proved that correlation is significant at 0.01 level as the *p* value obtained by two tailed test is 0.006. (If the *p* value is <0.05 it is said to be significant). The correlation between age and number of PIMs is shown in Table 5.

Correlation between number of comorbidities and total number of PIMs

As we can see in Table 6, the correlation between number of PIMs and number of comorbidities is having medium positive correlation as R = 0.317 and it is proved that correlation is significant at 0.01 level as the *p* value obtained by 2 tailed test is <.001. (If the *p* value is <0.05 it is said to be significant). The correlation between number of comorbidities and total number of PIMs is shown in Table 6.

DISCUSSION

This study aimed at evaluating the prescribing patterns of geriatric patients based on Beer's criteria 2019, a tool that can be used for astute prescribing of drugs for the elderly. The number of geriatric patients is increasing tremendously, and they are most prone to medical adverse events.[3] The response towards medications is different in elderly when compared with younger adults.[4,5] This is due to their pharmacokinetic changes that occurs with time.[4,5] Due the presence of multiple comorbidities in elderly

results in polypharmacy. Polypharmacy is the usage of 5 or more drugs which may lead to increased prevalence of potentially inappropriate medications, resulting in higher risk of adverse effects and drug interactions and has potential risks higher than their clinical benefits.[4,6]

The present study provided a valuable description of prescribing patterns of drugs in geriatric patients admitted to a tertiary care hospital as per Beer's criteria. A total of 110 prescriptions were analysed and majority of the patients were males that is 57.3%, and the rest were females that is 42.7%. Clinical conditions of study patients were examined and was found that hypertension was the most common illness spotted in the study sample, followed by Type 2 Diabetes Mellitus and Ischaemic heart disease. Maximum number of drugs prescribed per patient was 12, which constituted 10.9% of the total prescriptions which confirmed the tendency of polypharmacy in geriatric prescriptions.

A similar study conducted by Hani Ahmed Sultan *et al*. demonstrated high prevalence of polypharmacy (67.02%) and revealed that 15.6% of total drugs prescribed were inappropriate. The average number of drugs prescribed per prescription was 7+1. Patients of age group 65-70 years received maximum PIMs and patients aged greater than 90 years received least PIMs.[10]

This study helped us conclude that the prescribing patterns in the hospital was irrational as there were PIMs present in most prescriptions studied. According to Beer's 2019 criteria, our study identified that most prescriptions that is 22.7% of prescriptions had at least 4 PIMs present. Pantoprazole was found to be the most prescribed PIM with about 88.1% of patients prescribed with pantoprazole which was followed by diuretics with 44.5% of patients prescribed diuretics with Furosemide being the most prescribed diuretic.

This is similar to the study conducted by Pavani Golla *et al*. which attributed Pantoprazole to be the most frequently prescribed PIM and second often prescribed PIM as Furosemide.[11]

This study reported that prevalence of PIMs is directly proportional to number of total drugs prescribed to the patients as after the statistical analysis of the results it was found that there was medium positive correlation between number of PIMs and total number of drugs prescribed. It was also noted that prevalence of PIMs is also related to the age of the patients and to the no of comorbidities present. It is clear that Beer's criteria were not considered for prescribing drugs for geriatrics in the hospital. This escalates the risks of incidence of adverse events and undesirable drug interactions in the elderly patients.

Please note that this was a single site study and the study involved fewer number of samples and therefore has its own limitations. The study was conducted among Inpatients only and in a very short period. Therefore, the results obtained cannot be used to generalize the prescribing patterns for geriatrics all over the country.

Nevertheless, this study accentuates the fact that physicians and pharmacists must be made aware of guidelines or criteria like the Beer's criteria 2019, START criteria and STOPP criteria to practice safer prescribing patterns in elderly. This would help in avoiding use of inappropriate drugs and instead promote use of safer alternative options for geriatrics.

CONCLUSION

This study aided in assessing the prescribing patterns assessing the geriatric patients based on Beer's criteria 2019 which is a tool that can be used for astute prescribing of drugs for the elderly. The study revealed that the prescribing patterns in the hospital was irrational as there was at least one PIM present in each prescription that. This study reported that prevalence of PIMs is directly proportional to number of total drugs prescribed to the patients. It was also noted that prevalence of PIMs is also related to the age of the patients and to the no of comorbidities in the patients. It is clear that Beer's criteria were not considered for prescribing drugs for geriatrics in the hospital. This escalates the risks of incidence of adverse events and undesirable drug interactions in the elderly patients.

This study accentuates the fact that physicians and pharmacists must be made aware of guidelines or criteria like the Beer's criteria 2019, START criteria and STOPP criteria to practise safer prescribing patterns in elderly. This would help in avoiding use of inappropriate drugs and instead promote use of safer alternative options for geriatrics.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

ADR: Adverse Drug Reaction; **AGS:** American Geriatrics Society; **COPD:** Chronic Obstructive Pulmonary Disease; **HTN:** Hypertension; **IBM:** International Business Machines; **ICU:** Intensive Care Unit; **IP:** In patient; **IPD:** In Patient Department; **LRTI:** Lower Respiratory Tract Infections; **mm Hg:** Millimetres of mercury; **MRD:** Medical Record Department; **NSAID:** Non-steroidal Anti-inflammatory Drugs; **OPD:** Out Patient Department; **OSA:** Obstructive sleep apnoea; **PIMs:** Potentially inappropriate medications; **PPI:** Proton pump inhibitors; **RS:** Respiratory System; **SPSS:** Statistical Package for Social Sciences; **START:** Screening Tool to Alert to Right Treatment; **STOPP:** Screening Tool of Older Persons Prescriptions; **WHO:** World Health Organization.

SUMMARY

Rational drug use plays a vital role in geriatrics as they constitute majority of drug consuming population. The response of geriatrics towards medications differs from that of younger adults. The main objectives of this study were to evaluate and to determine the prevalence of PIMs in geriatric prescriptions according to Beer's criteria, to determine the correlation between age, number of comorbidities, total number of drugs prescribed and PIMs. The results were interpreted using IBM SPSS Statistics 28.0 version. It was observed that most of prescriptions (22.7%) had 4 PIMs present. There was a medium correlation between the number of drugs prescribed and the number of PIMs, low positive correlation between age, number of comorbidities and number of PIMs. This study gives prominence to the fact that physicians and pharmacists must be made aware of the guidelines or criteria like Beer's, START, STOPP. This would promote selection of safer alternative drugs for geriatrics and rational drug use.

Ethics Approval Statement

The project titled "A Study on Prescribing Patterns of Drugs in Geriatric patients in a Tertiary Care Hospital: A Cross-Sectional Study" was approved to be conducted by the Research Review Board of Mallige College of Pharmacy. Approval number: MCP/RRB/003/20-21.

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