

# Assessment of Polypharmacy and Appropriateness of Geriatric Prescription Using Beers Criteria: A Prospective Observational Study at a Tertiary Care Hospital

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## ABSTRACT

**Background:** The elderly population has constantly been rising over the past few years. As far as drug prescribing is concerned, this population is considered to be a particular risk group as polypharmacy and age-related physiological changes make them more vulnerable to the harmful effects of drugs. There are different tools to assess the appropriateness of prescription in geriatrics. Beers criteria are one of the most used tools for determining an elderly patient's prescription appropriateness. The study's main objective was to assess polypharmacy and appropriateness of prescription among geriatric patients of a tertiary care hospital using Beers criteria. **Materials and Methods:** A prospective observational study was carried out on geriatric patients (>65 years) of either gender for a period of 7 months with a validated data collection form. Prescriptions and in-patient case files were used to gather demographic information and specifics about the medications prescribed. **Results:** Two participants were completely disabled, i.e., GFI score 4, totally confined to bed. Polypharmacy was present in 74% of prescriptions. 50 (33.3%) Patients were on at least one potentially inappropriate medication as per Beers criteria. The current study did not see any association between frailty and PIMs identified, but there was a positive correlation seen between the number of drugs prescribed and co-morbidities with identified PIMs. **Conclusion:** Polypharmacy and Potentially Inappropriate medications are highly prevalent in the geriatric population, which has a significant healthcare outcome. Various criteria like Beers Criteria which is referred to as the golden standard, should be taken into account before prescribing drugs to the elderly population.

**Keywords:** Beers criteria, Geriatrics, Frailty, Polypharmacy.

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## INTRODUCTION

Aging is a biological process with its own dynamics that are primarily out of human control. To put it another way, aging is an incurable illness.<sup>1</sup> The elderly population in India is growing steadily by 8.6% as of the 2011 census. Also, India's elderly population (above 60 years) is estimated to reach 194 million by 2031 from 138 million in 2021, so a 41% rise in this population is seen over a decade, according to the National Statistical Office (NSO)'s Elderly in India 2021 report.<sup>2</sup> The geriatric population are the largest consumers of medication among different age groups. Prescribing medication to this vulnerable group requires a high level of vigilance as these people have an increased risk of developing ADRs due to modification of pharmacokinetics

and pharmacodynamics of drugs as a consequence of age-related changes in physiology.<sup>3</sup>

Frailty can be commonly defined as complex geriatric syndrome that leads to a decrease in physiological reserves with increasing age. It is characterized by the enhanced susceptibility to adverse health consequences among geriatric population. Elderly people who are frail frequently have more symptoms, such as weakness and lethargy, more complex medical conditions to treat, and a reduced tolerance for both medical and surgical procedures. The decline in physiological reserve come up with ageing however, but with frailty, this decline is accelerated and the ability to maintain homeostasis starts to deteriorate. Frailty has been proved to be a key barrier for selection of drug therapy among older population. Frailty can be quantified using GFI (Groningen Frailty index). The score ranges from 0 (regular activity without any restriction) to 15 (absolutely disabled). Subjects with a GFI rating of 4 and above are taking into account as frail.<sup>4</sup>

Chronic diseases and polypharmacy among the elderly population boost the risk of inappropriate drug usage. The use



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of drugs inappropriately has a negative impact on patients and drives up healthcare expenses. There is no universally accepted agreement related to definition of polypharmacy. Polypharmacy just implies multiple drug use by an individual patient. In the current study, when a patient took five or more medications at once polypharmacy was taken into account.<sup>5</sup>

Along with polypharmacy in geriatrics, inappropriate prescribing also offers a major challenge. Inappropriate prescribing is associated with deleterious effects on geriatric subjects. Different tools commonly used to evaluate appropriateness of medications in geriatrics include Beers criteria, Screening Tool of Older Person's Prescriptions (STOPP) criteria, Screening Tool to Alert to Right Treatment (START) criteria.<sup>6-8</sup>

Beers criteria for potentially inappropriate medication use in older adults (geriatrics) is also known by the name Beers list, these guidelines in the Beers criteria assist medical practitioners in improving the safety of drug prescriptions for patients over 65 years. Beer's criteria include a list of medications for which the risks may outweigh the benefits for those 65 years and older. By taking into account this information doctors can minimize the adverse effects of such medications.

Beers Criteria was formulated by Geriatrician Mark H. Beers using the expert consensus panel using the Delphi method. This procedure was initially published in the Archives of Internal Medicine in 1991 and was revised in following years-1997, 2003, 2012, 2015, and the most recent revision was done in January 2019.<sup>6</sup>

## MATERIALS AND METHODS

### Study Design

Prospective Observational study.

### Study Site

The study was conducted at the Srinivas Institute of Medical Science and Research Centre, Mukka-574146.

### Study Duration

The study was conducted for a duration of 7 months from January 2022 to July 2022.

### Sample Size

The study was limited to a sample of 150 based on the time Schedule allotted for the project including other circumstances.

### Ethical Clearance

The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science, Mukka, Mangaluru.

## Study Criteria

### Inclusion criteria

- Patients of either gender.
- Patients aged  $\geq 65$  years.
- Patient suffering from acute or chronic diseases.

### Exclusion criteria

- Vitamins, minerals and herbals.
- Patients who are aged less than 65 years.
- Prescriptions containing incomplete information.
- Patients with short duration of hospitalization (less than 24 hr) or day care (Out-patients).

## Source of Data

Data(s) for the study were collected using data collection form from the in-Patient medical files of patients admitted at Srinivas Hospital, Mukka-574146 and through direct interaction with the patient, nurse and other staffs.

## Study Method

**Preparation of Inform Consent Form:** Inform consent form was prepared in Kannada and English and same were used. Before selection of subjects the consent form was orally explained to the participants before filling it and nonverbally by taking help of caregiver and staffs who are well known of the subjects at the hospital and made them understood. In the study only the participants willed to fill ICF were included.

**Data(s) collection:** Data(s) were collected using data collection form with the aid of in-patient medical records and through direct interaction with the patient, nurse and other staffs from the hospital. Data collected include age, gender, social history, details of co morbid diseases, medication history, medical history, findings of clinical examination, drug treatment chart, etc.

## Data Analysis

The collected data(s) were analyzed using Microsoft Excel (version 2208) and Karl Pearson correlation was used to observe relationship between PIMs and co morbidity and PIMs with number of drugs prescribed.

## Operational Modality

## RESULTS

### Demographic characteristics of participants

The present study included a total of 150 participants from various Departments of a Tertiary Care Hospital (Srinivas hospital, Mukka-574146). Of these participants 50.6% (76) were

**Table 1: Demographics of study participants.**

Population characteristics	Number
Total patients	150
Male	76
Female	74
<b>Age group (in years)</b>	
65-70 y	85
71-80 y	51
81-90 y	12
>91 y	2

**Table 2: Distribution of Preexisting co-morbidities in study participants.**

Comorbidity	Total number
HTN	63
DM	54
IHD/CAD	17
COPD/BA	7
CKD/AKI	6
LIVER DISEASES	2
CNS DISORDERS	7
THYROID DISORDERS	8
CANCER	4
OTHER	20
NIL	57

male and 49.3% (74) were female. To examine the likelihood of more PIM events in various age groups, the individuals were further categorized by age group (Table 1).

### Distribution of pre-existing co-morbidities in study participants

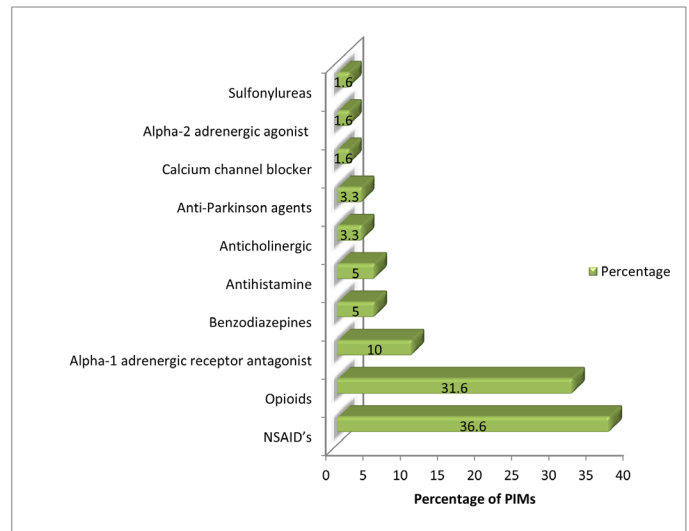
The study participants had various known preexisting co-morbidities and the most prevalent known medical condition noted in the study participants were Hypertension and Diabetes mellitus (Tables 2 and 3).

### Frailty

A total of 150 participants were analyzed during the study using GFI (Groningen Frailty index) Scale (Table 4 and Figure 2).

### Prevalence of Polypharmacy

To check for polypharmacy, all of the study participants prescriptions were carefully examined. Out of 150 prescriptions examined, 111 included more than five drugs, meaning that 74% of patients experienced polypharmacy (Table 5).

**Figure 1: Frequency of PIM prescribed.**

### Beers criteria

#### Prevalence of PIM in geriatrics

The study participant's prescriptions were evaluated using BEERS criteria. Post evaluation of 150 prescriptions as per Beers Criteria Identified a total of 60 PIMs (Table 6).

#### Frequency of PIM prescribed according to BEERS criteria

In the current study most commonly prescribed 3 classes of PIMs were observed with NSAID's (36.6%), Opioids (31.6%) and  $\alpha$ -1 adrenergic receptor antagonist (10%) (Table 7 and Figure 1).

#### BEERS criteria classification

PIMs identified using the criteria were grouped into three categories as per updated 2019 Beers criteria (Table 8).

#### Correlation between PIMs and number of drugs

A substantial positive association was identified between the number of PIMs utilizing the beer criteria ( $p$  value=0.000017) and number of drugs prescribed to study participants.

#### Correlation between PIMs and number of co-morbidities

The number of PIMs found using beers criteria was positively correlated with number of co-morbidities ( $p$ =0.0023).

### DISCUSSION

In terms of drug prescribing, the geriatric age group is considered to be a special risk group. Identifying the problem areas, suggesting interventions to improve the prescribing pattern, and reviewing current prescription patterns are all part of rationalizing prescriptions for geriatric patients.<sup>6</sup> The current study aimed to assess the proportion of geriatric patients receiving

**Table 3: Distribution of Elderly Patients with Number of Pre-existing Co-morbid Condition.**

Number of known preexisting Co-morbidities	Number of patients
0	57
1	39
2	34
3	9
4	6
5	5
Grand Total	150

**Table 4: Frailty status of the study participants.**

GFI Score	Number of Patients	Interpretation
0	22	Normal activity without restriction.
1	68	Restricted in physically strenuous activity but ambulatory and able to carry out light work.
2	42	Ambulatory and capable for self-care, unable to carry out any work and about >50% of waking hours.
3	16	Capable only limited self-care, confined to bed or chair and about <50% of waking hours.
≥4	2	Completely disabled cannot carry on any self-care, totally confined to bed.

**Table 5: Polypharmacy status among participants.**

Total patients with polypharmacy	111 (74%)
<5 drugs	39 (26%)
5-10 drugs	96 (64%)
11-15 drugs	15 (10%)

**Table 6: Prevalence of PIMs in geriatrics.**

Total medications	981
Mean number of medication (range)	6.54
Number of patients with at least one PIM	50
Total number of PIM	60

polypharmacy and inappropriate medication among hospitalized patients in various departments of a tertiary care hospital.

The current study included nearly equivalent number of male and female geriatric patients. Majority of the patients belonged to the age group 65-70 years (56.6%), followed by age group 71 -80 years (34%), followed by age group 81-90 (8%), followed by patients above 91 years (1.3%) of age, similar to findings of other studies.<sup>6,9</sup>

**Table 7: Frequency of PIM prescribed according to Beers criteria.**

Drug classes	Percentage
NSAID's	36.6
Opioids	31.6
α-1 adrenergic receptor antagonist	10
Benzodiazepines	5
Antihistamine	5
Anti-cholinergic	3.3
Anti-Parkinson agents	3.3
Calcium channel blocker	1.6
Alpha-2 adrenergic agonist	1.6
Sulfonylureas	1.6

**Table 8: Classification of Beers criteria.**

Beers Classes	n%
Should be avoided	31.6% (19 drugs)
Should be avoid in certain conditions	16.6% (10 drugs)
Use with caution	51.6% (31 drugs)

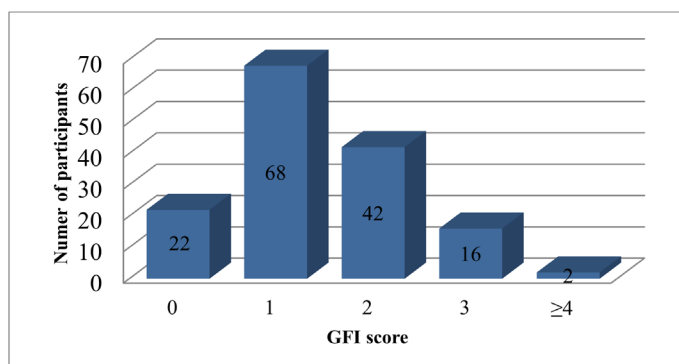
Number of co-morbidities is associated with growing age. Frailty implies a reduction in reserve capacity, resulting in decreased mobility, unintended weight loss, increased morbidity risk, and depression and anxiety. Early detection of frailty in older adults is possible with Groningen Frailty Indicator (GFI) which include 15 dichotomous items and can range from a total score of 0 (normal activity without restriction) to 15 (completely disabled). Participants with a GFI score of 4 and above were considered frail. In the present study 45.3% (68) participants were considered to be frail and 1.3% (2) participants were completely disabled (GFI Score ≥ 4), cannot carry on any self-care, totally confined to bed.

Polypharmacy in geriatrics is a result of multiple co-morbidities. In the current study 111 patients were prescribed with > 5 drugs during their admission at the hospital. In our study 74% (111) of participants were on polypharmacy which is slightly lower than one of the studies conducted by Kartik Janardan Salwe *et al.*, which showed 80% of polypharmacy in the patients admitted at a Tertiary Care Hospital in Pondicherry.<sup>9</sup>

Participants in the study had a comparatively high rate of potentially inappropriate medication use. The study identified 60 PIMs in 50 prescriptions of study participants as per Beers criteria. An Ethiopian study shows 40.3% Prevalence of PIM among evaluated prescriptions with Glibenclamide being the most common inappropriately prescribed drug.<sup>10</sup> In a study conducted by Parveen Bansal *et al.*, shows prevalence of PIM to be 61.9% as per 2019 beers criteria which is higher than prevalence seen in our study.<sup>11</sup> In the present study most frequently prescribed 3 classes of PIM were observed with NSAID's (36.6%), Opioids (31.6%) and α -1 adrenergic receptor antagonist (10%).

**Table 9: Potentially Inappropriate Medications according to Beer's criteria.**

Number of patients	Drugs	Total n%
	Avoid in certain condition	
1	Clonidine	1.6
8	Diclofenac	13.3
1	Etodolac	1.6
<b>Avoid</b>		
2	Atropine	3.3
1	Nifedipine	1.6
6	Prazosin	10
2	Triprolidine	3.3
2	Trihexyphenidyl	3.3
2	Alprazolam	3.3
1	Ketorolac	1.6
1	Glibenclamide	1.6
1	Lorazepam	1.6
1	Hydroxyzine	1.6
<b>Use With Caution</b>		
19	Tramadol	31.6

**Figure 2:** Frailty status of the study participant.

Several other drugs and drug classes account for the remaining PIM include Benzodiazepines (5%), Antihistamines (5%), Anticholinergic (3.3%), anti-parkinsonism agents (3.3%), Calcium channel blocker (1.6%), alpha-2 adrenergic agonist (1.6%) and Sulfonylureas (1.6%).

The present study results found an association between PIMs and Number of drugs prescribed to individual patients and showed a positive correlation. Even there was a positive correlation between the number of co-morbidities in participants and PIMs. These results are in line with previous studies where they observed association between PIMs and number of drugs prescribed and number of co morbidities.<sup>11</sup>

## CONCLUSION

The high prevalence of polypharmacy and PIM in geriatric patients has significant adverse impacts on healthcare outcomes. Attempts have been made in the current study to assess prescription for its inappropriateness utilizing BEERs criteria, which ought to be strictly utilized in everyday clinical practice. Further studies to assess the clinical implications of inappropriate prescribing have to be conducted and evaluated, which can be an indicative of scope for improvement in appropriate prescription.

The discrepancies in geriatric prescribing may be reduced to an acceptable level by sensitizing prescribers to the aforementioned aspects of geriatric prescribing, encouraging treatment of elderly as a unique risk population and emphasizing these aspects of prescribing in educational curriculum.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

## ABBREVIATIONS

**AGS:** American geriatric society; **DDI:** Drug-drug interaction; **STOPP:** Screening Tool of Older Persons Prescriptions; **START:** Screening Tool to Alert to Right Treatment; **GFI:** Groningen Frailty index; **ADR:** Adverse drug reactions; **DM:** Diabetes mellitus; **HTN:** Hypertension; **IHD:** Ischemic heart disease; **NSAID:** Non steroid anti-inflammatory drug; **PIM:** Potentially inappropriate medication; **PIP:** Potentially inappropriate prescription; **CKD:** Chronic kidney disease; **CNS:** Central Nervous system; **COPD:** Chronic obstructive pulmonary disease; **CAD:** Coronary artery disease; **AKI:** Acute kidney injury; **BA:** Bronchial asthma.

## SUMMARY

The outcome of the decision making process that optimizes overall improvement in individual health within the limitations of the society's resources is appropriate prescribing. The prescription of a drug is considered reasonable if the benefits outweigh the hazards. There is no doubt that medicines are necessary to treat a disease condition, but giving patients unnecessary doses of drugs will increase safety concerns. The present study concludes that assessing appropriateness in prescriptions using different tools



reduces the number of inappropriate prescriptions in elderly people by reducing the number of irrational drugs prescribed.

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