Research Article

# Assessing Medication Appropriateness: A Prospective Observational Study At A Tertiary Care Hospital Using Beers, Start/Stopp Criteria, And Polypharmacy Analysis

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## ABSTRACT

The elderly population has shown a consistent increase in recent years. In terms of drug prescriptions, this group is notably at risk due to factors like polypharmacy and physiological changes related to aging, making them more vulnerable to the adverse effects of medications. Various tools, such as Beer's criteria, Screening Tool of Older Persons' Prescriptions (STOPP), and Screening Tool to Alert to Right Treatment (START), are used to evaluate the appropriateness of prescriptions for geriatric patients. The primary aim of the study was to explore the correlation between Potentially Inappropriate Medications (PIMs), assess polypharmacy, drug interactions, and check the appropriateness of prescriptions among geriatric patients at a tertiary care hospital. Over a 7-month period, a prospective observational study was conducted on patients aged over 65, using a validated data collection form. Findings revealed that 74% of prescriptions exhibited polypharmacy, with 495 identified instances of Drug-Drug Interactions among the 150 participants. Notably, 33.3% of patients were found to be using at least one potentially inappropriate medication according to Beer's criteria. STOPP criteria identified a total of 18 such medications, while START criteria pinpointed 27 instances of prescribing omissions among the 150 prescriptions. The study also established a positive correlation between the number of prescribed drugs, existing medical conditions, and the presence of potentially inappropriate medications. The prevalence of polypharmacy, associated drug interactions, and PIMs among the geriatric population significantly impacts healthcare outcomes. It's crucial to consider these various criteria, often considered the gold standard, before prescribing medications to this demographic.

## INTRODUCTION

Aging is a biological process governed by factors beyond human control, often likened to an

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incurable illness. According to the 2011 census, India's elderly population has been steadily growing by 8.6%. Projections estimate an increase from 138 million in 2021 to 194 million by 2031, marking a 41% rise, as reported by the National Statistical Office (NSO) in their 'Elderly in India 2021' report [2].

The geriatric population stands as the most significant consumers of medication among various age groups. Ensuring safe prescription practices for this vulnerable group demands heightened vigilance, given their increased susceptibility to adverse drug reactions (ADRs) due to physiological changes affecting drug processing [3]. Chronic illnesses and extensive medication use among the elderly escalate the risk of inappropriate drug consumption. This inappropriate use not only adversely impacts patients but also drives up healthcare expenses. The term 'polypharmacy' lacks a universally agreed-upon definition but generally refers to the use of multiple medications by an individual. In this study, polypharmacy was considered when a patient used five or more medications simultaneously [5].

Apart from polypharmacy, inappropriate prescribing practices present a significant challenge. Such practices are associated with harmful effects on geriatric patients. Various tools, such as Beer's criteria, Screening Tool of Older Person's Prescriptions (STOPP) criteria, and Screening Tool to Alert doctors to Right Treatment (START) criteria, are commonly employed to assess the appropriateness of medications in geriatric care [6], [7], [8].

The Beer's criteria, also known as the Beer's list, assists medical practitioners in enhancing the safety of medication prescriptions for older adults (geriatrics) aged over 65. These guidelines encompass a list of medications where the potential risks might outweigh the benefits for individuals in this age group. By considering this information, doctors can minimize the adverse effects of such medications.

Formulated by Geriatrician Mark H. Beers, the Beers Criteria was developed using an expert consensus panel employing the Delphi method. Initially published in the Archives of Internal Medicine in 1991, it underwent subsequent revisions in 1997, 2003, 2012, 2015, and the most recent update took place in January 2019

## MATERIALS AND METHODS

**STUDY DESIGN**: Prospective Observational study.

**STUDY SITE**: The study was conducted at Srinivas Institute of Medical Science and Research Centre, Mukka-574146.

**STUDY DURATION**: The study was conducted for duration of 7 months from January 2022 to July 2022.

**SAMPLE SIZE**: The study was limited for 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 ≥ 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 h) 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 SPSS software (version 27). Karl Pearson correlation was used to observe relationship between PIMs and co morbidity and PIMs with number of drugs prescribed.

## RESULT

### 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 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).

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

| Population characteristics | Number |
|---|---|
| Total patients | 150 |
| Male | 76 |
| Female | 74 |

| Age group (in years) | |
|---|---|
| 65-70 y | 85 |
| 71-80 y | 51 |
| 81-90 y | 12 |
| >91 y | 2 |

### 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).

**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 |

**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 |

### 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 4).

**Table 4: Polypharmacy status among participants.**

| Total patients with polypharmacy | 111(74%) |
|---|---|

| <5 drugs | 39 (26%) |
|---|---|
| 5-10 drugs | 96 (64%) |
| 11-15 drugs | 15 (10%) |

## 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 5).

**Table 5: 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 |

### 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 α-1 adrenergic receptor antagonist (10%) (Table 6 and Figure 1).

**Table 6: 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 |

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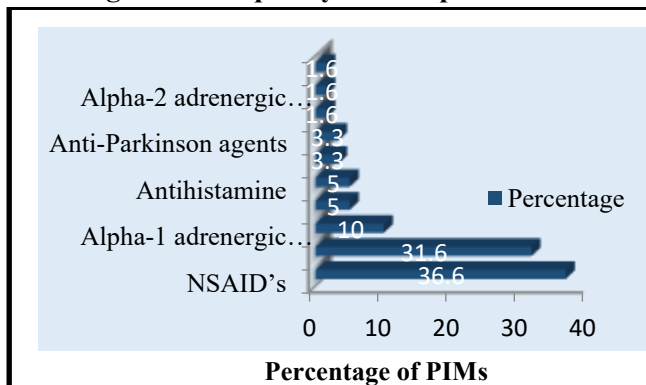


### BEERS criteria classification

PIMs identified using the criteria were grouped into three categories as per updated 2019 Beers criteria (Table 7).

**Table 7: 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) |

### Drug-drug interaction

Out of 150 prescriptions 120 prescriptions had at least one drug-drug interaction. Out of 120 prescriptions with DDIs, 1-2 Drug interactions were present in 49 prescriptions, 3-4 DDI's were found in 31 prescriptions,5-6 DDI's in 19 prescriptions and more than 7 DDI's were found in 21 prescriptions. In total 495 DDI's were detected among prescription of study participants.

**Figure 2: Number of prescriptions containing DDI's**
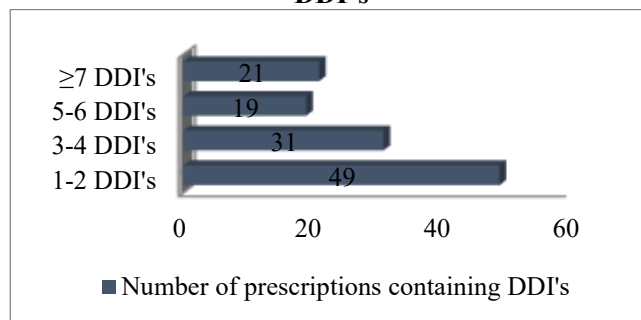


### Analysis of drug–drug interactions

Among the 495 DDIs detected there were 21 number of interactions that were classifiable as "X" and Table enlists the common DDIs encountered in "X" category where these combinations have to be avoided.58 number of interactions that were detected of "D" type where drug therapy has to be modified and 285 interactions were of category "C" where drug therapy needs to monitoring.

**Table 8: Potential DDI according to severity and rating**

| Category | Description | Number of Drug-Drug interactions |
|---|---|---|
| X | Avoid combination altogether | 21 |

| | | |
|---|---|---|
| D | Consider therapy modification | 58 |
| C | Monitor given therapy | 285 |

**Drug-Drug interactions resolved**

All the 495 interactions that were identified were bought to the notice of treating physicians, out of which only 137 DDI's were resolved by either modifying the therapy or by avoiding the combination.66.6% (14) of DDIs belonging to Category X were resolved by avoiding combination.

**Table 9: Drug-Drug interactions resolved**

| Category | No. Of DDIS Identified | No. Of DDIS Resolved |
|---|---|---|
| X | 21 | 14 |
| D | 58 | 32 |
| C | 285 | 91 |

**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.[6] The current study aimed to assess the proportion of geriatric patients receiving 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.[6,9] Number of co-morbidities is associated with growing age. 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.[9] 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.[10] 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.[11] 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 10: 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 |
| | **AVOID** | |

| | | |
|---|---|---|
| 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 |
| | **USE WITH CAUTION** | |
| 19 | Tramadol | 31.6 |
| 12 | Aspirin | 20 |

## 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 prescri bing 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.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ETHICAL APPROVAL
The study was approved by the Institutional Ethics Committee.

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