

RESEARCH ARTICLE

Assessing prescriptions for potentially inappropriate medications using Beer's criteria in elderly in-patients at a tertiary care hospital

Shukrath Chandrappa, Divya R, Kavitha Rajarathna

Department of Pharmacology, Bangalore Medical College and Research Institute, Bengaluru, Karnataka, India

Correspondence to: Kavitha Rajarathna, E-mail: kavitharajarathna@gmail.com

Received: November 18, 2018; Accepted: December 11, 2018

ABSTRACT

Background: The elderly population is growing rapidly worldwide. Many are suffering from multimorbidity. Inappropriate prescribing in the elderly can cause substantial morbidity and results in clinical and economic burden to patients and society at large. Gaining insight into physicians prescribing patterns to recognize prescribing problems is the fundamental first step in trying to improve the quality of prescribing. **Aims and Objectives:** The aim of the study was to assess the appropriateness of prescriptions using Beers criteria 2015. **Materials and Methods:** A cross-sectional study conducted at a medicine in-patient department of a tertiary care hospital over a period of 3 months. All the in-patients aged above 60 years were included in the study. The World Health Organization core prescribing indicators were used to analyze the prescriptions. Potentially inappropriate medicines (PIM) were identified using the Beers criteria. **Results:** A total of 300 in-patient prescriptions were studied. Of these 178 (59.34%) were male patients. 222 (74%) were 65–75 years age group. A total of 2175 drugs were prescribed. Average drug exposure per patient was 7.25. Based on 2015 Beers criteria, 86 (28.6%) of them had one or more PIM. Among 2175 prescribed drugs, 48 drugs were identified as drugs that generally should be avoided in older adults and 76 medications were to be used with caution in elderly. **Conclusion:** Polypharmacy and PIMs are prevalent. There is a need for guidelines for the use of drugs in the elderly, and further studies are needed on this issue.


KEY WORDS: Beers Criteria; Elderly; Drug Use Pattern; Potentially Inappropriate Medication; Polypharmacy

INTRODUCTION

The population of the elderly is increasing rapidly worldwide, and as per Population Census 2011, there are nearly 104 million elderly persons (aged 60 years or above) in India.^[1] Elderly people are prone to chronic and degenerative pathophysiology leading to polypharmacy. Various characteristics of aging affect medication prescribing for the

elderly population and render the selection of appropriate pharmacotherapy a challenging and complex process.^[2,3] Prescription of medicines is an essential element in the care of elderly people, and optimization of drug prescribing for this group of patients has become an important public health issue worldwide.^[2,4]

Use of drugs in elderly people is often inappropriate, partly due to the complexities of prescribing in elderly patients and presence of several comorbidities and associated poly-medication, exposing them not only to adverse drug reactions (ADR) but also to drug interactions and compliance errors.^[5] Beers criteria are the most frequently cited comprehensive set of explicit criteria in older persons to assess inappropriate prescriptions.^[6] It has proven useful in identifying drugs to be potentially avoided in older

Access this article online	
Website: www.njppp.com	Quick Response code 
DOI: 10.5455/njppp.2019.9.1236011122018	

National Journal of Physiology, Pharmacy and Pharmacology Online 2019. © 2019 Kavitha Rajarathna *et al.* This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), allowing third parties to copy and redistribute the material in any medium or format and to remix, transform, and build upon the material for any purpose, even commercially, provided the original work is properly cited and states its license.

adults, to reduce adverse drug events and drug-related problems and improve medication selection and overall medication safety. The original Beers criteria published in 1991 are regularly reviewed and updated by the American geriatric society (AGS).^[7] The present Beers criteria 2015 are an updated version that includes drugs to always avoid, drugs to use with caution, drug-disease interactions, drug-drug interactions, and drugs to be avoided or dose reduced with varying levels of kidney function.

Inappropriate prescribing can cause substantial morbidity, with the unfavorable clinical outcome and add to the economic burden of the patients and society.^[2] Hence, this study was conducted to review the prescriptions of all elderly inpatients in the medicine ward for potentially inappropriate medication using AGS Beers criteria 2015.

MATERIALS AND METHODS

After obtaining clearance from the Institutional Ethics Committee, this cross-sectional study was conducted in the inpatient ward of the department of general medicine at a tertiary care teaching hospital in Bengaluru for a period of 3 months. Patients of age 60 years and above of both sexes were enrolled in the study after taking informed consent. Patients on ventilators or critically ill patients requiring intensive care unit admission were excluded.

The relevant data were collected from case records and evaluated for the World Health Organization (WHO) core prescribing indicators, average number of drugs per prescription, percentage of drugs prescribed by generic name, percentage of encounters with an antibiotic prescribed, percentage of encounters with an injection prescribed, percentage of drugs prescribed from national list of essential medicine (NLEM), distribution of comorbidities, category-wise distribution of drugs (taking into consideration the number of active ingredients in a multidrug formulation), and reviewed for potentially inappropriate medication using AGS Beers criteria 2015. The data thus obtained were analyzed using descriptive statistics.

2015 AGS Beers Criteria^[7]

Beers criteria for potentially inappropriate medicine (PIM) Use in Older Adults are an explicit list of PIMs avoided in older adults:

- A. Drugs that generally should be avoided in older adults
- B. Drugs to be avoided in combination with specific comorbidities
- C. Drugs to be used with caution
- D. Drug-drug interactions that should be avoided in elderly
- E. Drugs to be avoided or dosage reduced with varying levels of kidney function.

RESULTS

A total of 300 in-patients records were reviewed. 59.34% of patients were males (178/300). The age of patients ranged from 60 to 98 years, 74% of (222) patients belonged to 60–75 years age group [Figure 1]. The morbidity pattern was respiratory disorders 28.3%, neurological disorders 19.3%, and infectious diseases 15.7% [Figure 2]. The comorbidity pattern was diabetes mellitus 35.8%, hypertension 30.7%, and both 24.33%.

A total of 2175 drugs were prescribed with an average of 7.25 drugs per prescription (Range: 2–18), of which 24.8% were drugs acting on gastrointestinal (GI) system followed by antimicrobials (22.5%) [Figure 3]. Among the GI drugs, antiulcer drugs and antiemetics were the most frequently prescribed drugs (8.4% and 6.4%, respectively). 22.5% were antimicrobials with ceftriaxone being most commonly used. In the present study, 16.5% of the drugs were prescribed by its generic name. 57% of drugs were given parenterally, 36% by oral route and 7% through inhalational route. 16.5% of prescriptions had at least three antimicrobial drugs (Range-0–5), and 37% of prescriptions were having two antibiotics. 15% of the drugs prescribed were fixed-dose combinations (FDC), with the majority of them being drugs acting on the respiratory system and antimicrobials. 90.8% of prescribed drugs were present in the NLEM list.

On application of Beers criteria, 2015 to all the 300 prescriptions, 86 (28.6%) of them had one or more PIM. A total of 2175 drugs were prescribed, of which 48 drugs were identified as drugs that generally should be avoided in older adults. Prescriptions with nitrofurantoin were 14 and prescriptions with hyoscine were 12. Prescriptions with nifedipine, chlorpheniramine, and atropine were 6 each followed by 4 prescriptions of lorazepam. Prescriptions containing the drugs to be avoided in combination with specific comorbidities were 10, in which, 5 cases of heart failure were prescribed nonsteroidal anti-inflammatory drugs (NSAIDs), and 5 cases of delirium received lorazepam or ranitidine. In the present study, 76 medications were to be used with caution in the elderly. These were diuretics 17.33% (52) and vasodilators 5.6% (17) followed by aspirin 2% and carbamazepine 0.3%. A total of 16 potential drug-drug interactions were identified that could have been avoided in elderly. 6 cases with reduced creatinine clearance received ranitidine [Table 1].

DISCUSSION

Toxic effects of medications and drug-related problems can have profound medical and safety consequences for older adults and economically affect the health-care system.^[8] Polypharmacy is one of the major risk factors for drug-related problems. The definition polypharmacy is variable, but the most frequently used definition is, the use of five or more medications in a single prescription.^[9] In the present study, an average of 7.25 drugs was prescribed per prescription,

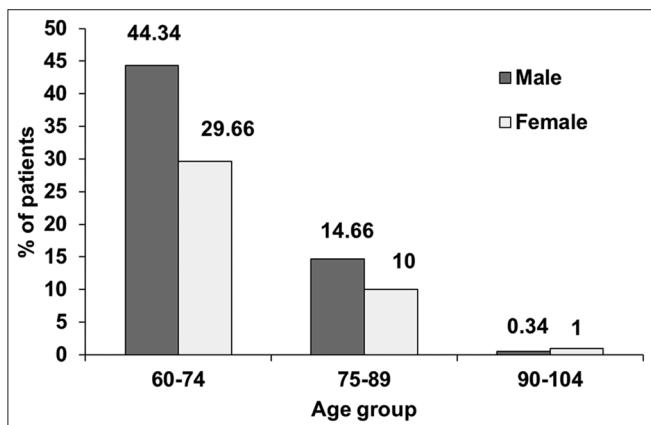


Figure 1: Age and gender distribution of the patients

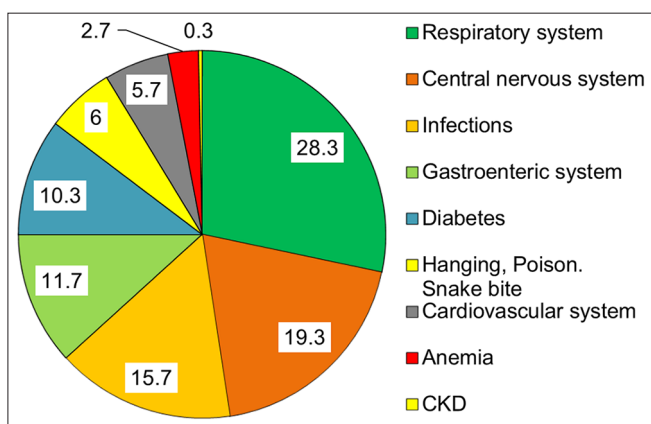


Figure 2: Morbidity pattern of the elderly patients

which is lesser compared to studies conducted by Sapkota *et al.*^[10] and Abraham *et al.*^[11] (9.8 and 9.09, respectively). Polypharmacy is related to inappropriate prescriptions, drug interactions, adverse effects, increase in the cost of therapy, and non-compliance. As the study population was elderly in-patients with comorbidities, average drugs per prescriptions were high. Hence, it requires us to understand the need for the drugs and its benefit to the condition of the patient before concluding as polypharmacy.

In the present study, there was a male preponderance, similar to the study conducted by Abraham *et al.*^[11] The most common morbidity resulting in hospitalization was respiratory disorders, namely acute exacerbation of chronic obstructive pulmonary disease (COPD) and lower respiratory tract infection (LRTI) followed by disorders affecting the central nervous system and the most common being cerebrovascular accident (CVA). This morbidity pattern is comparable to the studies conducted by Veena *et al.*^[12] in Bengaluru and Shankar *et al.*^[13] in Katmandu. This pattern of morbidity is not uncommon among elderly as age-related changes in pulmonary function, such as impaired mucociliary clearance and diminished pulmonary host defenses, makes them prone for respiratory morbidities and age is an important non-modifiable risk factor for CVA.

Majority of drugs prescribed to the study population were those acting on GI system mainly histamine-2 receptor blockers and proton pump inhibitors. This could be attributed

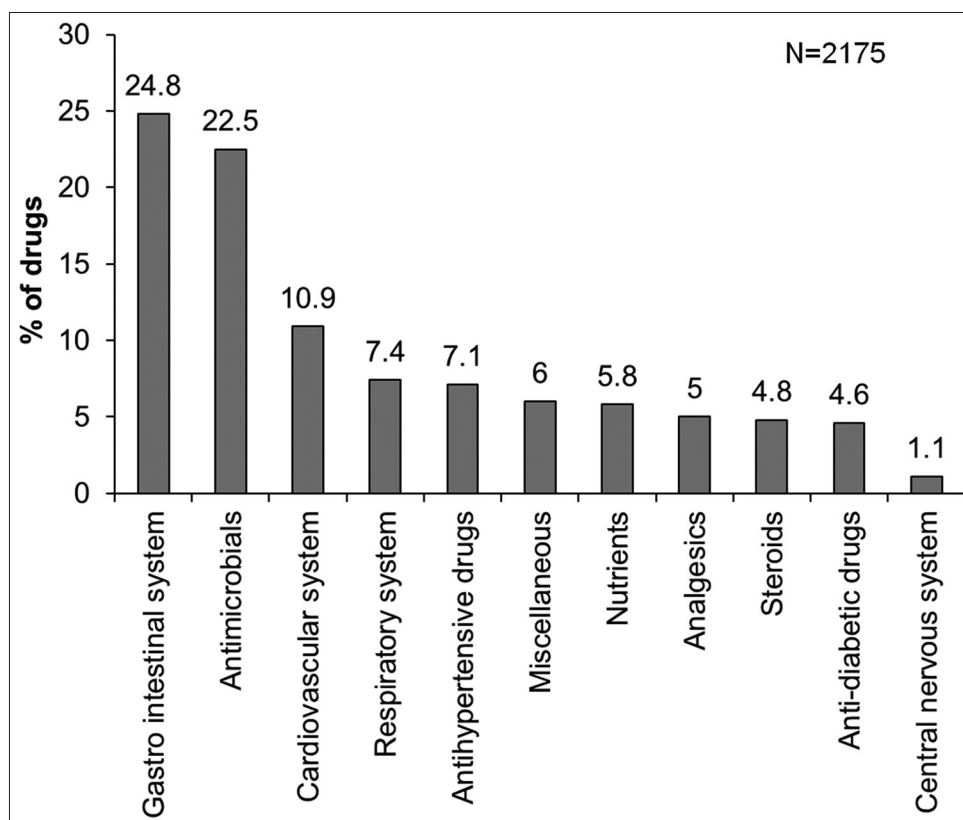


Figure 3: System-wise drug utilization pattern in elderly patients

Table 1: Potentially inappropriate medications using Beer's criteria in elderly patients

Drugs that generally should be avoided in older adults		
Drugs	Number of prescription	
Nitrofurantoin	14	
Hyoscine	12	
Nifedipine	6	
Chlorpheniramine	6	
Atropine	6	
Clonazepam	3	
Lorazepam	1	
Total	48	
Drugs to be avoided in combination with specific comorbidities		
Comorbidities	Drugs	Number of prescription
Heart failure	NSAIDs	5
Delirium	Ranitidine	4
	Lorazepam	1
Drugs to be used with caution		
Drugs	Number of prescription	
Diuretics	52	
Vasodilators	17	
Aspirin(<80 Crcl)	6	
Carbamazepine	1	
Drug-drug interactions that should be avoided in Elderly		
Drug-drug interaction	Number of drug-drug interactions	
NSAIDs-corticosteroid	16	
Drugs to be avoided or Dosage reduced with varying levels of kidney function		
Drugs	Number of prescription	
Ranitidine (<50 Crcl)	6	

NSAIDs: Nonsteroidal anti-inflammatory drug

to the high prevalence of *Helicobacter pylori* infection and increasing prescriptions of drugs damaging gastro-duodenal mucosa, such as NSAIDs and/or aspirin (acetylsalicylic acid) in the elderly population.^[14] This was followed by systemic antimicrobials to combat infections such as LRTI, urinary tract infection, and gastroenteritis which were common ailments in the study population, due to the age-related progressive impairment in immune function making them more susceptible to infections.^[15] This pattern was similar to the study done by Veena *et al.*

In the present study, the majority of drugs were given through parenteral route mainly injections followed by inhalational route, as the study populations were in-patients and parenteral route in the elderly gives the benefit of faster action, less gastrointestinal irritation, and higher systemic availability. The drugs given by parenteral route were IV fluids and antimicrobials, mainly ceftriaxone, metronidazole, and the

combination of piperacillin and tazobactam for infections such as pneumonia, gastroenteritis, and sepsis. Bronchodilators and inhalational corticosteroid were administered by inhalational route for COPD and pneumonia. The percentage of drugs given by parenteral route is comparatively lower to the findings in the studies conducted by Shankar *et al.*^[13] and Mandavi and Tiwari.^[16] This is because both the studies have included in-patients of surgical specialties and medical specialties, whereas the present study, included only in-patients of the medicine department.

Drugs prescribed by its generic name were higher compared to studies conducted by Nayaka *et al.* (8.9%)^[17] and Narvekar *et al.*,^[18] this could be attributed to increasing awareness about prescribing medicines using generic names. However, it was low as per the WHO recommendation of 100%, thus requiring more effective promotion of better prescription practices.

The prescriptions containing FDCs of the study population were low, and the combinations were rational. Commonly prescribed FDCs were the combination of piperacillin and tazobactam, salbutamol and ipratropium, and aspirin and atorvastatin followed by the combination of telmisartan and hydrochlorothiazide. All of these combinations were synergistic and rational. Prescription of rational FDCs is known to decrease the pill burden thus increasing medication compliance in the elderly population.

When analyzing the prescriptions of the present study using 2015 Beers criteria, the most common PIMs prescribed to the elderly were diuretics, vasodilators, nitrofurantoin, and anticholinergics. Diuretics have to be used with caution in elderly as these are known to cause or exacerbate syndrome of inappropriate antidiuretic hormone secretion or cause hyponatremia and thereby making it mandatory to monitor sodium levels when starting or changing the dose of diuretics.^[7] Vasodilators are known to increase the risk of syncope in the elderly. Anticholinergics such as hyoscine, atropine, and the first generation antihistaminics, all are known to have reduced clearance in elderly^[15] causing anticholinergic toxicity resulting in dry mouth, constipation, delirium, and confusion. Nitrofurantoin, as a urinary antiseptic in elderly, is one of the drugs that have been included in updated Beers criteria 2015 as PIMs because it has the potential for pulmonary toxicity, hepatotoxicity, and peripheral neuropathy, especially with long-term use and has to be avoided in patients with creatinine clearance <30 mL/min.^[7]

The number of prescriptions containing PIMs was relatively low as compared to the study done by Narvekar *et al.*^[18] (44%). In previous studies,^[12,13] PIMs are relatively lesser than the present study as they followed Beers criteria 2012. This inconsistency is because the 2015 Beers Criteria have several significant updates, including the addition of new drugs, the addition of selected medications for which dose

adjustment is required based on kidney impairment, and the addition of selected drug-drug interactions. This was done using a comprehensive, systematic review, and grading of the evidence on drug-related problems and adverse drug events. The prescriptions of PIMS may be attributed to the less awareness about the evidence-based guideline for appropriate prescribing in the elderly patients and the existence of particulars justifying exceptions to the rules in individual persons. Elderly patients suffer ADRs caused by suboptimal or inappropriate drug prescriptions, but Beers criteria do not address the suboptimal prescriptions.

Limitations of the study were that it was a cross-sectional study with only PIMs were noted using Beers criteria 2015 and the follow-up of the patients receiving PIMs was not done to verify the real-time adverse reactions in the elderly population.

CONCLUSION

Polypharmacy and PIMs are prevalent in elderly and are potential risk factors for drug-related problems. Hence, optimization of drug prescribing for the elderly is the need of the hour, and there is an urgent need for guidelines in India, to define and categorize appropriate prescribing in the elderly. It also calls for a critical review of the tools that are available to measure the inappropriate prescriptions and their effects and discuss their predictive validity in Indian population. More so physicians have to integrate clinical and pharmacological perspectives when reviewing medications for the elderly.

ACKNOWLEDGMENTS

The authors would like to thank the Faculty of the Department of Pharmacology, BMC, and RI, Bengaluru, for their support in conducting the study.

REFERENCES

1. Borah H, Shukla P, Jain K, Kumar SP, Prakash C, Gajrana KR. Elderly in India Central Statistics Office Ministry of Statistics and Programme Implementation, Government of India; 2016 Available from: www.mospi.nic.in/sites/default/files/publication_reports/ElderlyinIndia_2016.pdf. [Last cited on 2018 Aug 07].
2. Spinewine A, Schmader KE, Barber N, Hughes C, Lapane KL, Swine C, *et al.* Appropriate prescribing in elderly people: How well can it be measured and optimised? *Lancet* 2007;370:173-84.
3. Hedna K, Hakkarainen KM, Gyllensten H, Jönsson AK, Petzold M, Hägg S. Potentially inappropriate prescribing and adverse drug reactions in the elderly: A population-based study. *Eur J Clin Pharmacol* 2015;71:1525-33.
4. Straand J, Rokstad KS. Elderly patients in general practice:

Diagnoses, drugs and inappropriate prescriptions. A report from the more and Romsdal prescription study. *Fam Pract* 1999; 16:380-8.

5. Zaveri HG, Mansuri SM, Patel VJ. Use of potentially inappropriate medicines in elderly: A prospective study in medicine out-patient department of a tertiary care teaching hospital. *Indian J Pharmacol* 2010;42:95-8.
6. Ryan C, Mahony D, Kennedy J, Weedle P, Byrne S. Potentially inappropriate prescribing in an Irish elderly population in primary care. *Br J Clin Pharmacol* 2009;68:936-47.
7. American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American geriatrics society 2015 updated beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2015;63:2227-46.
8. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean JR, Beers MH. Updating the beers criteria for potentially inappropriate medication use in older adults. *Arch Intern Med* 2003;163:2716-24.
9. Vrdoljak D, Borovac JA. Medication in the elderly-considerations and therapy prescription guidelines. *Acta Med Acad* 2015;44:159-68.
10. Sapkota S, Pudasaini N, Singh C, Sagar GC. Drug prescribing pattern and prescribing error in elderly: A retrospective study of inpatient record. *Asian J Pharm Clin Res* 2011;4:129-32.
11. Abraham F, Varughese G, Mathew JC, John PM, Sam GK. Drug utilization pattern among geriatric patients admitted in medical intensive care unit of a tertiary care teaching hospital. *Asian J Pharm Clin Res* 2015;8:281-3.
12. Veena DR, Padma L, Patil S. Drug prescribing pattern in elderly patients in a teaching hospital. *J Dent Med Sci* 2012;1:39-42.
13. Shankar PR, Upadhyay DK, Subish P, Bhandari RB, Das B. Drug utilisation among older inpatients in a teaching hospital in western Nepal. *Singapore Med J* 2010;51:28-34.
14. Pilotto A, Franceschi M, Maggi S, Addante F, Sancarlo D. Optimal management of peptic ulcer disease in the elderly. *Drugs Aging* 2010;27:545-58.
15. Montecino-Rodriguez E, Berent-Maoz B, Dorshkind K. Causes, consequences, and reversal of immune system aging. *J Clin Invest* 2013;123:958-65.
16. Mandavi, Tiwari P. Profile of pharmacotherapy in elderly Indian patients; Preliminary finding. *Int J Risk Saf Med* 2006; 18:151-7.
17. Nayaka SR, Rajeshwari B, Venkatadri TV. Drug utilization pattern in geriatric inpatients of medicine department in a tertiary care teaching hospital. *Int J Basic Clin Pharmacol* 2015; 4:568-73.
18. Narvekar RS, Bhandare NN, Gouveia JJ, Bhandare PN. Utilization pattern of potentially inappropriate medications in geriatric patients in a tertiary care hospital: A retrospective observational study. *J Clin Diagn Res* 2017;11:FC04-8.

How to cite this article: Chandrappa S, Divya R, Rajarathna K. Assessing prescriptions for potentially inappropriate medications using Beer's criteria in elderly in-patients at a tertiary care hospital. *Natl J Physiol Pharm Pharmacol* 2019;9(2):145-149.

Source of Support: Nil, **Conflict of Interest:** None declared.