

Assessing potentially inappropriate medications use among Pakistani geriatric patients based on 2019 Beer's Criteria: A cross-sectional study

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Author's Contribution

¹ Conceptualization, Data analysis and interpretation, Manuscript drafting, and critical review

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Article Info.

Conflict of interest: Nil

Funding Sources: Nil

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Article information

Submission date: 04-05-2024

Acceptance date: 26-12-2024

Publication date: 31-12-2024

Cite this article as: Noor S, Ijaz A, Iftikhar L, Waqar M, Shoaib Z, Khan W. Assessing potentially inappropriate medications use among Pakistani geriatric patients based on 2019 Beer's Criteria: A cross-sectional study. JSTMU. 2024; 7(2):142-148.

A B S T R A C T

Introduction: Geriatric patients frequently develop drug-related problems due to alterations in age-related pharmacokinetics and pharmacodynamics. Consequently, selecting an appropriate pharmacotherapy for older adults is challenging. Furthermore, potentially inappropriate medications (PIMs) in such patients are associated with adverse health consequences, repeated hospitalization, and a higher risk of mortality. This study assessed the PIMs based on the 2019 Beer's Criteria among hospitalized geriatric patients.

Methodology: An observational cross-sectional study was conducted from May to June 2023. Data was collected from two hospitals in Abbottabad, Khyber Pakhtunkhwa. Hospitalized patients aged ≥ 60 years were included in the study. Patients who were at the end of their lives and in intensive care units were excluded. PIMs were identified using Beer's Criteria 2019, while potential drug-drug interactions (pDDIs) were identified using a Drug-interaction checker.

Results: Out of 100 geriatric patients' prescriptions, males (71%), age range 65-70 years (58%), and patients having intermediate education (34%) were predominant. Approximately, 83% of patients received PIMs, of which, 63% received PIMs of category A. Omeprazole (42%), dexamethasone (18%), and aspirin (16%) were frequently prescribed PIMs. Polypharmacy and pDDIs were observed in 38% and 37% of prescriptions, respectively. A total of 17 prescriptions had major pDDIs. No statistically significant association was observed for PIMs use with patient characteristics such as age, gender, and hospital stay.

Conclusion: This study identified a high prevalence of PIMs, polypharmacy, and pDDIs. Omeprazole is a commonly identified PIM, while category A PIMs are frequently detected. Geriatric patients' prescriptions should be thoroughly reviewed for any possible inappropriate medicines and DDIs so that rational medicines can be provided to such patients.

Keywords: Beer's criteria, Geriatrics, Pakistan, Potentially inappropriate medicines, Khyber Pakhtunkhwa, Abbottabad

Introduction

Worldwide the elderly population is projected to reach nearly 2.1 billion by 2050.¹ This rising trend of the elderly population is also witnessed in Pakistan. Approximately 7% of the population is over 60 years of age. Alarming, it is expected to reach 8.5% and 12.9% in 2030 and 2050,

respectively.² Thus, elderly individuals in Pakistan make up a high proportion of the population. Elderly individuals are more likely to consume a higher burden of pharmaceutical expenditures because of chronic diseases, disabilities, and dependencies which undoubtedly lead to greater

healthcare costs, non-adherence medication, increased risk of adverse drug reactions (ADRs), and drug-drug interactions (DDIs), reduced functional capacity, and multiple geriatric syndromes.³⁻⁶ Additionally, older adults are predominantly exposed to drug-related problems due to alterations in age-related pharmacokinetics and pharmacodynamics.⁷ So those alterations may further enhance the ADR risk, increase the hospitalization and disability rates, and impose an economic burden on the healthcare system.⁸ All these changes challenge the selection of an appropriate pharmacotherapy for older adults.

Polypharmacy is the concomitant administration of five or more medications and is not always avoidable among older adults. It also exposes geriatrics to the prescription of inappropriate medications and carries a risk of morbidity, mortality, and economic burden.⁵ For these reasons, spreading the culture of appropriate prescribing for geriatric patients in different clinical settings is important. Several tools are used to evaluate the prescription of potentially inappropriate medication (PIM) in older adults.⁹ PIM is a drug in which its risk of an adverse event outweighs its clinical benefit, particularly when there exists a safer or more effective alternate therapy for the same condition.¹⁰ Among all the tools, Beer's criteria is the most frequently used of those explicit methods for determining PIMs. American Geriatric Society developed this criterion to assist healthcare practitioners in improving medication safety and quality of care in older adults and reducing their exposure to PIMs. The Beers list was expanded to include all geriatric care settings, such as inpatient, outpatient, and primary care. This list was last updated in 2019.¹¹

Since the early 1990s, more than 500 studies evaluated the prevalence of PIMs usage among older patients in different settings such as ambulatory care,¹² in-patients, and community and home care centers.¹³⁻¹⁶ In the case of Pakistan, there are a few studies that have reported the prevalence of PIMs among elderly patients.¹⁷⁻²⁰ Most of these studies have predominantly focused on a single region of Pakistan, particularly Punjab and Sindh.¹⁸⁻²⁰ While up to our knowledge, the Khyber Pakhtunkhwa region is out of the scope of these studies. Additionally, the available studies have used older versions of Beer's criteria. Unfortunately, the available literature is scarce on

regional, provincial, and national levels that will give insight into the utilization of PIMs by the Pakistani elderly population. It can provide local prevalence data that will help in the improvement of guidelines for the management of diseases in geriatric patients. Moreover, such studies will determine the impact of medicines on a community level, provide a landmark for stakeholders in making policies, and prioritize medical needs. Therefore, the current study aimed to evaluate the prevalence and type of PIMs as well as polypharmacy and pDDIs in elderly patients hospitalized at two tertiary care hospitals in the Abbottabad region.

Methodology

An observational cross-sectional study was conducted during May to June 2023. Data was collected from all the wards of two hospitals of Abbottabad city of Khyber Pakhtunkhwa Province i.e., Abbottabad International Medical Institute Hospital (AIH) and Jinnah International Hospital (JIH). Abbottabad is the 40th largest city in Pakistan and the fourth largest in the province of Khyber Pakhtunkhwa by population. According to 2017 statistics, the Abbottabad region has a population of 1332912.²¹ There is no proper estimation of the elderly population in the Abbottabad district. AIH is located at N-35 Abbottabad, Khyber Pakhtunkhwa. JIH is located at Nawan Shehr Town, Abbottabad, Khyber Pakhtunkhwa, and is a 250-bed hospital having 14 different departments/specialties. Both these hospitals provide healthcare facilities to the main population of Abbottabad. In both hospitals, the record of hospital medications is available in hard form and manually maintained by the hospital staff.

Elderly patients aged ≥ 60 years (according to the WHO definition of elderly), mentally sound and responsive, given verbal consent, admitted to any of the hospitals' wards during the study period, and prescribed at least one medication were included in the study. Elderly patients have incomplete files or records of medications, are mentally not sound and responsive, avoid participating in studies, and were admitted to the Intensive Care Unit having an exacerbation of chronic diseases or infections, end-stage life-threatening diseases, providing pre-and post-surgery medical care, and palliative care were excluded. A sample of 100 geriatric patients based on

convenient sampling and a fixed time frame of data collection was included.

The following data points were collected: patient demographics and identification, hospital data, and disease, and medication-related data. These data collection points were finalized by three experts from the field of Pharmacy Practice. When data were compiled from the hospitals, then PIMs were identified using an updated version of Beer's criteria 2019.¹¹ Identifying PIM requires a comprehensive assessment of the patient's medical history, current medications, and individual factors such as age, health conditions, comorbidities, and drug interactions. Prevalence of the PIMs was identified. Categorization of PIMs was followed as; category A = Medicines that should be avoided in elderly patients, category B = Medicines that should be used with caution, category C = Medicines that should be avoided in specific circumstances, category D = Medicines avoided due to DDIs, category E = Medicines that should be avoided or reduce dose in renal impairment. Two researchers independently reviewed the medications of each patient and assessed PIMs. Any inconsistencies between the two researchers were resolved with the help of a third researcher.

DDIs were identified using freely available Drug interaction screening tools i.e., Drug interaction checker by Medscape. DDIs were classified based on the severity level provided by the interaction checker. Polypharmacy was identified as the number of prescribed drugs that are more than five per prescription. Descriptive and inferential statistics were used to describe the study population. Data was entered into the Excel sheet and then analyzed through SPSS v22.

Results

Table 1 shows that 100 case records were analyzed during the study period. Most of the patients were in the age group of 60 to 70 years (58%). The study population comprised 71% males and 29% females. Hospital stays predominantly lasted 4-6 days (53.5%), with the most frequent diagnosis of COPD (13%) and Stroke (12%). According to Beer's Criteria 2019, 83% of our patients received at least one PIMs (Table 2). Polypharmacy was identified in 38 patients, and DDIs were observed in 37

patients, with a major type of interaction identified in 17 patients.

Table 1: General characteristics of study participants (N= 100)

Variables	Frequency	Percentage
Age (years)		
60-70	58	58%
71-80	30	30%
≥ 80	12	12%
Gender		
Male	71	71%
Female	29	29%
Personnel status		
Married	88	88%
Divorced	7	7%
Widowed	4	4%
Single	1	1%
Employment status		
Unemployed	76	76%
Employed	24	24%
Pension status		
No	84	84%
Yes	16	16%
Education		
Intermediate	34	34%
Primary	20	20%
Matriculation	20	20%
Illiterate	12	12%
Graduation	12	12%
Post-Graduation	2	2%
Single	1	1%
Hospital stays in days		
1-3 days	37	37.4%
4-6 days	53	53.5%
Greater than 6 days	9	9.1%
Ward		
Medical	76	76%
Cardiology	7	7%
Other	6	6%
Gastroenterology	5	5%
Surgical	2	2%
CCU	2	2%
ICU	1	1%

Diagnosis		
COPD	13	13%
Stroke	12	12%
Diabetes	11	11%
Cardiovascular Disease	10	10%
Miscellaneous	102	100%
Comorbidities		
Hypertension	33	33%
Diabetes	27	27%
Respiratory tract infection	14	14%
Asthma	10	10%
Miscellaneous	11	11%

Abbreviations: CCU = Cardiac care unit; ICU = Intensive care unit; COPD = Chronic obstructive pulmonary disease

Table 2: Prevalence of PIMs, polypharmacy, and drug-drug interactions

Variables	Frequency (N=100)
PIMs use	
Yes	83
No	17
Polypharmacy	
No	62
Yes	38
DDIs	
No	63
Yes	37
DDI number	
1	9
2	11
3	11
4	2
5	4
DDIs severity	
Moderate	30
Major	17
Minor	4
Severe	2

Abbreviations: PIMs = Potentially inappropriate medicines; DDIs = Drug-drug interactions

Figure 1 illustrates commonly observed interacting pairs. Furosemide with Omeprazole and Clopidogrel with Rosuvastatin emerged as commonly observed drug-interacting pairs (n=4, each).

Figure 1: Most commonly observed drug interaction pairs

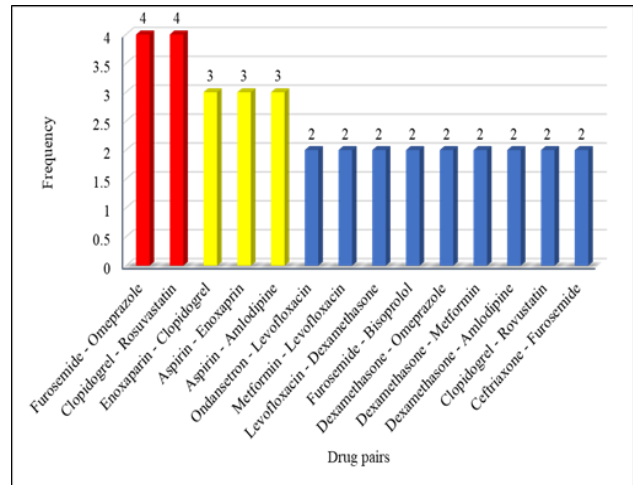


Figure 2 illustrates that most frequently prescribed PIMs belonged to Category A (63%), followed by Category C (29%), emphasizing the need for increased awareness in prescribing practices.

Figure 2: Prevalence of PIMs Category [A = Medicines that should be avoided in elderly patients, B = Medicines that should be used with caution, C = Medicines that should be avoided in specific circumstances, D = Medicines that should be avoided due to DDIs, E = Medicines that should be avoided or reduce dose in renal impairment]

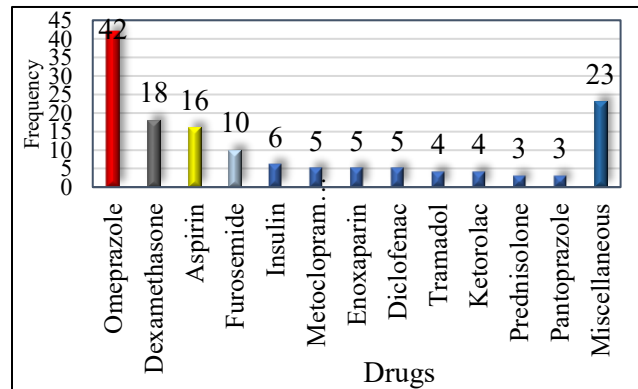


Figure 3 showed that 42 patients were inappropriately receiving omeprazole, followed by dexamethasone (n=18) and aspirin (16).

Figure 3: Prevalence of PIMs according to Beer's criteria 2019

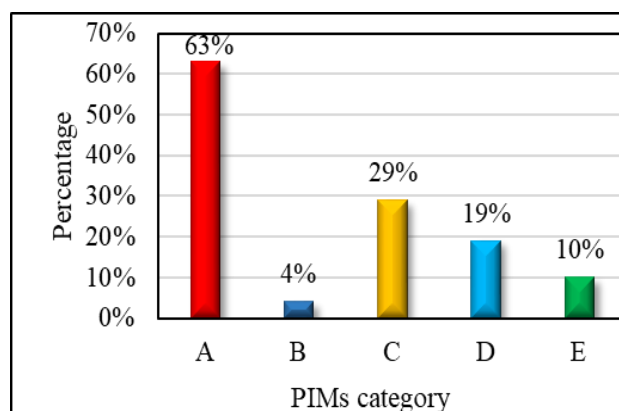


Table 3 shows that there were no statistically significant differences in PIMs used with patient characteristics such as age, gender, and hospital stay.

Table 3: Association of PIMs use with patient characteristics

Variables	PIMs not used (N)	PIMs used (N)	P value*
Age (Years)			
60-70	10	48	0.99
71-80	5	25	
≥ 80	2	10	
Gender			
Female	5	24	0.97
Male	12	59	
Hospital stays (days)			
1-3 days	6	31	0.36
4-6 days	10	43	
≥ 6 days	0	9	
Comorbidities			
Hypertension	4	29	NA
Diabetes	4	23	
Respiratory tract infection	3	11	
Asthma	1	9	
COPD**	0	2	
Dyslipidaemia	0	2	
Ischemic Heart Disease	0	2	
Anaemia	0	1	
CVS disease	0	1	
Kidney Stone	0	1	
Stroke	0	1	
Tuberculosis	0	1	

*Chi-square test was applied

**COPD = Chronic Obstructive Pulmonary Disease

Discussion

Hospitalized elderly patients are more exposed to polypharmacy because of the risk of increased health-related disorders or symptoms.⁵ The use of more drugs is also related to an increased risk of adverse outcomes in this population such as hospitalization, disabilities, DDIs, cognitive impairment, and fractures.^{6,5} Additionally, the use of inappropriate medicines in this group of population will further increase the chances of adverse outcomes.^{9,16} Our study explored a higher prevalence of PIMs use (83%) among elderly hospitalized patients. This was high in comparison to studies from Pakistan which reported prevalence in the range of 35-65%.¹⁸⁻²⁰

Similarly, it was also high in comparison to studies done in other countries (range; 34-48%).^{22,23} Additionally, the prevalence of polypharmacy in our study subjects was lower (38%) in comparison to that reported by other studies (72.3-85.6%)^{18,22,24} Correspondingly, DDIs prevalence (37%) was also inconsistent with reports of previous literature (54-62%).^{25,26} The differences in the results may be because of the variation in the study population, prescribing trend, and strict guidelines provision by the study setting. The lower prevalence of polypharmacy as well as pDDIs is also an indicator for rational prescribing in our study settings.

Beers Criteria are a set of guidelines that provide a list of medications for elderly patients. This list includes drugs that are either inappropriate for the elderly population, should be avoided, used with caution, or require dose adjustments. Most of the PIMs identified in our study are of category A (63%), which means these medicines should be avoided in elderly patients. Similar results were reported in previous studies conducted in Islamabad, Pakistan, and Saudia Arabia having a prevalence of category A PIMs in 63.5% and 57.6% of elderly patients, respectively.^{24,27} This shows there is a need for prescription analysis of geriatric patients, as if they use medicines that need to be avoided could lead to adverse outcomes related to drugs. Moreover, omeprazole followed by dexamethasone and aspirin were the most used PIMs in our study patients. These results are inconsistent with the study conducted in Canada, where they report benzodiazepines, followed by proton-pump inhibitors, and antipsychotics as frequently

prescribed inappropriate drugs.²² Likewise, a study in Brazil reported the following highly prevalent PIMs; digoxin followed by food supplement of ferrous sulfate, thioridazine, and lorazepam.²⁶ This shows that in our study settings PIMs were usually supportive medicines. Hence, it should be considered that supportive medicines must also be checked for appropriateness besides medicines for the actual condition of the patients. Additionally, elderly patients are more prone to DDIs, due to the use of many drugs for different indications. Polypharmacy and DDIs must be considered during prescription, and prescriptions must be screened for DDIs and their adverse outcomes. Therefore, prescribing medicines to elderly patients needs strict monitoring of all aspects of therapy.

To the best of our knowledge, this is the first study in the Khyber Pakhtunkhwa region of Pakistan, that evaluated prescriptions of hospitalized elderly patients for appropriateness using an updated version of Beer's criteria. The previous reports in Pakistan also evaluated geriatric patients' prescriptions but they had focused either on ambulatory geriatric patients, using single study settings, or using an older version of Beer's criteria. Our study highlights the need for standard treatment guidelines and monitoring systems for geriatric patients in all hospitals in Pakistan. The high prevalence of PIMs found by pharmacists in hospitalized elderly patients is a strong indication of unstandardized health services. Adaption of adequate policies by involving pharmacists in prescription analysis could prevent the inappropriate use of medicines in elderly patients, thus ensuring higher quality pharmacotherapy provision for the elderly.

This study also has a few limitations. First, the sample size in this study is very small, as we have too short of duration for data collection. Due to the small sample size, inferential statistics are not applied to get deeper insight from the available data. Secondly, the prescribing of PIMs may be justified in certain clinical conditions, but we were unable to report the reasons for prescribing a PIM intentionally.

Conclusion

This study indicates a high prevalence of PIMs, polypharmacy, and pDDIs. Omeprazole is commonly identified PIMs while category A PIMs are frequently

detected. No statistically significant association is observed for patient characteristics such as age, gender, and hospital stay with PIMs use. Prescriptions of geriatric patients should be thoroughly reviewed for any possible inappropriate medicines and DDIs so that safe and effective drug therapy should be provided to such patients.

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