International Journal of Pharmaceutical and Bio-Medical Science

ISSN(print): 2767-827X, ISSN(online): 2767-830X

Volume 04 Issue 08 August 2024

Page No: 715-723

DOI: https://doi.org/10.47191/ijpbms/v4-i8-09, Impact Factor: 7.792

Evaluation of Potentially Inappropriate Medications (PIMs) in Outpatient Geriatric Patients at RSKO Jakarta

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ABSTRACT

Introduction: The global incidence of Potentially Inappropriate Medication Use (PIM) in elderly patients ranges from 6% to 41%. Research indicates that some medications are not recommended for elderly patients due to their side effects outweighing clinical benefits. The American Geriatrics Society developed the Beers Criteria as guidelines in clinical practice and research to identify PIM and guide medication management in elderly patients. This study aims to assess the prevalence of inappropriate medication prescriptions in elderly outpatients at RSKO Jakarta using the Beers Criteria. Additionally, the study analyzes the relationship between polypharmacy and comorbidities with PIM occurrence.

Methods: The sample consists of elderly patients from general and internal medicine clinics at RSKO Jakarta from January to August 2023. This non-experimental study employs a descriptive approach, collecting retrospective data from 110 prescriptions. The data is analyzed univariately and bivariately using the chi-square test to determine the relationships between polypharmacy, comorbidities, and the occurrence of PIM.

Results: The study found that 53.64% of prescriptions for elderly patients at RSKO Jakarta were identified as PIMs, with 11.54% categorized under "avoid" and 88.46% under "use with caution." The most commonly prescribed PIMs were glimepiride (16.25%), gabapentin (15%), and omeprazole (13.75%). The findings indicate a significant relationship between polypharmacy (p=0.000) and comorbidities (p=0.000) with PIM occurrence.

Conclusion: These results highlight the need for further evaluation of medication prescribing patterns for elderly patients at RSKO Jakarta. The significant association between polypharmacy and comorbidities with PIM occurrence underscores the importance of careful medication management in this population, using guidelines such as the Beers Criteria to minimize the risks of inappropriate medication use.

KEYWORDS: PIMs; Beers Criteria; Geriatri

ARTICLE DETAILS

Published On:
29 August 2024

Available on:
http://ijpbms.com

I. INTRODUCTION

The incidence of PIMs in geriatrics is widespread worldwide, with an estimated prevalence ranging from 6% to 41% [1]. Research by Wulansari et al (2023)[2] showed that 63.1% of geriatric patients experienced PIMs based on the Beers Criteria 2019, while 36.9% did not. Another study by [3] found that out of 115 geriatric patients, 56 (48.70%) had potential inappropriate medication use (PIMs).

Potentially Inappropriate Medications (PIMs) are defined as drugs that should be avoided because their risk of adverse effects outweighs their clinical benefits, especially when safer or more effective alternative therapies are available for the same condition[4]. PIMs can increase the risk of falls in the elderly, particularly those with side effects on the nervous system or blood pressure, which can lead to serious injuries. Additionally, PIMs with anticholinergic effects or side effects on the central nervous system can cause cognitive issues, such as confusion and memory impairment, in older adults [5]

In 2019, the American Geriatrics Society (AGS) published the "Beers Criteria for Potentially Inappropriate Medication Use in Older Adults," intended as a prescribing

guide for geriatric patients. This guideline aims to avoid riskier or more harmful side effects, thereby reducing the incidence of PIMs. Thus, there is a relationship between the Beers Criteria and PIMs in geriatric patients. The Beers Criteria provide clinical guidance to help identify medications with high potential risks or side effects in the geriatric population, which can consequently be considered PIMs in this context.

Factors influencing the occurrence of PIM prescriptions include comorbidities and polypharmacy status. According to Kharunisa dkk (2023)[6] research, the number of comorbidities has a significant relationship with the incidence of PIMs, with a Sig value of 0.047. This indicates a correlation between the occurrence of potentially inappropriate medication use and the number of accompanying diseases. Comorbidities are medical conditions in which an individual suffers from two or more different diseases or conditions simultaneously [7]. Geriatric patients are prone to adverse drug reactions due to high comorbidity and the aging process, which disrupts drug metabolism [8]

Another influencing factor is polypharmacy status. A study in Canada found that 29.9% of geriatric patients use five or more medications simultaneously [4]Polypharmacy is the use of multiple types of medications by one individual simultaneously or sequentially to treat one or more diseases. The use of many medications often increases the risk of side effects, which can trigger the likelihood of PIM prescriptions and adverse drug interactions that harm patient health [9]. The reason for conducting this study at RSKO Jakarta is the lack of research on general patients, particularly geriatrics, at RSKO Jakarta, which makes this an important area of focus. This study aims to evaluate potentially inappropriate medications (PIMs) among geriatric outpatients and explore factors associated with the increased risk of PIM use in this population. The study uses a retrospective design, with data collected from the medical records at RSKO Jakarta.

II. METHODS

This study is an analytical observational study. The data used consists of all drug prescriptions from geriatric outpatient clinics and internal medicine departments that meet the inclusion and exclusion criteria during the period from January 2023 to August 2023. Data collection was conducted retrospectively. Prior to identifying PIMs occurrences, the primary diseases of the patients were grouped according to the ICD X guidelines, and the level of comorbidities was categorized based on the Charlson Comorbidity Index. Identification of PIM occurrences was carried out using the Beers Criteria 2019 guidelines by categorizing medications into "avoid" and "use with caution" categories. Data were obtained from prescription reports at the pharmacy installation and tracing patient medical records. Sampling was done using total sampling technique.

The data will be analyzed using statistical analysis. Univariate data analysis was performed to observe the prevalence of PIMs in geriatric outpatient patients. Bivariate analysis was conducted to determine the relationship between PIM occurrences with comorbid diseases and PIM occurrences with polypharmacy status using nonparametric chi-square tests. Descriptive data were managed in Microsoft Excel, and statistical data were analyzed using SPSS Ver. 24.

III. RESULTS AND DISCUSSION

Patient Demographic Profile

Table 1. Demographics of geriatric outpatients at the Drug Dependency Hospital for the period of January-August 2023

Criteria	Number of Patients (n=110)	Percentag %
Gender		
Male	64	58,18 %
Female	46	41,82%
Jumlah	110	100%
Age (Years)		
60 - 64	59	64,9 %
65 - 69	35	38,5 %
70 - 74	12	13,2 %
>75	4	4,4 %
Jumlah	110	100%
Polypharmacy		
2-4	60	54,54%
≥5	50	45,45%
Total	110	100%

Table 2. Primary Diagnoses According to ICD-10 Codes at the Drug Dependency Hospital.

ICD-10 Code	Main Diagnosis	Total Main Diagnoses (n=110)	Percentage %
A16	Tuberculosis	1	0,9 %
B18	Hepatitis C	1	0,9 %
B20	Human Immunodeficiency Virus	28	25,4 %
E11	Non Insulin Dependent Diabetes Mellitus	18	16,3 %
E78	Hyperlipidaemia	4	3,64 %
G56	Carpal Tunnel Syndrome	1	0,9 %
G62	Polyneuropathy, Unspecified	2	1,8 %
H10	Conjunctivitis	1	0,9 %
I10	Essential (Primary) Hypertension	26	23,6 %
I11	Hypertensive Heart Disease Without (Congestive) Heart Failure	8	7,2 %
I61	Intracerebral Haemorrhage	1	0,9 %
I64	Stroke, Not Specified As Haemorrhage Or Infarction	3	2,7 %
J02	Acute Pharyngitis	1	0,9 %
J06	Acute Upper Respiratory Infection, Unspecified	2	1,8 %
J10	Influenza With Other Respiratory Manifestations, Influenza Virusidentified	1	0,9 %
K30	Dyspepsia	2	1,8 %
M51	Intervertebral Disc Disorder, Unspecified	1	0,9 %
M54	Sciatica	2	1,8 %
M75	Adhesive Capsulitis Of Shoulder	2	1,8 %
R42	Dizziness And Giddiness	1	0,9 %
R50	Fever, Unspecified	2	1,82 %

S42	Fracture Of Shoulder And Upper Arm	1	0,9 %
Z03	Obervation For Supected Nervous Sstem isorder	1	0,9 %
Total		110	100%

Table 3. Profile of the most common comorbid diseases in geriatric outpatients at the general outpatient clinic and internal medicine department at RSKO Jakarta.

Severity Level	Number of Medical Record Data (n=110)	Percentage %
Mild 1-2 Comorbid	81	73,6 %
Moderate 3-4 Comorbid	9	8,1 %
Severe >5 Comorbid	0	0 %
No Comorbid	20	18,1 %
Total	110	100%

Based on the research findings, it was found that the most visited age group of geriatric patients at the general outpatient clinic and internal medicine department at RSKO Jakarta is the age group of 60 - 64 years. This finding is consistent with a study conducted by Goel et al (2018)[10], which concluded that the geriatric age group between 60 and 64 years tends to exhibit high levels of physical activity and good independence in carrying out daily activities. This directly affects their accessibility to healthcare services, both in clinics and hospitals, to receive outpatient care [11]. Additionally, their ability to adhere to medication instructions has been proven to be better compared to other geriatric groups, and the age group of 60 to 64 years tends to have a lower number of comorbidities [10,12].

The next variable analyzed is gender, where the majority of geriatric outpatient patients at RSKO Jakarta are male. This is due to biological differences in life expectancy between males and females, as emphasized by the World Health Organization (2023), which makes males more vulnerable to age-related diseases and complications. Additionally, lifestyle plays a significant role. Males tend to have riskier lifestyles than females. Smoking, alcohol consumption, and lack of physical activity in males increase the risk of diseases and complications, thus increasing the need for geriatric services. Besides lifestyle factors, social and psychological aspects also have an impact. These research findings are also consistent with the findings of a study by Rumi et al (2023)[13].

Geriatric outpatients at the general outpatient clinic and internal medicine department at RSKO Jakarta tend to experience polypharmacy, where they receive more than five types of medication. This phenomenon is influenced by several factors, as elucidated by Okuyama (2016) [14].

Pharmacokinetic factors, related to the decline in organ function in geriatrics, such as kidneys and liver, can affect drug metabolism. This can result in a longer half-life of drugs, causing them to stay in the body longer and increasing the risk of side effects. Additionally, a decrease in drug clearance can also lead to drugs not being efficiently eliminated from the body, ultimately increasing the risk of drug accumulation. Pharmacodynamic factors also play a role, as geriatrics tend to have higher sensitivity to drugs. This can increase the risk of side effects even at low doses, as well as the complexity and danger of drug interactions. The presence of comorbidities in geriatrics, who often have multiple chronic diseases simultaneously, is also a factor. This requires treatment with various types of drugs, increasing the likelihood of drug interactions and polypharmacy practices. This is also consistent with the study by Wahyuni et al (2023) [15], which found that the prevalence of polypharmacy prescribing in geriatric patients reached 68.21%.

The study found that geriatric patients at RSKO Jakarta tend to receive polypharmacy prescriptions. The most common primary diagnosis is Human Immunodeficiency Virus (HIV) with the code B.20, as RSKO Jakarta is a One Stop Service hospital for substance abuse (NAPZA) [16]. The second most common primary diagnosis is hypertension, followed by type 2 diabetes mellitus. These two diseases also frequently appear as comorbid conditions in geriatric patients. This is due to the susceptibility of the elderly to non-communicable diseases such as hypertension, diabetes mellitus, and others [15].

Aging causes a decline in organ function, such as the kidneys and heart, which increases the risk of hypertension. Risk factors for hypertension include age, gender, family history, unhealthy lifestyle, and others [14]. Aging also increases the

risk of type 2 diabetes mellitus through changes in carbohydrate metabolism and unhealthy lifestyle choices. Other contributing factors to the risk of type 2 diabetes mellitus include chronic inflammation, hormonal changes, and the use of certain medications [17]. Gastrointestinal (GI) diseases are also common in geriatric patients at RSKO Jakarta, related to the decline in digestive organ function. Hormonal changes also affect digestive function in the elderly[18].

Incidence Profile of PIMs

Table 4. Frequency profile of PIMs prescribing incidence in geriatric patients at RSKO Jakarta.

Incidence of PIMs	**Number of Prescriptions (n=110)**	**Percentage %**
Positif PIMs	59	53,64 %
Negatf PIMs	51	46,36 %
Total	110	100%
Number of PIMs	**Number of Prescriptions Identified as Positive for PIMs (n=59)**	**Percentage %**
1 PIMs	41	71,19 %
2 PIMs	16	22,03 %
3 PIMs	2	5,08 %
4 PIMs	2	1,69 %
Total	59	100%

Table 5. Frequency of Top 10 Drug Categories in Prescriptions Identified as Positive for PIMs According to Beers Criteria 2023.

Drug Name	**Number of rescriptions Identified as Positive for PIMs (n=59)**	**Percentage %**
Glimepirid	13	16,25 %
Gabapentin	12	15 %
Omeprazole	11	13,75 %
Lansoprazole	11	13,75 %
Acetylsalicylic Acid	11	13,75 %
Sodium Diclofenac	7	8,75 %
Potassium Diclofenac	6	7,5 %
Buscopan Plus (PCT, Hyoscine-N-buthylbromide)	4	5 %
Clonidin	3	3,75 %
Donepezil	2	2,5 %
Total	80	100%
Cathegory PIMs	**Number of Prescriptions Identified as Positive for PIMs (n=59)**	**Percentage %**
Avoid	9	11,25 %
Avoid with Caution	71	88,75 %
Total	80	100%

Table 6. Classification, Reasons, and Recommendations for Drugs Based on Beers Criteria 2023.

Drug Name	Category in Beers Criteria	Reason	Recommendation
Glimepiride	Avoid with Caution	Can increase cardiovascular risk and hypoglycemia	Avoid unless safer alternatives are available; choose short-acting alternatives if necessary
Gabapentin	Avoid with Caution	Increased risk of severe sedative side effects, including respiratory depression and death	Avoid unless in specific situations such as transitioning from opioid therapy
Omeprazole	Avoid with Caution	Risk of difficult-to-treat infections, pneumonia, gastrointestinal cancer, osteoporosis, and fractures	Avoid use >8 weeks unless for high-risk patients or specific conditions
Lansoprazole	Avoid with Caution	Risk of difficult-to-treat infections, pneumonia, gastrointestinal cancer, osteoporosis, and fractures	Avoid use >8 weeks unless for high-risk patients or specific conditions
Acetylsalicylic Acid	Avoid with Caution	Increased risk of major bleeding due to aspirin in the elderly, without sufficient proven benefit	Avoid using aspirin for primary cardiovascular disease prevention in the elderly
Sodium Diclofenac	Avoid with Caution	Increased risk of gastrointestinal bleeding in patients >75 years or with corticosteroids, anticoagulants, or antiplatelets	Avoid chronic use unless no effective alternatives are available and gastroprotective agents can be used
Potassium Diclofenac	Avoid with Caution	Increased risk of gastrointestinal bleeding in patients >75 years or with corticosteroids, anticoagulants, or antiplatelets	Avoid chronic use unless no effective alternatives are available and gastroprotective agents can be used
Hyoscine-N-butylbromide	Avoid	Highly anticholinergic	Avoid
Clonidine	Avoid	High risk of adverse CNS effects; can cause bradycardia and orthostatic hypotension; not recommended for routine hypertension treatment	Avoid as first-line treatment
Donepezil	Avoid	Causes bradycardia	Avoid

Research at RSKO Jakarta indicates that geriatric patients in general and internal medicine clinics have a significant likelihood of receiving prescriptions for Potentially Inappropriate Medications (PIMs) due to polypharmacy, comorbidities, and organ function decline [19]. The incidence rate of PIMs reaches 92.82% [20], and 55% of prescriptions for geriatric patients are PIMs [21]. More than 50% of patients receive prescriptions with one category of PIMs based on Beers Criteria, with the "avoid with caution" category being the most frequently prescribed [21].

Glimepiride, frequently prescribed in the "avoid with caution" category, has a rapid onset of action and intermediate duration, making it suitable for geriatric patients who need quick and stable glycemic control. Additionally, it has fewer gastrointestinal side effects compared to other sulfonylureas like glipizide [22]. However, glimepiride is included in the Beers Criteria because its long elimination half-life (10-16 hours)

increases the risk of hypoglycemia, especially in geriatric patients with reduced kidney and liver function [23]. Side effects such as nausea, vomiting, and diarrhea can exacerbate hypoglycemia and make patients unaware of their condition [24]. Gundala et al. (2013) [25]found that glimepiride significantly increases the risk of severe hypoglycemia in geriatric patients compared to metformin.

Omeprazole and lansoprazole, proton pump inhibitors (PPIs), are categorized as "avoid with caution" because the prevalence of gastroesophageal reflux disease (GERD) and peptic ulcers increases with age, with about 20-30% of the elderly over 65 years experiencing GERD and 10-15% experiencing peptic ulcers [26]Aging reduces saliva production and slows gastric emptying, as well as weakens the lower esophageal sphincter, thus increasing the risk of digestive disorders such as GERD and peptic ulcers [27]. PPIs are categorized as PIMs based on the Beers Criteria due to the increased risk of enteric infections such as Clostridium difficile with long-term use. Additionally, PPIs can disrupt the absorption of vitamin B12, calcium, and magnesium, which are crucial for bone health and nerve function in the elderly [28]. Long-term use of PPIs is also associated with an increased risk of dementia and cardiovascular disease in the elderly [29]

Buscopan Plus, which contains paracetamol and hyoscine n butylbromide (HNB), is often prescribed in the "avoid" category of the Beers Criteria due to the mechanism of action of HNB, which inhibits muscarinic cholinoreceptors in the parasympathetic nervous system. This leads to reduced gland secretion, smooth muscle relaxation, and decreased gastrointestinal motility [30]. Pharmacokinetically, HNB is readily absorbed after oral administration, reaching peak concentrations within 1-2 hours. Metabolism primarily occurs in the liver, with elimination mainly through the kidneys. Among the geriatric population, HNB has a favorable pharmacokinetic profile, with a longer half-life and slower elimination process [31]The inclusion of hyoscine n butylbromide (HNB) in the Beers Criteria is based on its potential for significant side effects in the geriatric population. HNB is known to cause symptoms such as dry mouth, constipation, and dizziness, increasing the risk of falls and injuries in the elderly [5]Furthermore, the use of HNB can exacerbate underlying medical conditions in the elderly, such as glaucoma, heart disease, and dementia [5]

Clonidine is known to help reduce the risk of hypertension complications in the geriatric population such as stroke, heart attack, and kidney failure [32]. Although effective in lowering blood pressure in the elderly [30]clonidine is included in the Beers criteria due to its potential significant side effects in this group. Side effects such as hypotension, bradycardia, and fatigue can increase the risk of falls and injuries in the geriatric population [5]Additionally, clonidine use may not be suitable for geriatric patients with certain medical conditions such as heart disease, stroke, and dementia as it may worsen existing conditions [5]

Warfarin is also considered a medication that should be avoided and is often prescribed due to its potential interactions with other drugs. This classification is attributed to the proven effectiveness of donepezil in slowing cognitive decline in patients with Alzheimer's and vascular dementia, as well as improving cognitive function, memory, and daily activities in those with mild to moderate Alzheimer's disease [33]However, donepezil is included in the Beers criteria because it can cause bradycardia and hypotension [34]and it may interact with anticholinergic and anticonvulsant drugs [24]Moreover, research by Birks et al. (2019) [33]indicates that donepezil offers only minimal benefits to patients with mild to moderate Alzheimer's, while Tsuno found that donepezil is not effective in preventing mortality in Alzheimer's patients.

Statistical analysis of the occurrence of PIMs in outpatient prescriptions of geriatricpatients at RSKO Jakarta.

Table 7. Chi-Square Test Results: Polypharmacy Status and Incidence of PIMs PIMs.

	Present		**No Present**		**P-value**
Number of Drugs	N	%	N	%	
<5	19	17,27 %	40	36,36 %	0.000
>5	40	36,36 %	11	10%	

Table 8. Chi-Square Test Results: Comorbid Status and Incidence of PIMs.

	Present		**No Present**		**p-value**
Comorbid Status	N	%	N	%	
Present	57	51,81%	33	30 %	0.000
No Present	2	1,81%	18	16,38%	

Based on the statistical analysis results presented in Table 7 and Table 8, it can be concluded that the p-value <0.05 indicates a significant relationship between polypharmacy status and the occurrence of PIMs, as well as between comorbidity status and the occurrence of PIMs. This demonstrates a significant association between the dependent and independent variables in the context of this study.

Statistical analysis reveals a significant association between the use of more than 5 medications (polypharmacy) and the occurrence of PIMs, as well as between the presence of comorbidities and the incidence of PIMs. These findings indicate that both factors influence the risk of PIMs in patients. The increase in prescribed medications, particularly in geriatric patients with comorbidities, can heighten the risk of PIM

occurrence. This is due to the complexity of treatment regimens, heightened potential for drug interactions, and decreased organ function affecting drug metabolism [19]. Another contributing factor is that geriatric patients with comorbidities often receive inappropriate prescriptions, duplicate therapies, or incorrect medication dosages, all of which can elevate the risk of PIM occurrence [35]These findings align with research conducted by Kumala et al. (2023), which demonstrates a correlation between polypharmacy and the occurrence of PIMs. Both studies show a significance value (P Value) of 0.000, thereby reinforcing the statistical relationship. Furthermore, this research aligns with the findings of Siti Julaiha et al. (2021), who discovered a significant association between comorbidity status and the occurrence of PIMs, with a P value of 0.001.

IV. CONCLUSION

The findings of this study underscore the significance of monitoring Potentially Inappropriate Medications (PIMs) among the geriatric population receiving care at the Drug Dependence Hospital (RSKO) Jakarta. In this research, 3.64% of prescriptions given to geriatric patients at RSKO Jakarta were identified to contain PIMs. Analysis results reveal that among them, PIMs were categorized as avoid in 11.25% and avoid with caution in 88.75%. The study also unveils a correlation between polypharmacy and the occurrence of PIMs in geriatric patients, as well as between comorbid disease status and PIMs occurrence, indicated by a p-value <0.05 through chi-square tests using SPSS software ver. 24. These findings emphasize the necessity for further evaluation by hospitals to enhance awareness regarding prescription compliance, particularly among the geriatric population, aiming to mitigate the risk of PIM occurrence.

V. ACKNOWLEDGMENTS

Gratitude is extended to God Almighty, to the author's parents, to the faculty members of the Faculty of Pharmacy at Jakarta Global University, to the staff at RSKO Jakarta, and to everyone who contributed to this research.

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