Identification of Potentially Inappropriate Medication in Geriatric Patients at Wangaya Hospital, Denpasar City with Beers Criteria and Stopp Criteria in 2023

Made Shinta Sanma Putri[1], Anak Agung Ngurah Putra Riana Prasetya[2*], Putu Dian Marani Kurnianta[3]

[1-2]Program Studi Sarjana Farmasi, Sekolah Tinggi Farmasi Mahaganesha, Denpasar, Indonesia
[3]Program Studi Diploma Tiga Farmasi, Sekolah Tinggi Farmasi Mahaganesha, Denpasar, Indonesia

Corresponding author: gungtra.apoteker95@gmail.com

ABSTRACT

Geriatric (elderly) patients generally require a number of drugs (polypharmacy) to cure health-related conditions that tend to occur Potentially Inappropriate Medication (PIM). Identification of PIM is very important to prevent Drug Related Problems (DRP). The purpose of the study was to identify the incidence of PIM using the Beers Criteria and STOPP Criteria and analyze the relationship between PIM risk factors and the incidence of PIM in geriatric patients at Wangaya Hospital, Denpasar City. This type of research is retrospective observational in a cross-sectional manner using simple random sampling techniques on all geriatric patients for the period 2023. Samples that met the inclusion criteria, namely geriatric patients aged ≥65 years in outpatient and inpatient facilities with geriatric patients who died and who were referred to other hospitals, were excluded from this study. Of the 354 samples, the prevalence of PIM in outpatient care was (4.23%) with the most common drugs being spironolactone (55.84%), Sulfonylureas (19.48%), and NSAIDs (6.49%) with Beers criteria. In hospitalization, (0.84%) with NSAIDs (25%), corticosteroids (25%), clopidogrel (25%), and antipsychotics (25%) with STOPP criteria. Based on the evaluation results, there was a very weak correlation between the number of drugs (p=0.000; r=0.199) and there was no relationship between the number of diagnoses (p=0.674) prescribed and the incidence of PIM. Based on this, it can be concluded that the greater the number of drugs can increase the risk of PIM.

INTRODUCTION

Indonesia is experiencing a population aging period, which is an increase of life expectancy and is followed by an increase in the elderly population (Hibattulwafi *et al.*, 2022). Elderly patients (geriatrics) are characterized by multiple illnesses or as a result of decreased function of organs, psychology, social, economic and the environment. This encourages the readiness of integrated health care facilities (Permenkes, 2014).

Drug administration in geriatric patients requires careful consideration of the benefits and risks of harm because it generally requires several drugs (polypharmacy) (Misrina *et al.*, 2023). Ensuring appropriate drug use can be achieved by identifying and evaluating the incidence of Potentially Inappropriate Medication (PIM) and Drug Related Problems (DRP). PIM focuses on assessing inappropriate use of drugs with a risk of adverse effects with consideration of alternative therapies (Namirah *et al.*, 2015). Some criteria that can be used in

identifying PIM in geriatric patients include the Beers criteria and Screening Tool of Old People's Prescription (STOPP) criteria (Blanco-Reina *et al.*, 2019).

Beers criteria can improve drug selection for geriatric patients, reduce the incidence of adverse drug events, improve drug selection, and serve to examine the patient care quality, expense, and drug use pattern in geriatric inpatients (AGS, 2023). STOPP criteria can improve drug effectiveness and safety for hospitalized geriatric patients. This method is therefore necessary for the identification of inappropriate drug prescribing, especially in patients with geriatrics (O'Mahony *et al.*, 2023). There are several studies related to the Beers and STOPP criteria. One of the studies on 324 geriatric patients at one of the hospitals in Jakarta found PIM in 136 patients (41.85%) using the 2019 Beers criteria and PIM was using STOPP criteria in 14 patients (4.55%) out of 308 geriatric patients (Viviandhari *et al.*, 2022). Based on the above research, there is still a lack of research related to PIM in Asian countries including Indonesia regarding problems related to drug use and based on several risk factors that trigger the incidence of PIM. The implementation of PIM can provide benefits for hospitals, patients, and treatment.

Based on this, it is important to identify PIM at Wangaya Regional General Hospital, Denpasar City in geriatric patients using the Beers criteria method in 2023 and STOPP criteria version 3 and analyze the relationship between risk factors causing PIM such as the amount of use of drugs and the number of diseases with PIM incidents in geriatric patients to overcome problems commonly encountered in geriatric patients who tend to have a higher risk of drug-related complications.

METHODS

This study uses observational research conducted on geriatric disease patients by using observational descriptive analysis with a cross-sectional design. The population and sample in this study were all medical record data for geriatric patients aged ≥65 years in inpatient and outpatient installations at Wangaya Hospital in 2023. Based on random sampling techniques, 354 samples were obtained using the Slovin equation with a precision of 5% (Sasfi *et al.*, 2022).

$$n = \frac{N}{1+N\,(a)^2} \qquad (1)$$

All medical record data of geriatric patients aged 65 years and over who underwent inpatient and outpatient care were inclusion criteria with exclusion criteria being geriatric patients who died while undergoing treatment and geriatric patients referred to other hospitals in the period 2023.

Research Instruments

The data collection sheet used contained patient initials, age, gender, patient complaints, medical history, type of medication, amount of medication, and clinical data. The type of data taken is nominal data on the incidence of PIM and ordinal data on the factors that cause PIM. The data that has been taken is entered into the Microsoft Excel application.

Data Analysis

Data were analyzed using descriptive analysis of percentage tables with Microsoft Excel performed on patient demographics and types of drugs received by patients as well as patient clinical data analyzed based on Beers criteria and STOPP criteria and types of drugs that cause many PIM events. The percentage of total PIM events and each drug was calculated using the following equation:

$$\text{Total PIM (\%)} = \frac{total\ PIM\ events}{total\ drugs\ prescribed} \; x \; 100\% \qquad (2)$$

$$\text{PIM per drug (\%)} = \frac{number\ of\ PIM\ per\ drug}{total\ PIM} \; x \; 100\% \qquad (3)$$

The analysis used is inferential analysis in the form of non-parametric Kendall's tau_b test based on the significance value and correlation value. If the significance value <0.05 states that there is a relationship between the risk factors that cause PIM and the incidence of PIM. The correlation value (r) used is in the following ranges: no correlation (0), very weak correlation (0.00-0.25), moderate correlation (0.25-0.50), strong correlation (0.50-0.75), very strong correlation (0.75-0.99), perfect correlation (1).

Ethics Approval

This study was obtained from the Health Research Ethics Committee of Wangaya Regional General Hospital, Denpasar City with Ethical Clearance number 000.9.2/1111/RSUDW.

RESULT AND DISCUSSION

Sample characteristics

Of the 354 geriatric patients who meet the criteria of inclusion and exclusion. **Table 1** illustrates patient classification by patient characteristics. Based on the age of the patients, it was found that the highest age range of patients was at the age of 65 - 75 years as many as 265 (74.86%), and based on gender, the proportion of female patients was higher at 188 (53.11%) compared to male patients as many as 166 (46.89%).

Table 1. Sample Characteristics

Characteristics	Amount	%
Age (year)		
65 - 75	265	74.86
76 - 85	77	21.75
>85	12	3.39
Gender		
Male	166	46.89
Female	188	53.11
Type of service		
Outpatient	278	78.53
Inpatient	76	21.47
Diagnose		
Hypertension	103	16.53
DM*	95	15.25
Atherosclerotic	55	8.83
HHD*	40	6.42
Dyspepsia	37	5.94
Others	293	47.03
Number of diagnoses		
1	154	43.5
>1	200	56.5
Drug quantity		
<5	75	21.19
≥5	279	78.81

*DM (*diabetes mellitus*);
HHD (*hypertensive heart disease*).

Based on the type of service, 278 (78.53%) outpatient services were higher than 76 (21.47%) inpatient services. Some diseases that are often suffered by geriatric patients such as hypertension and DM are due to changes in the condition of blood vessels, including the heart. With increasing age, arterial blood vessels become harder and less elastic. In addition, the number of DM diseases in geriatric patients is caused by the reduction of muscle mass and the appearance of changes in blood vessels, lack of physical activity, irregular diet, and genetics that can trigger the disease. There are 5 highest disease diagnoses experienced by geriatric patients, namely Hypertension 103 (16.53%), DM 95 (15.25%), Atherosclerotic 55 (8.83%), HHD 40 (6.42%), and Dyspepsia 37 (5.94%). A total of 623 diseases of geriatric patients with diagnosed 1 disease were 154 (43.5%) patients and diagnosed > 1 disease were 200 (56.5%). The diagnosis of the disease experienced by the patient can affect the amount of medication prescribed (Fauziah *et al.*, 2020). Geriatric patients tend to get polypharmacy, giving ≥5 types of drugs will increase as the patient ages. This can be seen that as many as 279 (78.81%) patients received ≥5 drugs.

Potentially Inappropriate Medication

Identification of PIMs is done to reduce polypharmacy in geriatric patients because it has a considerable cost in the care system. **Table 2** shows the prevalence of PIMs in outpatient and inpatient installation services. Based on **Table 2**, the prevalence of PIM in outpatient installations reached 4.23% using Beers criteria, and the prevalence of PIM in inpatient installations reached 0,84% using STOPP criteria.

Table 2. Prevalence of PIM

Installation	Drug quantity	Total PIM	% Total PIM*
Outpatient	1820	77	4.23
Inpatient	479	4	0.84

Identification of PIM with the Beers criteria has 5 categories, namely category 1 (PIM in geriatric patients in general), category 2 (PIM in geriatric patients caused by interactions between drugs and diseases or that exacerbate diseases), category 3 (PIM where drug use must be done with caution), category 4 (PIM caused by drug interactions), category 5 (PIM where the use of drugs should be avoided or reduced doses with varying degrees of renal function) (AGS, 2023). In STOPP version 3 criteria with a total of 133 criteria.

In **Table 3**, there are a total of 77 types of PIM. In category 1, the drugs with the most PIMs were antipsychotics (5.19%), benzodiazepines (5.19%), and sulfonylureas (19.48%). The use of sulfonylureas drugs as monotherapy in geriatric patients has a higher risk of cardiovascular events, causes of death, and hypoglycemia compared to other alternative drugs (Cenzer *et al.*, 2020). It is best

to avoid sulfonylureas monotherapy as first-line, second-line, or adjunctive therapy unless there are contraindications in the use of safer and more effective drugs (AGS, 2023).

In category 2 drugs with PIM, there were benzodiazepines (1.30%) in geriatric patients with a diagnosis of dementia. The use of antipsychotics in geriatric patients with a diagnosis of vascular dementia can cause the risk of stroke and death compared to dementia patients who do not use antipsychotics (Mueller et al., 2021). Long-term use of benzodiazepines in geriatric patients can increase sensitivity and drug metabolism in the body will decrease. In addition, it can cause the risk of falls and fractures in geriatric patients which was previously caused by the sedation effect (Zhang et al., 2022).

Table 3. PIM in Outpatients with Beers criteria

Category*	Frequency	% PIM per Drug	%PIM based on total patient
Category 1			
Cardiovascular and anti-thrombotic			
Digoxin	1	1.30	0.05
Central nervous system			
Antipsychotics	4	5.19	0.22
Benzodiazepine	4	5.19	0.22
Agen antiparkinson	1	1.30	0.05
Sulfonylureas	15	19.48	0.83
Dry thyroid	1	1.30	0.05
Pain treatment			
NSAID	5	6.49	0.28
Category 2			
Dementia			
Benzodiazepine	1	1.30	0.05
Category 3			
Diuretic			
Spironolactone	43	55.84	2.38
Hydrochlorothiazide	1	1.30	0.05
Antidepressants	1	1.30	0.05
Category 4	-	-	-
Category 5	-	-	-
Total PIM	77	100	4.23

Category 1: PIM in geriatric patients
Category 2: PIM in geriatric patients due to drug-disease interactions or drugs that may worsen disease
Category 3: PIM in geriatric patients due to drug-disease interactions or drugs that may worsen disease
Category 4: potentially clinically important drug interactions should be avoided in geriatric patients
Category 5: medications that should be avoided or reduced in dose with varying degrees of renal function in geriatric patients

In category 3 drugs with PIM there are diuretics, namely spironolactone (55.84%), hydrochlorothiazide (1.30%) and antidepressants (1.30%). The use of diuretics in geriatrics can cause syndrome of inappropriate antidiuretic hormone secretion (SIADH) and hyponatremia (Velat et al., 2020). Factors that cause hyponatremia are decreased renal function, SIADH, and comorbidities such as chronic heart failure, diabetes mellitus, cirosis, and renal failure (Filippatos et al., 2017).

Table 4 shows the prevalence of PIM in inpatient installations with STOPP version 3 criteria grouped into 13 sections. Based on **Table 4**, a total of 4 PIMs were obtained in the inpatient installation and there were a total of 4 types of PIM prescriptions. Based on the results of PIM on STOPP criteria, there are several sections, namely section B, section C, and section D. In section B, drugs with PIM are NSAIDs (25%) and corticosteroids (25%). For patients with congestive heart failure, the use of NSAIDs can aggravate and exacerbate heart failure. Research by (Girouard et al., 2017) showed a dose relationship with an increased risk of hospitalization for heart failure taking NSAID drugs. Therefore, NSAID drugs should be avoided or discontinued in heart failure patients. For patients with osteoarthritis, the use of corticosteroids can cause cardiovascular disorders and gastrointestinal disorders (Al-Azayzih et al., 2020). In section C, the drug with PIM is clopidogrel in stroke patients with atrial fibrillation. Clopidogrel is contraindicated in patients with active gastrointestinal bleeding, acute hemorrhagic stroke, or severe liver disorders which can cause an increased risk of serious bleeding complications in geriatric patients (Mende et al., 2022). In section D, drugs with PIM are antipsychotics in patients with delirium which can lead to the risk of falls and increased cerebrovascular side effects, including stroke and death (Thom et al., 2017).

Analysis of the Relationship between PIM Risk Factors and the Incidence of PIM

Table 5 shows the statistical analysis of the relationship between risk factors causing PIM and the incidence of PIM. The risk factors analyzed are the number of disease diagnoses and the number of drugs prescribed and then compared with the number of PIM events. This statistical analysis is based on the significance value and statistical correlation value. The

analysis showed that patients with the number of diagnoses >1 showed no association of the number of diseases with the incidence of PIM (p=0.674).

Table 4. PIM in Inpatients with STOPP criteria

Section*	Frequency	% PIM per Drug	%PIM based on Total patient
Section A	-	-	-
Section B			
NSAID	1	25	0.21
Corticosteroid	1	25	0.21
Section C			
Clopidogrel	1	25	0.21
Section D			
Antipsychotic	1	25	0.21
Section E	-	-	-
Section F	-	-	-
Section G	-	-	-
Section H	-	-	-
Section I	-	-	-
Section J	-	-	-
Section K	-	-	-
Section L	-	-	-
Section M	-	-	-
Total PIM	4	100	0.84

A: Indication of medication
B: Cardiovascular system
C: Coagulation system
D: Central Nervous system
E: Renal system
F: Gastrointestinal system
G: Respiratory system
H: Musculoskeletal system
I: Urogenital system
J: Endocrine system
K: Drug classes that predictably increase fall risk in susceptible older people
L: Analgesic drugs
M: Antimuscarinic/Anticholinergic drug burden

Table 5. Statistical analysis of Kendall's tau_b

Variable	Amount	PIM	r	p-value
Diagnose	1	34	0.022	0.674
	>1	40		
Drug quantity	<5	4	0.199	0.000
	≥5	70		

So it can be said that the number of diagnoses experienced by patients does not affect the incidence of PIM. Different results were shown from other studies, namely getting the association between the number of diseases and the incidence of PIM in geriatric patients with significant statistical analysis results (p=0.002) which indicated there was an association between number of diseases and the incidence of PIM (Simões *et al.*, 2019).

Based on **Table 5,** it is known that the result of another statistical analysis shows that the association between the use of prescribed drugs with the incidence of PIM (p=0.000) which indicates that there is. The other research results also found an association between the number of drugs and the incidence of PIM in geriatric patients with significant statistical analysis results (p=0.001) which indicates there is an association between using the amount of drugs with the incidence of PIM (Simões *et al.*, 2019). The more drugs that are prescribed or called polypharmacy will increase the incidence of PIM. The existence of polypharmacy is caused by several factors such as the presence of many chronic diseases experienced by patients and a decrease in physiological function which causes the use of more drugs (Tang *et al.*, 2023).

Although several studies have shown that the number of diseases can affect the number of drug prescriptions that can cause PIM events, it is necessary to evaluate treatment therapy and detect the incidence of PIM in geriatric patients to prevent PIM in geriatric patients (Wulansari *et al.*, 2023). This study is expected to provide education about treatment therapy using the Beers criteria method and the STOPP criteria, so that medical personnel can pay more attention to providing healing therapy to suit the patient's condition and can improve the quality of service in hospitals so that patient satisfaction is achieved (Hibattulwafi *et al.*, 2022).

CONCLUSIONS

From the results of the studies obtained, it can be concluded that the prevalence of PIM that occurred in geriatric patients at Wangaya Hospital, Denpasar City, in outpatient care was 4.56% and in inpatient care was 1.46%. In outpatient care, the drugs that caused the most PIM were spironolactone, sulfonylureas, and NSAIDs. In hospitalization, the drugs that cause PIM are NSAIDs, corticosteroids, clopidogrel, and antipsychotics. The statistical analysis results showed a very weak correlation

between the amount of drugs (p=0.000; r=0.199) and there was no relationship between the number of diseases (p=0.674) prescribed and the incidence of PIM. Based on this, we can conclude that the amount of medication can increase the risk of PIM and the service at Wangaya Hospital is included in the good service.

ACKNOWLEDGMENT

The researcher expresses deep gratitude to the honorable Director of Wangaya Hospital, Denpasar City, who has given permission to the author to conduct research and all hospital parties for their assistance in research, as well as the honorable Mahaganesha College of Pharmacy who have helped and supported the author's research.

AUTHORS' CONTRIBUTIONS

The path of data collection was undertaken with me Made Shinta Sanma Putri in charge of making research manuscripts along with licensing to conduct research to the process of collecting research data, and this research was undertaken with Anak Agung Ngurah Putra Riana Prasetya in charge of designing research concepts to discussions along with research licensing, and this research was also undertaken with Putu Dian Marani Kurnianta in charge of revising the format of the article manuscript along with writing in the article manuscript.

CONFLICT OF INTERESTS

There is no funding and conflict of Interests from any party in this research

ETHICAL CONSIDERATION

The researcher would like to express her deepest gratitude to the Ethics Committee Team of Wangaya Hospital, Denpasar City, which has assisted the author in licensing the code of ethics at Wangaya Hospital, Denpasar City.

BIBLIOGRAPHY

AGS. (2023), "American Geriatrics Society 2023 updated AGS Beers Criteria® for potentially inappropriate medication use in older adults", Journal of the American Geriatrics Society, John Wiley and Sons Inc, Vol. 71 No. 7, pp. 2052–2081, https://doi.org/10.1111/jgs.18372

Al-Azayzih, A., Al-Azzam, S.I., Alzoubi, K.H., Jarab, A.S., Kharaba, Z., Al-Rifai, R.H. and Alnajjar, M.S. (2020), "Nonsteroidal Anti-inflammatory Drugs Utilization Patterns and Risk of Adverse Events due to Drug-Drug Interactions among Elderly Patients: A Study from Jordan", Saudi Pharmaceutical Journal, Elsevier B.V., Vol. 28 No. 4, pp. 504–508, https://doi.org/10.1016/j.jsps.2020.03.001

Blanco-Reina, E., Valdellós, J., Aguilar-Cano, L., García-Merino, M.R., Ocaña-Riola, R., Ariza-Zafra, G. and Bellido-Estévez, I. (2019), "2015 Beers Criteria and STOPP v2 for detecting potentially inappropriate medication in community-dwelling older people: prevalence, profile, and risk factors", European Journal of Clinical Pharmacology, Springer Verlag, Vol. 75 No. 10, pp. 1459–1466, https://doi.org/10.1007/s00228-019-02722-0

Cenzer, I., Nkansah-Mahaney, N., Wehner, M., Chren, M.M., Berger, T., Covinsky, K., Berger, K., et al. (2020), "A multiyear cross-sectional study of U.S. national prescribing patterns of first-generation sedating antihistamines in older adults with skin disease", British Journal of Dermatology, Blackwell Publishing Ltd, Vol. 182 No. 3, pp. 763–769, https://doi.org/10.1111/bjd.18042

Fauziah, H., Mulyana, R. and Martini, R.D. (2020), Polifarmasi Pada Pasien Geriatri, Jurnal Human Care, Vol. 5 No. 3, pp. 804 - 812, https://dx.doi.org/10.32883/hcj.v5i3.79 6

Filippatos, T.D., Makri, A., Elisaf, M.S. and Liamis, G. (2017), "Hyponatremia in the elderly: Challenges and solutions", Clinical Interventions in Aging, Dove Medical Press Ltd., 14 November, Vol. 12 No. 1, https://doi.org/10.2147/CIA.S138535

Girouard, C., Grégoire, J.P., Poirier, P. and Moisan, J. (2017), "Effect of contraindicated drugs for heart failure on hospitalization among seniors with heart failure: A nested case-control

study", Medicine (United States), Lippincott Williams and Wilkins, Medicine Journal, Vol. 96 No. 9, https://doi.org/10.1097/MD.0000000000006239

Hibattulwafi, H., Ramadhan, A.M. and Prabowo, W.C. (2022), "Identification of Potentially Inappropriate Drug Prescribing in Geriatric Patients with Cardiovascular Disease Based on STOPP START Criteria at One of The Hospitals in Balikpapan", Proceeding of Mulawarman Pharmaceuticals Conferences, Faculty of Pharmacy, Mulawarman University, Vol. 15, pp. 77–83, https://doi.org/10.25026/mpc.v15i1.621

Mende, J., Rahmawati, F. and Puspitasari, I. (2022), "Safety of Anticoagulant Use in Ischemic Stroke Hospitalized Patients with Atrial Fibrillation", Jurnal Manajemen Dan Pelayanan Farmasi (Journal of Management and Pharmacy Practice), Universitas Gadjah Mada, Vol. 12 No. 3, p. 176, https://doi.org/10.22146/jmpf.74893

Misrina, T., Intannia, D., Lingga, H.N., Rahmatullah, S.W. (2023), "Potentially Inappropriate Medications (PIMs) and Potentially Prescribing Omissions (PPOs) on Inpatient Geriatric Patients", Jurnal Pharmascience 296 Jurnal Pharmascience, Vol. 10 No. 2, pp. 296–309, http://dx.doi.org/10.20527/jps.v10i2.17039.

Mueller, C., John, C., Perera, G., Aarsland, D., Ballard, C. and Stewart, R. (2021), "Antipsychotic use in dementia: the relationship between neuropsychiatric symptom profiles and adverse outcomes", European Journal of Epidemiology, Springer Science and Business Media B.V., Vol. 36 No. 1, pp. 89–101, https://doi.org/10.1007/s10654-020-00643-2

Namirah M.S.A.A., Darmawan, E. and Mustofa. (2015), "Potentially Inappropriate Medications (Pims) Use Among Elderly Hospitalized Patients with Osteoarthritis at PKU Muhammadiyah Yogyakarta General Hospital", PharmaCiana, Vol. 5 No. 1, pp. 77–84, http://dx.doi.org/10.12928/pharmaciana.v5i1.2289.

O'Mahony, D., Cherubini, A., Guiteras, A.R., Denkinger, M., Beuscart, J.B., Onder, G., Gudmundsson, A., et al. (2023), "STOPP/START criteria for potentially inappropriate prescribing in older people: version 3", European Geriatric Medicine, Springer Science and Business Media Deutschland GmbH, Vol. 14 No. 4, pp. 625–632, https://doi.org/10.1007/s41999-023-00777-y

Permenkes. (2014), Peraturan Menteri Kesehatan Republik Indonesia Nomor 75 Tahun 2014, Jakarta.

Sasfi, S.M., Untari, E.K. and Rizkifani, S. (2022), "Evaluation of Prescriptions Pattern in Geriatric Patients at Dr. Soedarso Regional Public Hospital Pontianak Based on Beers Criteria", Indonesian Journal of Clinical Pharmacy, Vol. 11 No. 2, pp. 95–104, https://doi.org/10.15416/ijcp.2022.11.2.95

Simões, P.A., Santiago, L.M., Maurício, K. and Simões, J.A. (2019), "Prevalence of potentially inappropriate medication in the older adult population within primary care in Portugal: A nationwide cross-sectional study", Patient Preference and Adherence, Dove Medical Press Ltd., Vol. 13, pp. 1569–1576, https://doi.org/10.2147/PPA.S219346

Tang, J., Wang, K., Yang, K., Jiang, D., Fang, X., Su, S., Lin, Y., et al. (2023), "A combination of Beers and STOPP criteria better detects potentially inappropriate medications use among older hospitalized patients with chronic diseases and polypharmacy: a multicenter cross-sectional study", BMC Geriatrics, BioMed Central Ltd, Vol. 23 No. 1, https://doi.org/10.1186/s12877-023-03743-2

Thom, R.P., Mock, C.K. and Teslyar, P. (2017), "Delirium in hospitalized patients: Risks and benefits of antipsychotics", Cleveland Clinic Journal of Medicine, Cleveland Clinic Educational Foundation, https://doi.org/10.3949/ccjm.84a.16077

Velat, I., Bušić, Ž., Jurić Paić, M. and Čulić, V. (2020), "Furosemide and spironolactone doses and hyponatremia in patients with heart failure", BMC Pharmacology and Toxicology, BioMed Central, Vol. 21 No. 1, https://doi.org/10.1186/s40360-020-00431-4

Viviandhari, D., Nurhasnah, N., Sakinah, R.N. and Wulandari, D. (2022), "A Comparison of Potentially Inappropriate Medications Identification Using Beers and STOPP Criteria in Hospitalized Geriatric Patients in Jakarta", Indonesian Journal of Clinical Pharmacy, Indonesian Journal of Clinical Pharmacy, Vol. 11 No. 2, pp. 105–115, https://doi.org/10.15416/ijcp.2022.11.2.105

Wulansari, A., Wiedyaningsih, C. and Probosuseno, P. (2023), "Potentially Inappropriate Medication (PIM) in Geriatric Hospitalized Patient at Dr. H. Moch. Ansari Saleh Regional Public Hospital Banjarmasin", Majalah Farmaseutik, Universitas Gadjah Mada, Vol. 19 No. 1, p. 91, https://doi.org/10.22146/farmaseutik.v19i1.70420

Zhang, Y., Chen, Z. and Tian, F. (2022), "Potentially inappropriate medications in older Chinese outpatients based on the Beers criteria and Chinese criteria", Frontiers in Pharmacology, Frontiers Media S.A., Vol. 13, https://doi.org/10.3389/fphar.2022.991087