Correlation Between the Number of Prescribed Drugs and Potentially Inappropriate Medication (PIMs) Based on Beers Criteria in Geriatric Hypertension Outpatients at Dr. Soedomo Hospital in Trenggalek

(Hubungan Jumlah Obat Resep terhadap *Potentially Inappropriate Medication (PIMs)* Berdasarkan *Beers Criteria* pada Pasien Hipertensi Geriatri Rawat Jalan RSUD Dr. Soedomo Trenggalek)

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ABSTRACT

Background: Geriatric patients are elderly people who have various diseases and or problems as a result of diminished organ, psychological, social, economic, and environmental functioning and who require integrated health treatments from a multidisciplinary team. Uncontrolled hypertension can lead to complications such as stroke, CHD, and kidney failure. The more incidence of complications, causing the geriatrics to get more drugs (polypharmacy). Polypharmacy is one of the risk factors for the occurrence of Potentially Inappropriate Medication (PIMs) that often occurs in geriatric patients. **Objectives**: This study aims to know the correlation between the number of drugs administered to hypertensive geriatric outpatients at Dr. Soedomo General Hospital in Trenggalek and the incidence of PIMs. **Methods:** This study employed an observational study with an analytical approach and retrospective with sample of 85 prescriptions in the period of October - December 2020 taken using the purposive sampling technique. Data were analyzed using the C contingency coefficient correlation test. **Results:** 67,1% of prescriptions contained ≥ 5 kinds of drugs and 32,9% of prescriptions contained < 5 kinds of drugs. Based on the incidence of PIMs, there were 97.6% of prescriptions for PIMs and 2.4% of prescriptions without PIMs**.** The C contingency coefficient correlation test shows the correlation coefficient (r) of 0.216 with a positive direction and p-value = 0.041. **Conclusions**: The number of drugs has a significant correlation and can cause the incidence of PIMs in geriatric patients with weak correlation strength. Collaboration between pharmacists and doctors is needed to provide the best therapy to patients, to maximize the role of pharmacists in monitoring drug use in geriatric patients at Dr. Soedomo Hospital in Trenggalek.

ABSTRAK

Latar Belakang: Pasien geriatri adalah pasien lanjut usia dengan multi penyakit dan/atau gangguan akibat penurunan fungsi organ, psikologi, sosial, ekonomi dan lingkungan yang membutuhkan pelayanan kesehatan secara terpadu dengan pendekatan multidisiplin yang bekerja secara interdisiplin. Hipertensi yang tidak terkontrol dapat mengakibatkan kondisi komplikasi seperti stroke, penyakit jantung koroner, dan gagal ginjal. Semakin banyak kejadian komplikasi, menyebabkan geriatri semakin banyak mendapatkan obat (polifarmasi). Polifarmasi merupakan salah satu faktor risiko kejadian *Potentially Inappropriate Medication* (PIMs) yang sering terjadi pada pasien geriatri. Salah satu kriteria eksplisit yang dapat digunakan untuk mengidentifikasi kejadian PIMs pada pasien geriatri yaitu Beers Criteria 2019. **Tujuan:** Penelitian ini untuk mengetahui bagaimana hubungan antara kejadian PIMs dengan jumlah obat yang diberikan pada pasien geriatri hipertensi rawat jalan di RSUD Dr. Soedomo Trenggalek. **Metode:** Desain penelitian adalah penelitian observasional dengan pendekatan analitik dan bersifat retrospektif. Sampel sebanyak 85 resep pasien hipertensi geriatri poli rawat jalan di RSUD Dr. Soedomo Trenggalek pada periode bulan Oktober – Desember 2020 dengan teknik pengambilan sampel yaitu *purposive sampling*. Analisis data menggunakan uji korelasi koefisien kontigensi. **Hasil:** Berdasarkan jumlah obat yang diperoleh pasien pasien, sejumlah 67,1% resep terdapat ≥ 5 macam obat dan 32,9% resep terdapat < 5 macam obat. Berdasarkan kejadian PIMs, terdapat 97,6% resep ada kejadian PIMs dan 2,4% resep tidak ada kejadian PIMs. Uji korelasi koefisien kontigensi C menunjukkan nilai koefisien korelasi (r) sebesar 0,216 dengan arah positif dan nilai p= 0,041. **Kesimpulan:** Jumlah obat memberikan hubungan yang bermakna dan dapat menyebabkan kejadian PIMs pada pasien geriatri dengan kekuatan korelasi lemah. Diperlukan kolaborasi antara apoteker dan dokter untuk memberikan terapi terbaik kepada pasien, serta memaksimalkan peran apoteker dalam melakukan monitoring terhadap penggunaan obat pada pasien geriatri di RSUD Dr. Soedomo Trenggalek.

Kata kunci: Geriatri, Polifarmasi, PIMs, Beers Criteria.

INTRODUCTION

The aging process caused changes in various organs in the body such as the gastrointestinal, genitourinary system, immunological system, cerebrovascular system, central nervous system, and so on (Fixen, *et al.,* 2019). Therefore, the disease in the elderly population is different in its course and appearance from that in other populations, where the disease is multi pathological, degenerative, interrelated, chronic, tends to cause long disability before death, and polypharmacy during the treatment (Supartondo, 2014). Based on the results of the 2018 Indonesian Basic Health Research, the most non-communicable diseases in the elderly are hypertension 2.63%, stroke 42.63%, joints 17.66%, chronic kidney disease 7.64%, diabetes mellitus (DM) 5.2%, heart disease 4.40%, asthma 4.33%, and cancer 3.99%. from the 2019 Indonesian Basic Health Research, the highest prevalence of non-communicable diseases in the elderly is hypertension.

Muharni *et al.,* in their study showed that one patient can experience more than one type of hypertension complication. The higher the incidence of complications in geriatrics, the more geriatrics get drugs (Muharni, *et al.,* 2019). The use of multiple drugs (polypharmacy) in geriatric patients causes drug side effects, including drug interactions in geriatric patients which is a common problem that occurs in

hospitals and is an important cause of morbidity and mortality (Darmawan, *et al.,* 2020). A study from a primary health care center in Riyadh Saudi Arabia found a polypharmacy prevalence of 89.1%. Polypharmacy is predicted by a number of chronic conditions, including hypertension, coronary heart disease, heart failure, obstructive lung disease, chronic kidney failure, and diabetes mellitus.

Polypharmacy is often referred to as the use of 5 or more drugs. The prevalence of polypharmacy use at the age of 65 years or more is 40% using 5-9 kinds of drugs and 18% using 10 or more kinds of drugs (Fixen and Robert, 2019). Polypharmacy is a term used to describe the usage of pharmaceuticals that are not appropriate (Potentially Inappropriate Medications). PIMs (Potentially Inappropriate Medications) are drugs that have the potential to be misused by geriatric patients and should be avoided (Samuel, 2015). In geriatrics, the rate of improper drug usage ranges from 11.5 percent to 62.5 percent. Adverse drug responses and interactions, non-adherence, higher risk of cognitive impairment, impaired balance and falls, increased risk of morbidity, hospitalization, and mortality are all outcomes of polypharmacy.

The Beers criteria are one of the explicit criteria that can identify potential inaccuracies in treatment which includes drugs that should be avoided or can be used with special attention in geriatric patients aged 65 years (Muharni, *et.al*, 2019). Muharni *et al.,* (2019) conducted a study on the correlation between the number of drugs prescribed and the incidence of PIMs using the 2015 Beers criteria on 287 geriatric hypertension patients aged ≥ 65 years and found a 26.8% incidence of PIMs based on the Beers criteria and a correlation between the number of drugs prescribed and the number of PIMs. Meanwhile, another study stated that there were 18.30% of geriatric patients who received the potential for inappropriate drug use based on the 2012 Beers criteria (Negara, *et.al* 2016).

Based on the background described above and research on Potentially Inappropriate Medications has never been done in RSUD Dr. Soedomo Trenggalek so the researchers are interested in conducting a study entitled "The Correlation of Number of Drugs to Potentially Inappropriate Medication (PIMs) Based on the 2019 Beers Criteria in Geriatric Hypertension Patients at Dr. Soedomo Regional General Hospital."

METHODS

This study is an observational study with an analytical approach that is retrospective. In this study, the sampling technique used was purposive sampling. Inclusion criteria are all prescriptions for geriatric BPJS patients who experienced hypertension and underwent treatment at the Outpatient Installation at Dr. Soedomo Regional Hospital Trenggalek Hospital in the period October – December 2020. Exclusion criteria are incomplete and illegible prescriptions. It is a total of 85 prescriptions. The dependent variable in this study is the incidence of PIMs and the independent variable in this study is the number of drugs.

The research instrument is all prescriptions for geriatric hypertension outpatient at RSUD Dr. Soedomo Trenggalek then entered in the data collection sheet. Data were analyzed using the C contingency coefficient correlation test. This study has been approved by the Research Ethics Committee of IIK Bhakti Wiyata Kediri with Research Ethics Certificate No: 08/PP2M-KE/I/2021.

RESULTS AND DISCUSSION

Characteristics profiles by gender

Table 1. Profile of characteristics by gender

Gender	Total (prescription)	Percentage (%)
Female	52	61.2
Male	33	38.8
Total	85	100

The characteristic profile based on gender in the prescription sample for hypertension geriatric outpatients at Dr. Soedomo Regional General Hospital Trenggalek showed that the female was 61.2% more than the male, 38.8%. These results support the 2018 Indonesian Basic Health Research which states that the prevalence of female hypertension patients is higher, 36.9%, while men are 31.3% (Ministry of Health of Republic of Indonesia, 2018). Furthermore, according to Statistics Indonesia in 2020, it is stated that the percentage of elderly women is more, which is 52.29% compared to elderly men, which is 47.71%. According to Meaningningrum in 2015, stated that compared to females, male lifestyles tend to cause hypertension. After menopause, however, the prevalence of hypertension in women is on the rise. This happens because the production of the hormone estrogen will decrease and affect the increase in the activity of the Renin-Angiotensin-Aldosterone System (RAAS) in women who experience menopause. The result of an increase in the RAAS might affect several cardiovascular physiological processes including regulation of arterial blood pressure (Alldredge, 2013).

Patient characteristic profile by age

Table 2. Profile of patient characteristics by age

Age	Total (prescription)	Percentage (%)
60-69	36	42.4
>70	49	57.6
Total	85	100.0

The characteristic profile based on age in the prescription sample for outpatient hypertension geriatric patients at the Dr. Soedomo Hospital in Trenggalek showed that over 70 years of age the highest percentage was 57.6% compared to those aged 65-69 with a percentage of 42.4. According to Fauzi, 2014 states that one of the factors that causes hypertension is age. Age is one of these factors that cannot be changed. The older people get, the greater their risk of suffering from high blood pressure. Along with increasing age, the flexibility in large blood vessels decreases, which cause an increase in systolic

blood pressure at the age of the seventh decade, whereas in the diastolic blood pressure it will increase at the age of the fifth and sixth decades and then tends to decrease or persist (Muharni, *et al.,* 2019). With increasing age, physiological functions will decrease as a result of degenerative processes (aging) which causes disease in the elderly population to experience differences in walking and appearance from other populations. Therefore, in the elderly population, the disease is multi pathological, degenerative, chronic, tends to cause long—term disability before death, and in treatment polypharmacy often occurs (Supartondo and Govinda, 2014).

Analysis of the number of types of drugs

Table 3. The number of types of drugs obtained by the patient

The number of types of drugs	Total (prescription)	Percentage (%)
< 5	28	32,9
≥ 5	57	67,1
Total	85	100.0

Furthermore, the number of medicines found in outpatient hypertension geriatric patients' prescription samples at Dr. Soedomo Hospital in Trenggalek showed that prescriptions with more than 5 drugs were more than prescriptions with fewer than 5 drugs (67.1 percent compared to 32.9 percent). According to WHO, polypharmacy is a form of irrational drug treatment, giving more than five kinds of drugs to one patient in one prescription. Polypharmacy is often referred to as the concurrent use of 5 or more kinds of drugs (Fixen and Robert, 2019). One aspect of drug use in geriatric patients, according to Martono and Pranaka in 2014 stated that in geriatric patients disease tends to occur in various organs of the body. Thus, drug administration also tends to be polypharmacy. This happens because in geriatric patients there is a physiological aging process that can cause changes in the pharmacokinetics and pharmacodynamics of drugs, as well as a decrease in function in various organs of the body. Therefore, the level of drug safety and drug effectiveness changes when compared to young age. Moreover, complications often occur in geriatric patients which cause them to experience polypharmacy in the treatment of disease.

Analysis of antihypertensive drugs

Table 4. Prescribed antihypertensive drugs

Drug Class	Medicine Name	Quantity (medicine items)	Percentage (%)
CCB	Amlodipine	55	11.90
	Nifedipine	10	2.16
Diuretic	Hidroclorotiazid	21	4.55
	Spironolactone	10	2.16
	Furosemid	2	0.43

	Irbesartan	21	4.55
	Candesartan	14	3.30
	Valsartan	3	0.65
	Telmisartan	2	0.43
ACE-i	Imidapril	20	4.33
	Lisinopril	4	0.87
Beta-Blocker	Bisoprolol	11	2.38
Alpha Blocker	Terazosine	2	0.43

Source: Secondary data processed in 2021

Analysis of drugs categorized into the 2019 Beers Criteria

Table 5. Drugs categorized into the 2019 Beers Criteria

Medicine Name	Quantity (medicine items)	
Category 1		
Nifedipine	10	2.16
Dexketoprofen	4	0,87
Diazepam	5	1,08
Digoksin	2	0.43
Dimenhydrinate	1	0.22
Terazosin	2	0.43
Ibuprofen	3	0.65
Lansoprazole	20	4.33
Meloxicam	12	2.60
Metoclopramide	1	0.22
Omeprazole	1	0.22
Trihexyphenidyl	3	0.65
Category 2		
Pioglitazone	12	2.60
Category 3		
Aspirin	11	2.38
Furosemide	2	0.43
Hydrochlorothiazide	21	4.55
Spironolactone	10	2.16
Category 5		
Gabapentine	5	1.08
Colchicine	21	4.55
Ranitidine	1	0.22

Source: Secondary data processed in 2021

The results of the analysis of antihypertensive drugs are widely prescribed in geriatric hypertension patients at Dr. Soedomo Hospital in Trenggalek, namely amlodipine with a percentage of 11.90%. according to the Joint National Committee (JNCVII), amlodipine is one of the antihypertensive drugs belonging to the calcium-channel blocker class which is included as one of the first lines of treatment

for hypertension in patients aged > 60 years. Amlodipine is a drug that has high selectivity, this is an advantage of amlodipine compared to other calcium-channel blocker drugs. Amlodipine has an oral availability of 65-90%. Thus, this drug works within a full 24 hours (Charfi, *et al.,* 2020).

The results of the analysis of drugs included in the 2019 Beers Criteria are categorized into several categories. Category 1 is for the Proton Pump Inhibitor (PPI) drug class, namely lansoprazole, and omeprazole. Drugs included in the PPI (Pump Proton Inhibitor) drug category have a mechanism of action of blocking the action of the K+H+-ATPase enzyme which will break down K+H+- ATPase to produce energy which is used to excrete HCl acid from the canaliculi and parietal to in the lumen of the stomach (Alldredge, *et al.,* 2013). Lansoprazole and omeprazole in the elderly are at risk of causing bone loss, fractures, and *Clostridium difficile*. Lansoprazole and omeprazole are suggested not to be used continuously for > 8 weeks unless the patient has erosive esophagitis, Barrett's esophagitis, pathological hypersecretory conditions, or indicates the need for maintenance treatment (AGS, 2019).

The next drug is NSAIDs, namely dexketoprofen, ibuprofen, and meloxicam. The NSAIDs are lipophilic and acidic which might cause topical damage, while the systemic effects of NSAIDs are caused by mucosal damage caused by decreased prostaglandin production. Inhibition of PF synthesis can lead to reduced mucosal resistance, which irritates in the form of acute lesions of the gastric mucosa of mild to severe forms. Lipophilic and acidic NSAIDs facilitate the trapping of hydrogen ions into the mucosa and cause ulceration. Inhibition of enzymes (COX-1 and COX-2) results in a decrease in (PGE2) and (PGI2). This decrease in prostaglandin production causes an increase in sodium retention. This increased sodium retention can lead to complications such as hypertension, impaired renal function, edema, and gastrointestinal bleeding. Increased sodium retention can lead to increased blood pressure (Amrulloh and Utami, 2016).

The next drug that is included in the 2019 Beers Criteria category is nifedipine. Nifedipine in the immediate release dosage form is a type of drug that should be avoided in the elderly because of the high risk of hypotension. In this study, there were no data on the duration of use of nifedipine, blood pressure in the elderly, and the incidence of falls in the elderly. Thus, it was not possible to further identify the effects of nifedipine. However, the risk of hypotension due to the administration of antihypertensives in the elderly increases in the following conditions: increasing age, having comorbidities with heart failure and impaired kidney function, inactive elderly, and physical weakness (Fixen, *et al.,* 2019). Therefore, the replacement of nifedipine with other antihypertensive drugs in the elderly needs to be reconsidered.

Diazepam is a benzodiazepine drug class that is used to treat anxiety, insomnia, and muscle spasms (Zhuo, *et al,* 2020). Benzodiazepines are among the drugs frequently used in elderly patients, where

they are associated with an increased risk of falls, with sometimes dire consequences. A previous investigation aimed at estimating the impact of benzodiazepine-related fall injuries in the elderly population showed that benzodiazepine use was significantly associated with the occurrence of fall injuries, with significant interaction with age.

Dimenhydrinate is a first-generation antihistamine that belongs to the anticholinergic drugs group. Anticholinergic drugs have the potential to cause side effects such as cognitive impairment, confusion, hallucinations, and sleep disturbances (American Geriatrics Society, 2012). Cholinergic inhibition in the brain due to inhibition of acetylcholine at its receptors is associated with unwanted side effects such as delirium, behavioral disturbances, reduced decision-making abilities, altered emotions, and reduced motor function. In the normal aging process, the concentration of acetylcholine tends to decrease and there are structural changes at the site where acetylcholine binds (Kersten and Wyller, 2014).

Digoxin is a cardiac glycoside medication that is used to lower the risk of heart failure (HF) hospitalization and control ventricular rate in atrial fibrillation (Charfi, R. *et al*, 2020). In elderly patients (≥65 years old), it is important to adjust the optimal dose, taking into account age, gender, kidney function, comorbidities, and drugs used (Charfi, R., *et al*, 2020). According to Lesauskaitė *et al* (2010), the daily dose of digoxin for the elderly should be 0.125 mg. Digoxin can cause side effects such as bradyarrhythmia, nausea or vomiting, abdominal pain, diarrhea, and neuropsychiatric symptoms that change mental status, headaches, hallucinations, and seizures (Ehle, *et al*, 2011).

Furthermore, the drug included in the 2019 Beers Criteria in category 2 is pioglitazone. Category 2 is a category of drug interactions with the disease. Pioglitazone is a thiazolidinedione group that acts on *Peroxisome Proliferator-Activated Receptorɣ* (PPARɣ) agonists which can increase insulin stipulation thereby increasing glucose uptake in peripheral tissues (Ulfa and Arfiana, 2020). The use of pioglitazone in patients with cardiovascular disease has the potential to increase fluid retention and/or worsen heart failure (Fixen and Robert, 2019).

Furthermore, drugs that are included in the 2019 Beers Criteria in category 3, namely the category of drugs that must be used with caution in elderly patients. The first is aspirin. Low-dose aspirin is one of the most widely used agents for cardiovascular prevention. The risk of major bleeding from aspirin increases markedly with advancing age. Several researchers have found no benefit in older adults with cardiovascular risk factors when used for primary prevention, although the evidence is not conclusive (Fixen and Robert, 2019).

The second in category 3 is a class of diuretic drugs, including spironolactone, furosemide, and hydrochlorothiazide. Diuretics are a class of drugs used to treat hypertension. In elderly patients, the use

of diuretics should be carried out with caution because diuretic treatment can cause hyponatremia (Fixen and Robert, 2019).

Drugs included in the 2019 Beers Criteria in category 5 are gabapentin, colchicine, and ranitidine. Gabapentin is an anticonvulsant drug that is included in the adjuvant treatment of persistent pain in geriatric patients. This drug is used in cases of neuropathic pain such as postherpetic neuralgia, DM neuropathy, etc. (Fixen, 2019). Side effects of gabapentin in the elderly include central side effects such as delirium and mild changes in memory skills (AGS,2019).

Furthermore, the drug included in category 5 in the 2019 Beers Criteria is colchicine. Colchicine is a nonsteroidal anti-inflamatory medications (NSAID) that is used to treat gout in older people. Colchicine should not be used for more than 3 months in elder patients with chronic renal disease, and it should be discontinued in geriatric patients with decreasing kidney function (Darmawan, E. *at al*, 2020). Colchicine in geriatric patients can cause gastrointestinal, neuromuscular disorders, and bone marrow toxicity (AGS, 2019). The use of NSAIDs, particularly in senior patients over 75 years old, can raise the risk of gastrointestinal bleeding or ulcers, cardiovascular adverse effects, and nephrotoxicity (AGS, 2015).

Ranitidine (H2 receptor antagonist/H2Ras), which is typically encountered in geriatric inpatients, is the third drug on the list. Although ranitidine is not prohibited, it is an anticholinergic drug burden (ACB) that, when taken with other anticholinergic drugs, may increase the risk of anticholinergic toxinity in geriatrics. Delirium and moderate abnormalities in memory skills are two symptoms of anticholinergic medications' central side effects (Darmawan, E., *et al*, 2020). Ranitidine in geriatric patients can cause changes in mental status and induce or worsen delirium (AGS,2015;2019).

Analysis of the incidence of PIMs

Table 6. Incidence of PIMs

Incidence of PIMs	Quantity (prescription items)	Percentage %)
Present	83	97.6
Not Present	2	2.4
Total	85	100.0

Furthermore, the results of the analysis of the incidence of PIMs in prescribing geriatric hypertension patients at Dr. Soedomo Hospital in Trenggalek, showed that patients who experienced PIMs were 97.6% (83 prescription items) more than those who did not experience PIMs, 2.4% (2 prescription items). Polypharmacy is a term used to describe the usage of pharmaceuticals that are not appropriate (Potentially Inappropriate Medications). Potentially Inappropriate Medications (PIMs) are the potential

for inappropriate drug use that should be avoided by geriatric patients (Samuel, 2015). Polypharmacy or the use of a lot of drugs in found out of 90% of geriatric patients who received multiple drugs (polypharmacy), 59% of them received PIMs. A study conducted by Asplund et al (2000) showed that geriatric patients in the geriatric ward had a shorter length of stay compared to geriatric patients in the general ward. One of the factors used to identify the success of treatment is the length of patient care. The faster the length of treatment, the more successful the treatment (Zulkarnaini and Martini, 2019). Monitoring of the treatment of geriatric patients is one of the factors used to show the success of treatment in geriatric patients. The high rate of PIMs in geriatric patients at Dr. Soedomo Hospital in Trenggalek highlights the need for pharmacists to play a larger role in drug selection and use, and it is suggested that a special polyclinic for geriatric patients be established to provide integrated health services to these patients.

Analysis of the coorelation

Table 7. The correlation between the number of medicines and the occurrence of PIMs based on the 2019 Beers Criteria

Correlation Test			
R	P	Correlation Direction	Results
0.216	0.041	+ Positive	Significant weak correlation

Source: Secondary data processed in 2021

Based on the 2019 Beers Criteria, the examination of the correlation between the number of medicines and the incidence of PIMs revealed a positive correlation coefficient (r) and a p-value of 0.041 (p<0.05). This test employed the C contingency correlation test using the SPSS application. The test results revealed a slight correlation between the number of medicines and the occurrence of PIMs in senior hypertensive patients. This study supports a previous study conducted by Anisa (2017) which concludes that the number of drugs affects the incidence of PIMs with a weak correlation strength. This demonstrates that the higher the number of medicines administered to senior individuals, the higher the risk of PIMs in this study. It is critical to closely monitor elderly patients in order to prevent the occurrence of incorrect treatment of geriatric hypertension patients. In this instance, pharmacists play a critical role in informing patients and their families about the prevalence of PIMs and the potential risks associated with medications supplied to elderly patients. Good communication between patients, doctors, and pharmacists, in this case, is the key to success in preventing and detecting the incidence of PIMs in geriatric patients. As a result, the potential for PIMs events to increase mortality and morbidity in older patients in health care can be minimized as much as possible (Darmawan, *et al*, 2020). The limitation of this study because The Beers Criteria has limitations where it does not consider the complexity of the patient. In this study is limited to PIMs analysis with explicit criteria without being

supported by observations whether clinical manifestations of PIMs also appear in patients. In addition, the study was carried out during the COVID-19 pandemic so that the number of samples was not too large.

CONCLUSION

Drugs prescribed to geriatric hypertension patients at Dr. Soedomo Hospital included in the 2019 Beers Criteria, category 1, consist of nifedipine (2.16 %), dexketoprofen (0.87 %), diazepam (1.08 %), digoksin (0.43 %), dimenhydrinat (0.22 %), terazosine (0.43 %), ibuprofen (0.65 %), lansoprazole (4.33 %), meloxicam (2.60 %), metoclopramide (0.22 %), and omeprazole (0.22 %). Drugs in category 2 consist of pioglitazone (6.20 %). Drugs in category 3 consist of aspirin (2.38 %), furosemid (0.43 %), hidroklorotiazid (4.55 %), and spironolactone (2.16 %). Drugs in category 5 consist of gabapentin (1.08 %), colchicine (4.55 %), and ranitidine (0.22 %). Drug in category 6 consist of tryhexyphenidil (0,65%). Based on the 2019 Beers Criteria, there is a modest correlation between the number of medications provided to hypertension senior patients and the incidence of PIMs, indicating that the more pharmaceuticals given to hypertensive geriatric patients, the higher the incidence of PIMs in geriatric patients.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

REFERENCES

Abdullah, R., and Barliana, MI. (2015). 'Potentially Inappropriate Medications in the Geriatric Population in Bandung'. *Journal of Indonesian Clinical Pharmacy*, vol. 4, no. 3, hh. 226 – 234.

Alldredge, B.K., Corelli, R.L., Ernst, M.E., Guglielmo, B.J., Jacobson, P.A., Kradjan, W.A. (2013). *Koda-Kimble & Young's Applied Therapeutics The Clinical Use of Drugs,* Edisi 10, Lippincott Williams & Wilkins, Pennsylvania, United States of America.

American Geriatrics Society. (2015). 'American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults'. *Journal of the American Geriatrics Society (JAGS)*. vol. 63, no. 11.

American Geriatrics Society. (2019). 'American Geriatrics Society 2019 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults'. *Journal of the American Geriatrics Society (JAGS)*.

Amrullah, F.M. and Utami, N., (2016) 'The Relationship of NSAID Consumption to Gastritis'. *Journal of Majority*, vol. 5, hh. 18–21.

Central Bureau of Statistics. (2019), Elderly Population Statistics, Central Bureau of Statistics, Jakarta

Charfi, R., Sassi M.B., Gaies E., Jebabli N., Daghfous R., dan Trabelsi, S. (2020). 'Digoxin Therapeutic Drug Monitoring: Age Influence and Adverse Events', *La Tunisie Medicale*, vol. 98, no. 1.

Darmawan, E., Hidayat A., Perwitasari, D.A and Kusumawardani, N. (2020). 'Pharmacist Intervention can Reduce the Potential Use of Inappropriate Drugs Medications in Indonesian Geriatric Patients', *Journal of Applied Pharmaceutical Science*. vol.10, no.1. hh. 88 – 95.

Dasopang, E.S., Harahap, U., Lindarto, D. (2015). 'Polypharmacy and Drug Interactions in Outpatient Elderly Patients with Metabolic Disease', *Journal of Indonesian Clinical Pharmacy*, vol.4, no.4, pp. 235 – 241.

Ehle M, Patel C, Giugliano RP. (2011). 'Digoxin: Clinical Highlights: A Review of Digoxin and Its Use in Contemporary Medicine', *Crit Pathw Cardiol*, vol.10, no.2, hh.93-98.

Fixen, Danielle R., dan Robet L. (2019) '2019 AGS Beers Criteria for older adult', *American Pharmacist Association.* Page II.

Ittaman, S.V., VanWormer J.J., Rezkalla, S.H. (2014). The role of aspirin in the prevention of cardiovascular disease'. *Clin Med Res*, vol.12, hh. 147–54.

Ministry of Health of the Republic of Indonesia. (2016). *Implementation of Geriatric Health Services in Hospitals - Regulation of the Minister of Health of the Republic of Indonesia Number 79 of 2014*, Ministry of Health of the Republic of Indonesia, Jakarta.

Ministry of Health of the Republic of Indonesia. (2018) *Main Results of Riskesdas 2018*. Ministry of the Republic of Indonesia, Jakarta.

Kersten, H. and Wyller, TB. (2014). 'Anticholinergic Drug Burden in Older People's Brain - How Well is it Measured ?', *Basic and Clinical Pharmacology and Toxicology*, vol.114, no.2, hh. 151–159.

Muharni, S., Aryanti, F., and Fadillah, R. (2019). 'Analysis Between The Number of Drugs and Potentially Inappropriate Medication (PIMs) Based on Beers Criteria 2019 in Geriatric Hypertension Patients at Sidomulyo Health Center Pekanbaru City'. *Journal of Indonesian Pharmaceutical Research*, vol.7, no.2, pp. 70 – 76.

Negara, Y.R., Machlaurin, A. and Rachmawati, E. (2016). 'Potentially Inappropriate Medications in Prescribing Outpatient Geriatric Patients at RSUD dr. Soebandi Jember Based on Beers Criteria', E-Journal of Pustaka Kesehatan, vol.4, no.1, pp. 14 – 19.

Samuel, M.J. (2015). 'American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults', *Journal of the American Geriatrics Society,* vol.3, no.11, hh. 2227–2246.

Supartondo and Govinda RA. (2014). *'Guidelines for Giving Medicine to Geriatric Patients and Overcoming Polypharmacy Problems',* in: Sudoyo AW, Setiyohadi B, Alwi I, Simadibrata M, Setiati S, editors (editors). Textbook of Internal Medicine, 6th edk, Internal Publishing. Jakarta.

Ulfa, N.M., Arfiana, N. (2020), 'Effectiveness of the Use of Oral Antidiabetic Combinations of Glimepiride With Pioglitazone in Patients with Type 2 Diabetes Mellitus', Journal of Pharmacy and Science, vol. 5, no.1.

Yogita, KS., dan Priti, D.P. (2013), 'Measuring Inappropriate Prescriptions In Geriatric Population: Overview Of Various Screening Tools'. *International Journal of Medical Research and Health Sciences*, vol.2, no.3, hh. 636-642.

Zhuo, Y., Meng, D., Chen, F., Wu, Z., Wang,B., Wang, S. *et al.* (2020), 'Inhibitory Effect of Imperatorin on the Pharmacokinetics of Diazepam In Vitro and In Vivo'*. Frontiers in Pharmacol*ogy, vol.11.

Zulkarnaini, A. and Martini, R.D. (2019). 'Overview of Polypharmacy of Geriatric Patients in several Polyclinics of Dr. M. Djamil Padang. *Journal of Andalas Health*, vol.8, no.1.