

Prevalence and associated factors of potentially inappropriate medications among Iranian older adults

Malihe Saboor¹, Ahmad-Ali Akbari Kamrani¹, Yadollah Abolfathi Momtaz^{1,2}, Robab Sahaf¹

¹Iranian Research Center on Ageing, University of Social Welfare and Rehabilitation Sciences Tehran, Iran, ²Malaysian Research Institute on Ageing (My Ageing), University Putra Malaysia, Serdang, Selangor, Malaysia

ABSTRACT

Aim Potentially inappropriate medications (PIMs) in older people are associated with the increased use of health care services. The aim of this study was to investigate the prevalence of PIMs among the elderly being referred to pharmacies in Tehran using the Beers criteria of 2012, and identify factors related to PIMs.

Methods This cross-sectional study was conducted on elderly patients (60 years and above) referred to pharmacies in Tehran, in 2017. The Beers' criteria 2012 were used to evaluate PIMs. The logistic regression analysis was used to find sociodemographic predictors of PIMs.

Results The mean age of 1591 patients was 70.51 years. The overall prevalence of PIMs was 26.0%. The most frequent PIMs, in order of frequency, included diclofenac (13.5%), \uparrow alprazolam (9.3%), and chlorthalidone (9.1%) and clonazepam (8.4%). The pain medications were found to be most common PIMs (37.6%). Polypharmacy \uparrow (OR=3.64, CI 95%: .81-4.70; $p<0.001$), number of chronic disease \uparrow (OR=2.371, CI 95%: 1.71-3.28; $p<0.001$) \uparrow insomnia (OR=1.45, CI 95%: 1.13-1.87; $p<0.01$) \uparrow and type of specialists were found as PIMs risk factors. Internal medicine specialists prescribed PIMs significantly fewer times than other specialists \downarrow (OR=0.59, CI 95%: 0.40-0.88; $p<0.01$) \downarrow and the orthopedic specialists prescribed PIMs significantly more times than other physicians \uparrow (OR=3.23, CI 95%: 5.76-1.81; $p<0.001$) \uparrow .

Conclusion High prevalence of PIMs among Iranian elderly patients implies a need for the development and operationalization of scientific guidelines for the use of medicines. It is also necessary to hold training courses for physicians to be educated in such cases.

Keywords: Beers criteria, elderly, potentially inappropriate medication, potentially inappropriate prescribing

Corresponding author:

Ahmad-Ali Akbari Kamrani
Iranian Research Center on Ageing,
University of Social Welfare and
Rehabilitation Sciences
Tehran, Iran
Phone/fax: +98 21 22 180 154;
E-mail: akbarikamrani@gmail.com
Malihe Saboor ORCID ID: <https://orcid.org/0000-0003-0279-1152>

Original submission:

22 October 2018;

Revised submission:

20 December 2019;

Accepted:

07 January 2019.

doi: 10.17392/989-19

INTRODUCTION

The world's population is rapidly aging. According to the UN Population Division estimates, the proportion of the world's elderly population will increase from 10.5% in 2007 to 21.8% in 2050 (1). Results of the latest census of Iran in 2016 indicate that the elderly accounts for 9.2% of the population of the country equivalent to 7,141.91 (2). The phenomenon of increasing population of the elderly in the world including Iran is important in terms of its consequences on different social and economic aspects, including resources of the health sector, and requires a thorough scientific study (2).

The elderly are the largest consumers of healthcare resources in most industrialized and developing countries (3). The extent of drug use has increased in recent populations, especially in the elderly in recent decades. Although the elderly population accounts for a small proportion of the world's population, approximately 40% of prescriptions are related to them in many parts of the world (4). Inappropriate drug prescription is a serious and universal problem in the health care of elderly people as it can increase the risk of adverse drug reactions. Inappropriate drugs refer to drugs in which the risk of an adverse event outweighs its clinical benefit when there is a safer or more effective alternate therapy for the same condition. The use of inappropriate drugs can lead to adverse drug reactions (5).

Inappropriate prescription in the elderly population, considering its direct relationship with high morbidity, mortality and waste of health resources caused by adverse drug reactions, is now considered as a major public health problem (6). Inappropriate drug prescription has become a major health issue in recent years, and numerous tools have been developed to evaluate it (7).

The American Geriatrics Society (AGS) uses the Beers' list to evaluate potentially inappropriate medications (PIMs). The list includes a number of potentially inappropriate medications that should either be avoided in the elderly or used with caution at a low dose with certain diseases or syndromes (8,9). The AGS widely uses the Beers' criteria in the field of clinical geriatric medicine, education and research, and for promoting the quality of indicators. The responsibility

of this society is to continually update the Beers' criteria. The criteria were re-evaluated and updated in 2003, 2012, and 2015 (10,11).

The aim of the present study was to assess the prevalence of PIMs and its related factors in a sample of Iranian elderly people.

METHODS

Study design and population

This cross-sectional study was conducted to investigate PIMs and their related factors on elderly patients referred to pharmacies in Tehran in 2017. Attempts were made in this study to collect and investigate the prescriptions of individuals aged 60 and above who were referred to the pharmacies of the city of Tehran using random cluster sampling. To do so, the name of all pharmacies covered by Tehran University of Medical Sciences was first listed and each pharmacy was considered as a cluster, then the samples were selected using multi-stage proportional random sampling. Out of 2169 pharmacies covered by the University of Medical Sciences, 84 were selected randomly. Trained pharmacists and pharmaceutical technicians interviewed 1591 elderly patients aged over 60 years who were referred to pharmacies with prescriptions in their hands after obtaining their consent and then completed the questionnaire.

The study was approved by the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. The purpose of the study was elucidated and verbal consent was obtained before the participants were interviewed, respecting their autonomy and anonymity.

Methods

The 2012 Beers Criteria were used as a source for identifying PIMs for the preparation of the questionnaire (11). According to these criteria, drugs that are identified as potentially inappropriate in the elderly are divided into three categories: 1) drugs that the elderly should avoid, 2) drugs that should be avoided by elderly people with certain diseases and syndromes because these drugs can exacerbate certain diseases and infections, 3) drugs that should be used with caution in elderly people (11).

Therefore, this list was first matched with medications available in the Iranian Pharmacopoeia (12), which is updated through the Food and

Drug Prescription website of the Ministry of Health (12) every six months. The medications that were unavailable at the Iranian Pharmacopoeia were removed from the list.

The questionnaire contained questions on the socio-demographic characteristics of the elderly, the type of pharmacy visited, the municipal district, the university covering the pharmacy, the diseases and syndromes mentioned in the Beers list in the Beers' tool including heart failure, syncope, epilepsy, Parkinson's disease, delirium, dementia, fall, stomach disorders, chronic constipation, insomnia, urinary incontinence, prostate hypertrophy as well as the number of prescribed drugs, the names of drugs and drug category, inappropriately prescribed drugs and their drug groups according to the Beers' classification table, and type of insurances and physician's socio-demographic profile (age, gender, type of specialization, and work experience).

RESULTS

The mean ±SD of the elderly's age among 1591 involved in the study was 70.51± 8.74 years. The elderly aged 60-70 accounted for majority of the studied population, 72.7%. The female and male participants made up 54.1% and 45.9% of the total subjects, respectively. The majority of the elderly had less than a primary degree (36.6%). In addition, a total of 1214 (76.3%) of the elderly were married. Also, a total of 1568 (98.6%) and 23 (1.4%) of the elderly were insured and not by the Social Security Organization.

The mean± SD of physicians' age and their average work experience was 53.25±11.01 and

25.5± 10.5 years, respectively. There was a total of 415 (26.1%) female and 1176 (73.9%) male physicians. Of the total number of physicians, 402 (25.3%) were general practitioners and 1189 (74.7%) were specialists.

The prevalence of PIMs among the elderly referred to the pharmacies of Tehran was estimated to be 26% (412 out of 1591). Among 412 PIMs, one PIM was noticed in 316 (19.9%), two PIMs in 81 (5%), three in 14 (0.9%), and four PIMs in one (0.1%) case. Based on the Beers criteria diclofenac (13.5%), alprazolam (9.3%), chlorthalidone (9.1%) and clonazepam (8.4%), spironolactone (7.1%), prazosin (5.9%), naproxen (5.5%), piroxicam (4.4%), ketorolac and digoxin (2.8%) were among the most frequently prescribed PIMs. Analgesics, medications acting on the central nervous system, and cardiovascular drugs with prevalence rates of 169 (37.6%), 159 (35.3%), and 86 (19.1%) respectively, were among the most common drug groups prescribed for the elderly who were referred to the pharmacies of Tehran (Table 1).

The elderly aged 75-84 years received the highest rate of PIMs (26.1%). The prevalence of inappropriate drug prescriptions in women (24.5%) was higher than men (22.3%), in illiterate individuals (no formal education) (25.1%) as compared to individuals with other educational levels, widow individuals (26.9%) as compared to other groups, and among those who were insured by the Social Security Organization (23.5%). Inappropriate drug prescription in male physicians (24.1%) was slightly higher than female physicians (21.9%). There was no significant relationship among

Table 1. Distribution of potentially inappropriate medications (PIMs) by drug groups according to 2012 Beers Criteria

PIM	Therapeutic category PIM	N (%)	PIM	Therapeutic category PIM	N (%)
Diclofenac	Pain medication	61 (13.5)	Hydroxyzine	Anticholinergic	9 (1.8)
Alprazolam	CNS	42 (9.3)	Indomethacin	Pain Medication	8 (1.6)
Chlorthalidone	CNS	41 (9.1)	Clomipramine	CNS	8 (1.6)
Clonazepam	CNS	38 (8.4)	Methocarbamol	Pain Medication	8 (1.6)
Spironolactone	Cardiovascular	32 (7.1)	Zolpidem	CNS	8 (1.6)
Prazosin	Cardiovascular	28 (5.9)	Imipramine	CNS	7 (1.3)
Naproxen	Pain medication	26 (5.5)	Amiodarone	Cardiovascular	6 (1.2)
Piroxicam	Pain medication	22 (4.4)	Terazosin	Cardiovascular	6 (1.2)
Ketorolac	Pain medication	14 (2.8)	Mefenamic acid	Pain Medication	5 (1.0)
Digoxin	Cardiovascular	14 (2.8)	Oxazepam	CNS	5 (1.0)
Clidinium-chlordiazepoxide	Anticholinergic	12 (2.4)	Metoclopramide	Gastrointestinal	5 (1.0)
Lorazepam	Cardiovascular	12 (2.4)	Amitriptyline	CNS	4 (0.8)
Diphenhydramine	Anticholinergic	11 (2.0)	Total		473 (100)
Ibuprofen	Pain medication	9 (1.8)			
Meloxicam	Pain medication	9 (1.8)			

CNS, central nervous system

any of the demographic variables. However, polypharmacy was more common in subjects with inappropriate drug prescription (22.2%) than in those without inappropriate drug prescription ($p < 0.001$) (Table 2).

Table 2. The relationship between demographic characteristics of the sample and potentially inappropriate medication (PIM) test

Variables	Category	Non- PIM		p
		No (%)	PIM No (%)	
Patient's gender	Females	651(76)	210 (24.5)	0.302
	Males	568 (78)	162 (22.3)	
Education	No formal education	302 (75)	101 (25.1)	0.738
	Primary	444 (76.2)	139 (23.8)	
	Secondary	330 (77)	97 (22.7)	
Marital status	Tertiary education	141 (79)	37 (20.8)	0.363
	Married	937 (77)	277 (22.8)	
Age group (years)	Single	31 (80)	8 (20.5)	0.771
	Divorced	12 (86)	2 (14.3)	
Insurance	Widow	237 (73)	87 (26.9)	0.494
	60-74	888 (79)	268 (20.9)	
Polypharmacy	75-84	256 (74)	85 (26.1)	0.001*
	+85	73 (78)	21(22.4)	
chronic disease	YES	1200 (77)	368 (23.2)	0.01*
	NO	19 (75)	4 (24.9)	
Physician gender	YES	313 (78)	203 (22.2)	0.377
	NO	906 (69)	169 (21.3)	
Specialist physician	YES	893 (73)	364 (39.3)	0.020*
	NO	285 (61)	49 (15.7)	
Physician gender	Female	324 (84)	91(29)	0.377
	Male	893 (71)	283 (14.7)	
Specialist physician	General	281(69.8)	122 (30.2)	0.020*
	Expert	897 (75.5)	291(24.5)	

* $p < 0.05$

There was a significant relationship between having chronic diseases with the inappropriate drug prescription found ($p < 0.001$). The prevalence of PIMs was significantly higher in general practitioners (30.2 %) than medical specialists (24.5%) ($p < 0.05$) (Table 2).

Independent sample t-test showed no significant relationship between physicians' age and work experience with inappropriate drug prescription. A significant relationship between epilepsy, falls, insomnia and Parkinson's disease with the inappropriate drug prescription was found (Table 3).

The results of logistic regression analysis (Table 4) showed that people with polypharmacy had 3.5 times the odds of having inappropriate drug prescription than other individuals (OR = 3.64, 95% CI: 2.81-4.70; $p < 0.001$), and those with insomnia had 1.45 times the odds of having inappropriate drug prescriptions (OR = 1.45, 95% CI: 1.13-1.87; $p < 0.003$). In addition, the odds of prescribing inappropriate drugs were 41% lower in internal medi-

Table 3. The association between a disease and potentially inappropriate medications (PIMs)

Disease	Category	PIM		p
		No (%)	Non-PIM No (%)	
Heart failure	Yes	175 (25)	541 (75.6)	0.366
	No	197 (23)	678 (77.5)	
Syncope	Yes	17 (22)	63 (78.8)	0.644
	No	355 (24)	1156 (76.5)	
Epilepsy	Yes	16 (38)	27 (62.8)	0.03*
	No	356 (23)	1192 (77)	
Delirium	Yes	20 (28)	51 (71.8)	0.33
	No	352 (23)	1168 (76.8)	
Dementia	Yes	35 (21)	131 (78.9)	0.46
	No	337 (24)	1088 (76.4)	
History of falls or fractures	Yes	51 (31)	114 (69.1)	0.016*
	No	321 (23)	1105 (77.5)	
Insomnia	Yes	194 (28)	489 (71.6)	0.001*
	No	178 (20)	730 (80.4)	
Parkinson	Yes	34 (32)	72 (67.9)	0.029*
	No	338 (23)	1147 (77.2)	
Chronic constipation	Yes	157 (25)	474 (75.1)	0.252
	No	215(22)	745 (77.6)	
Ulcers	Yes	72 (25)	217 (75.1)	0.496
	No	300 (23)	1002 (77)	
Chronic kidney disease	Yes	70 (26)	198 (73.9)	0.246
	No	302 (23)	1021 (77.2)	
Incontinency	Yes	103 (25)	311 (75.1)	0.403
	No	269 (23)	908 (77.1)	
Prostatic hyperplasia	Yes	64 (24)	203 (76)	0.803
	No	308 (23)	1016 (76.7)	

* $p < 0.05$

Table 4. Multiple logistic regression with dependent variable of potentially inappropriate medications (PIMs) test

Variables	OR	95% CI	p
Polypharmacy	3.64	2.81-4.70	0.001*
Number of chronic disease	2.37	1.71-3.28	0.001*
Epilepsy	1.52	0.76-3.02	0.234
Falls	1.19	0.81-1.76	0.373
Insomnia	1.45	1.13-1.87	0.003*
Parkinson	1.1	0.68-1.80	0.69
Type of specialty			
Heart specialist	0.88	0.57-1.35	0.549
Gastroenterologist	0.65	0.27-1.58	0.345
Internists	0.59	0.40-0.88	0.009*
Endocrinologist	0.47	0.21-1.06	0.068
Neurologist	1.45	0.92-2.27	0.109
Nephrologist	0.87	0.54-1.39	0.555
Infectious specialist	0.58	0.24-1.36	0.208
Ophthalmologist	0.6	0.17-2.08	0.422
Orthopedics	3.23	1.81-5.76	0.001*
Emergency Medicine	1.98	0.89-4.37	0.093
Oncologist	0.72	0.29-1.83	0.495
General surgeon	1.17	0.52-2.63	0.712
Pediatrician	0.74	0.16-3.38	0.695
Gynecologist	2.34	0.64-8.51	0.196
Physiatrist	2.35	0.51-10.73	0.272
Others	0.63	0.18-2.25	0.477

* $p < 0.05$; CI, confidence interval; OR, odds ratio; PIMs, potentially inappropriate medications

cine specialists than in general practitioners (OR = 0.59, 95% CI: 0.40-0.88; $p < 0.009$). Orthopedic specialists had 23.3 times the odds of inappropriate drug prescriptions than general practitioners,

which is significant in the regression model (OR = 3.23, 95% CI: 5.76-1.81; $p < 0.001$). Also, people with at least one chronic disease had 2.371 times the odds of experiencing inappropriate drug prescriptions than other elderly people (OR = 2.371, 95% CI: 1.71-3.28; $p < 0.001$).

DISCUSSION

The aim of the present study was to determine the prevalence of PIMs of drugs and identify factors related to PIMs in pharmacies across the city of Tehran. There have been numerous studies on the use of PIMs in the elderly in the United States as well as in many European and Asian countries (13-17). The discrepancy of the results obtained is partly due to differences in the type of medications used in countries, which have been mentioned as a limitation in these studies (3,18,19). The prevalence of PIMs is different in various studies and ranges from 13 to 40.7% (18). The same prevalence obtained in the present study (26.0%) is similar to those obtained in Japan and South Korea (5,17).

The present study also showed that the prevalence of one, two, three, and four PIMs was 19.9%, 5.1%, 0.9%, and 0.1%, respectively. The results of similar studies carried out in the Czech Republic, Japan, and Ireland are close to these figures (15,20,21). This study showed that diclofenac (13.5%), alprazolam (9.3%), and chlorthalidone (9.1%) and clonazepam (8.4%), spironolactone (7.1%), prazosin (5.9%), naproxen (5.5%), pyroxicam (4.4%), ketorolac and digoxin (2.8%) were among the most frequently prescribed PIMs. This study also showed that analgesics, medications acting on the central nervous system, and cardiovascular drugs with prevalence rates of 37.6%, 35.3%, and 17.1%, respectively, were among the most common drug groups prescribed for the elderly who were referred to the pharmacies of Tehran, which is consistent with the results of studies carried out in the United States and South Korea (14,17). Benzodiazepines are frequently used by the elderly due to the high incidence of insomnia; however, they cause drowsiness and, as a result increase the fall risk in elderly people (22). Older people tend to take more analgesic drugs, because they are more likely to have musculoskeletal pain.

This study showed that PIMs were highly prevalent among the elderly aged 75-84 years, which

is consistent with the results of a study carried out in Slovakia. The prevalence of PIMs in women (24.5%) is slightly higher than that of men (22.3%), which is consistent with the results of many studies, and can be attributed to the fact that women visit physicians more frequently (13,17,18, 23-25).

Although this study showed that the prevalence of PIMs in the individual health insurance was higher than those who did not have insurance, it was not statistically significant. The results of a study in Mexico showed that having Medicare insurance increases the odds of having PIMs differences.

This study showed that the level of literacy has no effect on the prevalence of PIMs; however, the results of a study in Mexico and Heydari et al. study in Iran showed that the prevalence of PIMs is higher in people with low educational levels, and it seems that illiterate and low-literate elderly are more likely to suffer from diseases due to lack of acquaintance with health issues; they thus take more PIMs (17,18,26).

The present study indicated that the prevalence of PIMs was higher in the spouseless elderly (26.9%) than others. Similarly, two other studies also show that PIMs are more common in single subjects (14,18).

The prescription of inappropriate drugs was significantly related to at least having one chronic disease in presented study and had 2.37 times the odds of having PIMs as compared to others, which is similar to results reported in other studies (13,18,25,27). The current study revealed no significant relationship between the physicians' age and the rate of inappropriate drug prescriptions, which was consistent with the results of another study in 2004 (13).

In this study it was found that the prevalence of PIMs was higher in male physicians (no significance). Harvard et al. (2004) also found that male physicians tended to prescribe drugs more inappropriately (26), which may be due to the increased female physicians' attention and awareness of the inappropriate drug prescription. This study showed no significant relationship between physicians' work experience and inappropriate drug prescription, which was also consistent with the results of a study carried out in Taiwan (2004) (5,14).

Our study showed that inappropriate drug prescription was significantly more common among general practitioners. This can be attributed to the fact that the elderly refer to general practitioners more frequently due to their financial problems and often suffer from various diseases for which the physician has to prescribe many medications, or it can be due to general practitioners' lack of familiarity with inappropriate drugs for the elderly.

Highest prevalence of PIMs among orthopedic specialists (43.1%), who had 2.3 times of the odds of prescribing PIMs as compared to the general practitioners was found in our study. This could be due to the pain medications prescribed for the elderly by these professionals. Furthermore, the odds of prescribing inappropriate drugs were 41% lower in internal medicine specialists than in general practitioners suggesting internists are more aware of inappropriate drugs for the elderly. Goulding (2004) also showed that internists had lower inappropriate drug prescriptions as compared to the general practitioners. However,

the results of another study in Japan showed significant inappropriate drug prescriptions among internists (5,13).

In conclusion, the results of this community pharmacy-based study showed that the prevalence of PIMs among elderly people is high. The high prevalence of PIMs indicates developing scientific guidelines for good prescribing in geriatrics patients.

ACKNOWLEDGMENT

The authors would hereby like to express their gratitude to all the pharmacies in the community where the study was conducted and to patients participating in this study.

FUNDING

No specific funding was received for this study

TRANSPARENCY DECLARATION

Competing interests: None to declare.

REFERENCES

1. Rasel M, Ardalan A. The future of ageing and its health care costs: a warning for health system. *Iranian Journal of Ageing* 2007; 2:300-5.
2. Statistics Center of Iran. Results of national census according age groups (Persian). Tehran: Statistics Center of Iran, 2018.
3. Barry PJ, Gallagher P, Ryan C. Inappropriate prescribing in geriatric patients. *Curr-Psychiatry Rep* 2008; 10:37-43.
4. Trends G. Public health and aging: trends in aging—United States and worldwide. *Public Health* 2003; 347:921-5.
5. Imai H, Fick DM, Waller JL, Maclean JR. Physician characteristics associated with prescription of inappropriate medications using Beers criteria. *Geriatr Gerontol Int* 2007; 7:380-7.
6. Klarin I, Wimo A, Fastbom J. The association of inappropriate drug use with hospitalisation and mortality. *Drugs Aging* 2005; 22:69-82.
7. Kaufmann CP, Tremp R, Hersberger KE, Lampert ML. Inappropriate prescribing: a systematic overview of published assessment tools. *Eur J Clin Pharmacol* 2014; 70:1-11.
8. Stockl KM, Le L, Zhang S, Harada A. Clinical and economic outcomes associated with potentially inappropriate prescribing in the elderly. *Am Manag Care* 2010; 16:e1-10.
9. Fick DM, Mion LC, Beers MH, L Waller J. Health outcomes associated with potentially inappropriate medication use in older adults. *Res Nurs Health* 2008; 31:42-51.
10. Gallagher P, O'Mahony D. STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions): application to acutely ill elderly patients and comparison with Beers' criteria. *Age Ageing* 2008; 37:673-9.
11. American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc* 2012; 60:616-31.
12. Food And Drug Administration of The Islamic Republic of Iran. Iran Drug List. 2018 : <http://www.fda.gov.ir/item/463> (07 January 2019)
13. Goulding MR. Inappropriate medication prescribing for elderly ambulatory care patients. *Arch Int Med* 2004; 164:305-12.
14. Chang CM, Liu PYY, Yang YHK, Yang YC, Wu CF, Lu FH. Potentially inappropriate drug prescribing among first visit elderly outpatients in Taiwan. *Pharmacotherapy* 2004; 848-55.
15. Niwata S, Yamada Y, Ikegami N. Prevalence of inappropriate medication using Beers criteria in Japanese long-term care facilities. *BMC Geriatr* 2006; 6:1.
16. Zeenny R, Wakim S, Kuyumjian YM. Potentially inappropriate medications use in community-based aged patients: a cross-sectional study using 2012 Beers criteria. *Clin Interv Aging* 2017; 12:65-73.
17. Ye F, Luo Y-J, Xiao J, Yu N-W, Yi G. Impact of insulin sensitizers on the incidence of dementia: a meta-analysis. *Dement Geriatr Cogn Disord* 2016; 41:251-60.

18. Raji MA, Ostir GV, Markides KS, Espino DV, Godwin JS. Potentially inappropriate medication use by elderly Mexican Americans. *Ann Pharmacother* 2003; 37:1197-202.
19. Di Giorgio C, Provenzani A, Polidori P. Potentially inappropriate drug prescribing in elderly hospitalized patients: an analysis and comparison of explicit criteria. *Int J Clin Pharm* 2016; 38:462-8.
20. Fialová D, Topinková E, Gambassi G, Finne-Soveri H, Jónsson PV, Carpenter I, Schroll M, Onder G, Sørbye LW, Wagner C, Reissigová J, Bernabei R; AdHOC Project Research Group. Potentially inappropriate medication use among elderly home care patients in Europe. *JAMA* 2005; 293:1348-58.
21. Ryan C, O'Mahony D, Kennedy J, Weedle P, Barry P, Gallagher P, Byrne S. Appropriate prescribing in the elderly: an investigation of two screening tools, Beers criteria considering diagnosis and independent of diagnosis and improved prescribing in the elderly tool to identify inappropriate use of medicines in the elderly in primary care in Ireland. *J Clin Pharm Ther* 2009; 34:369-76.
22. Vali L, Pour Reza A, Rahimi Foroushani A, Ahmadi B, Akbari Kamrani AA. Analysis of inappropriate medication use in older adults discharged from hospitals affiliated with Tehran University of Medical Sciences (TUMS) using the Beers criteria in 2010. *Iranian Journal of Ageing* 2011; 6:56-65.
23. Corsonello A, Pedone C, Lattanzio F, Lucchetti M, Garasto S, Di Muzio M, Giunta S, Onder G, Di Iorio A, Volpato S, Corica F, Mussi C, Antonelli Incalzi R; Pharmacosur Veillance in the Elderly Care Study Group. Potentially inappropriate medications and functional decline in elderly hospitalized patients. *J Am Geriatr Soc* 2009; 57:1007-14.
24. Bierman AS, Pugh MJV, Dhalla I, Amuan M, Finkle BG, Rosen A, Berlowitz DR. Sex differences in inappropriate prescribing among elderly veterans. *Am J Geriatr Pharmacother* 2007; 5:147-61.
25. Fadare JO, Desalu OO, Obimakinde AM, Adeoti AO, Agboola SM, Aina FO. Prevalence of inappropriate medication prescription in the elderly in Nigeria: a comparison of beers and STOPP criteria. *In J Risk Saf Med* 2015; 27:177-89.
26. Howard M, Dolovich L, Kaczorowski J, Sellors C, Sellors J. Prescribing of potentially inappropriate medications to elderly people. *Fam Pract* 2004; 21:244-7.
27. Nam Y-S, Han JS, Kim JY, Bae WK, Lee K. Prescription of potentially inappropriate medication in Korean older adults based on 2012 Beers Criteria: a cross-sectional population based study. *BMC Geriatr* 2016; 16:118.