

An evaluation of the appropriateness of drug prescriptions in geriatric patients using multiple logistic regression

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Abstract

Introduction: The phenomenon of population ageing is becoming a major concern for the policy makers all over the world. But the problems arising out of it will have varied implications for underdeveloped, developing and developed countries. Starting first in the more developed countries, population ageing has now become apparent in much of the developing world and it will affect virtually all countries over the medium-term, although its intensity will vary considerably among countries. **Aims and Objective:** To evaluate the appropriateness of drug prescriptions in geriatric patients with respect to their age, sex and polypharmacy using multiple logistic regression. **Materials and Method:** The present cross sectional study was conducted in the Outpatient departments of Kannur Medical College, Kannur from January 2014 to March 2014. Total 350 patients who were attending Outpatient departments were in the geriatric age group selected. Information retrieved from the files included the age and sex, medical conditions (diagnosis) for which the patient was receiving treatment and the prescribed drugs and their dosages. The drugs were classified according to the chemical therapeutic anatomical (ATC) system developed by WHO⁸. The PIMs were identified with help of the updated Beers criteria 2012. **Results:** In multiple multivariate logistic regression analysis, the factors that exhibits the significant association with PIM prescriptions include females (odds ratio = 1.976, 95% CI=1.155-3.383), 5-10 different medication used (OR=17.787, 95% CI= 3.718-85.09) and more than 10 different medications used (OR= 67.479, 95% CI= 12.534-363.28). Thus PIM use is found to be more common in females and patients receiving more than five medications. The risk of PIM use further increased if more than ten medications were prescribed. **Conclusion:** Thus it was evident that PIM use in the elderly was primarily affected by two factors; gender and polypharmacy.

Keywords: potentially inappropriate medication, geriatric patients, polypharmacy.

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Received Date: 08/05/2015 Revised Date: 16/05/2015 Accepted Date: 20/05/2015

Access this article online

Quick Response Code:



Website:

www.statperson.com

DOI: 22 May 2015

INTRODUCTION

The phenomenon of population ageing is becoming a major concern for the policy makers all over the world. But the problems arising out of it will have varied implications for underdeveloped, developing and

developed countries¹. Starting first in the more developed countries, population ageing has now become apparent in much of the developing world and it will affect virtually all countries over the medium-term, although its intensity will vary considerably among countries². In the current age, drug consumption and medication is vital in the sustenance of life among the elderly. The discriminate selection of medication is a challenging and complicated process. Thanks to modern medicine many diseases and ailments are treatable. Hence, the geriatric population are often prescribed drugs for multiple ailments³. The rise in the occurrence of degenerative pathologies and chronic diseases result in the prescription of drugs specific to each disease/ailment making the elderly more predisposed to drug related side effects and complications. Unfortunately, for a number of reasons linked to old age, the geriatric population is more susceptible to the side

effects of various medications. It is a well-known fact that one of the most critical problems faced by health workers who look after the elderly is polypharmacy. Even so, many elderly people receive medications which cause more harm than do good^{4,5}. Since the prescription of drugs is one of the most important aspects of taking care of the elderly there is a growing need to optimize drug prescription for the geriatric population worldwide. One should understand that although medications are important to ensure the well-being of the aged, irrational and indiscrete prescriptions can do more harm than good. Potentially inappropriate medication (PIM) is described as “a drug in which the risk of an adverse event outweighs its clinical benefit, particularly when there is a safer or more effective alternate therapy for the same condition”⁶. In the present study we tried to evaluate the appropriateness of drug prescriptions with respect to age, sex and polypharmacy.

AIMS AND OBJECTIVE

To evaluate the appropriateness of drug prescriptions in geriatric patients with respect to their age, sex and polypharmacy using multiple logistic regression.

MATERIALS AND METHOD

The present cross sectional study was conducted in the Outpatient departments of Kannur Medical College, Kannur from January 2014 to March 2014. Patients who were attending Outpatient departments were in the geriatric age group selected by using following inclusion and exclusion criteria.

Inclusion Criteria

- Age group above 65 years.
- Genders of both sexes.
- Patients ready to provide informed, written consent.

Exclusion Criteria

- Patients who are below 65 years of age.
- Patients who are not willing to participate in the study

Thus by using the above mentioned inclusion and exclusion criteria and prevalence of 7.42% in the

proportion⁷, the sample size was calculated and it was 305 was rounded to 350. After receiving ethical clearance from the Institutional Human Ethics Committee, Kannur Medical College, Kannur and Informed, written consent was obtained from each subject the study was started. Heads of all clinical departments in the hospital were approached and the type of study was explained to them and their permission to conduct the study was taken. Permission was also taken from the Medical Superintendent to access the medical records. Information retrieved from the files included the age and sex, medical conditions (diagnosis) for which the patient was receiving treatment and the prescribed drugs and their dosages. The drugs were classified according to the chemical therapeutic anatomical (ATC) system developed by WHO⁸. The PIMs were identified with help of the updated Beers criteria 2012. According to these criteria, drugs which are prescribed inappropriately are classified into one of the following categories:

- Category A: Potentially inappropriate medications and classes to avoid in older adults.
- Category B: Potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes that the drugs listed can exacerbate.
- Category C: Medications to be used with caution in older adults.

Since category C were drugs to be used with caution they were not included, in calculating total PIMs. The baseline characteristics were described by numbers, percentages and averages with its standard deviation. Univariate and multivariate analysis was performed to analyze the association between inappropriate medication and drugs pre-valentes with variables such as gender, age, and polypharmacy. We identified three age groups, adults aged 65 and 75, between 75 and 85 and above 85 years. The reasons of probabilities or odds ratios (OR) were obtained with corresponding 95% confidence intervals (95% CI). Data was analyzed using Statistical Package for Social Sciences (SPSS) software version 20.

RESULTS

Table 1: Drug prescription in geriatric patients

	Total	Minimum	Maximum	Mean	Std. Deviation
Drugs	1976	2.00	11.00	5.6457	2.10339

It was observed that the total number of drugs prescribed in 350 patients were 1976 with mean 5.65 ± 2.10 drugs prescribed per patients with a range from 2 to 11.

Table 2: Age and sex distribution of patients

		No. of patients	Percentage
Age group	65-75	245	70.0
	76-85	91	26.0
	85 above	14	4.0
Sex	Male	197	56.3
	Female	153	43.7

It was observed that the mean age was 72.43 years. Distribution of the patients according to age groups revealed 70% of the patients fell into the 65–75 years bracket. It seen that 56.3% were males and 43.7% were females.

Table 3: Classification and sub classification of drugs according to ATC classification

Groups and sub groups	N	%
Alimentary tract and metabolism	90	24.3
Cardiovascular system	72	20.2
Nervous system	57	15.5
Anti infective for systematic use	42	11.3
Musculoskeletal system	33	8.9
Respiratory system	27	7.2
Blood	21	5.7
Others	30	6.9

There were 1976 medications prescribed in this study out of which (24.30%) affected alimentary tract and metabolism, 20.20% on the cardiovascular system and 15.50% on nervous system. 11.30% drugs were anti infectives for systemic use, 7.20% respiratory system

drugs, 5.70% affected blood system and 6.90% were under other category according to WHO ATC classification. Table 4 and Figure 2 shows the medications the participants used most, classified into their pharmacological/therapeutic subgroups.

Table 4: Potentially Inappropriate Medications

Potentially inappropriate medications	Number of patients	Percent
No	259	74.0
Yes	91	26.0
Total	350	100.0

It was evident from the table that, according to Beers criteria 26% elderly received PIM. It was seen that out of

which 85 had received single inappropriate medication where as 6 had received multiple PIM.

Table 5: Univariate logistic regression: Predictors of PIM use (Beer's criteria 2012, n= 350)

Factors		PIM used (n= 91)	Non PIM used(n= 259)	Odds Ratio	95% confidence interval		p value
					Lower limit	Upper limit	
Age	65-75	51	194				
	76 -85	34	57	2.853	0.947	8.592	0.062
	85 above	6	8	1.257	0.402	3.934	0.694
Gender	Male	42	155				
	Female	49	104	1.739	1.075	2.813	0.024*
Poly pharmacy	1-4	10	94				
	5-10	70	163	12.807	2.766	59.291	0.001*
	Above 10	11	2	51.700	10.012	266.958	0.000*

*statistically significant

The univariate logistic regression analysis of PIM use with age, gender and poly pharmacy was done. And it was observed that the females have 1.793 times more risk of getting PIM than males and the risk was significant. The study subjects those who has received 5-10 medications per prescription have 12.807 times and above 10 medications have 51.7 times higher risk of getting

PIM as compared to the patients those who received 1-4 medications per prescription and the risk was significant. The patients who belonged to the age group 76-85 have 2.853 times and the age group 85 and above have 1.257 times more risk of getting PIM as compared to the patients in the age group of 65-75 but the risk was not significant.

Table 6: Multiple logistic regression: Predictors of PIM use (Beer's criteria 2012, n= 350)

Factors		PIM used (n= 91)	Non PIM used (n=259)	Odds Ratio	95% confidence interval		p value
					Lower limit	Upper limit	
Age	65-75	51	194	0.849	0.244	2.947	0.796
	76-85	34	57	1.572	0.470	5.254	0.462
	>85	6	8				
Gender	Male	42	155	1.976	1.155	3.383	0.013*
	Female	49	104				
Poly pharmacy	1-4	10	94	17.787	3.718	85.090	0.000*
	5-10	70	163	67.479	12.534	363.289	0.000*
	>10	11	2				

*statistically significant

Applying multivariate logistic regression analysis the factors that exhibits the significant association with PIM prescriptions include females (odds ratio = 1.976, 95% CI=1.155-3.383), **5-10** different medication used (OR=17.787, 95% CI= 3.718-85.09) and **above 10** different medication used (OR= 67.479, 95% CI= 12.534-363.28).

DISCUSSION

It was seen that majority of the cases (70%) in the present study were in the age group of 65-75 years. Fadare JO *et al*⁹ observed that 61.8% of the patients fell into the 65–74 years bracket which was comparable with the present study. The mean age of study cases was 72.43 years. Taufik G. Mominet.al³ also observed similar findings in their study. Out of a total of 350 patients, 56.3% were males and 43.7% were females. Shah R B *et al*¹⁰ observed predominantly male population (60%) in their study. There were 1976 medications prescribed in this study out of which (24.30%) affected alimentary tract and metabolism, 20.20% on the cardiovascular system and 15.50% on nervous system. De Oliveira Alves C *et al*¹¹ also observed similar findings in their study. It was evident from the table that, according to Beers criteria 26% elderly received PIM. It was seen that out of which 85 had received single inappropriate medication where as 6 had received multiple PIM. These findings were in agreement with a study performed by Zaveri HG *et al*⁷, in which 23.59% older adults received at least one potentially inappropriate drug prescription. Univariate logistic regression was applied to predict PIM use among the elderly. Female gender and polypharmacy increases the incidence of PIM use in elderly but increase in age was not considered significant. In multiple multivariate logistic regression analysis, the factors that exhibits the significant association with PIM prescriptions include females (odds ratio = 1.976, 95% CI=1.155-3.383), 5-10 different medication used (OR=17.787, 95% CI= 3.718-85.09) and more than 10 different medications used (OR= 67.479, 95% CI= 12.534-363.28). In a study in India by Taufik .G.Momin *et al.*, multivariate logistic regression

analysis suggested number of drugs (7-10 and >11) as positive predictor for PIM use using updated Beers criteria 2012.³ Similar results were also obtained by Undela K *et al* in a study in Punjab¹². Cahir *et al*¹³ in their analysis showed that one-third of the Irish population aged 70 years were prescribed at least one potentially inappropriate medication in 2007 based on European criteria. There was a significant association between polypharmacy and the risk of PIP. Avoiding the use of inappropriate and high-risk drugs is an important, simple, and effective strategy in reducing medication-related problems and ADEs in older adults. Methods to address medication-related problems include implicit and explicit criteria. Explicit criteria can identify high-risk drugs using a list of PIMs that have been identified through expert panel review as having an unfavourable balance of risks and benefits by themselves and considering alternative treatments available. A list of PIMs was developed and published by Beers and colleagues for nursing home residents in 1991 and subsequently expanded and revised in 1997 and 2003 to include all settings of geriatric care¹⁴.

CONCLUSION

Thus it was evident that PIM use in the elderly was primarily affected by two factors; gender and polypharmacy.

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Source of Support: None Declared
Conflict of Interest: None Declared