

USE OF POTENTIALLY INAPPROPRIATE MEDICATION BY PHYSICALLY INDEPENDENT ELDERLY**Ariane Bachega¹, Mayra C. Frâncica², João Paulo M. Santos³, Bianca B. P. Fernandes⁴, Paulo Victor C. Dalaqua⁴, Paulo R. Bignardi⁵ and Karen B. P. Fernandes^{5,6*}**¹Graduate Student, Biomedical Sciences, Pitagoras UNOPAR University, Londrina, PR, Brazil.²Associate Professor, Department of Physical Therapy, Pitagoras UNOPAR University, Londrina, PR, Brazil.³Assistant Professor, Department of Physical Therapy, Pitagoras UNOPAR University, Londrina, PR, Brazil.⁴Undergraduate student, School of Medicine, Pontifical Catholic University of Parana (PUCPR), Londrina, PR, Brazil.⁵Associate Professor, School of Medicine, Pontifical Catholic University of Parana (PUCPR), Londrina, PR, Brazil.⁶Département Des Sciences de la Santé, Centre Intersectoriel en Santé Durable, Laboratoire de recherche BioNR, Université du Québec à Chicoutimi (UQAC), Saguenay, Québec, Canada.***Corresponding Author: Karen B. P. Fernandes**

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ABSTRACT

Introduction: The aging process is related to an increase in comorbidities and medication use, evoking adverse events and negative impact on functional status in elderly. **Aims:** This study aimed to identify the profile of older adults and the factors related to the use of potentially inappropriate medication (PIM). **Methods:** This was a cross-sectional, descriptive, and observational study, involving 501 physically independent elder individuals (age over 60 years). To assess the use of potentially inappropriate medication, Beers-Fick and Priscus criteria were considered adjusted to Brazilian Pharmacopoeia. **Results:** Nearly 18% of the study population was taking PIM, mainly medication acting at central nervous system, particularly benzodiazepines. An association between the use of potentially inappropriate medication and polypharmacy was observed considering both Priscus ($p=0.0001$) and Beers-Fick list ($p=0.0001$). Similar results were observed concerning the multimorbidity and both criteria (Priscus and Beers-Fick, $p=0.0001$). Regarding the economic status, individuals with lower income tend to use more frequently potentially inappropriate medication according to both lists ($p=0.016$). However, no association between gender, age or education level with the potentially inappropriate medication use was verified ($p>0.05$). **Conclusions:** Older adults with worse economic status, with multimorbidity and polypharmacy consumption have a higher risk of using potentially inappropriate medication, particularly central nervous system acting agents. Thus, educational preventive strategies and additional studies are highly recommended to improve the prescription of medicine for the elderly.

KEYWORDS: Elderly; Polypharmacy; Potentially Inappropriate Medication; Older adults; Drugs.**INTRODUCTION**

Population ageing is one of the greatest concerns for public health worldwide. It is expected that 1 in 6 people in the world will be an older adult in 2030 and this proportion is supposed to double by 2050, representing 2.1 billion people.^[1]

Prescribing for elder people may be challenging, considering effective medications with few side effects. However, many medications which are safe and effective in younger patients are not the best option or should be avoided in older adults because of the age-related changes in pharmacokinetics and pharmacodynamics.^[2] On the other hand, the increase in chronic degenerative diseases in elders is associated with the burden of complex pharmacological regimen in this population.

Polypharmacy may be defined as high numbers of medications (e.g., concurrent use of five or more medications), use of more drugs than are clinically indicated, and/or use of inappropriate medications.^[3]

Polypharmacy is associated with poor medication adherence, drug-drug interactions, medication errors, adverse drug events, and an increased incidence of falls, hip fractures, confusion, and delirium.^[5]

Collectively, polypharmacy accounts for a significant percentage of potentially preventable emergency room visits and hospitalizations in older adults.^[5] and it also increases the incidence of potentially inappropriate medication – PIM.^[6]

In addition, there is a growing increase in the use of PIM, which are known for having several adverse effects that

outweigh their benefits when compared to other categories of medications, and they should be avoided in the elderly.^[7,8] Indeed, two examples of known criteria to address inappropriate medications are the Beers-Fick list, which is the most cited and used worldwide, but there are criticisms regarding its scope and adaptability to the specific pharmacopoeia of each country,^[9] and the PRISCUS list adapted to the Brazilian pharmacopoeia.^[10] The criteria established by these lists cover drugs from different drug classes as well as therapeutic different options for clinical practice.^[11-12]

Although several epidemiological studies have described the prevalence of polypharmacy and/or self-medication in the elderly, few pharmaco-epidemiological studies have investigated the prevalence of PIM consumption in Brazilian older adults. It is noteworthy that these inappropriate medications could have several deleterious effects, negatively impacting the functional capacity and quality of life of these people.^[7-8]

Considering possible adverse effects and economic impact of the use of inappropriate medications, this study aimed to analyze the prevalence and determining factors of PIM use in elder people in Brazil.

METHODS

This study was approved by the institutional Research Ethics Committee (Protocol # PP0070/09).

This is a cross-sectional, descriptive, and observational study, based on the list of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), developed in the Londrina, Parana State, Brazil. In this city, the proportion of elderly individuals represents 12% of the total population, a similar proportion of elderly observed in several developed countries.

A sample size calculation was made considering a sampling error of 5% and the number of elderly people living in the urban area of Londrina (43,610 individuals). A sample of 378 individuals was set as the minimum needed to represent the target population.

This study included data from 501 older adults (aged 60 years or over), physically independent, according to the Functional Status of Spirduso,^[13] and from both genders. Individuals who had any illness or limitations that prevented them from completing the questionnaires, such as physical and mental disabilities, were excluded from the sample.

The elderly were members of the Study on Aging and Longevity project (EELO), a thematic project for identifying socio-demographic factors and health conditions of the elder population.

Structured questionnaires were used to collect data regarding the presence of comorbidities, medication

consumption and sociodemographic characteristics (gender, age, marital status, and educational level).

In addition, the PRISCUS list adapted to the Brazilian pharmacopoeia,^[10] and the Beers-Fick criteria,^[9] were used to screen the prevalence of PIM use in the elderly.

The Statistical Package for Social Sciences version 20.0 program was used for statistical analysis. A confidence interval of 95% and a significance level of 5% ($p < 0.05$) were established for all applied tests.

The *Chi-Square* test was used to assess a possible association between the use of potentially inappropriate medications for the elderly and the following variables: gender, age range, the occurrence of comorbidities and polypharmacy in the studied population.

RESULTS

The study included 501 older adults, with a mean age of 69.08 (SD: 7.34) years, 333 women and 168 men (Table 1).

In our sample, 89 individuals were using MPI, representing nearly 18% of the general population. Medications acting at CNS as well as benzodiazepine have been reported as the majority of PIM used by the elderly.

Polypharmacy consumption and the presence of multimorbidity increase the risk for PIM in elderly, according to *Chi Square* test ($p < 0.001$, Table 2).

Additionally, socioeconomic status was also associated with the use of PIM ($p < 0.001$), whereas individuals with lower socioeconomic status are more susceptible for PIM use. On the other hand, no association was observed between MPI and educational level (Table 3), gender or age range (Table 4), according to *Chi Square* test ($p > 0.05$).

Table 1: General characteristics of the study population.

Variables	Absolute Frequency (n)	Relative Frequency (%)
Gender		
Female	333	66.5
Male	168	33.5
Age Range		
60 – 70 years	294	58.7
> 70 years	207	41.3
Education level		
Up to 8 years	458	91.4
> 8 years	43	8.6
Economic Status		
A+ B	88	17.6
C	315	62.9
D+ E	98	19.6
Multimorbidity		
No	235	46.9
Yes	266	53.1
Polypharmacy		
No	274	54.7
Yes	227	45.3
Total	501	100.0

Table 2: Relation between polypharmacy and multimorbidity with inappropriate medication use according to PRISCUS and Beers-Fick criteria.

Polypharmacy		PRISCUS*			BEERS-FICK**		
		No	Yes	Total	No	Yes	Total
No	n	250	24	274	247	27	274
	%	91.2	8.8	100.0	90.1	9.9	100.0
Yes	n	171	56	227	165	62	227
	%	75.3	24.7	100.0	72.7	27.3	100.0
Multimorbidity							
No	n	215	20	235	212	23	235
	%	91.5	8.5	100.0	90.2	9.8	100.0
Yes	n	206	60	266	200	66	266
	%	77.4	22.0	100.0	75.2	24.8	100.0
Total	n	421	80	501	412	89	501
	%	84.0	16.0	100.0	82.2	17.8	100.0

*Statistically significant (*Chi Square*= 18.34 and $p=0.0001$);

**Statistically significant (*Chi Square*=19.28 and $p=0.0001$).

Table 3: Relation between economic status and educational level and inappropriate medication use according to PRISCUS and Beers-Fick criteria.

Economic Status		PRISCUS*			BEERS-FICK**		
		No	Yes	Total	No	Yes	Total
A + B	n	81	7	88	80	8	88
	%	92.0	8.0	100.0	90.9	9.1	100.0
C	n	265	50	315	260	55	315
	%	84.1	15.9	100.0	82.5	17.5	100.0
D + E	n	75	23	98	72	26	98
	%	76.5	23.5	100.0	73.5	26.5	100.0
Educational Level							
0 – 8 years	n	384	74	458	375	83	458
	%	83.8	16.2	100.0	81.9	18.1	100.0
> 8 years	n	37	6	43	37	6	43
	%	86.0	14.0	100.0	86.0	14.0	100.0
Total	n	421	80	501	412	89	501
	%	84.0	16.0	100.0	82.2	17.8	100.0

*Statistically significant (*Chi Square*= 8.32 and $p=0.016$);

**Statistically significant (*Chi Square*= 9.70 and $p=0.008$).

Table 4: Relation between age and gender and inappropriate medication use according to PRISCUS and Beers-Fick criteria.

Age Range		PRISCUS*			BEERS-FICK*		
		No	Yes	Total	No	Yes	Total
60-70 years	n	246	48	294	242	52	294
	%	83.7	16.3	100.0	82.3	17.7	100.0
> 70 years	n	175	32	207	170	37	207
	%	84.5	15.5	100.0	82.1	17.9	100.0
Gender							
Male	n	143	25	168	140	28	168
	%	85.1	14.9	100.0	83.3	16.7	100.0
Female	n	278	55	333	272	61	333
	%	83.5	16.5	100.0	81.7	18.3	100.0
Total	n	421	80	501	412	89	501
	%	84.0	16.0	100.0	82.2	17.8	100.0

* Statistically not significant, *Chi Square Test*, $p>0.05$.

DISCUSSION

The use of inappropriate medications is a public health problem. Avoiding its use is essential to prevent both adverse drug effects in the elderly (e.g., morbidity, mortality) and increased health care expenses.

There are many factors that play a role in PIM prescription including: positive features of PIM, barriers to PIM deprescribing, system-related factors (e.g. medications available at the public health system), health beliefs, and general practitioner (GP)–patient interaction.^[14]

In this study, an inverse relationship between economic status and the use of PIM can be observed. This can be explained by the dependence of the less favored classes on the popular pharmacy, which has several drugs classified as inappropriate for the elderly.^[14] in developing countries, such as Brazil.

There is evidence that the acceptance of non-medical services and the choice of over-the-counter drugs favors the use of MPI.^[15] However, in this study, the prescribed medication particularly central nervous system drugs such as benzodiazepines have been found to be the most prescribed PIMs, agreeing with previous data.^[16]

Benzodiazepines can be difficult to de-prescribe because there are no good alternatives for the most common reason that they are used; namely, insomnia. Success is more often achieved when patients are educated about the adverse effects of the medication that is being recommended to be de-prescribed. Clinical practice guidelines and algorithms exist to mitigate this.^[17]

The use of potentially inappropriate medication in the elder population is a phenomenon that occurs in developing countries and in developed countries.^[18] This usually occurs due to lack of knowledge of the general practitioner regarding the prescription of PIM, which leads to serious clinical and economic consequences.^[19]

Therefore, a combined caregiver–patient-centered approach is needed to gain patient buy-in in deprescribing.^[20] Given that decreasing PIM use is multifactorial, attention should be driven to interdisciplinary strategies to improve medical prescription.^[21]

The use of PIM by elderly has become a public health problem, considering age-related changes on drugs' pharmacodynamics and pharmacokinetics, thus increasing the risk of drug interactions.^[22] Moreover, sometimes the prescriptions are repeated indefinitely due to the lack of guidance about treatment duration.^[23] and the side effects resulting from medication are considered new signs and symptoms and treated as such.^[24]

Older adults using polypharmacy showed a statistically significant frequency of PIM consumption, increasing

the risk of several potential adverse events.^[4-5,25] particularly because adverse reactions arising from drug interactions may result in a greater risk of hospitalization and the costs for health assistance.^[11-12]

On the other hand, no association was observed between gender and the use of PIM in this sample, disagreeing with previous studies.^[4,26] One potential cause described at the other studies is the self-medication practice which is more common in women. However, our contrasting result may be explained by the fact that in our sample the PIM used are only prescribed medication, especially drugs acting at central nervous system.

Although some studies reported that PIM tends to increase with ageing,^[14] it was not observed in our study population, perhaps because we are only dealing with older adults. In addition, it was observed that the use of PIM by the elderly is directly related to polypharmacy and multimorbidity.^[12]

Regarding educational level, no association was observed with PIM, agreeing with several studies.^[16-17,19] On the other hand, there is some evidence about association of low educational level with non-adherence to medication, self-medication, and polypharmacy.^[27-28] Indeed, low education level is a risk factor for high consumption of medication by the elderly population.^[12,19,24]

The lack of comparisons of socio-demographic characteristics in relation to the different classes of inappropriate medication used by this population can still be highlighted as primary limitation of the study, and this topic could be addressed in another study.

Explicit criteria can identify high-risk drugs using a list of PIMs that have been identified through expert panel review and consider alternative medications. Thus, the lists of inappropriate medications for the elderly, such as the Beers-Fick^[9] and Priscus list,^[10] are widely recommended at the literature in different countries, since they are simple, practical, and easy to memorize criteria, although they do not include local realities regarding the pattern of medications accessible at the health system and prescribed by general practitioners.

There is evidence that an increased awareness of PIM among physicians is needed to further decrease PIM use.^[29] However, the drugs available in public health systems do not necessarily include the best pharmacopoeia available for the elderly. Indeed, it is up to the managers responsible for health services and to geriatricians and other professionals, to address the pharmacotherapy properly, choosing the best drug option with lower risks and greater benefits.

CONCLUSION

It can be concluded that the use of potentially inappropriate medication by the elderly is associated

with socioeconomic status, the occurrence of multimorbidity and polypharmacy. However, other pharmaco-epidemiological studies in different countries as well as educational-preventive measures that improve the prescription of medicine for the elderly are necessary. In addition, it is worth highlighting the need for a review of the pharmacopoeia available in the popular pharmacy in different countries because the prevalence of PIM users could be considered a parameter of the quality of medical, sanitary and outpatient care.

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