

Potentially inappropriate medication use among institutionalized elderly individuals in southeastern Brazil

Mauro Cunha Xavier Pinto¹, Dalila Pinto Malaquias¹, Felipe Ferré²,
Marcos Luciano Pimenta Pinheiro^{3,*}

¹Department of Pharmacy, College of Biological Sciences and Health, Federal University of Jequitinhonha and Mucuri Valleys, Diamantina, MG, Brazil, ²Department of Biochemistry and Immunology, Biological Sciences Institute, Federal University of Minas Gerais, Belo Horizonte, MG, Brazil, ³Department of Basic Sciences, College of Biological Sciences and Health, Federal University of Jequitinhonha and Mucuri Valleys, Diamantina, MG, Brazil

In recent decades, the elderly population in Brazil has grown rapidly, as has concern for the health of this population. Institutionalization in nursing homes has appeared as an alternative form of health care for frail elderly that live alone. The present study evaluated the pharmacotherapy and inappropriate drug prescriptions for institutionalized elderly patients living in long-term institutions in southeastern Brazil. This research was conducted at five institutions with a total sample of 151 individuals aged at least 60 years. Databases were used to identify drug interactions, defined daily dose and inappropriate prescriptions. The prevalence of drug intake among the elderly was 95.36%, and there were an average of 3.31 ± 1.80 drug prescriptions per individual. Based on Beers criteria, the prevalence of inappropriate prescriptions was 25.83%. In addition, 70.2% of prescriptions were prescribed at a higher dosage than the defined daily dose (ATC/WHO). Potential drug interactions were identified for 54.11% of prescriptions; 81.42% of these were of moderate severity. The main inappropriate drugs were prescribed for cardiovascular and nervous system problems. Institutionalized elderly individuals presented a high consumption and misuse of medications, requiring professional intervention to monitor prescriptions and improve the quality of service for this population.

Uniterms: Pharmacoepidemiology. Drug interactions. Beers criteria. Elderly/inappropriate use of medicines. Medicines//inappropriate use.

Nas últimas décadas, o número de idosos no Brasil cresceu rapidamente, bem como, a preocupação com a saúde desta parcela da população. Neste cenário, a institucionalização em casas de repouso aparece como uma alternativa para os cuidados com a saúde dos idosos debilitados ou que vivem sozinhos. O presente estudo avaliou a farmacoterapia e a prescrição inadequada para idosos que residem em instituições de longa permanência no sudeste do Brasil. Esta pesquisa foi realizada em cinco instituições, totalizando uma amostra de 151 indivíduos com idade a partir de 60 anos. O banco de dados foi analisado para identificação de interações medicamentosas, dose diária definida e critérios de Beers. Dentre os indivíduos avaliados, 95,36% consomem algum tipo de medicamento, sendo $3,31 \pm 1,80$ medicamentos prescritos por indivíduo. Com base nos critérios de Beers, a prevalência de prescrições inadequadas foi de 25,83%, sendo também encontradas 70,2% das prescrições com doses superiores à dose diária definida (ATC/WHO). Interações medicamentosas potenciais estavam presentes em 54,11% das prescrições, sendo 81,42% com grau moderado de gravidade. Os principais medicamentos inadequados foram prescritos para problemas cardiovasculares e do sistema nervoso. Os idosos institucionalizados apresentam alto consumo e uso inadequado de medicamentos, sendo necessária a intervenção profissional para monitorar as prescrições médicas e melhorar a qualidade do serviço de distribuição de medicamentos a esta parte da população.

Unitermos: Farmacoepidemiologia. Interações medicamentosas. Critérios de Beers. Idosos/uso inadequado de medicamentos. Medicamentos/uso inadequado.

*Correspondence: M. L. P. Pinheiro. Universidade Federal dos Vales do Jequitinhonha e Mucuri. Rua da Glória, 187, Centro, 39100-000 – Diamantina - MG, Brasil. E-mail: marcospimenta@ufvjm.edu.br

INTRODUCTION

The Brazilian elderly population has grown steadily in recent decades due to substantial changes in contemporary society. The first significant change was the increase in life expectancy by medical advances and increased access to public health and sanitation, which occurred between the 1940s and 1970s (Flores, Mengue, 2005; Nóbrega, Karnikowski, 2005; Chaimowicz, Greco, 1999). The second important change was the introduction of the contraceptive pill in the 1960s and the advent of family planning, which led to a significant decline in fertility. These factors led to an increase in the population 60 years of age or older, considered elderly in developing countries. It was estimated that in 2025, the Brazilian population will be 12% elderly and will have the sixth largest elderly population in the world by absolute numbers (Nóbrega, Karnikowski, 2005; Loyola-Filho *et al.*, 2005; Coelho-Filho *et al.*, 2004; Chaimowicz, Greco, 1999).

There is a high prevalence of health conditions in this age group that require chronic drug treatment, including cardiovascular disease, metabolic syndromes, neurodegenerative diseases and affective disorders (Chaimowicz, Greco, 1999). Elderly patients frequently have difficulty reading prescriptions, resulting in errors in drug intake and dosage (Nóbrega, Karnikowski, 2005; Loyola-Filho *et al.*, 2005; Almeida *et al.*, 1999). Furthermore, most elderly patients have comorbid ailments, which require the use of several medications. This can lead to potentially inappropriate or excessive drug usage (polypharmacy) and puts them at risk for drug interactions (Medeiros-Souza *et al.*, 2007; Berenbeim, 2002). In Brazil, the prevalence of drug consumption among the elderly is above 80% across the country, which represents a great concern to health care services (Ribeiro *et al.*, 2008; Flores, Benvegnú, 2008; Loyola-Filho *et al.*, 2005; Chaimowicz, Greco, 1999).

The main challenge of pharmacotherapy for the elderly is the decrease in metabolic competence, which requires specific knowledge about the pharmacokinetics and pharmacodynamics of any medications prescribed to a patient (Chaimowicz, Greco, 1999). A lack of evaluation of medical prescriptions for elderly patients increases the risk of adverse reactions and iatrogenic diseases (Pereira *et al.*, 2004). Prescription of potentially inappropriate medications to older people is highly prevalent in the United States and Europe, ranging from 12% in community-dwelling elderly to 40% in nursing home residents (Gallagher *et al.*, 2007). The main solution to avoid inappropriate treatment or irregular dosage

depends on the advising and monitoring actions of health professionals during the pharmacotherapy (Ribeiro *et al.*, 2008; Pereira *et al.*, 2004; Romano-Lieber *et al.*, 2002).

Institutionalization in nursing homes is a healthcare option for older patients, but high occupancy rates, long waiting lists and bed scarcity make the institutionalization process in Brazil difficult (Chaimowicz, Greco, 1999). In addition to these problems, institutionalization in Brazil is linked to the outbreak of comorbidities such as immobility, emotional instability, social isolation, loss of autonomy and cognitive losses (Del Duca *et al.*, 2012; Converso, Iartelli, 2007). In this context, institutionalization itself seems to be a health risk factor for the elderly, requiring specialized care, support and health services to prevent new diseases or worsening of physical and mental health problems (Gonçalves *et al.*, 2008; Chaimowicz, Greco, 1999).

The presence of a multidisciplinary team specializing in the assistance of elderly patients could reduce problems related to drug therapy and prevent iatrogenic diseases. Optimizing drug treatment for older patients is challenging; however, the analysis of pharmacotherapy prescribed for the elderly is fundamental to the success of the treatment (Gallagher *et al.*, 2007). This study evaluates the pharmacotherapy used by institutionalized elderly patients from five southeastern Brazil long-term institutions (LTIs) to determine the prescription quality and promote the rational use of medication.

MATERIAL AND METHODS

This work was a descriptive transversal study that determined the qualitative and quantitative profile of prescription drugs used by 151 institutionalized individuals over the age of 60. The patients were located in five long-term institutions for the elderly in southeastern Brazil: Asilo de Idosos (Curvelo-MG), in Asilo Pão de Santo Antônio and Asilo Frederico Ozanan (Diamantina-MG), Lar das Damas de Caridade e Asilo São Vicente de Paulo (Montes Claros-MG). This study was conducted during the year 2010. Data collection was performed by analysis of patients' medical prescriptions and medical records from the institutions. This research project was approved by the Ethics in Research Committee of the State University of Montes Claros on the register number 1250/2008.

The database of patient information was subjected to a pretreatment system for insertion into a MySQL database (version 5.1.37) that employed SQL queries for patient, age, gender, prescription drugs, dose and dosage regimen. The drug names were classified using the manual

of Brazilian Nonproprietary Names (DCB). The active principle components were organized according to the Anatomical Therapeutic Chemical (ATC) Classification System of the World Health Organization (WHO) (WHO, 2011). The prescription drugs were evaluated according to the Brazilian National List of Essential Medicines (RENAME). The prescription dose was compared to the defined daily dose (DDD) as proposed by the World Health Organization-WHO (WHO, 2011; Brazil, 2008). The therapy, dose and dosage regimen were evaluated using Beers criteria for potentially inappropriate medication use in older adults (Fick *et al.*, 2003; The American Geriatrics Society Beers Criteria Update Expert Panel, 2012). Drug interactions were assessed in pairs and classified by severity (major, moderate or minor) according to the website www.drugs.com, which included the database sources Micromedex™, Cerner Multum™ and Wolters Kluwer™.

For the evaluation of statistical data, R project software (version 2.11.1) was used. The normality of the distributions was tested with the Shapiro-Wilk normality test (Royston, 1982). The data were expressed as the mean \pm standard deviation. The groups were compared with Pearson's Chi-squared test. When the matrix was 2x2, the Yates' continuity correction was carried out.

RESULTS

The LTI population was composed of 62.91% (n=95) female and 37.09% (n=56) male patients with a medicine intake prevalence of 95.36% (n=146). The average age of the elderly population was 76.69 ± 10.97 , with no difference between the male (73.68 ± 7.79) and female (78.36 ± 12.11) population age. The average number of medications consumed per individual was 3.31 ± 1.80 (3.40 ± 1.82 for females, 3.19 ± 1.76 for males). In addition, 66.20% (n=500) of medications were present in the RENAME list, and 52.95% were prescribed under the generic name. Only 38.4% of medications prescribed were in agreement with Anatomical Therapeutic Chemical Classification System of the World Health Organization.

The anatomical group evaluation of institutionalized elderly patients revealed that nervous system medicines (80.79%) were the most prescribed in southeastern Brazil LTIs, follow by cardiovascular medicines (58.28%). A closer look at the pharmacological groups showed that psycholeptics (42.38%) and ACE inhibitors (35.10%) were prevalent drug classes. In addition, consumption of diuretics (31.13%) and psychoanaleptics (26.49%) was common. Consumption of nervous system drugs and antithrombotic agents presented significant gender

differences ($p < 0.05$, chi-squared test with Yates' correction). The prescription profile of this group of institutionalized elderly patients is detailed in table I.

An additional analysis was performed to evaluate drug interactions in prescriptions for the elderly. The analysis found a total of 226 occurrences with an average of 1.5 ± 2.55 drug interactions per prescription. In all, 3.1% were major cases, 81.42% were moderate cases and 15.49% were minor cases of interaction. The overall prevalence of drug interactions was 54.11% (n=79). These were greater in female patients (65.93%) than male patients (34.09%) ($p < 0.05$, Pearson's Chi-squared test). The evaluation of drug interactions across anatomical groups revealed that 39.74% of combinations were cardiovascular medicines with nervous system medicines, closely followed by interactions between two different cardiovascular medicines at 36.42%. Pharmacological group interactions most frequently occurred between ACE inhibitors and antithrombotic agents (12.58%), followed by interactions between ACE inhibitors and diuretics (9.27%). Interactions between cardiovascular system medicines and blood/blood forming organs presented significant gender differences ($p < 0.05$, chi-squared test with Yates' correction). The profile of drug interactions in this group of institutionalized elderly patients is detailed in Table II.

Medical prescription evaluations that look for the presence of inappropriate medication are an important indicator of prescription quality. First, Beers Criteria was utilized to classify inappropriate medications prescribed to institutionalized elderly individuals. Inappropriate prescriptions showed a prevalence of 63.01% in the institutionalized elderly population, and these were greater in elderly females ($p < 0.05$, chi-squared test with Yates' correction). These prescriptions for the elderly represented 26.38% of all medications prescribed. The main pharmacological group inappropriately prescribed was psycholeptics (50.33%), followed by cardiac medicines (14.56%) and endocrine drugs (4.63%). In a second analysis, inappropriate medication was evaluated by the DDD, which is the assumed average maintenance dose per day for a drug used for its main indication in adults. The prescription evaluations showed that 70.2% of the institutionalized elderly patients had an intake dosage higher than the DDD, which represented 38.4% of the total medication prescribed. When Beers List and the DDD were evaluated together, 52.74% of elderly patients presented both types of inappropriate medications in their prescriptions, with no difference between female and male patients ($p > 0.05$, chi-squared test).

Regarding drug interactions, in 32% of occurrences, at least one drug belonged to Beers List. In 14.67% of

cases, both medications were inappropriate. Analysis of drug interactions and the DDD showed that 34.44% of prescriptions had at least one medication prescribed at a higher dose than the DDD. Finally, both medications

TABLE I - Drug prescriptions for elderly patients in Brazilian long-term institutions (Southeastern Brazil, 2010)

	Prevalence (%)	Female (%)	Male (%)	P-value
Anatomical group				
Nervous system	80.79	71.58	96.43	0.00***
Cardiovascular system	58.28	58.95	57.14	0.96
Alimentary tract and metabolism	37.09	40.00	32.14	0.43
Blood and blood forming organs	24.50	20.00	32.14	0.14
Systemic hormonal preparations. excl. sex hormones and insulin	8.61	10.53	5.36	0.43
Skeleton-muscular system	3.97	4.21	3.57	0.81
Respiratory system	3.31	3.16	3.57	0.74
Dermatologicals	1.99	2.11	1.79	0.64
Anti-infectives for systemic use	0.66	1.05	0.00	0.78
Sensory organs	0.66	1.05	0.00	0.78
Pharmacological group				
Psycholeptics	42.38	47.37	33.93	0.15
ACE inhibitors	35.10	31.58	41.07	0.32
Diuretics	31.13	31.58	30.36	0.98
Psychoanaleptics	26.49	28.42	23.21	0.61
Antiepileptics	19.21	16.84	23.21	0.46
Antithrombotic agents	19.21	13.68	28.57	0.04*

Each parameter was individually analyzed by a chi-squared test with Yates' correction. Differences between the observed and expected frequencies were considered significant when $p < 0.05$ (*) or $p < 0.001$ (***)

TABLE II - Drug interactions for elderly patients in Brazilian long-term institutions (Southeastern Brazil, 2010)

	Prevalence (%)	Female (%)	Male (%)	P-value
Anatomical group				
Cardiovascular system & nervous system	39.74	41.05	37.50	0.80
Cardiovascular system & cardiovascular system	36.42	42.11	26.79	0.09
Cardiovascular system & blood and blood forming organs	18.54	10.53	32.14	0.00**
Nervous system & nervous system	17.22	22.11	8.93	0.06
Cardiovascular system & alimentary tract and metabolism	7.95	7.37	8.93	0.98
Pharmacological group				
Ace inhibitors & antithrombotic agents	12.58	9.47	17.86	0.21
Ace inhibitors & diuretics	9.27	5.26	16.07	0.05
Ace inhibitors & antidepressants	6.62	5.26	8.93	0.59
Diuretics & Antithrombotic agents	5.30	4.21	7.14	0.69
Diuretics & cardiac glycosides	4.64	5.26	3.57	0.95

Each parameter was individually analyzed by a chi-squared test with Yates' correction. Differences between the observed and expected frequencies were considered significant when $p < 0.05$ (*).

TABLE III - Inappropriate medication prescribed for elderly patients in Brazilian long-term institutions (Southeastern Brazil, 2010)

	Prevalence (%)	Female (%)	Male (%)	P-value
Beers list				
Yes	63.01	90.28	50.00	0.02*
No	36.99	9.72	50.00	
Dosage higher than DDD				
Yes	70.20	74.74	62.50	0.16
No	29.80	25.26	37.50	
Dosage higher than DDD and Beers list				
Yes	52.74	57.61	44.44	0.17
No	47.26	42.39	55.56	
Drug interaction and Beers list				
Both	14.67	15.69	12.5	0.09
Only one	32	39.22	16.67	
None	53.33	45.09	70.83	
Drug interaction and dosage higher than DDD				
Both	11.26	14.74	5.36	0.00**
Only one	34.44	42.11	21.43	
None	54.30	43.16	73.21	

Each parameter was individually analyzed by a chi-squared test. Differences between the observed and expected frequencies was considered significant when $p < 0.05$ (*).

were inappropriate in 11.26% of occurrences. In both evaluations, gender differences were found ($p < 0.05$, chi-squared test). The profile of inappropriate medications in this group of institutionalized elderly patients is detailed in Table III.

An analysis of the chemical substances taken by institutionalized elderly patients shows that among the five most prescribed medicines, four are substances that act on the cardiovascular system. This is in contrast to the analysis by pharmacological group. Captopril is prescribed to 31.13% of institutionalized elderly patients; however, the high prevalence of risperidone (20.53%) and haloperidol (9.93%) is relevant for this group of patients. Five of the six most common drug interactions found in this analysis involve the most prescribed drugs for the elderly, in accordance with the pharmacological group analysis. Captopril and furosemide are major sources of the drug interactions found in this study. Likewise, we find that digoxin (7.95%) is the most inappropriate medication prescribed for these patients, followed by a food supplement of ferrous sulfate (6.62%), thioridazine (5.96%), lorazepam (3.31%) and diazepam (1.99%). The profile of chemical substances found in this group of institutionalized elderly is detailed in Table IV.

DISCUSSION

This work presented a detailed profile of medication consumption and inappropriate medication use in elderly patients in long-term institutions in southeastern Brazil. The sample population we evaluated had a representative age distribution with an average age of approximately 75 years; similar numbers were reported in the Federal District-DF, Fortaleza-CE and Rio Grande-RS (Gonçalves *et al.*, 2008; Menezes, Marucci, 2005). In long-term institutions in southeastern Brazil, women were predominant; however, regional differences influenced the prevalence of gender, with women being more prevalent in Fortaleza-CE, Rio Grande-RS and Belo Horizonte-MG (69.2%, 75.0% and 81.0%, respectively) and men being more prevalent in the Federal District (58.8%) (Gonçalves *et al.*, 2008; Menezes, Marucci, 2005; Chaimowicz, Greco, 1999).

In this report, the prevalence of prescription medications in southeastern Brazil (95.36%) was greater than in northeastern Brazil (87.2%). The prevalence was also greater than for community-dwelling elderly reported in Belo Horizonte-MG (72.1%), Bambui-MG (79.7%), Diamantina-MG (80.3%), Rio de Janeiro-RJ (85%), Porto

TABLE IV - Chemical substances prescribed for elderly patients in Brazilian long-term institutions (Southeastern Brazil, 2010)

	Prevalence (%)	Female (%)	Male (%)	P-value
Substances most prescribed				
Captopril	31.13	26.32	39.29	0.14
Risperidone	20.53	23.16	16.07	0.40
Acetylsalicylic acid	19.21	14.74	26.79	0.11
Furosemide	17.22	16.84	17.86	0.95
Hydrochlorothiazide	14.57	14.74	14.29	0.87
Calcium carbonate	11.26	14.74	5.36	0.13
Haloperidol	9.93	13.68	3.57	0.04*
Amlodipine	8.61	9.47	7.14	0.85
Omeprazole	8.61	9.47	7.14	0.85
Beers Criteria				
Risperidone	20.53	23.16	16.07	0.30
Thioridazine	9.93	10.53	8.93	0.97
Haloperidol	9.93	13.68	3.57	0.04*
Digoxin	7.95	10.53	3.57	0.22
Phenobarbital	5.30	6.32	3.57	0.46
Chlorpromazine	5.30	6.32	3.57	0.46
Clonazepam	4.64	4.21	5.38	0.75
Glyburide	3.97	5.26	1.79	0.29
Nifedipine	3.31	5.26	0.00	0.20
Lorazepam	3.31	5.26	0.00	0.20
Drug interactions				
Captopril and acetylsalicylic acid	9.93	6.32	16.07	0.10
Captopril and hydrochlorothiazide	7.95	6.32	10.71	0.51
Captopril and furosemide	6.62	4.21	10.71	0.22
Furosemide and acetylsalicylic acid	5.96	2.11	12.50	0.02*
Furosemide and digoxin	5.96	1.05	16.07	0.00***
Captopril and calcium carbonate	2.65	4.21	0.00	0.30

Each parameter was individually analyzed by a chi-squared test with Yates' correction. Differences between the observed and expected frequencies were considered significant when $p < 0.05$ (*) or $p < 0.001$ (***)

Alegre-RS (85.8%) and Fortaleza-CE (80.3%) (Pinto *et al.*, 2012; Venturini *et al.*, 2011; Rozenfeld *et al.*, 2008; Aguiar *et al.*, 2008; Loyola-Filho *et al.*, 2005; Coelho-Filho *et al.*, 2004). In the southeast, the average of three medications per institutionalized elderly patient was also higher than for community-dwelling elderly; in cities Belo Horizonte-MG, Fortaleza-CE and Santa Rosa-RS, the average prescription number ranged from 2.18 to 2.71 medications per elderly patient (Flores, Benvegnú, 2008; Loyola-Filho *et al.*, 2005b; Coelho-Filho *et al.*, 2004). Corroborating these findings, a cross-sectional survey performed in São José dos Campos-SP demonstrated that

institutionalized elderly presented a higher prevalence of medication use and polypharmacy (92% and 3.2 medications, respectively) when compared to community-dwelling groups (80.7% and 1.8 medications, respectively) (Marchini *et al.*, 2011). These data suggested that institutionalized elderly were more exposed to the risks of inappropriate medications than community-dwelling groups.

Nervous system drugs represented four fifths of the anatomical medicine groups consumed by institutionalized elderly. Lucchetti *et al.* (2010) reported that 58.9% of institutionalized elderly patients were prescribed nervous

system medications; this reported prevalence was lower than found in LTIs of southeastern Brazil. Risperidone and haloperidol were the most prescribed chemical substances, followed by antidepressants and benzodiazepines (Lucchetti *et al.*, 2010). Likewise, psycholeptics were on the top of the list in southeastern Brazil LTIs, which were also characterized by a high consumption of risperidone and haloperidol. Around the country, the prevalence of psychotropic drug use among non-institutionalized elderly ranged between 15% and 25%, which is lower than the prevalence found in southeastern Brazil LTIs (Venturini *et al.*, 2011; Rozenfeld *et al.*, 2008; Loyola-Filho *et al.*, 2005b; Coelho-Filho *et al.*, 2004). In fact, Marchini *et al.* (2011) described that institutionalized elderly (59.3%) used psychotropic drugs more frequently than community-dwelling elderly (14.7%) (Marchini *et al.*, 2011). The frequency of psychotropic drug consumption was an indicator of the high psychiatric component of LTIs in southeastern Brazil.

Cardiovascular agents are the most consumed medication by community-dwelling elderly in Brazil, with a prevalence that ranges from 30% to 60% of prescriptions; the prevalence is strongly related to regional features (Pinto *et al.*, 2012; Venturini *et al.*, 2011; Rozenfeld *et al.*, 2008; Aguiar *et al.*, 2008; Loyola-Filho *et al.*, 2005; Coelho-Filho *et al.*, 2004). In the five long-term institutions studied, the prevalence of cardiovascular drug consumption is close to that of northeastern Brazil, where institutionalized elderly present a prevalence of 47.3%. The consumption of alimentary tract and metabolism agents are also similar (Aguiar *et al.*, 2008). In southeastern Brazil LTIs, the consumption of medication related to heat problems is within the national rates, but the use of alimentary tract and metabolism agents is lower than in cities like Rio de Janeiro-RJ and Fortaleza-CE; their use in the southeast is similar to the use reported in Belo Horizonte (Rozenfeld *et al.*, 2008; Loyola-Filho *et al.*, 2005b; Coelho-Filho *et al.*, 2004). In the first inappropriate prescription evaluation, we look for the rate of prescription drug interactions. In institutionalized elderly, 54.11% of the prescriptions present some drug interaction, which is higher than found in community-dwelling elderly from Diamantina-MG (45.8%) and Porto Alegre-RS (32.6% of men and 49.2% of women) (Pinto *et al.*, 2012; Venturini *et al.*, 2011). When we evaluate the pharmacological group and chemical substances, the main drug interactions occur between cardiac medications. This is compatible with observations in community-dwelling elderly around the country and is expected due to the prevalence of these drugs in prescriptions (Pinto *et al.*, 2012; Venturini *et al.*, 2011). Although these combinations are common in

pharmacotherapy, concomitant administration of these agents may lead to hypotension and hypovolemia. To prevent this type of iatrogenic problem, teamwork between physicians and pharmacists is required for intervention and revision of the prescriptions.

Another important indicator of medical prescription quality is provided by Beers criteria, which lists the primary inappropriate drugs for the elderly. Almost two-thirds of individuals in southeastern Brazil long-term institutions consume inappropriate medication according to Beers criteria, higher than the prevalence in northeastern Brazil long-term institutions. In part, the high amount of inappropriate medication use is due to the extension of the medications on Beers criteria in 2012. In the community-dwelling elderly, the consumption of inappropriate medication by Beers criteria ranges between 10-30%, with psychotropic drugs being the most dangerous group (Pinto *et al.*, 2012; Rozenfeld *et al.*, 2008; Coelho-Filho *et al.*, 2004). Surprisingly, a great number of prescriptions are for dosage higher than the DDD, which is a serious risk for individual that already have reduced metabolic capacity.

In this study, efforts were made to avoid possible biases. The data collection procedure and forms were standardized, and collectors were trained. Nevertheless, this study was performed in only five long-term institutions; definitive conclusions about inappropriate use of medicines in other locations must be drawn with caution. The features of the sample collected were similar to others studies. For example, the number of women was higher than men. This was likely related to differences in lifespan between the genders. In our study, any brand name drugs were re-classified according the naming of ATC Classification System. For the evaluation of our data according to Beers criteria, the DDD and drug interactions, our analysis was limited to the databases provided by the current literature and the drugs.com database. However, reasoned that most important inappropriate use of medications and interactions were included in these databases.

This work provides valuable information about inappropriate prescription of medicines to elderly patients in LTIs and characterizes the current profile of medication use in southeastern Brazil. The high prevalence of inappropriate prescriptions found in institutionalized elderly patients is a strong indication of poor quality health services; the prevention and correction of these inadequacies requires the adoption of new practices and policies. We believe that the involvement of a pharmacist in nursing homes could help identify, prevent and resolve problems related to prescription medication, thus ensuring higher quality pharmacotherapy for the elderly.

In addition, prescription of generic drugs and those on the RENAME list allows access to medicines through the Brazilian health care system (SUS); thus, medicines can be purchased at more affordable prices and with guaranteed quality and interchangeability. In conclusion, an individual analysis of prescriptions is essential to prevent iatrogenic disease, promote the rational use of medicines and increase the quality of care in institutional environments.

REFERENCES

- AGUIAR, P.M.; LYRA-JUNIOR, D.P.; SILVA, D.T.; MARQUES, T.C. Avaliação da farmacoterapia de idosos residentes em instituições asilares no nordeste do Brasil. *Lat. Am. J. Pharm.*, v.27, p.454-459, 2008.
- ALMEIDA, O.P.; RATTO, L.; GARRIDO, R.; TAMAI, S. Fatores preditores e conseqüências clínicas do uso de múltiplas medicações entre idosos atendidos em um serviço ambulatorial de saúde mental. *Rev. Bras. Psiquiatr.*, v.21, p.152-157, 1999.
- BERENBEIM, D.M. Polypharmacy: overdosing on good intentions. *Manag. Care Q.*, v.10, p.1-5, 2002.
- BRASIL. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Assistência Farmacêutica e Insumos Estratégicos. Relação nacional de medicamentos essenciais – Rename. 6.ed. Brasília: Editora do Ministério da Saúde, 2008. Available at: <<http://www.anvisa.gov.br/medicamentos/essencial.htm>>. Accessed on: 16 Mar. 2012.
- CHAIMOWICZ, F.; GRECO, D.B. Dinâmica da institucionalização de idosos em Belo Horizonte, Brasil. *Rev. Saúde Pública*, v.33, p.454-460, 1999.
- COELHO-FILHO, J.M.; MARCOPITO, L.F.; CASTELO, A. Perfil de utilização de medicamentos por idosos em área urbana do Nordeste do Brasil. *Rev. Saúde Pública*, v.38, p.557-64, 2004.
- CONVERSO, M.E.R.; IARTELLI, I. Caracterização e análise do estado mental e funcional de idosos institucionalizados em instituições públicas de longa permanência. *J. Bras. Psiquiatr.*, v.56, p.267-272, 2007.
- DEL DUCA, G.F.; SILVA, S.G.; THUMÉ, E.; SANTOS I.S.; HALLAL, P.C. Predictive factors for institutionalization of the elderly: a case-control study. *Rev. Saúde Pública*, v.46, p.147-153, 2012.
- FICK, D.M.; COOPER, J.W.; WADE, W.E.; WALLER, J.L.; MACLEAN, J.R.; BEERS, M.H. Updating the Beers criteria for potentially inappropriate medication use in older adults: results of a US consensus panel of experts. *Arch. Intern. Med.*, v.163, p.2716-2724, 2003.
- FLORES, L.M.; MENGUE, S.S. Uso de medicamentos por idosos em região do sul do Brasil. *Rev. Saúde Pública*, v.39, p.924-929, 2005.
- FLORES, V.B.; BENVENÚ, L.A. Perfil de utilização de medicamentos em idosos da zona urbana de Santa Rosa, Rio Grande do Sul, Brasil. *Cad. Saúde Pública*, v.24, p.1439-1446, 2008.
- GALLAGHER, P.; BARRY, P.; O'MAHONY, D. Inappropriate prescribing in the elderly. *J. Clin. Pharm. Ther.*, v.32, p.113-121, 2007.
- GONÇALVES, L.G.; VIEIRA, S.T.; SIQUEIRA, F.V.; HALLAL, P.C. Prevalência de quedas em idosos asilados do município de Rio Grande, RS. *Rev. Saúde Pública*, v.42, p.938-945, 2008.
- LOYOLA-FILHO, A.I.; UCHOA, E.; FIRMO, J.O.A.; LIMA-COSTA, M.F. Estudo de base populacional sobre o consumo de medicamentos entre idosos: Projeto Bambuí. *Cad. Saúde Pública*, v.21, p.545-553, 2005.
- LOYOLA-FILHO, A.I.; UCHOA, E.; LIMA-COSTA, M.F. Estudo epidemiológico de base populacional sobre uso de medicamentos entre idosos na Região Metropolitana de Belo Horizonte, Minas Gerais, Brasil. *Cad. Saúde Pública*, v.22, p.2657-2667, 2005.
- LUCCHETTI, G.; GRANERO, A.L.; PIRES, S.L.; GORZONI, M.L.; TAMAI, S. Fatores associados ao uso de psicofármacos em idosos asilados. *Rev. Psiquiatr. Rio Gd. Sul*, v.32, p.38-43, 2010.
- MARCHINI, A.M.P.S.; DECO, C.P.; SILVA, M.R.V.; LODI, K.B.; ROCHA, R.F.; MARCHINI, L. Use of medicines among a brazilian elderly sample: a cross-sectional study. *Int. J. Gerontology*, v.2, p.94-97, 2011.
- MEDEIROS-SOUZA, P.; SANTOS-NETO, L.L.; KUSANO, L.T.E.; PEREIRA, M.G. Diagnosis and control of polypharmacy in the elderly. *Rev. Saúde Pública*, v.41, p.1049-1053, 2007.

- MENEZES, T.N.D.; MARUCCI, M.D.F.N. Antropometria de idosos residentes em instituições geriátricas, Fortaleza, CE. *Rev. Saúde Pública.*, v.39, p.169-175, 2005.
- NÓBREGA, O.D.T.; KARNIKOWSKI, M.G.D.O. A terapia medicamentosa no idoso: cuidados na medicação. *Ciênc. Saúde Coletiva*, v.10, p.309-313, 2005.
- PEREIRA, L.R.L.; VECCHI, L.U.P.; BAPTISTA, M.E.C.; CARVALHO, D. Avaliação da utilização de medicamentos em pacientes idosos por meio de conceitos de farmacoepidemiologia e farmacovigilância. *Ciênc. Saúde Coletiva*, v.9, p.479-481, 2004.
- PINTO, M.C.X.; FERRÉ, F.; CALEGÁRIO, L.O.; PINHEIRO, M.L.P. Potentially inappropriate medication use in a city of southeast Brazil. *Braz. J. Pharm. Sci.*, v.48, p.79-86, 2012.
- RIBEIRO, A.Q.; ROZENFELD, S.; KLEIN, C.H.; CÉSAR, C.C.; ACURCIO, F.D.A. Inquérito sobre uso de medicamentos por idosos aposentados, Belo Horizonte, MG. *Rev. Saúde Pública.*, v.42, p.724-732, 2008.
- ROMANO-LIEBER, N.S.; TEIXEIRA, J.J.V.; FARHAT, F.C.L.G.; RIBEIRO, E.; CROZATTI, M.T.L.; OLIVEIRA, G.S.A. Revisão dos estudos de intervenção do farmacêutico no uso de medicamentos por pacientes idosos. *Cad. Saúde Pública*, v.18, p.1499-1507, 2002.
- ROYSTON, J. P. Algorithm AS 181: the W test for normality. *Appl. Statistics*, v.31, p.176-180, 1982.
- ROZENFELD, S.; FONSECA, M.J.M.; ACURCIO, F.A. Drug utilization and polypharmacy among the elderly: a survey in Rio de Janeiro city, Brazil. *Rev. Panam. Salud Publica*, v.23, p.34-43, 2008.
- THE AMERICAN GERIATRICS SOCIETY BEERS CRITERIA UPDATE EXPERT PAINEL. American Geriatrics Society Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. *J. Am. Geriatr. Soc.*, v.60, p.616-631, 2012.
- VENTURINI, C.D.; ENGROFF, P.; ELY, L.S.; ZAGO, L.F.A.; SCHROETER, G.; GOMES, I.; CARLI, G.A.; MORRONE, F.B. Gender differences, polypharmacy, and potential pharmacological interactions in the elderly. *Clinics*, v.66, p.1867-1872, 2011.
- WORLD HEALTH ORGANIZATION. Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC classification and DDD assignment 2010. Oslo, 2009. Available at: <<http://www.whocc.no/news/340.html>>. Accessed on: 16 Mar. 2012.

Received for publication on 23rd October 2012

Accepted for publication on 08th May 2013