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# Potentially inappropriate medication use among elderly patients from a Brazilian general hospital

## Uso de medicamentos potencialmente inadequados entre idosos em um hospital geral brasileiro

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## ABSTRACT

The aim of this study was to determine the profile of the pharmacotherapy used by hospitalized elderly. A cross-sectional study was conducted at a Brazilian charitable general hospital. Drug prescriptions for hospitalized elderly patients (age≥60 years), dated from May to September 2010, were the source of data for this study and retrospectively analyzed (n=1,783). Polypharmacy (use of 5 or more drugs) and potentially inappropriate medications (PIMs – according to the Beers Criteria) were identified. Associations between sex, age, admission for cardiovascular disease or hospital stay and polypharmacy or PIM prescription were studied using univariate analysis (Pearson's Chi-square test). The association between polypharmacy and PIM prescription was also evaluated. A total of 204 elderly were hospitalized (mean age = 75 years) during the study period. The most commonly prescribed drugs acted on the cardiovascular system (29%) and the alimentary tract and metabolism (26%). Around 90% of the elderly were submitted to polypharmacy and 59% had, at least, one prescription of PIMs. A hospital stay of five days or more was associated with polypharmacy and PIM prescription. This study revealed a worrying drug utilization profile of high PIM use and polypharmacy practice. There is a need to implement strategies to improve geriatric prescribing.

**Keywords:** aged; inappropriate prescribing; polypharmacy; aging; pharmacoepidemiology

## RESUMO

O objetivo deste estudo foi determinar o perfil da farmacoterapia utilizada por idosos hospitalizados. Foi realizado um estudo transversal em hospital brasileiro geral filantrópico. As prescrições de pacientes idosos hospitalizados (idade ≥ 60 anos), datadas a partir de maio a setembro de 2010 foram a fonte de dados para este estudo e foram analisadas retrospectivamente (n=1.783). A prática de polifarmácia (consumo de 5 ou mais medicamentos) e uso de medicamentos potencialmente inadequados (MPI - de acordo com o critério de Beers) foram identificados. As associações entre gênero, idade, admissão para doença cardiovascular ou tempo de estadia hospitalar e polifarmácia ou uso de MPI foram analisadas por meio de análise univariada (teste do qui-quadrado de Pearson). A associação entre polifarmácia e MPI prescrição também foi avaliada. Durante o período do estudo, 204 idosos foram hospitalizados (idade média=75 anos). Os medicamentos mais prescritos agiam sobre o sistema cardiovascular (29%) e sistema digestório e metabolismo (26%). Cerca de 90% dos idosos praticavam polifarmácia e 59% usavam pelo menos um MPI. A estada hospitalar de cinco dias ou mais foi associada a polifarmácia e uso de PIM. Este estudo permitiu o diagnóstico de um perfil de utilização de medicamentos preocupante. Assim, surge a necessidade de implementação de estratégias para melhorar a prescrição geriátrica.

**Palavras-chave:** idosos; prescrição inadequada; polifarmácia; envelhecimento; farmacoepidemiologia

## INTRODUCTION

The aging of the population is a phenomenon observed worldwide. However, few countries have an aging process as fast as that of Brazil (1,2). Besides changes in the population´s age structure, a transition is also occurring in patterns of disability, morbidity, and mortality, redefining the national epidemiological profile (1,3).This epidemiological transition is mainly characterized by a shift in the prevalence of infectious and parasitic diseases to more chronic diseases, which predominantly affect the elderly (3,4).

These demographic and epidemiological transitions have led to a greater burden on the health system since the elderly population requires more health services and needs constant monitoring, special care, and numerous medicines (1, 5-7). Developing quality geriatric prescriptions, however, becomes a complex process given the various physiological peculiarities and high prevalence of chronic diseases among this patient group, which is exposed to a greater risk of Adverse Drug Reactions (ADR) and another iatrogenesis (8-11).

With this in mind, a quality prescription must contain medications with appropriate indications at the properly adjusted dose for the kinetic profile of the elderly patient. Also, in geriatric prescribing, combinations of medicines which cause drug interactions, fixed combinations, dual therapy, and drugs with questionable therapeutic value should all be avoided (9-11).The quality of drugs prescription for the elderly may, therefore, be assessed by different indicators. In pharmacoepidemiological studies targeting hospitalized elderly, evaluation of parameters such as the use of potentially inappropriate medication (PIM) and polypharmacy is common (8, 12-17).

Pharmacotherapy is considered potentially inappropriate when the risks of its use outweigh its benefits (18-20).Exposure of the elderly population to this type of medication has been shown to be associated with increased morbidity and mortality, increased the frequency of health service use and higher occurrence of ADR (12, 13, 15, 16, 21, 22).Studies have shown that the prescription of PIM to Brazilian elderly is commonplace in some different settings (23-25). However, the number of pharmacoepidemiological studies focusing on the Brazilian hospitalized elderly population during their hospital stay is small (26).

These issues prompted the present epidemiologic study conducted at a philanthropic hospital to evaluate the prevalence and factors associated with polypharmacy and use of potentially inappropriate medicines among hospitalized elderly.

## MATERIALS AND METHODS

A cross-sectional study was conducted to define the quantitative and qualitative profile of the pharmacotherapy provided to a hospitalized elderly population (persons aged 60 years or older) of a general hospital located in the city of Mariana, Minas Gerais State, Brazil.

A convenience sample was selected representing each elderly patient admitted to one of the 18 beds of the general ward of the hospital studied between May 1st and September 30th, 2010. All of the patients´ prescriptions were retrospectively checked. Data on medicine use, age, sex, length of stay and main diagnosis were collected.

All medicines identified on the prescriptions were classified according to the first and second level of the ATC (Anatomical Therapeutic Chemical) classification system of the World Health Organization (WHO).

The dependent variable was polypharmacy and use of potentially inappropriate medicines (PIM). Polypharmacy was determined through the use of five or more drugs, and PIM as "PIM independent of diagnoses or condition" and "PIM considering diagnoses or conditions" according to the Beers criteria, updated by Fick and cols (2003). (19). PIM regarding diagnoses or conditions were identified after taking into account the principal diagnosis.

The explanatory variables sex, age, the length of stay and admission for cardiovascular disease were analyzed to evaluate polypharmacy practice and use of PIM. Polypharmacy was also employed as an explanatory variable for PIM use.

For data organization and processing, a database was created using EpiInfo® 7 software.

Univariate analysis was performed using Pearson's Chi-Square tests to investigate the association between the explanatory and dependent variables at a level of statistical significance of 5%. Odds ratio and 95% confidence interval were also determined for each association evaluation.

This study was conducted in accordance with the standards required by the Declaration of Helsinki and was approved by the Ethics and Research Committee of the State University of Montes Claros (UNIMONTES) under process number 2427.

## RESULTS AND DISCUSSION

During the period of analysis, 398 patients were admitted to the general ward of the hospital studied, 204 (51.3%) of whom were elderly. And 1,783 prescriptions were evaluated (mean of 8.7 prescriptions/elder).

Among the individuals included in the study, 112

were female (54.9%), with age ranged from 60 to 105 years (mean of 74.8 ± 9.7 years). The length of hospital stay ranged from 1 to 34 days, with a mean stay of 7 ± five days.

Regarding the assessment of the main diagnosis of the elderly individuals at the time of admission, 42 different diseases were listed. The most frequent conditions were: "pneumonia and influenza" (15.7%), "chronic lower respiratory tract diseases" (10.8%), "heart failure" (9.8%) and "stroke" (8.8%).

A total of 2,109 drugs were prescribed and according to ATC classification, 28.9% of these acted on the cardiovascular system, 26.5% on the alimentary tract and metabolism, and 20.7% on the nervous system.

Prescription analysis revealed that 90.2% of the elderly in the study (n=184) had, at least, one prescription exhibiting polypharmacy.

It was also observed that 59.3% of older people (n=121) had, at least, one prescription of PIM independent of diagnoses or condition; and among these,71 had only one PIM prescribed (Table 1).A total of 197 PIMs were prescribed, representing an average of 1.0 PIM/patient.

The most frequently prescribed PIMs independent of diagnoses or conditions were diazepam (24.9%), digoxin, at doses ≥ 0.125 mg/day (18.8%), and tenoxicam (13.7%) (Table 2).

**Table 1.** Potentially inappropriate medications (PIM) identified in the prescriptions to the elderly patients from a hospital in Mariana, Minas Gerais, Brazil, according to the Beers Criteria.

| PIM | Absolute Frequency (n) | Relative Frequency (%) |
|---|---|---|
| 0 | 83 | 40.7 |
| 1 | 71 | 34.8 |
| 2 | 30 | 14.7 |
| 3 | 15 | 7.3 |
| 4 | 4 | 2.0 |
| 5 | 1 | 0.5 |
| **Total** | **204** | **100** |

The only PIM considering diagnoses or conditions identified in the prescriptions analyzed was tenoxicam, prescribed for 27 elderly diagnosed with gastric or duodenal ulcer.

Univariate analysis found no statistically significant association between sex, age or admission for cardiovascular disease and polypharmacy (Table 3).

**Table 2.** Frequency of prescription of potentially inappropriate medications (PIM) to the elderly patients from a hospital in Mariana, Minas Gerais, Brazil, according to the Beers Criteria.

| Drug | Frequency | |
|---|---|---|
| | Absolute (n) | Relative (%) |
| Diazepam | 49 | 24.9 |
| Digoxin (dose > 0.125 mg/day) | 37 | 18.8 |
| Tenoxicam | 27 | 13.7 |
| Scopolamine | 23 | 11.7 |
| Nifedipine (immediate release) | 17 | 8.6 |
| Promethazine | 8 | 4.1 |
| Amiodarone | 7 | 3.6 |
| Methyldopa | 5 | 2.5 |
| Dexchlorpheniramine | 5 | 2.5 |
| Mineral oil | 4 | 2.0 |
| Amitriptyline | 4 | 2.0 |
| Ferrous sulfate (dose > 325 mg/day) | 3 | 1.5 |
| Clonazepam | 3 | 1.5 |
| Others | 5 | 1.1 |

Similarly, no association was found between sex, age, admission for cardiovascular disease or polypharmacy and PIM prescription (Table 4). However, longer hospital stay (over 4 days) was associated with both polypharmacy and PIM use (Tables 3 and 4).

The prevalence of polypharmacy among the hospitalized elderly was high (90.2%) and similar to the rate detected in a study conducted in India (90.4%) but higher than the prevalence identified in an Italian study (20.1%) (27,28). Polypharmacy exposes elderly patients to a greater likelihood of drug-related problems (or drug therapy problems), adverse reactions and drug interactions (8).

The prevalence of prescription of PIMs independent of diagnoses or condition (59.3%) was higher than that reported in other studies employing similar methods (14, 16, 17, 26, 28) The high frequency of prescription of PIMs may reflect the lack of knowledge regarding the Beers Criteria among prescribers. This reinforces the importance of the dissemination of the Beers Criteria among physicians, and the implementation of prescription review.

The most frequently prescribed PIMs in this study, namely, the long-acting benzodiazepine diazepam, digoxin, scopolamine and short-acting nifedipine, also featured among the five most prescribed PIMs of other similar studies (16, 17, 26, 28). These results demonstrate that hospitalized elderly may be at greater risk of ADRs such as constipation, orthostatic hypotension, sedation, walking difficulties, falls and fractures (18, 19).

A length of hospital stay of five days or longer was associated with a higher chance of exposure to polypharmacy (OR = 0.23, 95%CI= 0.84-0.62) and PIMs (OR = 0.54, 95%CI = 0.30-0.95). This shows that, although patients hospitalized for longer periods are believed to be more fragile, no additional efforts were made to safeguard them from the potential harm of polypharmacy and PIM use. Likewise, several other studies also found an association between longer lengths of stay and PIM use (17, 26, 28).

**Table 3.** Association between sex, age, admission for cardiovascular disease, the duration of stay and polypharmacy among the elderly patients from a hospital in Mariana, Minas Gerais, Brazil.

| Variables | Polypharmacy | | | | |
|---|---|---|---|---|---|
| | With Polypharmacy n (%) | Without Polypharmacy n (%) | N | p-value | Odds Ratio (95% CI) |
| **Gender** | | | | | |
| Male | 85(46.2%) | 7(35.0%) | 92 | 0.339 | 1.59 (0.61-4.17) |
| Female | 99(53.8%) | 13(65.0%) | 112 | | |
| **Age group** | | | | | |
| 60-79 | 127(69.0%) | 12(60.0%) | 139 | 0.411 | 1.50 (0.58-3.83) |
| Over 79 | 57(31.0%) | 8(40.0%) | 65 | | |
| **Admission for cardiovascular disease** | | | | | |
| Yes | 48(26.1%) | 5(25.0%) | 53 | 0.916 | 1.06 (0.37-3.07) |
| No | 136(73.9%) | 15(75.0%) | 151 | | |
| **Length of stay** | | | | | |
| 1-4 days | 64(34.8%) | 14(70.0%) | 78 | 0.002 | 0.23 (0.84-0.62) |
| Over 4 days | 120(65.2%) | 6(30.0%) | 126 | | |

None of the other analyzed associations were statistically significant. In other studies, PIM use was associated with female gender, (14, 26), admission for cardiovascular disease (14), and younger age groups (14, 16).

The present study has some limitations. The first is that analyzes were based on a convenience sample. Another limitation is that the version of the Beers Criteria used (2003) has now been updated by the American Geriatric Society (latest version 2015). All of the PIMs identified in the present study using the 2003 Beers Criteria, except ferrous sulfate, remain in the 2015 version.

However, some new drugs have been added to the criteria. This suggests that, although not performed, an analysis of the data using the 2015 Beers Criteria would probably show an even higher PIM prescribing prevalence.

Despite these limitations, the present study has great relevance, especially given the lack of international, and particularly national, aging pharmacoepidemiology studies in hospital settings. Moreover, unlike many studies available assessing prescription on hospital admission, the present investigation evaluated the drugs used by the elderly during their hospital stay, revealing the nosocomial pharmacotherapy provided to this growing and vulnerable population.

**Table 4.** Association between sex, age, admission for cardiovascular disease, length of stay, polypharmacy and PIM prescription, among the elderly patients from a hospital in Mariana, Minas Gerais, Brazil

| Variables | Prescription of PIM | | | | |
|---|---|---|---|---|---|
| | With PIM n (%) | Without PIM n (%) | N | p-value | Odds Ratio (95% CI) |
| **Gender** | | | | | |
| Male | 60(49.6%) | 32(38.6%) | 92 | 0.120 | 1.57 (0.89-2.77) |
| Female | 61(50.4%) | 51(61.4%) | 112 | | |
| **Age group** | | | | | |
| 60-79 | 78(64.5%) | 61(73.5%) | 139 | 0.174 | 0.65 (0.35-1.21) |
| Over 80 | 43(35.5%) | 22(26.5%) | 65 | | |
| **Admission for cardiovascular disease** | | | | | |
| Yes | 30(24.8%) | 23(27.7%) | 53 | 0.641 | 0.86 (0.46-1.62) |
| No | 91(75.21%) | 60(72.3%) | 151 | | |
| **Length of stay** | | | | | |
| 1-4 days | 39(32.2%) | 39(47.0%) | 78 | 0.033 | 0.54 (0.30-0.95) |
| Over 4 days | 82(67.8%) | 44(53.0%) | 126 | | |
| **Polypharmacy** | | | | | |
| No | 12(9.9%) | 8(9.6%) | 20 | 0.948 | 0.97(0.34-2.70) |
| Yes | 109(90.1%) | 75(90.4%) | 184 | | |

## CONCLUSION

Although the clinical outcomes of drug therapy were not analyzed, this study revealed a worrying drug utilization profile of a high prevalence of PIM use and polypharmacy practice. The association between length of stay and PIM use shows that continuous and intensive prescription analyzes should be practiced, especially among those elderly hospitalized for four days or longer.Given that the elderly segment is a major user of medications and hospital institutions, these results show the need to implement strategies to improve geriatric prescribing.

## REFERÊNCIAS


1. IBGE. Instituto Brasileiro de Geografia e Estatística. Síntese de indicadores sociais – uma análise das condições de vida da população brasileira 2013. [acesso em 2015 dezembro 12]. Disponível em: <http://biblioteca.ibge.gov.br/visualizacao/livros/liv66777.pdf>.
2. Veras R. Population aging today: demands, challenges and innovations. Rev Saude Publ. 2009; 43(3):548-54. DOI: 10.1590/S0034-89102009005000025
3. Mendes AC, Sá DA, Miranda GMD, Lyra TM, Tavares RAW. Assistência pública de saúde no contexto da transição demográfica brasileira: exigências atuais e futuras. Cad Saúde Pública. 2012; 28(5):955-64. DOI: 10.1590/S0102-311X2012000500014.
4. BRASIL. Plano de Ações Estratégicas para o Enfrentamento das Doenças Crônicas não Transmissíveis (DCNT) no Brasil. 2011. [acesso 2016 janeiro 27]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/plano_acoes_enfrent_dcnt_2011.pdf.
5. Borges GM, Campos MB, Castro e Silva LG. Transição da estrutura etária no Brasil: oportunidades e desafios para a sociedade nas próximas décadas. [acesso 2016 janeiro 27]. Disponível em: http://biblioteca.ibge.gov.br/visualizacao/livros/liv93322.pdf
6. IBGE. Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Saúde 2013 – Percepção do estado de saúde, estilos de vida e doenças crônicas. 2014. [acesso em 2015 dezembro 08]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/pns/2013/default.shtm>.
7. Loyola-Filho AI, Matos DL, Giatti L, Afradique ME, Peixoto SV, Lima-Costa MF. Causes of public hospital admissions among older adults in Brazil's Unified Health System. Epidemiol Serv Saude. 2004; 13(4)229-38. DOI: 10.5123/S1679-49742004000400005
8. Maher RL, Hanlon JT, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014; 13(1):57-65. DOI: 10.1517/14740338.2013.827660
9. Gupta M, Agarwal M. Understanding medication errors in the elderly. NZMJ. 2013; 126(1385):73-99.
10. Patterson SM, Hughes C, Kerse N, Cardwell CR, Bradley MC. Interventions to improve the appropriate use of polypharmacy for older people. Cochrane Database Syst Rev. 2014;10:CD008165. DOI: 10.1002/14651858.CD008165.pub3.
11. Sergi G, De Rui M, Sarti S, Manzato E. Polypharmacy in the elderly: can comprehensive geriatric assessment reduce inappropriate medication use? Drugs Aging. 2011; 28(7):509-518. DOI: 10.2165/11592010-000000000-00000
12. Nassur BA, Braun V, Devens LT, Morelato RL. Evaluation of inappropriate medications for elderly ambulatory admitted of a general hospital philanthropy. Rev Soc Bras Clin Med. 2010; 8(3):208-11.
13. Page RL, Linnebur SA, Bryant LL. Inappropriate prescribing in the hospitalized elderly patient: Defining the problem, evaluation tools, and possible solutions. Clin Interv Aging. 2010; 5:75-87.
14. Rothberg MB, Pekow PS, Liu F, Korc-Grodzicki B, Brennan MJ, Bellantonio S, et al. Potentially inappropriate medication use in hospitalized elders. J Hosp Med. 2009; 3(2):91-102. DOI: 10.1002/jhm.290
15. Wawruch M, Fialova D, Zikavska M, Wsolova L, Jezova D, Kuzelova M, et al. Factors influencing the use of potentially inappropriate medication in older patients in Slovakia. J Clin Pharm Ther. 2008; 33(4):381-92. DOI: 10.1111/j.1365-2710.2008.00929.x
16. Onder G, Landi F, Liperoti R, Fialova D, Gambassi G, Bernabei R. Impact of inappropriate drug use among hospitalized older adults. Eur J Clin Pharm. 2005; 61(5-6):453-59.
17. Egger SS, Bachmann A, Hubmann N, Schlienger RG, Krahenb S. Prevalence of potentially inappropriate medication use in elderly Patients: Comparison between General Medical and Geriatric Wards. Drugs Aging. 2006; 23(10):823-837.
18. American Geriatrics Society (AGS). American Geriatrics Society updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. JAGS. 2015; 63(11):2227-46. DOI: 10.1111/jgs.13702
19. Fick DM, Cooper JW, William EW, Waller JL, Maclean JR, Beers MH. Updating the Beers criteria for potencially inappropriate medication use in older adults. Arch Intern Med. 2003;1 63(22):2716-2724.
20. Beers MH, Baran RW, Frenia K. Drugs and the elderly, Part 1: The problems facing managed care. Am J Manag Care. 2000; 6(12):1313-1320.
21. Barry PJ, O'Keefe N, O'Connor KA, O'Mahony D. Inappropriate prescribing in the elderly: a comparison of the Beers criteria and the improved prescribing in the elderly tool (IPET) in acutely ill elderly hospitalized patients. J Clin Pharm Ther. 2006;31(6):617-26.
22. Caterino JM, Emond JA, Camargo CA. Inappropriate medication administration to the acutely III elderly: a nationwide emergency departament study, 1992-2000. J Am Geriatr Soc. 2004;52(11):1847-1855.
23. Santos TR, Lima DM, Nakatani AY, Pereira LV, Leal GS, Amaral RG. Consumo de medicamentos por idosos, Goiânia, Brasil. Rev Saude Publica. 2013;47(1):94-103.

24. Oliveira MG, Amorim WW, De Jesus SR, Rodrigues VA, Passos LC. Factors associated with potentially inappropriate medication use by the elderly in the Brazilian primary care setting. Int J Clin Pharm. 2012; 34(4):626-632. DOI: 10.1007/s11096-012-9656-9.
25. Nascimento MMG, Pereira ML, Souza ACS, Ribeiro AQ, Dias-Junior CAC. Potential drug therapy problems on an elderly nursing home population. Lat Am J Pharm. 2011; 30(10):1985-1990.
26. Locatelli J, Lira AR, Torraga LKLA, Paes AT. Inappropriate medications using the Beers Criteria in Brazilian hospitalized elderly patients. Consult Pharm. 2010; 25(1):36-40. DOI: 10.4140/TCP.n.2010.36.
27. Pasina L, Djade CD, Tettamati M, Franchi C, Salerno F, Corrao S, Marengoni A, Marcucci M, Mannucci PM, Nobili A. Prevalence of potentially inappropriate medications and risk of adverse clinical outcome in a cohort of hospitalized elderly patients: results from the REPOSI Study. J Clin Pharm Ther. 2014; 39(5):511-515. DOI: 10.1111/jcpt.12178.
28. Harugeri A, Joseph J, Ramesh M, Guido S. Potentially inappropriate medication use in elderly patients: A study of prevalence and predictors in two teaching hospitals. Postgrad Med J. 2010; 56(3):186-91. DOI: 10.4103/0022-3859.68642