Application of the 2015 Beers Criteria Operationalized for Portugal in Institutionalized Elderly People: A Cross-Sectional Study

Aplicação dos Critérios de Beers de 2015 Operacionalizados para Portugal em Pessoas Idosas Institucionalizadas: Um Estudo Transversal

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ABSTRACT

Introduction: The consumption of potentially inappropriate medicines is high among institutionalized elderly, predisposing to potential drug interactions, adverse drug events, risk of iatrogenic cascade, increased morbidity and mortality and health costs. Medication review is a promising strategy for therapeutic optimization, although scarcely documented in Portugal. The aim of this study was to characterize, using explicit criteria, the existence of potentially inappropriate medicines, among institutionalized elderly, and to calculate the eventual cost savings, with their discontinuation.

Material and Methods: Descriptive and cross-sectional study conducted in three residential homes for the elderly, from different geographic regions, based on a random sample of 33 health records. In order to characterize the existence of potentially inappropriate medicines, we used the 2015 Beers criteria, revised by the American Geriatrics Society and in the Portuguese version.

Results: On average, 11 drugs are prescribed to elderly residents of three residential structures for the elderly. All health records contain potentially inappropriate medicines (mean 4.8 ± 2.0 per resident), with anxiolytics (17.7%), antidepressants (17.7%) and antipsychotics (15.8%) being the most prevalent. Its reduction would result in an average monthly savings of €9.6 per resident.

Discussion: The consumption of potentially inappropriate medicines is higher than the literature describes, and the cost of medicines is high. The involvement of nurses in the process of drug management and reconciliation, in coordination with the physician, could be an effective strategy. This is the first study using the latest Portuguese version of the Beers criteria, which makes the comparability of the results difficult.

Conclusion: The consumption of potentially inappropriate medicines is high, which suggest the need for adoption of improvement measures.

Keywords: Aged; Inappropriate Prescribing; Institutionalization; Portugal; Potentially Inappropriate Medication List

RESUMO

Introdução: O consumo de medicamentos potencialmente inapropriados é elevado entre idosos institucionalizados, predispondo à ocorrência de potenciais interações medicamentosas, eventos adversos a medicação, risco de cascata iatrogénica, aumento da morbimortalidade e dos custos em saúde. A revisão da medicação é uma estratégia promissora com vista à otimização terapêutica, ainda que pouco documentada em Portugal. Este estudo pretende caraterizar, utilizando critérios explícitos, a existência de medicamentos potencialmente inapropriados, entre idosos institucionalizados, e calcular a eventual poupança, em medicamentos, com a sua supressão.

Material e Métodos: Estudo descritivo e transversal, realizado em três estruturas residenciais para pessoas idosas, de regiões geográficas distintas, a partir de uma amostra aleatória de 33 processos clínicos. Para a caracterização da existência de medicamentos potencialmente inapropriados, utilizaram-se os Critérios de Beers de 2015, revistos pela American Geriatrics Society e na versão operacionalizada para Portugal.

Resultados: Em média, 11 fármacos são prescritos aos idosos residentes das estruturas residenciais para pessoas idosas. Todos os processos contêm medicamentos potencialmente inapropriados (média de 4,8 ± 2,0 por residente), sendo os ansiolíticos (17,7%), antidepressivos (17,7%) e antipsicóticos (15,8%) os mais prevalentes. A sua redução resultaria numa poupança média mensal de €9,6, por residente.

Discussão: O consumo de medicamentos potencialmente inapropriados é superior ao que a bibliografia descreve e o custo com os medicamentos é elevado. O envolvimento dos enfermeiros no processo de gestão e reconciliação medicamentosa, em articulação com o médico, poderá ser uma estratégia eficaz. O estudo é pioneiro na utilização da última versão portuguesa dos critérios de Beers, o que dificulta a comparabilidade dos resultados.

Conclusão: O consumo de medicamentos potencialmente inapropriados é elevado, o que sugere a necessidade de adoção de medidas de melhoria.

Palavras-chave: Idoso; Institucionalização; Lista de Prescrições Potencialmente Inapropriadas; Portugal; Prescrição Inapropriada

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INTRODUCTION

Potentially inappropriate medications (PIMs) are defined as those with poor efficacy or with poor risk-benefit ratio, when safer and equally effective alternatives are available.[1] Other concepts could be considered, related to the increased risk of adverse reactions, aggravating the underlying disease or even with unproven therapeutic efficacy, since the elderly are scarcely included in scientific research for approval of drug marketing.[2] More than 90% of the elderly patients take at least one PIM and 66% take at least three, according to different studies.[3]

Data have shown that it may be considered a public health issue in institutionalised elderly patients, with prevalence of PIM use ranging between 26.6 and 97%.[4-15] The population of residential care facilities for the elderly (RCFEs) is characterised by advanced age, multiple health problems and polymedication,[4,6,10,11,15-18] all predisposing to the use of inappropriate medications.[15,19-24] In addition, age-related physiological changes including pharmacokinetic and pharmacodynamic processes make elderly people more susceptible to drug interactions, as well as toxic and adverse effects.[25] Adverse drug events (ADEs) are induced by the combined action of these factors,[26,27] in addition to the potential iatrogenic cascade (prescription cascade or drug cascade).

The iatrogenic cascade occurs whenever a side effect of a drug is considered as a new clinical condition and therefore a new drug is added by the prescriber. This unnecessary use of a second drug puts patients at risk of further side effects and potentially severe pharmacological interactions.[28,29]

ADEs are associated with an increased morbidity and hospital admission, according to literature,[24,30-33] in addition to lower levels of quality of life[11] and high healthcare costs.[21,34-36] An estimated two million ADEs occur each year in geriatric inpatient units and at least 10 each month.[37] Therefore, regular medication review is recommended by international policies and guidelines aimed at the promotion of quality and safety of medication in geriatric inpatient facilities.[38,39]

Medication review is the basis of therapy optimisation within the different care settings, with advantages in reducing the use of PIMs[40] and potential adverse events,[41,42] in search for discrepancies[43,44] and reducing costs.[21,34,45] This allows for the analysis of each medicine individually, regarding its effectiveness and potential harm as regards comorbidities and the remaining medications (drug interactions).[44] Evidence suggests that 44% of the patients in RCFEs do not undergo any periodic assessment of their medication regimen.[38]

Growing interest in the development of tools for the definition of an adequate pharmacological treatment has occurred in recent decades, in addition to the development of protocols for the systematic definition of PIMs. Beers criteria, including the latest 2019 update by the American Geriatric Society (AGS), are the most frequently used guideline and with the largest number of reviews. These were originally created by Beers *et al.* in 1991, in the United States of America (USA) and were the first explicit tool used in the identification of inappropriate medications in institutionalised elderly patients.[46] These are widely used and are considered as effective tools for the identification of PIMs in elderly patients.[47]

Even though these were designed for American elderly patients, their restricted applicability outside the USA interferes with its instrumentation, as it depends on the medication availability in other countries.[48,49] In addition, the continuous market input and output of medications and the update of scientific knowledge led to the development of an update version of the 2015 Beers criteria by Soares and Soares in 2017, adapted to Portugal and published by the *Núcleo de Estudos de Geriatria* of the *Sociedade Portuguesa de Medicina Interna*.[1] This study is based on this adapted version as this is currently the most recent operationalisation to the Portuguese reality.

PIM management in RCFEs requires an interdisciplinary, shared and coordinated approach involving physicians, pharmacists and nurses.[50] Therefore, it is expected that health professionals working in these facilities have the appropriate scientific knowledge in the identification of PIMs and ADEs, allowing the promotion of a safe environment in collaboration with the remaining interdisciplinary team.

This study was aimed at characterising the medication regimen of patients living in RCFEs with the application of the 2015 Beers criteria version adapted to Portugal and describing the frequency of PIMs and monthly savings following the medication review.

MATERIAL AND METHODS

This was a descriptive and cross-sectional study carried out between March and April 2019, involving three RCFEs located in Mainland Portugal (Northern coast, Southern coast and interior of *Trás-os-Montes*) that were selected by convenience of the main researcher and were invited to participate.

The sample was selected according to the following criteria: a) patients aged 65 and older; and b) living for at least one year at the care facility.

Considering the time constraints, in order to meet the deadline set for the completion of the research, 25% of the clinical records of the residents at each facility that met the inclusion criteria were selected using a simple random sampling technique.

Data were obtained by using a data collection instrument built by the researchers (called script), which allowed characterising the demographic variables (patient's gender and age), health conditions and medication regimen (active ingredients, dose and posology).

Health conditions were categorised quantitatively and qualitatively by anatomical system, according to the nomenclature standardised by the international classification of Primary Health Care.[51] Pharmacological groups and active

ingredients were ranked according to the third (pharmacological group) and fifth level (chemical substance), respectively, of the taxonomy - anatomical therapeutic chemical code (ATC) - recommended by the World Health Organization (WHO)[52] and made available at the Infomed database of human medicines of the Portuguese Infarmed online services.[53] This classification system and levels were selected as these are widely used in literature.[4,6-9,15]

The costs of each medication were based on the minimum price charged to the user and obtained from the Portuguese Infarmed's online services (*Pesquisa de Preço de Medicamentos*).[54] Based on the dosage recorded in the clinical record, the monthly costs of medication per patient were obtained and Microsoft Excel 2010 software was used.

PIMs were based on the total value found by the full application of the five tables included in the 2015 Beers criteria (adapted version for Portugal).[1] It is worth mentioning that the average monthly savings per patient were established based on the total cost of PIMs after the medication review.

The study was approved by all participants by submitting a formal approval request via email, which was signed and stamped by the board of each RCFE. The access to the files was controlled by the institutions, which were responsible for personal data protection. The identity of each patient was protected by replacing his/her name by a code. In the cases where PIMs were identified, the results of the study were shared with the institutions involved. The application of the Beers criteria was performed by the researchers and, subsequently, validated by a physician with experience in geriatrics.

Data were entered into Microsoft Excel (2010) and subsequently converted into SPSS (Statistical Package for the Social Sciences), version 25.0, for Windows. Quantitative variables were described in the descriptive statistical analysis by measures of central tendency, including the mean, in addition to measures of dispersion, including standard deviation and interquartile range (IQR). Qualitative variables were presented as absolute and relative frequency distribution tables (percentage).

The study complied with all ethical requirements and was approved by the Ethics Committee of the Regional Centre of Porto of the *Universidade Católica Portuguesa* (reference number CE.266.2019).

RESULTS

A total of 157 patients were identified by the analysis of the total number of patients living in the three RCFEs, including 26 patients from the Northern coast, 61 from the Southern coast and 39 from the interior of *Trás-os*-Montes, while 26 patients were excluded from the study. Given the time constraints, 25% of the population of each unit was selected, leading to a final sample of 33 patients, mostly female (72.7%), aged on average 84.9 ± 6.7 years, including approximately 76% of patients aged 80 or older (Table 1); 278 health conditions were found, including on average 8.4 ± 3.5 comorbidities per patient. It is worth mentioning that 100% of the patients presented with more than two medical conditions simultaneously (multimorbidity). Hypertension was most frequently presented by 69.7% of the patients, followed by dementia (54.5%), sleep disturbances (51.5%) and falls (48.5%) (Table 1).

A total of 374 drugs were prescribed, with an average of 11.3 ± 3.7 per patient. Mostly polymedicated patients (more than five drugs a day) have been found, corresponding to 97% of the sample. The pharmacological groups with the highest relative rate of prescribed drugs included antidepressants (7.8%), followed by anxiolytics (7.5%) and antipsychotics (6.7%) (Table 2).

Out of the 374 medications that were analysed by using the 2015 Beers criteria, adapted version for Portugal, 158 were considered as inappropriate (42.2%), including at least one PIM per patient (100%), with a 4.8 ± 2.0 mean PIM use per patient, ranging between 1 and 9 (Table 1).

Anxiolytics (benzodiazepines) and antidepressants included the pharmacological group of PIMs with the highest number of prescriptions (17.7% of 158 prescriptions), followed by antipsychotics (15.8%) and drugs for the treatment of peptic ulcer and gastroesophageal reflux (GER) (12.0%) (Fig. 1).

Among the active ingredients most frequently classified as PIMs, quetiapine was the most frequently prescribed, taken by 54.5% of the sample, followed by alprazolam (42.4%) and omeprazole (39.4%) (Fig. 2).

Costs with medication reached the average monthly value of €46.2 ± €30.6 per patient. Following the medication review, by means of the Beers criteria, a monthly saving of €9.6 ± €13.4 per patient has been found (Table 1).

DISCUSSION

A slightly higher prevalence of polymedicated patients and higher mean number of prescribed drugs have been found in this study when compared to literature,[6,8,10,11,14]

Table 1 – Characteristics of the study population (demography, health conditions and medication) (n = 33)

Study variables	Results
Study population, n (%)	33 (100%)
Age group, n (% ≥ 80 years)	25 (75.8%)
Age, (mean ± SD)	84.9 ± 6.7
Gender, n (% female)	24 (72.7%)
Number of health conditions (mean ± SD)	8.4 ± 3.5
Health conditions - categories, n (%)	
Hypertension	23 (69.7%)
Dementia	18 (54.5%)
Sleep disturbances	17 (51.5%)
Falls	16 (48.5%)
Number of medications, (mean ± SD)	11.3 ± 3.7
Number of PIMs, (mean ± SD)	4.8 ± 2.0
Custo mensal em medicamentos, (média ± DP)	46.2 ± 30.6
Monthly savings following the medication review, (mean ± SD)	9.6 ± 13.4

The results were presented as n (%) and mean ± standard deviation (SD)

Table 2 – Pharmacologic groups regarding the 374 medications that were analysed (%), according to the Anatomical Therapeutic Chemical Code classification

Pharmacological group	n (%)
Antidepressants	29 (7.8%)
Anxiolytics	28 (7.5%)
Antipsychotics	25 (6.7%)
Medications for the treatment of peptic ulcer and GER (proton pump inhibitors)	22 (5.9%)
Analgesics	22 (5.9%)
Anti-constipation drugs	21 (5.6%)
Anti-thrombotic agents	20 (5.3%)
ACE inhibitors	20 (5.3%)
Lipid-modifying agents	17 (4.5%)
Anti-dementia medication	16 (4.3%)
Vitamin A and D, including associations of both	14 (3.7%)
Loop diuretics	12 (3.2%)
Vitamin B12 and folic acid	11 (2.9%)
Oral blood glucose lowering drugs	9 (2.4%)
Anti-epileptic drugs	9 (2.4%)
Dopaminergic drugs	9 (2.4%)
Insulin and analogues	6 (1.6%)
Beta-blockers	6 (1.6%)
Potassium-sparing agents	5 (1.3%)
Opioids	5 (1.3%)
Anti-glaucoma drugs	5 (1.3%)
Iron deficiency anaemia medications	4 (1.1%)
Benign prostatic hyperplasia medications	4 (1.1%)
Medications for thyroid disorders	4 (1.1%)
Gout medications	4 (1.1%)
Others (< 1%)	47 (12.6%)
Total of prescribed medications	**374 (100%)**

GER: gastro-oesophageal reflux; ACE: angiotensin-converting enzyme

even though showing a lower mean drug usage when compared to other studies.[4] Patient's advanced age, associated with the high number of chronic conditions,[55] may explain the high prevalence of polymedication found in these patients.[16-18,56] At the same time, the fact that drugs prescribed on an 'as-needed' basis are included in the analysis of chronic medication has an impact on an increased number of drugs used daily.

A slightly higher prevalence of PIMs was found in this study when compared to other studies.[4-15] A high prevalence of PIMs associated with the institutionalisation of elderly patients has been found in literature, regardless of the tool that was used.[7,15] The differences may be explained by the heterogeneity of the tools, the analysis criteria and the variability in the economy, culture and health systems of each country. It is worth mentioning that, during the literature review, no study using the Portuguese version of the 2015 Beers criteria has been found, making this comparison a difficult task.

Among the inappropriate pharmacological classes, psychotropic drugs stood out, which could have been explained by the high prevalence of dementia,[57-59] sleep disturbances[57-59] and delirium in the patients included in the study.

Antidepressants assume a prominent role in the identification of PIMs, although this has not been confirmed in literature.[5,6,8,9,11,12,14] These are considered as inappropriate medications in elderly patients with a history of falls or fractures;[1,45] therefore, this finding can be explained by the high percentage of patients with a history of falls. The effectiveness of psychotherapeutic interventions, devoid of the adverse risks associated with antidepressants would be useful as an alternative.[1,48,58,60]

The use of benzodiazepines is in line with other studies[5,7,8,12-14] and alprazolam is mostly prescribed and use on an 'as-needed' basis by 13 patients (its administration is therefore at the professionals' discretion). In general, anxiolytics are associated with decreased consciousness and

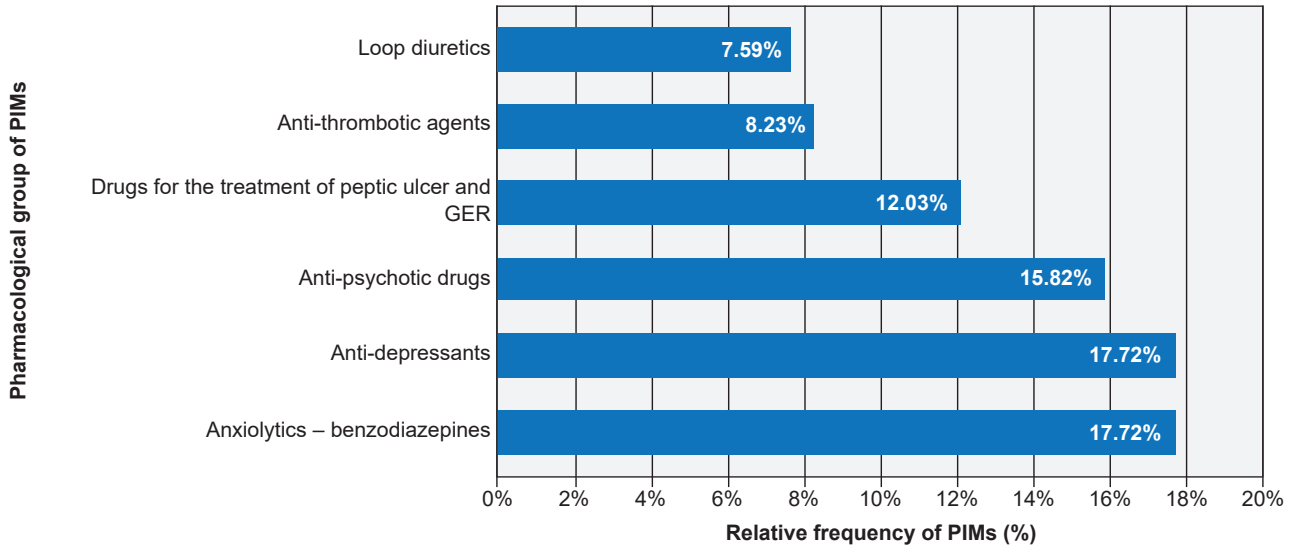

Figure 1 – Distribution (percentage) of the most frequently prescribed potentially inappropriate medications, per pharmacological group (n = 158)

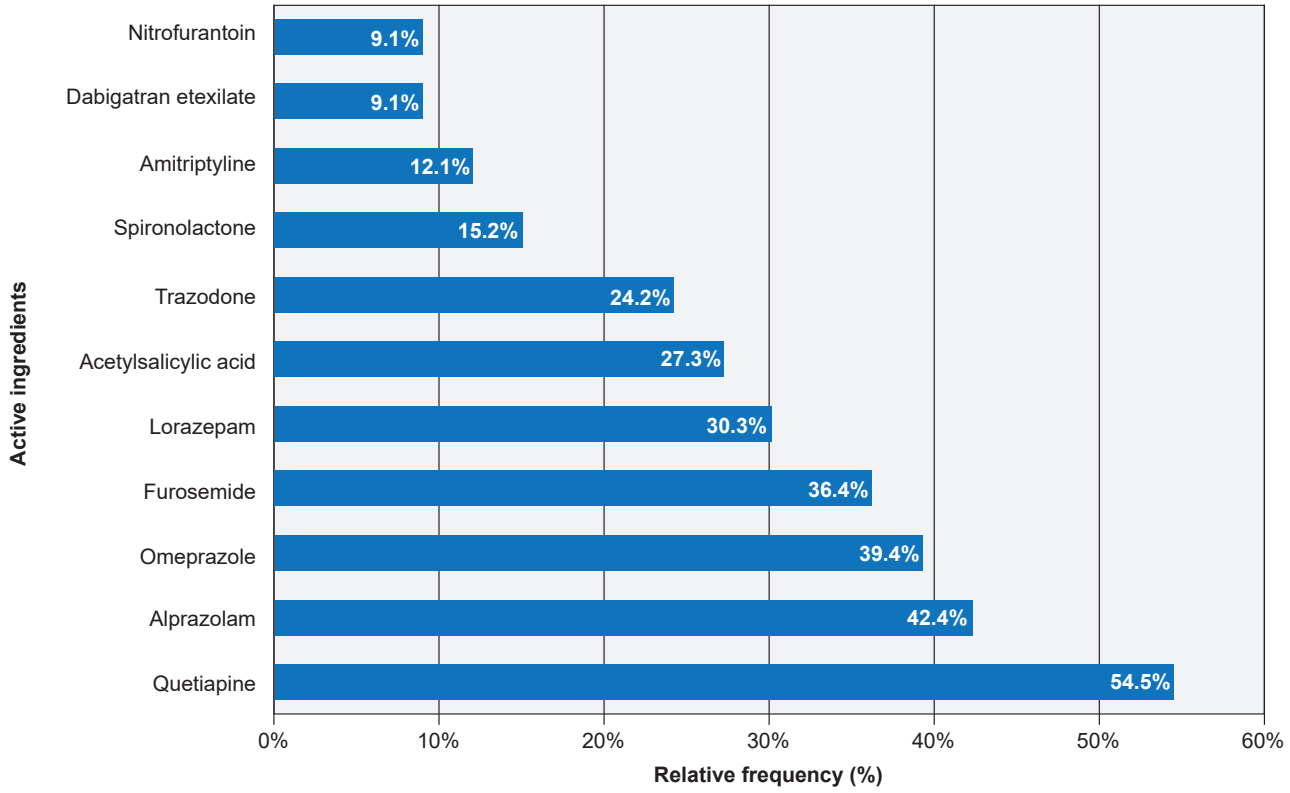

Figure 2 – Active ingredients of the most prevalent PIMs (n = 33)

increased risk of daytime sleepiness and nocturia; therefore, decreased alertness is related to an increased risk for falls (and fractures), reduced mobility and muscle strength, decreased fluid intake and diet and aggravating frailty in elderly patients. It should also be considered that benzodiazepines might induce symptoms of frontal lobe damage, memory disorders, chronic numbness, confusion, which may be confused with dementia, or even aggravate cognitive decline in older people[1,48,59,61] and their use should be discouraged and/or reduced.

A prevalence in line with literature has been found as regards the use of antipsychotics,[5,7,8,12-14] even though lower rates have been found when compared to the European reality, in which these are used by up to seven out of 10 institutionalised elderly patients.[57] This class of drugs is associated with severe adverse events in the elderly patients, including anticholinergic effects, extrapyramidal symptoms,[61] increased risk of thrombotic stroke and higher rates

of cognitive decline and mortality.[1,48] Non-pharmacological interventions are recommended by international guidelines as first line of treatment and keeping the use of antipsychotics whenever these measures are unavailable, ineffective or at the risk of self-injury.[1,48]

The meta-analysis by Brodaty and Arasaratnam[62] has shown how non-pharmacological interventions in the home setting are able to reduce the frequency and severity of behavioural and psychological symptoms of dementia. However, there is not enough evidence to support the effectiveness of these interventions in residential settings.[63] Therefore, well-designed research on the effectiveness and efficiency of non-pharmacological interventions as an alternative to pharmacological prescriptions in these settings is a priority.

As regards the drugs used for the treatment of peptic ulcer and GER, specifically proton pump inhibitors (PPIs), the decrease in gastric hydrochloric acid production reduces calcium absorption and has a relevant impact on commensal microbiota, predisposing to an increased risk for bone loss, fractures and *Clostridium difficile* infection; impaired absorption of some nutrients, gastric atrophy, higher risk for developing gastric cancer, pneumonia and kidney damage have also been described.[64-66] The regular prescription of PPIs beyond an eight-week period was considered as inappropriate by the 2015 Beers criteria, based on this evidence, except in patients at high risk[1,48]; these explain the high prevalence of PIMs found in the study, as well as in most RCFEs.[7,11,66]

Considering these results, the adoption of interdisciplinary strategies[50] is considered crucial to the optimisation of the medication regimen of elderly patients, including educational interventions, medication review, clinical case conferences and the use of computer programs to support clinical decision making.[67,68] Every effort should be made in the medication review process to minimise the use of drugs, mainly regarding the most problematic pharmacological groups, as explained above.[67,68]

Despite discussions on the direct and indirect economic benefits obtained by removing PIMs in the elderly population,[21,31-33,42] some divergence related to the economy and health system of each country remains, in addition to co-payments and the price used for the calculation. However, this would be an effective measure leading to a 21% reduction in the costs of medication, bearing in mind that well above-average monthly expenses have been found regarding most of these patients in the European Union member states.[69]

The main limitations of the study relate to the difficult comparability due to the scarce research based on the Portuguese update of the 2015 Beers criteria. In addition, appropriate clinical data for deciding whether a drug should be considered as PIM were sometimes unavailable. PIMs were presented in a global way, not showing in detail the inappropriate drugs included in the 2015 Beers criteria, regardless of the diagnosis, which may have overestimated the prevalence. Another limitation relates to the small sample size, making any generalisation impossible and compromising the external validity of the study.

CONCLUSION

Polymedication and the use of PIMs are highly prevalent, corresponding to public health concerns, particularly in the population of residential care facilities for the elderly (RCFEs), involving frail older patients with different comorbidities. Polymedication is the main determinant underlying the use of PIMs and medication review, through the application of Beers criteria, is an effective measure in reducing the number of inappropriately prescribed drugs and subsequently in reducing the associated healthcare expenses.

The interdisciplinary involvement and the development of strategies to systematically implement therapeutic reconciliation, adapted to the organisational culture of each RCFE, are included as some of the recommendations to increasing safety and quality of care. In addition, quality policies and guidelines established by policy-makers and RCFE managers for the management of medication are crucial requirements.

AUTHOR CONTRIBUTION

SP, AA: Contribution to the study design and data analysis; critical revision, final version approval. In agreement to be accountable for all the aspects of the work.

AC, LM: Data analysis; critical revision; final version approval. In agreement to be accountable for all aspects of the work.

HUMAN AND ANIMAL PROTECTION

The authors declare that this project complied with the regulations that were established by the Ethics and Clinical Research Committee, according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

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