

# Analysis of potentially inappropriate medications prescribed to older patients in a hospital setting

MÓNICO B<sup>1</sup>, FREIRE I<sup>1,2</sup>, MENDES M<sup>1</sup>, MORGADO M<sup>1,2</sup>, MORGADO S<sup>1</sup>, FONSECA MO<sup>1,2</sup>

1 University Hospital Centre of Cova da Beira. Covilhã (Portugal)

2 Faculty of Health Sciences of University of Beira Interior. Covilhã (Portugal)

Fecha de recepción: 22/05/2019 - Fecha de aceptación: 05/06/2019

## SUMMARY

**Introduction:** An ever increasing number of elderly live with multiple chronic diseases and take several drugs concomitantly. The elderly are subjected to a variety of pharmacodynamic and pharmacokinetic alterations that change the responsiveness of drugs, which makes them potentially inappropriate to use in older people. The aim of this study is to quantitatively assess the prescription pattern of potentially inappropriate medications (PIMs) in different inward clinical services of University Hospital Center of Cova da Beira, Covilhã, Portugal.

**Methods:** We searched the hospital's computerized system database for every patient admitted in previously selected clinical services, from January 1<sup>st</sup> to June 30<sup>th</sup> 2018. Patients less than 65 years old were excluded. Data regarding the patients' hospital ID number, their age, prescribed drugs during admission, prescribed dose, frequency, medications' start date and their

respective end date were anonymously collected. The patients' medications prescribed during the admission period were assessed, and the PIMs were identified according to Beers Criteria 2015.

**Results:** The benzodiazepines were the most frequently prescribed potentially inappropriate therapeutic drug class in the four clinical services studied, accounting for 29.97% in Medicine 2, 39.96% in Cardiology, 30.21% in Medicine 1 and 41.10% in Pneumology of the total of prescribed PIMs. The antipsychotics were the next most prescribed potentially inappropriate therapeutic drug classes. Intestinal motility modifiers, namely metoclopramide, also had a significant expression.

**Conclusions:** Reconciliation tools such as the Beers Criteria are useful to identify inappropriate prescribing during the pharmaceutical validation of prescription. Further studies will provide more insight into the impact of the pharmacist's intervention.

**Key Words:** Potentially inappropriate medications, polypharmacy, medication reconciliation, older people, clinical pharmacist, hospital.

## Análisis de medicamentos potencialmente inapropiados recetados a personas mayores pacientes en un entorno hospitalario

### RESUMEN

**Introducción:** Un número cada vez mayor de ancianos vive con múltiples enfermedades crónicas y toma varios medicamentos concomitantemente. Los ancianos presentan una variedad de alteraciones farmacodinámicas y farmacocinéticas que alteran la respuesta de los fármacos, lo que los hace potencialmente inapropiados para su uso en estos pacientes. El objetivo de este estudio es evaluar cuantitativamente el patrón de prescripción de medicamentos potencialmente inapropiados (PIMs) en diferentes servicios clínicos de hospitalización en el Centro Hospitalario Universitario de Cova da Beira, Covilhã, Portugal.

**Métodos:** Se realizó una investigación en la base de datos del sistema informático del hospital para todos los pacientes internados en servicios clínicos previamente seleccionados, del 1 de enero al 30 de junio de 2018. Se excluyeron a los pacientes menores de 65 años. Los datos referentes al número del proceso clínico del paciente, edad, medicamentos prescritos en el momento de la admisión en el hospital, dosis prescrita, frecuencia, fecha de inicio de los medicamentos y sus respectivas fechas finales fueron recolectados anónimamente. Se evaluaron los medicamentos prescritos de los pacientes durante el período de internamiento, y los PIMs se identificaron de acuerdo con

los criterios de Beers de 2015.

**Resultados:** Las benzodiazepinas fueron la clase terapéutica medicamentosa potencialmente inapropiada prescrita con mayor frecuencia en los cuatro servicios clínicos estudiados, siendo el 29,97% en la Medicina 2, el 39,96% en la Cardiología, el 30,21% en la Medicina 1 y el 41,10% en la Neumología del total de PIMs prescritos. Los antipsicóticos fueron la segunda clase más prescrita de PIMs. Los modificadores de la motilidad intestinal, en particular la metoclopramida, también tuvieron una expresión significativa. **Conclusiones:** Las herramientas de reconciliación, como los criterios de Beers, son útiles para identificar prescripciones inadecuadas durante la validación farmacéutica de la prescripción. Otros estudios proporcionarán más información sobre el impacto de la intervención del farmacéutico.

**Palabras clave:** Medicamentos potencialmente inapropiados, polifarmacia, reconciliación medicamentosa, ancianos, farmacéutico clínico, hospital.

## INTRODUCTION

Demographic aging and the subsequent increase on the prevalence of multimorbidity currently pose significant challenges for therapeutic management. An ever increasing number of individuals over 50 years old live with multiple chronic diseases and take several concomitant drugs<sup>1</sup>. Polypharmacy can be defined as the simultaneous taking of 5 or more medications<sup>2</sup>, and can be either appropriate, when medicines use is optimized considering the patient's multiple morbidities and according to the best evidence, or inappropriate<sup>1</sup>. Not adequate polypharmacy is associated with several adverse drug events, including mortality, falls, adverse reactions, increased length of stay in hospital and readmission to hospital soon after discharge<sup>3-6</sup>.

In a cross-sectional study from 2015 conducted in Family Health Unit Rainha D. Amélia, in Oporto, Portugal, a sample of 747 patients over 64 years old was analyzed. The results showed that polypharmacy was present in 59.2% of the population, and 37.0% of them were taking potentially inappropriate medications (PIMs)<sup>7</sup>.

European Union has identified as a key priority the reduction of avoidable harm in healthcare. It is estimated that up to 11% of all hospital admissions are due to adverse drug events<sup>1</sup>. In order to prevent these adverse events, it is crucial to consider the pharmacokinetic and pharmacodynamic changes that the elderly are subjected to, in the moment of prescribing. These changes often translate in an increased sensitivity to adverse effects of several drugs, or in a reduction of their responsiveness<sup>8</sup>. With aging, there is also a reduction in hepatic metabolism and renal function, a decrease in the distribution volume of hydrophilic drugs and an increase in the distribution volume of lipophilic drugs, which may be relevant in drugs such as vancomycin, amiodarone, diazepam, flurazepam and digoxin<sup>8</sup>. Moreover, the majority of clinical trials on drug safety are also conducted in young healthy subjects with a single medical condition receiving few or no other drugs<sup>8</sup>. Consequently, therapeutic management in the elderly assumes a particular relevance and requires special care.

For all these reasons, a relatively well-tolerated drug in a young individual may be considered potentially inappropriate in an older adult. A potentially inappropriate medication (PIM) is a drug whose risks of adverse reactions outweigh the clinical benefits in an elderly patient, particularly when there is a safer and more effective alternative for the same medical condition<sup>9,10</sup>. In the last few years, there have been developed several reconciliation tools that aid in the identification of PIMs.

The Beers Criteria<sup>9</sup> is the reconciliation tool most frequently applied and widely published in the literature. They were originally developed in America in 1991, and have been updated ever since. This tool includes a table with potentially inappropriate medications (regardless of dose, duration of treatment or clinical condition); a list of drugs that may exacerbate certain diseases or clinical syndromes; drugs that should be used with caution in the elderly; and a list of drug interactions and other drugs that should be avoided in the elderly or whose dose should be reduced accordingly to the patient's renal function.

The European Union PIM List<sup>11</sup> is a screening tool which was developed with the participation of experts from seven European countries, that allows identification and comparison of PIM prescribing patterns for older people across European countries. The EU PIM List took several international PIM lists into consideration (i.e. the German PRISCUS list<sup>12</sup>, the American Beers Criteria<sup>13,14</sup>, the Canadian List<sup>15</sup> and the French list<sup>16</sup>), as well as further drugs suggested by experts.

Several studies have shown the importance of applying these reconciliation tools in clinical practice, as well as their impact on the reduction of the number of adverse drug events, on the improvement of the patient's quality of life and on the promotion of responsible medicines use<sup>4,17</sup>. A recent study assessed the changes in the number of prescribed medications between admission to and discharge from a geriatric ward, having concluded that geriatric hospitalization results more often in deprescribing rather than in prescribing new medications<sup>18</sup>.

Inappropriate polypharmacy and therapeutic compliance in elderly patients is one of the most important public health challenges<sup>1</sup>. Polypharmacy management involves complex decision making, and requires the combined knowledge of a multidisciplinary team, including medical doctors, pharmacists and nurses.

The objective of this study is to quantitatively assess the prescription pattern of PIMs in different inward clinical services of University Hospital Center of Cova da Beira (CHUCB), in order to identify common PIMs, to minimize the risk of adverse effects and other drug-related problems and ultimately, to promote awareness campaigns directed to multidisciplinary teams and posteriorly assess the impact of this intervention.

## METHODS

This article consists in a retrospective study aiming at quantitatively assessing the prescription pattern of PIMs in selected clinical services of CHUCB, namely Medicine 1, Medicine 2, Cardiology and Pneumology.

A preliminary search was performed in the hospital's computerized system database to assess the ratio of older patients (65 years old or more) vs. the total of patients admitted in several inward clinical services of the hospital, in order to select the clinical services with a higher ratio of older patients that would motivate the pharmacists' intervention.

Afterwards, the hospital's computerized system database was searched for every patient admitted in the clinical services of Cardiology, Medicine 1, Medicine 2 and Pneumology, from January 1<sup>st</sup> to June 30<sup>th</sup> 2018. Patients less than 65 years old were excluded. Data regarding the patients' hospital ID number, their age, prescribed drugs during admission, prescribed dose, frequency, medications' start date and their respective end date were anonymously collected. Each patient was given an alphanumeric code number. The patients' medications prescribed during the admission period were assessed, and the PIMs were identified according to Beers Criteria 2015.

A descriptive statistical analysis was conducted. The average patient age and the respective standard deviation, total of patients admitted in the selected clinical services, average number of PIMs prescribed and relative percentages were calculated. The therapeutic drug classes of PIMs were identified. The analysis was conducted using the Microsoft Excel<sup>®</sup> tool.

This study was approved by the Ethics for Health Commission of University Hospital Center of Cova da Beira (study number 69/2018).

## RESULTS

From January 1<sup>st</sup> to June 30<sup>th</sup> 2018, the clinical services with higher ratio of elderly patients admitted were the Medicine 2 (86.7%), Medicine 1 (86.5%), Cardiology (83.6%) and Pneumology (68.8%) services (Table 1). Medicine 2 was the service with the highest number of patients admitted during the first semester of 2018, followed by Cardiology, Medicine 1 and Pneumology (Table 1).

Table 2 includes the statistical data relative to each clinical service included in this study. The average age of the older patients ( $\geq 65$  years old) admitted in these clinical services was approximately 81 years old. The percentage of older patients with, at least, one PIM prescribed during the inpatient period was highest in Medicine 1 (72.6%) and lowest in Cardiology (64.5%). The clinical service which had a higher percentage of prescribed PIMs was Cardiology, with 9.2% of the total of medicines prescribed being PIMs, followed by Medicine 2 (8.3%), Medicine 1 (7.7%) and Pneumology (6.7%).

Figure 1 represents the number of prescribed PIMs per patient in the clinical services mentioned above, during the inpatient period. Medicine 2 was the clinical service with the highest number of prescribed PIMs ( $n=9$ ) during the inpatient period. There were 174 patients with only one PIM in Medicine 2.

Table 3 represents the therapeutic drug classes of PIMs prescribed in the services of Medicine 2, Medicine 1, Cardiology and Pneumology. The benzodiazepines were the most prescribed potentially inappropriate therapeutic drug class (PITDC) in all services included in this study, accounting for 29.97% in Medicine 2, 39.96% in Cardiology, 30.21% in Medicine 1 and 41.10% in Pneumology of the total of prescribed PIMs. The first- and second-generation antipsychotics were the next most prescribed PITDCs in the services of Medicine 1 and Medicine 2. Intestinal motility modifiers, namely metoclopramide, also had a significant expression in Medicine 2 (12.87%), Medicine 1 (11.96%) and Pneumology (11.66%).

Meanwhile, in the Cardiology service, the antiarrhythmics, specifically amiodarone, were the second most prescribed PITDC, accounting for 18.83% ( $n=106$ ) of the total of prescribed PIMs. Amiodarone is considered a PIM in the Beers Criteria<sup>9</sup> when used as first line therapy for atrial fibrillation, unless the patient has heart failure or substantial left ventricular hypertrophy. Nevertheless, given the design of the study, since we did not know the patient's diagnosis, we cannot assess whether the drug is potentially inappropriate.

Regarding the prescription of non-selective NSAIDs, the Beers Criteria<sup>9</sup> recommend avoiding their use, unless other

alternatives are not effective and patient can take a gastro-protective agent. After the analysis of the prescriptions, we concluded that the majority of the patients with NSAIDs prescriptions were taking a PPI simultaneously. The *Others* category included prescriptions of megestrol, spironolactone  $>25$  mg per day and desmopressin, all considered potentially inappropriate by the Beers Criteria<sup>9</sup>.

Proton pump inhibitors (PPIs) are considered PIMs by the Beers Criteria if used for periods longer than 8 weeks, in non-high-risk patients<sup>9</sup>. The analysis of the inpatient prescriptions, during the first semester of 2018, retrieved only two results of a PPI (pantoprazole) prescribed for more than 8 weeks, one prescription in the service of Medicine 1 and the other in Pneumology (Table 3). However, given the nature of the data retrieved, we do not know if this was, or not, a high-risk patient, or whether the clinical condition of the patient justified the prolonged use of the PPI.

Table 4 represents the benzodiazepines prescribed by active substance, dosage and pharmaceutical form, and their respective relative percentages, in the services of Medicine 2, Medicine 1, Cardiology and Pneumology. In Medicine 1, Medicine 2 and Pneumology, lorazepam 1 mg and lorazepam 2.5 mg were the most frequently prescribed benzodiazepines, followed by alprazolam 0.5 mg. In the service of Cardiology, alprazolam 0.5 mg was the most frequently prescribed benzodiazepine, accounting for 33.3% of all benzodiazepines.

Table 5 represents the antipsychotics by active substance, dosage and pharmaceutical form prescribed in the services of Medicine 2, Medicine 1, Cardiology and Pneumology. The most frequently prescribed antipsychotic in all services was injectable haloperidol, accounting for 42.6% of the total of prescribed antipsychotics in the service of Medicine 1. Quetiapine 25 mg was the second most prescribed antipsychotic in all services studied, accounting for 25.6% of all antipsychotics prescribed in Cardiology, 23.4% in Medicine 1, 21.7% in Medicine 2 and 19.4% in Pneumology.

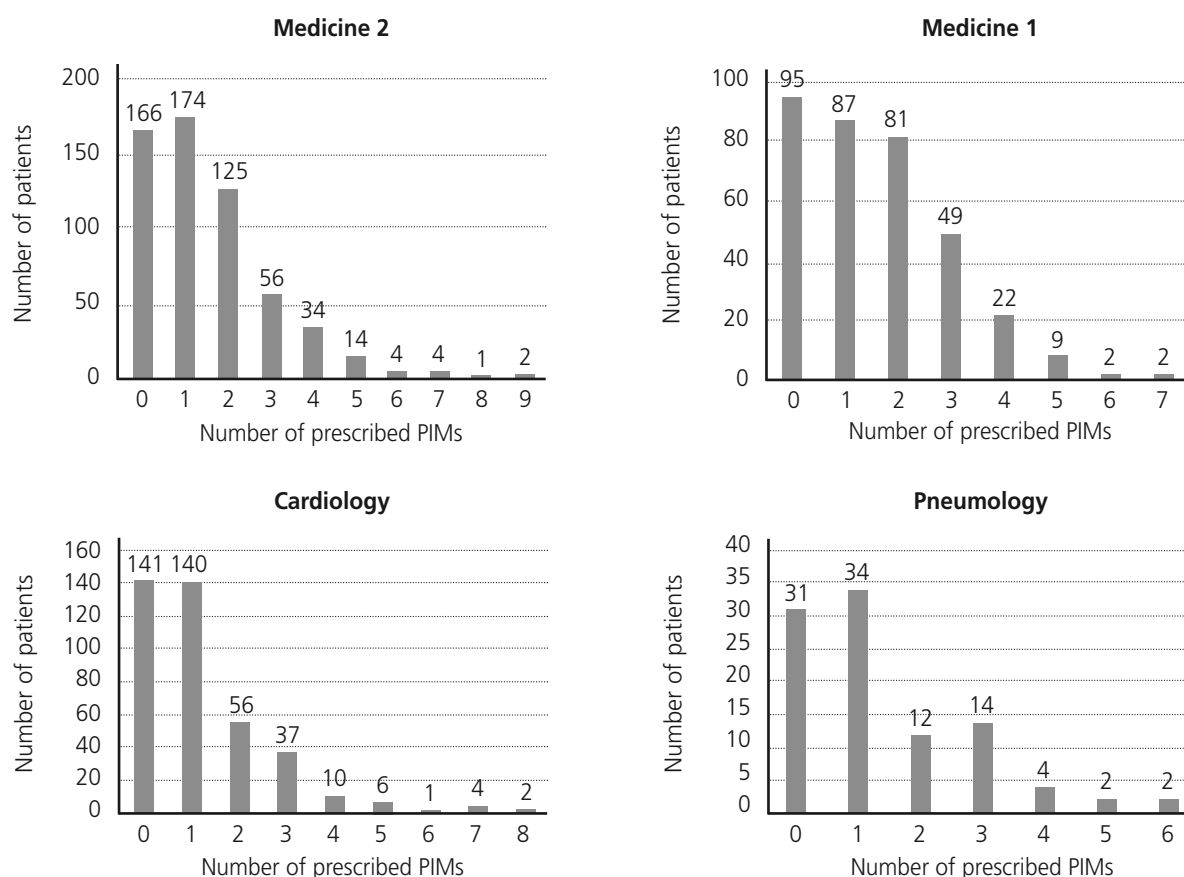
**Table 1. Number of older patients ( $\geq 65$  years old) admitted vs. the total of patients admitted in different services from January 1<sup>st</sup> to June 30<sup>th</sup> 2018**

Clinical service	Total of admitted patients	Number of older patients ( $\geq 65$ years old) admitted (%)
Medicine 2	669	580 (86.7%)
Medicine 1	401	347 (86.5%)
Cardiology	475	397 (83.6%)
Pneumology	144	99 (68.8%)

**Table 2. Statistical data regarding each clinical service, during the period from January 1<sup>st</sup> to June 30<sup>th</sup> 2018**

	Patients ( $\geq 65$ years old) admitted	Average age	Standard deviation (SD)	Patients with prescribed PIMs (%)	Total of prescribed medications	Total of PIMs prescribed (%)
Medicine 1	347	82.4	8.0	252 (72.6%)	8432	652 (7.7%)
Medicine 2	580	83.3	8.3	414 (71.4%)	12,574	1,041 (8.3%)
Cardiology	397	79.6	7.3	256 (64.5%)	6,142	563 (9.2%)
Pneumology	99	77.5	7.9	68 (68.7%)	2,442	163 (6.7%)

**Figure 1. Number of potentially inappropriate medications prescribed per patient, during the inpatient period, in the services of Medicine 2, Medicine 1, Cardiology and Pneumology. PIMs: Potentially Inappropriate Medications**



## DISCUSSION

This study aimed to quantitatively assess the prescription pattern of PIMs in different clinical services of the hospital, namely Medicine 1, Medicine 2, Cardiology and Pneumology. It is evident by the analysis of the obtained data that benzodiazepines were the most frequently prescribed PITDC in the four clinical services studied.

Benzodiazepines have been widely used in the treatment of sleep and anxiety disorders<sup>19</sup>. However, among older individuals, long-term use of benzodiazepines is associated with significant adverse effects, including impaired cognitive function, reduced mobility and driving skills, balance issues, increased risk of falls and fractures, drowsiness and memory disorders, and might also lead to psychological and physical dependence<sup>19,20</sup>. Furthermore, new evidence suggests that the efficacy of benzodiazepines for insomnia can diminish in as little as 4 weeks, while the adverse effects might persist<sup>21</sup>.

According to Beers Criteria all benzodiazepines are considered PIMs, regardless of dose and duration of action<sup>9</sup>. However, in the EU PIM List<sup>11</sup>, lorazepam and oxazepam are not considered potentially inappropriate if prescribed in doses inferior to 1 mg a day and 60 mg a day, respectively. Furthermore, the EU PIM List even suggests both drugs, as long as the previously mentioned doses are not exceeded, as safer alternatives when compared to other drugs from the same therapeutic class.

Cardiology was the clinical service with higher percentage of prescribed PIMs when compared with the total of prescribed medicines (9.2%). However, 18.83% of the PIMs

prescribed corresponded to amiodarone (Table 3), which is considered potentially inappropriate when used as first line therapy for atrial fibrillation, unless the patient has heart failure or substantial left ventricular hypertrophy<sup>9</sup>. Given the nature of the study, it was not possible to assess whether the drug is, in fact, potentially inappropriate, which may have led to an overestimation of the results.

Antipsychotics, both first and second generation, were another PITDC frequently prescribed in these services. Antipsychotics should be avoided for treatment of behavioral problems of dementia or delirium, due to being highly anticholinergic drugs, and being associated with a higher risk of cognitive impairment, stroke and mortality<sup>9,22</sup>.

These are examples of therapeutic drug classes that are often prescribed in older people and that in some cases may be causing harm or no longer providing benefit. In developed countries, it is estimated that 30% of patients aged 65 years or older are prescribed 5 or more drugs<sup>23</sup>, a clear indicator of polypharmacy, which is associated with several adverse drug events<sup>3-6</sup>. This evidence of the adverse effects of polypharmacy in older adults indirectly supports the need for deprescribing in this population<sup>24,25</sup>.

Deprescribing can be defined as the planned and supervised process of dose reduction or stopping of medication that might be causing harm or no longer providing benefit<sup>20</sup>. Scott et al.<sup>26</sup> proposed a deprescribing protocol composed by 5 simple steps: 1) ascertain all drugs the patient is taking at the moment and the reasons for each one; 2) consider overall

**Table 3. Therapeutic drug classes of potentially inappropriate medications prescribed in the services of Medicine 2, Medicine 1, Cardiology and Pneumology, and the respective relative percentages, from January 1<sup>st</sup> to June 30<sup>th</sup> 2018. Most frequently prescribed therapeutic drug classes are represented in bold**

	Medicine 2		Medicine 1		Cardiology		Pneumology	
Therapeutic drug class	No. pts	%	No. pts	%	No. pts	%	No. pts	%
<b>Antiarrhythmics</b>	79	7,59%	37	5,67%	<b>106</b>	<b>18,83%</b>	14	8,59%
Antibiotics	1	0,10%	0	0,00%	2	0,36%	0	0,00%
Anticoagulants	8	0,77%	6	0,92%	21	3,73%	1	0,61%
Antidepressants	20	1,92%	14	2,15%	11	1,95%	5	3,07%
Antihypertensives	1	0,10%	2	0,31%	1	0,18%	1	0,61%
Antiparkinsonian agents	15	1,44%	6	0,92%	0	0,00%	1	0,61%
Antispasmodics	11	1,06%	10	1,53%	6	1,07%	0	0,00%
Barbiturates	6	0,58%	3	0,46%	1	0,18%	0	0,00%
<b>Benzodiazepines</b>	<b>312</b>	<b>29,97%</b>	<b>197</b>	<b>30,21%</b>	<b>225</b>	<b>39,96%</b>	<b>67</b>	<b>41,10%</b>
Cardiotonics	14	1,34%	7	1,07%	17	3,02%	4	2,45%
First-generation antihistaminics	43	4,13%	21	3,22%	15	2,66%	3	1,84%
<b>First-generation antipsychotics</b>	<b>180</b>	<b>17,29%</b>	<b>113</b>	<b>17,33%</b>	41	7,28%	16	9,82%
<b>Intestinal motility modifiers</b>	<b>134</b>	<b>12,87%</b>	<b>78</b>	<b>11,96%</b>	30	5,33%	<b>19</b>	<b>11,66%</b>
Non-benzodiazepine hypnotics	5	0,48%	1	0,15%	9	1,60%	2	1,23%
Non-selective NSAIDs	15	1,44%	8	1,23%	14	2,49%	7	4,29%
Opioid analgesics	1	0,10%	0	0,00%	0	0,00%	0	0,00%
Others	30	2,88%	26	3,99%	19	3,37%	7	4,29%
Proton pump inhibitors	0	0,00%	1	0,15%	0	0,00%	1	0,61%
<b>Second-generation antipsychotics</b>	<b>166</b>	<b>15,95%</b>	<b>122</b>	<b>18,71%</b>	45	7,99%	15	9,20%
<b>Total</b>	<b>1041</b>	<b>100%</b>	<b>652</b>	<b>100%</b>	<b>563</b>	<b>100%</b>	<b>163</b>	<b>100%</b>

No. pts: number of patients ( $\geq 65$  years old); NSAIDs: non-steroid anti-inflammatory drugs.

risk of drug-induced harm in individual patients in determining the required intensity of deprescribing intervention; 3) assess each drug for its eligibility to be discontinued (for example, no valid indication, part of a prescribing cascade, etc.); 4) prioritize drugs for discontinuation; and finally, 5) implement and monitor drug discontinuation regimen<sup>26</sup>.

This study has some limitations that must be considered, and the results obtained must be cautiously interpreted. First, given the retrospective design of the study, it is not possible to assess the context in which a certain PIM was prescribed, since we did not have any knowledge of the patients' diagnosis, clinical conditions or comorbidities. Consequently, this may have led to an overestimation of the percentage of PIMs prescribed in each service. Second, the severity of the PIM was not analyzed or determined, and neither did the clinical outcomes of the patients. Finally, PIM identification was performed using only the Beers Criteria (2015), given that it was the reconciliation tool which was more appropriate considering the nature of the study, since it indicated PIMs regardless of dose, duration of treatment and clinical condition. However, there are several other si-

milar prescription tools in the literature that can and should be used to complement one another, for instance, the European Union PIM List<sup>11</sup> and the STOPP/START Criteria<sup>27</sup>.

## CONCLUSIONS

Inappropriate drug use and its associated harm is a growing issue among older patients. Therapeutic reconciliation has been recognized as a major intervention tackling the burden of medication discrepancies and subsequent patient harm at care transitions. Reconciliation tools such as the Beers Criteria are useful to identify inappropriate prescribing during the pharmaceutical validation of prescription. Further studies will provide more insight into the impact of the pharmacist's intervention.

*Funding: This study had the financial support of Investment Incentives to R&D of Portugal 2020 (POCI-01-0247-FEDER-017655).*

*Conflicts of interest: The authors declare that they have no conflict of interest.*

**Table 4. Benzodiazepines prescribed by active substance, dosage and pharmaceutical form, in the services of Medicine 2, Medicine 1, Cardiology and Pneumology, and the respective relative percentages, from January 1<sup>st</sup> to June 30<sup>th</sup> 2018. Most frequently prescribed benzodiazepines are represented in bold**

	Medicine 2		Medicine 1		Cardiology		Pneumology	
<b>Benzodiazepines</b>	<b>No. pts</b>	<b>%</b>	<b>No. pts</b>	<b>%</b>	<b>No. pts</b>	<b>%</b>	<b>No. pts</b>	<b>%</b>
Alprazolam 0.25 mg tablet	23	7,4%	13	6,6%	18	8,0%	6	9,0%
<b>Alprazolam 0.5 mg tablet</b>	<b>43</b>	<b>13,8%</b>	<b>24</b>	<b>12,2%</b>	<b>75</b>	<b>33,3%</b>	<b>10</b>	<b>14,9%</b>
Alprazolam 1 mg tablet	19	6,1%	13	6,6%	5	2,2%	3	4,5%
Bromazepam 1.5 mg tablet	8	2,6%	5	2,5%	5	2,2%	0	0,0%
Bromazepam 3 mg tablet	4	1,3%	8	4,1%	5	2,2%	0	0,0%
Clobazam 10 mg tablet	2	0,6%	0	0,0%	0	0,0%	0	0,0%
Clonazepam 2 mg tablet	9	2,9%	5	2,5%	5	2,2%	1	1,5%
Clozapem 2 mg tablet	0	0,0%	1	0,5%	1	0,4%	0	0,0%
Diazepam 10 mg SR capsule	0	0,0%	0	0,0%	2	0,9%	2	3,0%
Diazepam 10 mg tablet	3	1,0%	2	1,0%	4	1,8%	1	1,5%
Diazepam 10 mg/2 ml inj sol, IM, IV	30	9,6%	20	10,2%	4	1,8%	0	0,0%
Diazepam 5 mg tablet	9	2,9%	11	5,6%	17	7,6%	3	4,5%
Estazolam 2 mg tablet	1	0,3%	1	0,5%	0	0,0%	0	0,0%
Flurazepam 15 mg capsule	3	1,0%	1	0,5%	6	2,7%	0	0,0%
Ethyl loflazepate 2 mg tablet	0	0,0%	1	0,5%	0	0,0%	0	0,0%
<b>Lorazepam 1 mg tablet</b>	<b>62</b>	<b>19,9%</b>	<b>31</b>	<b>15,7%</b>	<b>29</b>	<b>12,9%</b>	<b>14</b>	<b>20,9%</b>
<b>Lorazepam 2.5 mg tablet</b>	<b>44</b>	<b>14,1%</b>	<b>27</b>	<b>13,7%</b>	<b>26</b>	<b>11,6%</b>	<b>10</b>	<b>14,9%</b>
Mexazolam 1 mg tablet	1	0,3%	2	1,0%	6	2,7%	0	0,0%
Midazolam 15 mg/3 ml inj sol, IM, IV, rectal	5	1,6%	6	3,0%	2	0,9%	4	6,0%
Midazolam 50 mg/10 ml inj sol, IM, IV, rectal	0	0,0%	1	0,5%	0	0,0%	4	6,0%
<b>Oxazepam 15 mg tablet</b>	<b>43</b>	<b>13,8%</b>	<b>22</b>	<b>11,2%</b>	14	6,2%	<b>8</b>	<b>11,9%</b>
Oxazepam 50 mg tablet	3	1,0%	3	1,5%	1	0,4%	1	1,5%
<b>Total</b>	<b>312</b>	<b>100%</b>	<b>197</b>	<b>100%</b>	<b>225</b>	<b>100%</b>	<b>67</b>	<b>100%</b>

Inj sol: injectable solution; No. pts: number of patients (≥65 years old); SR: sustained release.

## BIBLIOGRAPHY

- Mair A, Fernandez-Llmos F, Alonso A, Harrison C, Hurding S, Kempen T, Kinneer M, Michael N, McIntosh J, Wilson M. SIMPATHY -Polypharmacy Management by 2030: a patient safety challenge. SIMPATHY Consort [Internet]. 2017; Available from: [http://www.simpathy.eu/sites/default/files/Managing\\_polypharmacy2030-web.pdf](http://www.simpathy.eu/sites/default/files/Managing_polypharmacy2030-web.pdf).
- Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. BMC Geriatr. BMC Geriatrics. 2017;17:1-10.
- Caughey GE, Roughead EE, Vitry AI, McDermott RA, Shakib S, Gilbert AL. Comorbidity in the elderly with diabetes: Identification of areas of potential treatment conflicts. Diabetes Research and Clinical Practice. 2010;87:385-93. Available from: <http://dx.doi.org/10.1016/j.diabres.2009.10.019>.
- Heider D, Matschinger H, Meid AD, Quinzler R, Adler J-B, Günster C, et al. The impact of potentially inappropriate medication on the development of health care costs and its moderation by the number of prescribed substances. Results of a retrospective matched cohort study. PLoS One [Internet]. 2018;13:e0198004. Available from: <http://dx.plos.org/10.1371/journal.pone.0198004>.
- Caughey GE, Roughead EE, Pratt N, Shakib S, Vitry AI, Gilbert AL. Increased risk of hip fracture in the elderly associated with prochlorperazine: is a prescribing cascade contributing? Pharmacoeconomic Drug Saf. 2010;19:977-82.
- Milton JC, Hill-Smith I, Jackson SHD. Prescribing for older people. BMJ. 2008;336:606-9.
- Eiras A, Teixeira MA, González-Montalvo JI, Castell MV, Queipo R, Otero Á. Consumo de medicamentos en mayores de 65 años en Oporto (Portugal) y riesgo de prescripción de medicamentos potencialmente inapropiados. Aten Primaria. 2016;48:110-20. Available from: <http://dx.doi.org/10.1016/j.aprim.2015.03.005>.

- Midlov P. Pharmacokinetics and pharmacodynamics in the elderly. Open Access Elderly Medicine. 2013 Aug 01;1(1):1.
- By the American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. J Am Geriatr Soc. 2015;63:2227-46.
- Corsonello A, Pranno L, Garasto S, Fabietti P, Bustacchini S, Lattanzio F. Potentially Inappropriate Medication in Elderly Hospitalized Patients. Drugs Aging. 2009;26 Suppl:31-9.
- Renom-Guiteras A, Meyer G, Thürmann PA. The EU(7)-PIM list: A list of potentially inappropriate medications for older people consented by experts from seven European countries. Eur J Clin Pharmacol. 2015;71:861-75.
- Holt S, Schmiedl S, Thürmann PA. Potentially Inappropriate Medications in the Elderly: The PRISCUS List. Dtsch Arzteblatt Int [Internet]. 2010;107:543-51. Available from: <https://www.aerzteblatt.de/10.3238/arztebl.2010.0543>.
- Fick D, Semla T, Beizer J, Brandt N, Dombrowski R, DuBeau CE, et al. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc. 2012;60:616-31.
- Campanelli CM, Fick DM, Semla T, Beizer J. Potentially Inappropriate Medication Use in Older Adults: The American Geriatrics Society 2012 Beers Criteria. J Am Geriatr Soc. 2012;60:616-31.
- McLeod PJ, Huang AR, Tamblyn RM, Gayton DC. Defining inappropriate practices in prescribing for elderly people: A national consensus panel. CMAJ. 1997;156:385-91.
- Laroche ML, Charnes JP, Merle L. Potentially inappropriate medications in the elderly: A French consensus panel list. Eur J Clin Pharmacol. 2007;63:725-31.
- Sakr S, Hallit S, Haddad M, Khabbaz LR. Assessment of potentially inappropriate

**Table 5. Antipsychotics by active substance, dosage and pharmaceutical form, and the respective relative percentages, prescribed in the services of Medicine 2, Medicine 1, Cardiology and Pneumology, from January 1<sup>st</sup> to June 30<sup>th</sup> 2018. Most frequently prescribed antipsychotics are represented in bold**

	Medicine 2		Medicine 1		Cardiology		Pneumology	
Antipsychotics	No. pts	%	No. pts	%	No. pts	%	No. pts	%
Amisulpride 50 mg tablet	1	0,3%	2	0,9%	0	0,0%	0	0,0%
Cyamemazine 100 mg tablet	1	0,3%	0	0,0%	0	0,0%	0	0,0%
Chlorpromazine 25 mg tablet	3	0,9%	0	0,0%	0	0,0%	0	0,0%
Chlorpromazine 25 mg/5 ml inj sol, IM	3	0,9%	1	0,4%	1	1,2%	0	0,0%
Chlorpromazine 50 mg/2 ml inj sol, IV	1	0,3%	0	0,0%	2	2,3%	0	0,0%
Clozapine 100 mg tablet	0	0,0%	1	0,4%	0	0,0%	0	0,0%
Clozapine 25 mg tablet	5	1,4%	0	0,0%	1	1,2%	0	0,0%
Haloperidol 1 mg tablet	4	1,2%	1	0,4%	1	1,2%	1	3,2%
Haloperidol 2 mg/ml oral solution	3	0,9%	1	0,4%	0	0,0%	1	3,2%
Haloperidol 5 mg tablet	4	1,2%	1	0,4%	1	1,2%	0	0,0%
<b>Haloperidol 5 mg/1 ml inj sol, IM, IV</b>	<b>128</b>	<b>37,0%</b>	<b>100</b>	<b>42,6%</b>	<b>30</b>	<b>34,9%</b>	<b>10</b>	<b>32,3%</b>
Haloperidol, decanoato 100 mg/1 ml inj sol, IM	0	0,0%	1	0,4%	0	0,0%	0	0,0%
Levomepromazine 25 mg tablet	2	0,6%	0	0,0%	0	0,0%	0	0,0%
Levomepromazine 25 mg/1 ml inj sol, IM	0	0,0%	0	0,0%	1	1,2%	0	0,0%
Melperone 25 mg tablet	14	4,0%	16	6,8%	7	8,1%	1	3,2%
Melperone 50 mg tablet	0	0,0%	2	0,9%	0	0,0%	2	6,5%
Olanzapine 10 mg orodispersible tablet	1	0,3%	1	0,4%	0	0,0%	3	9,7%
Olanzapine 5 mg orodispersible tablet	11	3,2%	7	3,0%	3	3,5%	0	0,0%
Quetiapine 100 mg tablet	29	8,4%	18	7,7%	4	4,7%	0	0,0%
Quetiapine 200 mg tablet	2	0,6%	2	0,9%	0	0,0%	0	0,0%
<b>Quetiapine 25 mg tablet</b>	<b>75</b>	<b>21,7%</b>	<b>55</b>	<b>23,4%</b>	<b>22</b>	<b>25,6%</b>	<b>6</b>	<b>19,4%</b>
Quetiapine 300 mg tablet	0	0,0%	2	0,9%	0	0,0%	0	0,0%
Risperidone 1 mg tablet	19	5,5%	15	6,4%	8	9,3%	3	9,7%
Risperidone 1 mg/ml oral solution	3	0,9%	2	0,9%	0	0,0%	0	0,0%
Risperidone 2 mg tablet	7	2,0%	1	0,4%	0	0,0%	0	0,0%
Tiapride 100 mg tablet	23	6,6%	5	2,1%	5	5,8%	<b>4</b>	<b>12,9%</b>
Tiapride 100 mg/2 ml inj sol, IM, IV	7	2,0%	1	0,4%	0	0,0%	0	0,0%
<b>Total</b>	<b>346</b>	<b>100%</b>	<b>235</b>	<b>100%</b>	<b>86</b>	<b>100%</b>	<b>31</b>	<b>100%</b>

Inj sol: injectable solution; No. pts: number of patients (≥65 years old).

medications in elderly according to Beers 2015 and STOPP criteria and their association with treatment satisfaction. Arch Gerontol Geriatr [Internet]. Elsevier Ireland Ltd; 2018;78:132-8. Available from: <https://doi.org/10.1016/j.archger.2018.06.009>.  
 18. Bie B, Bien-barkowska K. Prescribing or deprescribing in older persons: What are the real-life concerns in geriatric practice? Polish Archives of Internal Medicine. 2018;128:200-8.  
 19. Olsson M, King M, Schoenbaum M. Benzodiazepine Use in the United States. JAMA Psychiatry. 2015;72:136-42.  
 20. Pottie K, Thompson W, Davies S, Grenier J, Sadowski CA, Welch V, et al. Deprescribing Benzodiazepine Receptor Agonists: Evidence-Based Clinical Practice Guideline. Can Fam Physician [Internet]. 2018;64:339 LP-351. Available from: <http://www.cfp.ca/content/64/5/339.abstract>.  
 21. Vinkers CH, Olivier B. Mechanisms Underlying Tolerance After Long-Term Benzodiazepine Use: A Future for Subtype-Selective GABAA Receptor Modulators? Adv Pharmacol Sci. 2012;2012.  
 22. Brodaty H, Aerts L, Harrison F, Jessop T, Cations M, Chenoweth L, et al. Antipsychotic Deprescription for Older Adults in Long-term Care: The HALT Study.

J Am Med Dir Assoc [Internet]. Elsevier Inc.; 2018;19:592-600.e7. Available from: <https://doi.org/10.1016/j.jamda.2018.05.002>.  
 23. Qato DM, Alexander GC, Conti RM, Johnson M, Schumm P, Lindau ST. Use of Prescription and Over-the-counter Medications and Dietary Supplements Among Older Adults in the United States. JAMA. 2008;300:2867-78.  
 24. Budnitz DS, Lovegrove MC, Shehab N, Richards CL. Emergency Hospitalization for Adverse Drug Events in Older Americans. N Engl J Med. 2011;365:2002-12.  
 25. Bennett A, Gnjjidic D, Gillett M, Carroll P, Matthews S, Johnell K, et al. Prevalence and Impact of Fall-Risk-Increasing Drugs, Polypharmacy, and Drug-Drug Interactions in Robust Versus Frail Hospitalised Falls Patients: A Prospective Cohort Study. Drugs and Aging. 2014;31:225-32.  
 26. Scott IA, Hilmer SN, Reeve E, Potter K, Couteur D Le, Rigby D, et al. Reducing inappropriate polypharmacy: The process of deprescribing. JAMA Intern Med. 2015;175:827-34.  
 27. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: Version 2. Age Ageing. 2015;44:213-8.