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ORIGINAL ARTICLE

Prevalence and Variables Associated With the Use of Potentially Inappropriate Medications Among Institutionalized Older Adults

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Highlights

1. Three out of four institutionalized older adults used Potentially Inappropriate Medications (PIMs)
2. Psycholeptics were the most prescribed PIMs among institutionalized older adults.
3. Cognitive decline and chronic diseases were the factors associated with PIMs.

ABSTRACT

The objective of this study was to determine the prevalence and factors associated with the use of Potentially Inappropriate Medications (PIMs) in institutionalized older adults. This is a cross-sectional study conducted with 86 older individuals residing in Long-Term Care Facilities (LTCFs) in Brasília/DF and the city of Salvador/BA. Health and medication data were evaluated through descriptive and inferential analyses (p-*value* ≤ 0.05). From the sample, 76.7% of the individuals used at least one PIM and 91.8% had one or more diseases, with hypertension being the most common. Psycholeptics were the most frequently prescribed PIMs, with a usage frequency of 28.0%, and psychoanaleptics (34.8%) and psycholeptics (28.1%) were the most frequently prescribed medications that should be used with caution. Regarding associated factors, there was a statistically significant association between cognitive decline and the use of medications that should be used with caution (OR=2.98; p=0.024) and between the number of chronic diseases and the use of potentially inappropriate medications in older adults (OR=2.95; p=0.024). It was concluded that the high prevalence of PIM use by institutionalized older adults indicates the need for a remodeling of medication treatments, as well as an improvement in medical care in Brazilian LTCFs. The high use of psychotropic medications highlights the treatment of dementia and mental disorders as one of the main challenges in care in these services.

Keywords: list of potentially inappropriate medications; older adults; long-term care facilities for older individuals. health.

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INTRODUCTION

Given the increase in the older population and higher prevalence of Chronic Non-Communicable Diseases (NCDs), therapy with potentially inappropriate medications (PIMs) presents a public health challenge[1]. PIMs are characterized by their greater adverse effects. Thus, before prescribing such medications, a comprehensive evaluation of the older individual's health status is necessary to establish the cost and benefit of their use, considering more appropriate therapeutic alternatives, whether pharmacological or not[1].

Therefore, it is necessary to adjust prescriptions according to the particularities of older individuals, whether pharmacokinetic, pharmacodynamic, or clinical — observing how each body reacts to a given comorbidity — to avoid or minimize adverse events, intoxications, and mortality. This adjustment also reduces public health costs, given the high number of hospitalizations due to medication intoxication[2-3].

Regarding the prevalence of PIM use, a study conducted in the United States observed that 40% of residents in Long-Term Care Facilities (LTCFs) used at least one PIM. This finding highlighted this problem and the need to evaluate medication-induced iatrogenesis, serving as a stimulus for the implementation of a list known as the AGS/Beers Criteria[4] in 1991.

Initially, the list presented implicit and explicit criteria, describing 48 inappropriate medications and 20 unsuitable ones. It has undergone various modifications over the years, with the latest update in 2023. These changes contribute to a critically important evidence base and the discussion of medications to be avoided[4].

These criteria should be seen within the broader context of tools and strategies to improve pharmacological care for older adults and used in conjunction with management alternatives to enhance the safety and efficacy of medications[3-5].

In addition to the AGS/Beers Criteria, Brazil has another important reference, the Brazilian consensus on potentially inappropriate medications, developed in 2016 based on the AGS/Beers Criteria (2012 version) and STOPP (2006). This consensus adapts a list of medications that is consistent with the Brazilian reality, which is important since many medications available in other countries are not approved in Brazil and vice versa. These criteria were used for their wide application and complementarity[5].

For this purpose, the data from these criteria were reviewed, and the availability of medications in the Brazilian market was verified to propose a list with 43 criteria for medications that should be avoided regardless of clinical condition and 75 dependent criteria.

In the context of population aging, institutionalized older adults constitute a risk group for PIMs, characterized by being frailer and having more chronic diseases and clinical and care complexities than older individuals living in the community. Furthermore, the population does not always have easy access to the Unified Health System and secondary care services for clinical and pharmacological management, which can aggravate possible adverse health outcomes.

In this regard, the present study aimed to investigate the prevalence of potentially inappropriate medication use in institutionalized older individuals and describe the factors associated with this condition. The importance of this study lies in the need to study conditions of medication-induced iatrogenesis in institutionalized populations with a comprehensive research protocol on the living and health conditions of this population. Moreover, the study investigated institutionalized older adults residing in Salvador/BA and Brasília/DF, located in the Northeast and Midwest regions of Brazil, respectively. In line with the need to outline policies for continued care in Brazil, the findings of this study will contribute to the discussion on directing medication prescriptions for older adults residing in LTCFs, consequently improving the well-being and health of the residents.

MATERIAL AND METHODS

This is a cross-sectional, exploratory, descriptive, and quantitative study conducted with older adults residing in Long-Term Care Facilities (LTCFs) in the cities of Brasília (DF) and Salvador (BA), Brazil. The research is part of the projects titled "*Gestão da atenção ao idoso institucionalizado: Estudo multicêntrico*" ("Management of Care for Institutionalized Older Adults: A Multicentric Study") and "*Fragilidade em idosos brasileiros institucionalizados: Estudo multicêntrico*" ("Frailty in Institutionalized Brazilian Older Adults: A Multicentric Study"), linked respectively to the *Stricto Sensu* Graduate Program in Gerontology at Universidade Católica de Brasília and the Graduate Program in Food, Nutrition, and Health at Universidade Federal da Bahia.

The total sample consisted of 185 institutionalized older adults, with 90 from Brasília/DF and 95 from Salvador/BA. The final sample included 86 participants. In Brasília/DF, of the 70 potentially eligible older adults out of 90 residents, only 22 were investigated due to the interruption caused by the Covid-19 pandemic. Specifically, the evaluations began in January and were halted in March. In Salvador/BA, of the 75 potentially eligible participants out of 95 residents, 64 were investigated.

Older adults of both sexes, residing in LTCFs, one located in Brasília (DF) and two in Salvador (BA), Brazil, were investigated. The three participating LTCFs were selected based on the following inclusion criteria:

a) being public or philanthropic;

b) having been in the same physical location for at least two years;

c) having a Technical Manager responsible for activities;

d) agreeing to participate in the study.

In both cities, four institutions met all the established criteria. Two institutions in Brasília (DF) and three in Salvador (BA) agreed to participate, but due to the COVID-19 pandemic, only one in Brasília (DF) and two in Salvador (BA) were investigated.

Regarding the inclusion criteria for participants, they had to be institutionalized for at least six months and agree to participate in the study. The exclusion criteria included sensory or comprehension issues; aphasia, agnosia, or articulation and language problems that could hinder communication; and bedridden individuals or those with untreated psychiatric morbidities.

Initially, visits to the selected LTCFs were scheduled to establish bonds, explain the project's objectives, and agree on the data collection process. After the visits, deadlines were set with the institution managers for conducting individual interviews with the institutionalized older adults. The interviews were conducted between January and early March 2020, in the pre-COVID-19 pandemic scenario, with the participation of a team of 15 undergraduate and graduate students at each research site. All researchers were trained in the application of the instruments to ensure the reliability of the data collection procedures at both research sites.

To conduct the assessments, all participants were informed about the study objectives and then instructed to sign the Informed Consent Form (ICF), respecting the ethical principles of research as per Ordinance 466/2012 of the Ministry of Health. The study was approved by the Research Ethics Committee of the Universidade Federal da Bahia – CAAE: 18561419.5.1001.5023, opinion number: 3.793.529; and the Universidade Católica de Brasília – CAAE: 18151019.1.1001.0029, evaluation number: 3.621.190.

After consenting to participate in the study, individual interviews were scheduled and carried out in a calm and quiet environment within the institution, at previously agreed-upon times compatible with the routine of both the institution and the participants.

Participants were evaluated using the following: 1) a sociodemographic questionnaire with information on age, biological sex, and education level; 2) the Mini-Mental State Examination (MMSE) to assess global cognitive status according to the cutoff points suggested by Bertolucci et al.; 3) the 4-item short version of the Geriatric Depression Scale (GDS), validated by Castelo *et al.*; and 4) a health questionnaire with information on the number of self-reported chronic diseases (heart diseases, hypertension, stroke, cancer, rheumatoid arthritis, lung diseases, depression, and osteoporosis); performance in Basic Activities of Daily Living (having or not having difficulties in any of the activities related to self-care: toileting, eating, mobility, bathing, personal hygiene); number and description of medications taken (collected from medical records).

All medications used were systematized in a technical sheet and classified according to Level 2 of the Anatomical Therapeutic Chemical (ATC) classification, corresponding to the main therapeutic group, and according to the Brazilian Consensus of Potentially Inappropriate Medications for Older Adults (CBMPII). According to the AGS/Beers Criteria, the medications were grouped into four categories: 1) potentially clinically significant drug interactions in older adults; 2) medications that should be used with caution in older adults; 3) Potentially inappropriate medications for older adults; and 4) Potentially inappropriate medications for older adults due to disease-medication or syndrome--medication interactions.

Initially, the data were analyzed using descriptive analysis and non-parametric statistical tests to compare groups of older adults who met or did not meet the criteria of the four AGS Beers Criteria categories based on independent variables (sociodemographic, mood, global cognitive performance, chronic diseases, and health conditions). Inferential analysis was performed using the chi-square test, calculating Odds Ratios for each bivariate analysis. For this, the Jamovi program version 2.3.24 was used. The significance level adopted was $p \leq 0.05$.

RESULTS

As shown in Table 1, most of the sample was composed of women (60%), aged between 70 and 79 years (30.2%), with 5 to 8 years of formal education (33.7%), without a partner, and self-reported as Black or Mixed-race. It was observed that 91.8% (79) had one or more pathologies, with a median frequency of 2.0 and an interquartile range of 2.0. Systemic arterial hypertension was the most prevalent comorbidity, followed by cognitive decline, diabetes, depression, cardiovascular disease, stroke, among others (Table 1).

Table 1 also shows that 43% (34) of the older adults had one or more limitations in basic activities of daily living, and 48.7% (37) of the total 76 older adults were exposed to polypharmacy, i.e., they were using five or more medications. Of these, 3 older adults were using more than 10 medications, characterized as excessive polypharmacy.

Table 1 – Sociodemographic characterization and health conditions of institutionalized older adults investigated in Brasília/DF and Salvador/BA – Brazil, 2020

Variable	n	%
Biological Sex		
Female	52	60.5
Male	34	39.5
Age Range		
60 to 69 years	18	20.9
70 to 79 years	26	30.2

Variable	n	%
80 to 89 years	25	29.1
90 years and older	17	19.8
Education		
Illiterate	15	18.1
1 to 4 years	18	21.7
5 to 8 years	28	33.7
9 years or more	22	26.5
Marital status		
Married	8	9.4
Single	41	48.2
Divorced	19	22.4
Widowed	17	20
Self-reported ethnicity		
White	19	22.1
Black	23	26.7
Mixed-race	25	29.1
Yellow	4	4.7
Others	11	12.8
Does not know/did not answer	4	4.6
Health conditions		
Systemic Arterial Hypertension	57	66.3
Cognitive Decline	46	54.1
Diabetes	29	33.7
Depression	24	28.2
Osteoporosis	7	28.2
Cardiovascular Disease	24	28.2
Stroke	15	17.4
Arthritis or Rheumatism	14	16.3
Dementia	12	14.3
Lung Disease	11	13.0
Cancer	4	4.7
Parkinson's	2	2.4
Limitations in Basic Activities of Daily Living	34	43
Polypharmacy	37	48.7

Regarding the medications, as shown in Table 2, the most used category was potentially inappropriate medications for older adults, regardless of diagnosis. This was followed by medications that should be used with caution in older adults, potentially clinically significant drug interactions in older adults, and the use of potentially inappropriate medications in older adults due to disease-medication or syndrome-medication interactions.

In the analysis of medications according to their ATC Level 2 classification, corresponding to the main therapeutic group, it was observed that psycholeptics were the most used PIMs in the categories "potentially inappropriate medications for older adults, regardless of diagnosis", "potentially clinically significant drug interactions in older adults", and "use of potentially inappropriate medications in older adults due to disease-medication or syndrome-medication interactions". Psychoanaleptics were the most prevalent in the category of medications that should be used with caution in older adults. Of the 235 recorded uses of medications, 58.0% (138) corresponded to psychotropic medications.

Table 2 – Distribution of PIMs for older adults according to ATC Level 2 classification, 2020

ATC Classification	N	%
Potentially inappropriate medications for older adults, regardless of diagnosis (n = 105)		
Psychoanaleptics	10	9.5
Anti-inflammatory Drugs	22	21.0
Cardiac Therapy	1	1.0
Psycholeptics	41	39.0
Drugs for Stomach Acidity Disorders	15	14.3
Diabetes-related Medications	9	8.6
Antipruritics - Including Antihistamines	3	2.8
Antihypertensives	4	3.8
Medications that should be used with caution in older adults (n = 89)		
Psychoanaleptics	31	34.8
Non-steroidal Anti-inflammatory and Anti-rheumatic Drugs	22	24.7
Psycholeptics	25	28.1
Antiepileptics	4	4.5
Diuretics	7	7.9
Potentially clinically significant drug interactions in older adults (n = 31)		
Psychoanaleptics	8	25.8
Cardiac Therapy	2	6.5
Psycholeptics	15	48.4
Antiepileptics	6	19.4
Use of potentially inappropriate medications in older adults due to disease-medication or syndrome-medication interactions (n = 10)		
Psycholeptics	8	80.0
Cardiac Therapy	1	10.0
Non-steroidal Anti-inflammatory and Anti-rheumatic Drugs	1	10.0
Total Use of PIMs (n=235)		

Table 3 shows a statistically significant association between cognitive decline and the increased use of medications that should be used with caution in older adults (OR=2.98; *p*=0.024). There was also a statistically significant association between the use of potentially inappropriate medications in older adults and the number of chronic diseases (OR=2.95; *p*=0.024). No statistically significant association was found between the other categories and the sociodemographic and health conditions of the older adults investigated.

Given the low percentage of cases in the items “Potentially clinically significant drug interactions in older adults” (n = 31) and “Use of potentially inappropriate medications in older adults due to disease-medication or syndrome-medication interactions” (n = 10), inferential analyses were not employed due to reduced statistical power.

Table 3 – Distribution of medications that should be used with caution and PIMs according to sociodemographic and health conditions of institutionalized older individuals, 2020

	Medications that should be used with caution in older adults			**Potentially inappropriate medications for older adults, regardless of diagnosis**		
	No – N (%)	Yes – N (%)	Odds Ratio (95% CI) and *p*-value	No – N (%)	Yes – N (%)	Odds Ratio (95% CI) and *p*-value
Age Range			OR=0.6 (0.23 – 1.52) – p=0.280			OR=0.62 (0.25 – 1.50) – p=0.290
60 to 79 years	11 (42.3)	33 (55.0)		14 (43.8)	30 (55.6)	
80 years and older	15 (57.7)	27 (45.0)		18 (56.3)	24 (44.4)	
Biological Sex			OR=0.75 (0.31 – 1.84) – p=0.538			OR=1.07 (0.41 – 2.74) – p=0.893
Female	18 (56.3)	34 (63)		16 (61.5)	36 (60)	
Male	14 (43.6)	20 (37)		10 (38.5)	24 (40)	
Education			OR=1.62 (0.65 – 3.98) – p=0.294			OR=1.47 (0.57 – 3.76) – p=0.421
Illiterate to 4 years	15 (46.9)	18 (35.3)		12 (46.2)	21 (36.8)	
5 years or more	17 (53.1)	33 (64.7)		14 (53.8)	36 (63.2)	
Cognitive Decline			**OR=2.98 (1.20 – 7.41) – p=0.024**			OR=1.99 (0.78 – 5.07) – p=0.147
No	20 (62.5)	19 (35.8)		15 (57.7)	24 (40.7)	
Yes	12 (37.5)	34 (64.2)		11 (42.3)	35 (59.3)	
Polypharmacy			OR=1.25 (0.49 – 3.19) – p=0.634			OR=2.19 (0.78 – 6.07) – p=0.129
0 to 4 Medications	15 (53.6)	23 (47.9)		14 (63.6)	24 (44.4)	
5 Medications or More	13 (46.4)	25 (52.1)		8 (36.4)	30 (55.6)	
Cardiovascular Disease			OR=0.60 (0.23 – 1.58) – p=0.303			OR=0.818 (0.29 – 2.25) – p=0.697
No	21 (65.6)	41 (75.9)		18 (69.2)	44 (73.3)	
Yes	11 (34.4)	13 (24.1)		8 (30.8)	16 (26.7)	
Hypertension			OR=1.31 (0.52 – 3.217) – p=0.568			OR=1.06 (0.40 – 2.79) – p=0.908
No	12 (37.5)	17 (31.5)		9 (34.6)	20 (33.3)	
Yes	20 (62.5)	37 (68.5)		17 (65.4)	40 (66.7)	
Number of chronic diseases			OR=1.69 (0.68 – 4.18) – p=0.252			**OR: 2.95 (1.14 – 7.66) – p=0.024**
0 or 1 chronic disease	14 (43.8)	17 (31.5)		14 (53.8)	17 (28.3)	
2 diseases or more	18 (56.3)	37 (68.5)		12 (46.2)	43 (71.7)	
Basic Activities of Daily Living			OR=1.34 (0.53 – 3.36) – p=0.532			OR=1.97 (0.72 – 0.53) – p=0.178
Without Limitations	19 (61.3)	26 (54.2)		17 (68)	28 (51.9)	
1 or more limitations	12 (38.7)	22 (45.8)		8 (32)	26 (48.1)	

DISCUSSION

The findings of this study indicate that 76.7% of older adults used at least one PIM. The most prescribed PIMs were psycholeptics, and the most prescribed medications that should be used with caution were psychoanaleptics (34.8%) and psycholeptics (28.1%). Additionally, a high prevalence of diseases was found in this population, with 91.8% having one or more chronic diseases. Regarding the association between PIM use and health conditions, statistically significant associations were observed between the variable cognitive decline and the category of medications that should be used with caution in older adults, and between the variable number of chronic diseases and potentially inappropriate medications, regardless of diagnosis. There was no association between PIM use and the variables biological sex, age, and education level.

It is observed that the high prevalence of PIMs indicates a concerning scenario, as the use of these medications is associated with adverse health events and problems, such as decreased motor coordination, cognitive disturbances, dizziness, tinnitus, falls, increased number of hospitalizations, and higher mortality[7]. However, it should be considered that the inclusion of medications in the AGS/Beers Criteria does not exclude the possibility of their use in the therapy of older adults. The adherence to the use of PIMs should be supported by an assessment of risks and benefits according to the context and condition of the assisted older adult, in addition to considering the implementation of safer treatments[5].

In a study conducted with older adults residing in Long-Term Care Facilities (LTCFs) in Natal, Rio Grande do Norte, Brazil, it was found that 54.6% of the older adults used at least one PIM[15]. Another national study found a prevalence of 28.57% of PIM use[17]. In a systematic review study, the average prevalence of PIM use was 65%[3]. Therefore, it is perceived that studies on the prevalence of PIM use present a wide variety of results.

In a study on the evaluation of the heterogeneity of studies that estimate the use of PIM therapy for older adults, a great diversity in design, sample selection, and versions of the AGS/Beers Criteria was identified. Also, many reviews do not consider medications that should be used with caution, as well as drug interactions and diagnoses in older adults. Consequently, it is difficult to compare results on the prevalence of PIM use[9].

In addition to PIMs, it was observed that 48.7% of the older adults investigated in the present study were exposed to polypharmacy, corroborating other Brazilian studies[12, 17–18]. This prevalence may be related to the increased severity of pathologies, the presence of multiple chronic diseases, and the increased use of health services. Added to these factors are cultural issues that lead to the medicalization of care[9].

In assessing the most used classes of PIMs, it was noted that psycholeptics, which are medications that have a moderating or calming effect on psychic functions, had a prevalence of use in three of the four analyzed categories. These medications mainly include barbiturates, benzodiazepines, some non-benzodiazepines, some antidepressants, antipsychotics, and some anticonvulsants.

According to the AGS/Beers Criteria, some psycholeptics are considered PIMs due to their increased sensitivity in older adults, decreased metabolism of long-acting agents, rate of physical dependence, tolerance to sleep benefits, and increased risk of overdose at low doses. There is also an increased risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults[13].

Psychoanaleptics were the most frequent in the category of medications that should be used with caution. These medications are those that, in contrast to psycholeptics, increase psychic tone. This group includes medications such as antidepressants, psychostimulants, nootropics, and

anti-dementia agents. The justification for the Beers criteria categorizing some of these medications as PIMs is their anticholinergic effect and the increased risk of delirium, falls, orthostatic hypotension, and fractures[13].

This study found a high prevalence of psychotropic use (58.7%), which includes all medications that affect the central nervous system. This finding is similar to another study[14]. The significant number of prescriptions for this type of medication in older adults reflects this population's susceptibility to psychiatric and neurological conditions, such as depression, insomnia, stress, dementia syndromes, neuropsychiatric alterations, and cognitive decline. Studies show that factors involved in this reality are not only biological conditions but also social ones, such as exclusion and isolation, family dysfunction, poorer financial conditions, loss of spouses, and exposure to violence[15,16,18].

Regarding the association between cognitive decline and medications that should be used with caution, it is possible that it was supported by the high frequency of psychotropic prescriptions in institutionalized older adults with cognitive decline or signs suggestive of dementia syndromes[19]. It is worth noting that treating dementia and cognitive impairments are the main challenges of institutional care. In this scenario, the use of non-pharmacological interventions, combined with proper clinical management, is increasingly necessary.

Non-pharmacological interventions include engaging in cognitive stimulation activities, offering activities that are meaningful to residents, staff training to alleviate and manage the residents' neuropsychiatric symptoms, and the establishment of a care routine focused on independence, autonomy, and social interaction[2-3]. Regarding clinical management, the inclusion of geriatrics and a specialized outpatient service becomes essential, given the high rates of morbidity and inappropriate drug therapies observed in the investigated population[2].

The association between the number of chronic diseases and "Potentially Inappropriate Medications, regardless of diagnosis" confirms that the institutionalized population is a group with high health and care complexity. Therefore, greater involvement of the Unified Health System and trained professionals can contribute to changing the current situation[2-3].

Currently, in Brazil, there is a discussion about designing a policy of continued care that facilitates the integration of services and the care of institutionalized older adults in health care services. At present, there are no comprehensive and programmatic health actions in institutions. Thus, the presented data support the urgency of implementing integrated gerontological and geriatric outpatient care systems in LTCFs, which will allow qualified health care for institutionalized older adults[2-3].

Although the findings of the present study confirm the literature data, it is not possible to establish cause-and-effect relationships, only associations. Therefore, the data are exploratory and based on a small, non-probabilistic sample, making generalizations impossible. In addition to the usual challenges faced in conducting studies in institutions, the Covid-19 pandemic significantly impacted the evaluations of institutionalized older adults, a group with high mortality rates associated with Sars-CoV-2.

On the other hand, the present study has high internal validity, as the evaluations were based on well-established instruments in geriatrics and gerontology and the analysis of medical records (number of medications). Its contributions and innovations in the field include the analysis of two categories from the 2019 version of the AGS/Beers Criteria, with differentiation of the results for each category, also considering the classification of medication types. From a care perspective, the findings call for the reconfiguration of medication treatments for institutionalized older adults and highlight the need to design health care policies for Brazilian long-term care facilities.

CONCLUSION

A high prevalence of PIMs was observed among institutionalized older adults, particularly in the class of psychotropic drugs, highlighting the need to evaluate the cost-benefit of PIM prescriptions through the use of tools such as the AGS/Beers Criteria. The importance of comprehensive public health actions is also emphasized, with integrated care and the adoption of non-pharmacological treatment alternatives that contribute to reducing the use of PIMs and, consequently, to the promotion and maintenance of the health of institutionalized older adults.

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