Prevalence and factors associated with excessive polypharmacy in institutionalized older people in southern Brazil

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Abstract

Objective: To verify the prevalence and factors associated with excessive polypharmacy in institutionalized older people. *Method*: Cross-sectional study with 478 older people living in long-term care facilities. The dependent variable was excessive polypharmacy which is defined as the concomitant use of ten or more medications. The independent variables included sociodemographic and health information. The Poisson regression with robust variance was used to analyze the effect of the independent variables compared to the outcome. *Results*: The prevalence of excessive polypharmacy was 29.3% associated with heart disease (PR=1.40; 95%CI 1.03-1.91), diabetes *mellitus* (PR=1.52; 95%CI 1.15-2.01), depression (PR=1.42; 95%CI 1.08-1.87), hospitalization in the last year (PR=1.36; 95%CI 1.02-1.80), and the use of potentially inappropriate medication for older people (PR=2.13; 95%CI 1.60-2.83). *Conclusion:* Excessive polypharmacy was frequent among institutionalized older people. The results suggest that prevalent diseases among older people, hospitalization, and the use of potentially inappropriate medications are reasons for the use of excessive polypharmacy by this population. Said findings can guide actions aimed at optimizing the pharmacotherapy prescribed to older people.

Keywords: Polypharmacy. Elderly. Homes for the Aged. Health of the Elderly. Cross-Sectional Studies.

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INTRODUCTION

Chronic and multiple diseases tend to manifest frequently in the group of older people and contribute to the use of polypharmacy by this population[1,2]. One or more drugs can be used to treat each disease or symptom[2,3] leading to complex therapeutic regimens[3,4].

Polypharmacy is a global public health problem[5] and one of the greatest challenges related to the aging population, with a burden on older people, their families, and healthcare systems[6]. The medication prescription rates show an increasing trend worldwide due to the increasingly older population and the availability of drugs[2,6]. The prevalence of polypharmacy reported in the literature ranges from 10% to around 90% in studies considering different age groups, polypharmacy definitions, and geographic locations[6].

There is no literature consensus regarding the definition of polypharmacy and excessive polypharmacy. However, most studies use the numerical criterion[2,6] that considers polypharmacy as the simultaneous use of five or more medications[7,8] and excessive polypharmacy as the concomitant use of 10 or more medications[4,9].

Excessive polypharmacy alone does not denote inadequate polypharmacy[2,3]. The use of multiple medications is not necessarily imprudent, and in some cases, it may be necessary and beneficial[2,5]. However, although an adequate combination of drugs for patients with complex health problems can improve their clinical condition[2], the greater the number of medications they use, the greater the risks for the older person[1] as the chances of adverse effects and drug interactions are increased[2].

Chronic diseases, functional status, and physiological changes inherent to aging cause changes both in the body's action on drugs and in the drug's action on the body. The reduction of body water, serum albumin, hepatic and renal blood flow, and the increased body fat are examples of physiological changes that lead to changes in the volume, concentration, and distribution of medications[10].

No drug is completely safe for use by older people as the pharmacokinetic and pharmacodynamic properties of many of them are not completely known for this group. Older people are frail and present multimorbidities which are commonly excluded from the research necessary for the approval of new medications. However, this group is often more present in clinical practice and is more subject to polypharmacy[2].

In this sense, the institutionalized older population deserves more attention as they are generally frailer, have a greater number of chronic diseases, and make use of more medications compared to older people in the community[1–4], thus being more susceptible to the risks of complications associated to polypharmacy[2]. Studies show that the average number of medications used and the prevalence of excessive polypharmacy are higher among institutionalized older people. Previous investigations have reported the prevalence of excessive polypharmacy among older people living in institutions, from 16.8%[3] to 44.1%[11], a segment demanding special attention[3,11]. Factors such as using 10 or more medications and living in a long-term care facility can increase the likelihood of an older person suffering medication-related harm[2].

In some countries, especially in the developed ones, the study of this topic is well established[3,4]. However, no publication on the prevalence and factors associated with excessive polypharmacy among older people living in long term care facilities (LTCF) was found in Brazil after an extensive search in the MEDLINE/Pubmed database using the descriptors "Polypharmacy", "Aged" and "Homes for the Aged" in the last 10 years.

Therefore, the present study aimed to verify the prevalence and factors associated with excessive polypharmacy among institutionalized older people.

METHOD

This is a cross-sectional study with people aged 60 years and over living in Long Term Care Facilities (LTCF). The present study is an excerpt from the research *Patterns of aging and longevity: biological, educational, and psychosocial aspects* developed under the coordination of Universidade Estadual de Campinas

(UNICAMP), São Paulo (SP) with the participation of Universidade Católica de Brasília (UCB), Federal District (DF) and Universidade de Passo Fundo (UPF), Rio Grande do Sul (RS). Data were collected in 2017 at 19 LTCFs located in the municipalities of Passo Fundo (RS), Carazinho (RS), and Bento Gonçalves (RS), Brazil.

All LTCFs in the municipalities of Passo Fundo (RS), Carazinho (RS), and Bento Gonçalves (RS) located in the northern and the mountains of the state of RS were included in the study due to the need to add a larger sample of institutionalized older people. The choice of municipalities followed criteria such as geographic proximity and similar characteristics to the ratio of older people in the population and distribution by gender and age group. The estimated population for the year 2015 in the municipality of Passo Fundo (RS) was 196,741 inhabitants, in Carazinho (RS) was 62,037 inhabitants, and in Bento Gonçalves (RS) was 113,287 inhabitants, and the respective ratio of older people in the population was 13.58%, 16.13%, and 14.11%. Among the older people in each location, the majority were women (58.2%, 58.1%, and 56.1%), and the ratio of people aged 80 years and over was 13.9%, 14.6%, and 14.1%, respectively[12].

All the 35 LTCFs located in the selected municipalities were invited to participate in the research. However, only 19 accepted, of which 14 (58.3%) were located in the municipality of Passo Fundo (RS) where 281 older people lived, 1 (50.0%) in the municipality of Carazinho (RS) with 92 older people, and 4 (44.4%) in the municipality of Bento Gonçalves (RS) where 106 older people lived. The total population living in these facilities was 479 older people. After the LTCFs were accepted, the older people and their guardians were invited to participate in the study. All individuals aged 60 years and over were included, and those who were hospitalized at the time of the interview or who were not located after three attempts by the interviewers on alternate days and times were excluded.

To calculate the sample, a confidence level of 95%, the statistical power of 80%, the ratio of not exposed: exposed (presence of Non-Communicable Chronic Disease) of 2, the prevalence of the outcome in the exposed group of 30% were taken into account[1,4,9,11], totaling 291 older people, and 20% was added for losses and refusals (n=349). However, as this is a study with different outcomes, we decided to investigate all older people living in LTCFs who met the inclusion criteria in the selected municipalities. The study sample comprised 478 older people.

Excessive polypharmacy is defined as the concomitant use of 10 or more medications prescribed in the three months before the research, and it was considered as the dependent variable. The use of medications was analyzed in the medical records of older people, and the active substances were listed according to the fifth level of the Anatomical Therapeutic Chemical (ATC) classification system[13].

The independent variables defined based on previous investigations[1,4,9,11,14] included sociodemographic and LTCF related information: type of LTCF (private/philanthropic), age (in years), longevity considered as age 80 years and older (long-lived/non-long-lived), gender (male/female), color/race (white/non-white), marital status (with a partner/without a partner), length of hospital stay (in months), education (attended/did not attend school), and family visits (yes/no);

Health-related variables included heart disease (yes/no), systemic arterial hypertension (yes/no), cerebrovascular accident (yes/no), diabetes *mellitus* (yes/no), pulmonary disease (yes/no), depression (yes/no), dementia (yes/no), chronic pain in the last six months (yes/no), multimorbidity (yes/no), use of potentially inappropriate medication for older people (PIM) (yes/no), urinary incontinence in the last 12 months (yes/no), fecal incontinence (yes/no), insomnia (yes/no), hospitalization (yes/no), and number of hospitalizations (number). The functionality-related variables were cognitive status (with cognitive decline/no cognitive decline), and basic activities of daily living (BADL) (independent/dependent).

Multimorbidity was characterized by the presence of two or more chronic conditions in an individual. As the list of morbidities for its operationalization has not yet been defined for the Brazilian context, conditions with one or more of the following

characteristics were included for the construction of the variable: they cause non-reversible pathological changes in the body, generate residual disability, are permanent, indicate the need for rehabilitation or long term care[15]. Thus, the morbidities included were the presence of heart disease, systemic arterial hypertension, diabetes *mellitus*, rheumatism, pulmonary disease, depression, osteoporosis, dementia, Parkinson's disease, sarcopenia, and frailty.

For the variable use of PIM, the criteria of Beers 2015[16] were used. The Mini-Mental State Examination (MMSE) was used to assess the cognitive status with cutoff points suggested by Bertolucci et al[17]: 13 for illiterate, 18 for low and medium education, and 26 for high education. The older person was classified (with cognitive decline/without cognitive decline) based on the score obtained.

For BADL, the older person was classified as independent or dependent according to the Katz Index[18]. Those who were able to perform one or more activities only with help were classified as dependent[7].

The sociodemographic, health and medication information were obtained from the medical record, and those related to functionality were obtained directly from the older person in an individualized environment designated by the person responsible for the LTCF.

To minimize inconsistencies in data collection, the 4 interviewers - nursing and physiotherapy students - underwent a training program and were followed by two research professors responsible for the study.

Categorical variables were presented using univariate frequency distributions and bivariate and multivariate contingency tables. The quantitative variables were described using measures of central tendency or position and variability, and the normality was verified using the Kolmogorov-Smirnov test. The Pearson's chi-square test was applied to assess the association between excessive polypharmacy and the categorical independent variables. The nonparametric Mann Whitney U test was used to compare the groups of quantitative independent variables regarding the dependent variable. The level of significance adopted was 5%. The Poisson regression with robust variance was used for the multivariate analyses to estimate the crude and adjusted prevalence ratios and calculate the respective 95% confidence intervals. In the multiple model, the variables with a *p-value* ≤ 0.20 in the bivariate analysis were considered, and those with $p<0.05$ remained in the model.

The research was approved by the Research Ethics Committee of Universidade de Passo Fundo (UPF), Opinion No. 2,097,278 according to Resolution 466/2012 of Conselho Nacional de Saúde (the Brazilian National Health Council). All the participants in the study signed the Informed Consent Form.

RESULTS

The study included 478 older people with an average age of 80.3 (±9.77) years, with a minimum variation of 60 and a maximum of 109 years. Women were predominant (71.1%), long-lived people (57.0%), educated (83.5%), and those living in philanthropic LTCF (57.1%), as shown in Table 1.

They had an average length of stay at the LTCF of 50.53 (±73.46) months, and the average number of drugs used was 7.40 (±3.65), with a minimum variation of 1 and a maximum of 22 medications. Only 1.5% did not use medication.

There was a high prevalence of cognitive decline (73.2%) and dependence for BADL (85.0%) in the population studied. The most prevalent chronic disease was systemic arterial hypertension (54.8%), and 59.6% presented multimorbidity (Table 2).

Excessive polypharmacy was observed in 29.3% of older people. There was a higher prevalence of excessive polypharmacy in residents of private LTCF (33.7%), females (32.6%), among those who used PIM (45.6%), those who had a diagnosis of heart disease (44.0%), diabetes *mellitus* (41.8%), pulmonary disease (40.0%), and depression (38.6%) (Table 3).

The main groups of medications responsible for excessive polypharmacy in the population studied were those acting on the digestive system and metabolism (95.4%), followed by those acting on

the nervous system (88.5%). In each of the groups, the most frequently used substances were omeprazole (53.4%) and quetiapine (40.5%), respectively.

In the present study, age, length of stay at the LTCF, and the number of hospitalizations were not related to excessive polypharmacy (p>0.05).

In the crude analysis, excessive polypharmacy was associated with gender (p=0.011), heart disease (p=0.001), systemic arterial hypertension (p=0.003), diabetes *mellitus* (p=0.002), depression (p=0.001), urinary incontinence (p=0.016), hospitalization in the last year (p=0.008), and use of PIM (p<0.001) (Table 3).

Table 1. Sociodemographic characteristics and those related to the Long Term Care Facility for Older People of institutionalized older people (n=478). Passo Fundo, Carazinho, and Bento Gonçalves, RS, Brazil, 2017.

Variable	n (%)	95% CI*
Type of LTCF		
Philanthropic	273 (57.1)	52.3 - 61.5
Private	205 (42.9)	38.5 - 47.7
Longevity		
Non-long-lived	205 (43.0)	38.8 – 47.2
Long-lived	272 (57.0)	52.8 – 61.2
Gender		
Male	138 (28.9)	25.1 – 33.3
Female	340 (71.1)	66.7 – 74.9
Family visit		
Yes	411 (87.4)	84.7 – 90.6
No	59 (12.6)	9.4 – 15.3
Color		
White	424 (89.5)	86.7 – 92.0
Non-white	50 (10.5)	8.0 – 13.3
Marital status		
With spouse	30 (6.3)	4.2 – 8.4
Without spouse	445 (93.7)	91.6 – 95.8
Education		
Did not attend school	76 (16.5)	13.0 – 19.7
Attended school	386 (83.5)	80.3 – 87.0

LTCF: Long Term Care Facility; *CI: Confidence Interval. The total absolute frequencies diverge due to missing data. Valid longevity =477; Family visit n valid =470; Color n valid =474; Marital status n valid =475; Education n valid =462.

Table 2. Health characteristics and medication use of institutionalized older people (n=478). Passo Fundo, Carazinho, and Bento Gonçalves, RS, Brazil, 2017.

Variable	n (%)	CI* 95%
Cognitive status		
With decline	349 (73.2)	69.0 - 77.4
Without decline	128 (26.8)	22.6 - 31.0
Heart disease		
Yes	84 (17.8)	14.4 – 21.4
No	389 (82.2)	78.6 – 85.6
Arterial hypertension		
Yes	259 (54.8)	49.9 – 59.2
No	214 (45.2)	40.8 – 50.1
Cerebrovascular Accident		
Yes	103 (21.6)	18.1 – 26.1
No	373 (78.4)	73.9 – 81.9
Diabetes *mellitus*		
Yes	98 (20.6)	17.2 – 24.4
No	378 (79.4)	75.6 – 82.8
Depression		
Yes	176 (37.4)	32.9 – 42.5
No	295 (62.6)	57.5 – 67.1
Dementia		
Yes	236 (49.8)	44.5 – 54.2
No	238 (50.2)	45.8 – 55.5
Urinary incontinence		
Yes	309 (65.2)	61.0 – 69.6
No	165 (34.8)	30.4 – 39.0
Hospitalization		
Yes	148 (31.5)	27.0 – 36.4
No	322 (68.5)	63.6 – 73.0
Chronic pain		
Yes	167 (36.6)	31.4 – 41.5
No	289 (63.4)	58.5 – 68.6
Insomnia		
Yes	156 (33.3)	29.1 – 37.8
No	312 (66.7)	62.2 – 70.9
Potentially Inappropriate Medication		
Yes	158 (35.3)	31.1 – 39.4
No	289 (64.7)	60.6 – 68.9
Basic activities of daily living		
Independent	69 (15.0)	12.1 – 18.4
Dependent	392 (85.0)	81.6 – 87.9
Excessive polypharmacy		
Yes	140 (29.3)	25.3 – 33.7
No	338 (70.7)	66.3 – 74.7
Multimorbidity		
Yes	283 (59.6)	55.4 – 64.2
No	192 (40.4)	35.8 – 44.6

MMSE: Mini Mental State Examination; *CI: Confidence Interval. The total absolute frequencies diverge due to missing data. Cognitive status n valid =477; Heart disease n valid =473; Arterial hypertension n valid =473; Cerebrovascular accident n valid =476; Diabetes mellitus n valid =476; Depression n valid =471; Dementia n valid =474; Urinary incontinence n valid =474; Hospitalization n valid =470; Chronic pain n valid =456; Insomnia n valid =468; PIM n valid =447; Basic activities of daily living n valid =461; Multimorbidity n valid =475.

Table 3. Prevalence of excessive polypharmacy and factors associated in institutionalized older people (n=478). Passo Fundo, Carazinho, and Bento Gonçalves, RS, Brazil, 2017.

Variable	n (%)	*p**	RR** (95% CI)	RR***(95% CI)
Gender		0.011		---
Female	111 (32.6)		0.69(0.47 - 1.00)	
Male	29 (21.0)		1.00	
Type of LTCF		0.069		---
Philanthropic	71 (26.0)		1.21(0.90 - 1.63)	
Private	69 (33.7)		1.00	
Heart disease		0.001		
Yes	37 (44.0)		1.70(1.24 – 2.33)	1.40(1.03 – 1.91)
No	101 (26.0)		1.00	1.00
Arterial hypertension		0.003		---
Yes	90 (34.7)		1.74(1.25 – 2.43)	
No	48 (22.4)		1.00	
Diabetes *mellitus*		0.002		
Yes	41 (41.8)		1.82(1.35 – 2.46)	1.52(1.15 – 2.01)
No	98 (25.9)		1.00	1.00
Pulmonary disease		0.121		---
Yes	16 (40.0)		1.47(0.96 – 2.24)	
No	123 (28.3)		1.00	
Depression		0.001		
Yes	68 (38.6)		1.53(1.14 – 2.05)	1.42(1.08 – 1.87)
No	71 (24.1)		1.00	1.00
Dementia		0.060		---
Yes	78 (33.1)		1.24(0.92 – 1.67)	
No	60 (25.2)		1.00	
Urinary incontinence		0.016		---
Yes	102 (33.0)		1.45(1.03 – 2.04)	
No	37 (22.4)		1.00	
Fecal incontinence		0.063		---
Yes	74 (33.5)		1.22(0.91 – 1.65)	
No	65 (25.7)		1.00	
Multimorbidity		0.109		---
Yes	90 (31.8)		1.18(0.86 – 1.61)	
No	48 (25.0)		1.00	
Hospitalization		0.008		
Yes	56 (37.8)		1.52(1.13 – 2.05)	1.36(1.02 – 1.80)
No	83 (25.8)		1.00	1.00
PIM		<0.001		
Yes	72 (45.6)		2.43(1.81 – 3.27)	2.13(1.60 – 2.83)
No	54 (18.7)		1.00	1.00

**p*: Pearson's chi-square test; **RR: Crude Prevalence Ratio, Poisson Regression with robust variance; ***RR: Adjusted Prevalence Ratio, Poisson Regression with robust variance.

In the final model, having heart disease (RR=1.40; 95%CI 1.03–1.91), diabetes *mellitus* (RR=1.52; 95%CI 1.15–2.01), depression (RR=1.42; 95%CI 1.08–1.87), history of hospitalization in the last year (RR=1.36; 95%CI 1.02–1.80), and use of PIM (RR =2.13; 95%CI 1.60–2.83) remained associated with excessive polypharmacy (Table 3).

DISCUSSION

The present study analyzes the prevalence and factors related to excessive polypharmacy among older people living in an LTCF in southern Brazil. The results suggest that excessive polypharmacy is common in the studied population, with one in every four older people taking 10 or more drugs and that not only chronic diseases such as heart disease, diabetes *mellitus*, and depression but also a history of hospitalization in the last year and the use of PIM are associated with it.

In the present study, the prevalence of concomitant use of 10 or more medication was higher than that found among older people living in nursing homes in Europe, 24.3%[4] and in France, 21.1%[9]. Other studies with institutionalized older people found a higher prevalence of excessive polypharmacy, as in the Swedish example -35.5%[1] and in the Swiss one -44.1%[11].

In the Brazilian context, studies investigated the use of polypharmacy (five or more medications) among older people living in LTCF and found a prevalence of 27.5%, in a survey including LTCF in Rio de Janeiro, Minas Gerais, Mato Grosso, and Mato Grosso do Sul[7] and 73.9% in the state of SP[8]. However, no publication was found analyzing the simultaneous use of 10 or more medications by institutionalized older people. Only one study with older people in the community treated at two basic healthcare units in Minas Gerais analyzed the use of excessive polypharmacy, in which 4.8% of older people used 10 or more medications[14]. This percentage is much lower than that found in the present study, which could be explained by the fact that institutionalized older people are generally more fragile, have a greater number of chronic diseases, and use more medications compared to those in the community[1–4]. However, it is prudent to consider that the different methodologies used in the studies make comparisons difficult, besides influencing the prevalence of excessive polypharmacy.

The differences in the prevalence of excessive polypharmacy among institutionalized older people from different contexts may be influenced by the different attitudes of prescribers facing the challenge of treating complex patients[4]. While some adopt therapeutic approaches based on guidelines or protocols in force in the country, others may consider, for example, the characteristics and preferences of the older person[2,4] as the basis for the therapeutic recommendation, which could result in different amounts of the medication prescribed.

From this perspective, a factor that could contribute to the use of excessive polypharmacy by institutionalized older people in the South of the country is the growing use of clinical protocols and therapeutic guidelines as the basis for medical conduct. In Brazil, the Ministry of Health recommends for primary care teams - who are the first entry of older people to the healthcare system - to use evidence-based clinical guidelines for the treatment of people with chronic diseases[19]. Traditionally, these guidelines are based on single diseases and do not consider the complexity of the individual with multimorbidity, which is why older patients with coexisting diseases may be prescribed several medications[2]. This evidence is in line with our findings since most older people who use excessive polypharmacy also have multimorbidities.

And issues related to the healthcare system of each country may be at the genesis of such differences. In the Brazilian healthcare system, the implementation of public policies in recent years aimed at guaranteeing the treatment and control of prevalent diseases in the country has allowed for the expansion of access to medicines[20] with emphasis on the South region, in which the highest percentage of access to pharmaceutical care in the country is registered[21]. The highest percentage of older people using polypharmacy is also seen in this region, with 25.0% versus only 3.0% in the

North region[22]. This evidence makes us believe that the excessive polypharmacy analyzed in the present study could be favored by the greater ease of access to medication, as people with free drug coverage show a greater polypharmacy risk compared to those who need to pay for pharmaceutical care[23,24]. This hypothesis is also corroborated by the fact that in the present study the medications most frequently used by older people in excessive polypharmacy, namely omeprazole and quetiapine, are part of the National List of Essential Medications, and therefore are made available free of charge by the Unified System of Health[20].

In the present study, excessive polypharmacy was associated with heart disease, diabetes *mellitus,* and depression. Other studies found the same association[4,23]. Said diseases are highly prevalent among older people regardless of the context in which they live[4,23], and are commonly treated with a combination of drugs[23,25].

Counterintuitively, no association was identified in this study between excessive polypharmacy and multimorbidity. This finding contrasts with the literature on the topic[5,6] and can be justified by the fact that the main substances responsible for excessive polypharmacy in the population studied were omeprazole and quetiapine, and the use of these medications does not necessarily indicate a chronic condition[26,27].

Among those studied, excessive polypharmacy was associated with hospitalization in the last year. This result is supported by the literature[3,22,28]. A survey carried out among older people hospitalized in Pakistan found that patients using excessive polypharmacy had 37 times higher odds ratio of hospitalization compared to those not exposed to polypharmacy[28]. The use of multiple medications can cause harm capable of determining hospitalization[5], and the greater the number of medications in use, the greater the probability of adverse events that can be serious and fatal[1].

In Brazil, hospitalizations related to damage caused by medications show a growing trend, especially in the South and Southeast regions of the country, with the representation of the older population. Older people are more susceptible to adverse effects, interactions, and toxicity caused by medication[29] which could contribute to the need for hospitalization in this group and justify the association between excessive polypharmacy and hospitalization.

Another possible explanation could be supported by the fact that hospitalization presupposes the displacement of the older person via different care settings, and this movement could favor the occurrence of inconsistencies in the list of medications used by the older person. Data from the World Health Organization reveal that most institutionalized older people have already been victims of inconsistencies in the list of medications[30]. In this context, it is possible that the medications in use and the previous health problems are not considered for the onset of a new therapeutic scheme, making the identification of adverse effects to medications and their possible interactions unlikely. Thus, adverse reactions can be interpreted as new health problems and treated with new drugs, which starts the prescription cascade, a factor that could contribute to the use of excessive polypharmacy[25].

In the present study, excessive polypharmacy was associated with the use of PIM. Our findings are in line with the literature[1,11,31]. Among those exposed to excessive polypharmacy, most used PIM, but this percentage was reduced by half in the unexposed group. In fact, evidence suggests that the greater the number of medications prescribed, the greater the chances of receiving a PIM[11,28,31].

These results point to a worrying condition, as they indicate a high prevalence of PIM use among institutionalized older people using excessive polypharmacy, which should be a reason for warning professionals and managers since the risks of harmful effects of these drugs can exceed the benefits[15]. However, despite the relevant concern with the negative results associated with the use of PIM, the literature shows that the prescription of these medications is frequent and points to an increased prevalence over time[9,11], which indicates the need for interventions aimed at reducing the prescription of PIM.

As for strengths, we emphasize the period considered for the analysis of medication use involving the three months before the survey, which could reduce the possibility of underestimating excessive polypharmacy as medications can be used weekly or monthly; information on the health status was collected to allow us to study the factors associated with excessive polypharmacy; information regarding the use of medications, health status, and the presence of chronic diseases was obtained by the analysis of medical records, which contributes to the reliability of the findings.

The present study has some limitations: the cross-sectional design of this survey does not allow establishing a cause-and-effect relationship; the percentage of refusals may have occurred in LTCF with older people with a health profile different from the investigated sample, influencing the study results and the non-response rate in some variables; some medications classified as a product may contain more than one chemical, thus the user may have been wrongly classified as non-excessive polypharmacy, which could contribute to the underestimation of the outcome. As this is a non-probabilistic sampling, the generalization of the results is harmed. However, the findings are similar to those found in the scientific literature.

CONCLUSION

Our findings follow the internationally observed trend and suggest that diseases prevalent among older people, hospitalization, and the use of potentially inappropriate medications are factors contributing to the use of excessive polypharmacy. Most of the associated factors fall into the non-modifiable group, as is the case with chronic diseases. However, the use of potentially inappropriate medications for older people is a modifiable factor, as safer and more effective alternatives are often available. Thus, actions are needed to optimize the pharmacotherapy prescribed to institutionalized older people. Interventions aimed at training and continuing education of teams working in institutions considering the specificities of the area of geriatrics and gerontology could contribute to the quality of drug therapy recommended for older people. In addition, the periodic review of drug prescriptions and the implementation of a referral and counter-referral system between different professionals and services involved in the health care of older the person are initiatives with the potential to reduce excessive polypharmacy and the use of potentially inappropriate medications.

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