

Polymedication and its association with individual factors in Portuguese older adults—a cross-sectional study

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Abstract

Background: Population aging is a reality resulting in polymedication and its harmful consequences. Therefore, determining polymedication state in Portugal and identifying its associated characteristics is vital.

Methods: Among the cross-sectional study Nutrition UP 65, information on socio-demographic data, cognitive performance, lifestyle, health, and nutritional status was collected in the Portuguese older population. Frequency of polymedication (self-reported concomitant administration of ≥ 5 medications and/or supplements) was calculated. Associated factors were determined.

Results: A total of 1317 individuals were included in the sample and the frequency of polymedication was 37.1%. Characteristics associated with higher odds of polymedication were living in an institution (OR: 1.97; CI: 1.04–3.73); being overweight (OR: 1.52; CI: 1.03–2.25) or obese (OR: 1.57; CI: 1.06–2.34); perceiving health status as reasonable (OR: 1.68; CI: 1.25–2.27) or bad/very bad (OR: 2.04; CI: 1.37–3.03); having illnesses of the circulatory system (OR: 2.91; CI: 2.14–3.94) or endocrine, metabolic, and nutritional diseases (OR: 1.79; CI: 1.38–2.31).

Conclusions: A 3 to 4 out of 10 Portuguese older adults are polymedicated. Intervention in modifiable factors and the monitorization of others is an important strategy in the care of the elderly.

Keywords: elderly, NUTRITION UP 65, overweight, polymedication, Portugal

Introduction

It is estimated that in the 28 member states of the European Union the proportion of individuals over 65 years of age will increase from 17% in 2008 to more than 25% by 2035.¹ This increase will also occur in Portugal—in the most recent census data for 2011, 19% of the Portuguese population is over 65 years of age, reflecting an increase of 18.7% compared to 2001.²

During aging, several chronic pathologies and multimorbidity develop, which accumulate over time and, consequently, lead to a

need to take multiple medications, increasing the risk of polymedication.³ There is no consensual definition of this term in the literature.⁴ The World Health Organization (WHO) defines polymedication as “the administration of many drugs simultaneously, or the administration of an excessive number of drugs.”⁵ Thus, it can be classified according to the number of drugs taken (5 or more drugs simultaneously being the most frequent definition), or by taking more medication than indicated by the clinician, or by taking drugs that are not suitable for the patient’s clinical status.^{4,6,7}

Other factors that contribute to polymedication are self-medication—there is an increasing availability of drugs that do not require a medical prescription—and the existence of complementary and alternative therapies, such as homeopathic supplements, naturalists, among others. Often, patients do not report their use of these complementary therapies to their physicians, as they do not regard them as medication.⁷ However, these supplements may interact with conventional drugs, causing a wide range of adverse effects.⁸

Several studies have demonstrated an association between polymedication and adverse events in the elderly population, such as increased interaction between drugs,⁹ poor adherence to therapeutic regimens,^{10,11} and declining nutritional status.^{12–14} They have also found a higher risk of functional impairment,^{13,15,16} frailty,¹⁷ sarcopenia,¹⁸ falls,¹⁹ cognitive dysfunction,^{13,15,20} and high rates of hospitalization²¹ and mortality.²²

In Portugal, data on the factors associated with polymedication are scarce. Only 1 European study, using data from the SHARE project,²³ determined the prevalence of polymedication (36.9%) in a nationwide representative sample of individuals aged 65 and

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over. Although factors associated with polymedication were investigated, results are only available for the entire sample and were not displayed specifically for the Portuguese older adults.²³ Only community-dwelling individuals were included in the sample.

It is therefore essential to know the reality of polymedication in Portugal and to identify the characteristics of the elderly Portuguese population that are associated with it. This information will be of major relevance in contributing to the design of potential interventions. This study aims to characterize polymedication in the Portuguese elderly population (≥ 65 years) and to clarify its association with individual characteristics.

Methods

Study design and variables

This study is based on data from the Nutrition UP 65 study collected between December 2015 and July 2016 in Portugal. It is a cross-sectional study whose sample of 1500 older adults (≥ 65 years) is representative of the Portuguese population in relation to age, sex, education, and the regional area. The detailed methodological protocol of Nutrition UP 65 is published elsewhere.²⁴

Inclusion criteria were as follows: Portuguese individuals with a single nationality, current residence in the country and aged 65 or over, and without physical or medical conditions that made it impossible to collect blood samples or 24-hour urine. Eligible individuals were contacted by an interviewer, who informed them about the objectives and methodology of the study, inviting them to participate.

Information on socio-demographic data, cognitive performance, lifestyle, health status and clinical history, and nutritional status was collected through a structured questionnaire during an interview. The interviews were conducted by 8 previously trained nutritionists. This study focused on the elderly, and age was divided into 2 categories: 1 from 65 to 79 years old and the other aged 80 and above, the last 1 classified as “oldest old,” according to the classification of the United Nations.²⁵

The Mini-Mental State Examination was used in the evaluation of cognitive function, applying the validated cutoff points for the Portuguese population, according to the degree of literacy.²⁶ Moderate alcohol consumption was defined as 1 drink per day for women and 2 drinks per day for men, and excessive consumption as ≥ 2 drinks a day for women and ≥ 3 drinks a day for men.²⁷ The adherence to the Mediterranean diet was quantified with the Portuguese version of the PrediMed questionnaire.²⁸

Concomitant administration of at least 5 drugs and/or supplements was considered polymedication.

The Portuguese version of the Mini Nutritional Assessment-Short Form (MNA-SF) was used to identify participants who were undernourished or at risk of undernutrition.²⁹ Anthropometric measurements were carried out according to standardized procedures.³⁰ When height measurement was impossible, the length of the non-dominant hand (cm), was measured with a calibrated pachymeter Fervi Equipment (Vignola, Italy), with 0.1 cm resolution.³¹ When the measurement of body weight was impossible, the weight was estimated.³² The low body mass index (BMI) category is composed of a small number of participants ($n=3$) and therefore they were excluded from the statistical analysis.

The frailty phenotype was assessed according to Fried et al. The grip strength of the non-dominant hand was measured

according to the previously described methodology. The dominant hand was used when it was impossible to use the non-dominant hand.²⁴ To assess the walking speed, the time, in seconds, required to travel a distance of 4.6 m was determined.²⁴ The self-reported level of exhaustion was evaluated through 2 items of the Depression Scale of Epidemiological Studies.³³ These sentences were read to the participant – “I feel that everything I do is with effort” and “last week I could not go”—and the participant was asked “how many times in the last week have you felt this?.” Physical activity was evaluated with the short form of the international questionnaire for physical activity, questioning the type and frequency of physical activities performed in the last 7 days.³⁴

Nurses collected the blood samples after the questionnaire. These were collected, dated, and analyzed by a certified laboratory, Labco Portugal, and with the same equipment. The level of vitamin D was determined according to the serum 25 (OH) D levels, obtained through an electrochemiluminescence immunoassay, using a Roche Cobas Vitamin D reagent (Roche Diagnostics, Mannheim, Germany). Participants were considered as having adequate levels when they were at least 50.0 nmol/L (nmol/L), inadequate levels between 30.0 and 49.9 nmol/L and at risk of deficiency below 30.0 nmol/L.³⁵ One individual presented values compatible with toxicity and due to the reduced number was excluded from the present sample. According to the data collection date, the participants were grouped in Autumn and Winter or Spring and Summer.

The missing cases in each studied variable were: “marital status” $n=1$, “professional activity” $n=5$, “ingestion of alcoholic beverages” $n=2$, “self-perception of health status” $n=4$, “season of data collection” $n=2$, “Frailty” $n=43$, “number of chronic diseases” $n=8$, “BMI” $n=4$ and “polymedication” $n=109$. Thus, 1317 individuals were included in the final sample.

Ethics

Prior to the interview, a pre-prepared document entitled “Information for the participant” was read by the prospective participant or his/her representative. If he/she agreed to participate, the participant (or 2 representatives, in the case of individuals without pre-served cognitive function) would read and sign informed consent.

This study was carried out according to the rules established by the Declaration of Helsinki.³⁶ The protocol was approved by the Ethics Commissions of the University of Minho (128/2018), Campus de Gualtar 4710-057 Braga, and of Department of Social Sciences and Health of the Faculty of Medicine of the University of Porto, Al. Prof. Hernâni Monteiro, 4200 – 319 Porto, Portugal (15/2015), and by the National Data Protection Commission (9427/2015).

Statistical analysis

A descriptive analysis of the variables was performed according to the polymedication status. The normality of data distribution was assessed visually and also through their symmetry and kurtosis. The chi-square test³⁷ was used to determine the existence of an association between categorical variables and the presence of polymedication. Finally, a binary logistic regression was performed to infer the influence of the variables on the participants’ polymedication status.³⁸ The Hosmer–Lemeshow test was used to assess the goodness of fit of the model.

The results were considered significant when $P < .05$ (confidence interval (CI) at 95%).

Results

The characteristics of 1317 elderly Portuguese individuals according to polymedication status—without polymedication (0–4 drugs and/or supplements) and with polymedication (5 or more drugs and/or supplements), are described in Table 1.

In this sample, 828 participants (62.9%) were not polymedicated, while 489 (37.1%) were polymedicated. In comparison with the non-polymedicated participants, the majority of those who were polymedicated resided in the Center (45.4%) and in the North (44.8%), were single, divorced, or widowed

(57.7%), had lower schooling and lower levels of vitamin D did not consume alcoholic beverages, presented a higher frequency of obesity, a worse self-perception of health status, a higher number of diseases and a higher frequency of frailty ($P < .01$). Most were evaluated in autumn/winter.

A binary logistic regression model was carried out and it was found to be statistically significant ($P < .001$) (model coefficient omnibus test), with a pseudo- R^2 of 0.232—independent variables explaining 23.2% of the variance of the outcome (39). With the $P = .595$ ($P > .05$) value of the Hosmer–Lemeshow test, the goodness of fit of the model was verified.³⁹

The factors associated with polymedication with statistical significance were “region, residence, alcohol intake, BMI, self-perception of health status, diseases of the circulatory system,

Table 1

Sociodemographic, clinical, and nutritional characteristics of 1317 Portuguese people ≥ 65 years of age, according to their polymedication status (≥ 5 drugs and/or supplements)

	No polymedication n = 828 (62.9%)	Polymedication n = 489 (37.1%)	Significance
Sex (n, %)			
Women	433 (52.3)	328 (67.1)	<0.001 [†]
Men	395 (47.7)	161 (32.9)	
Age (n, %)			
65–79 yrs old	649 (78.4)	342 (69.9)	0.001 [†]
≥ 80 yrs old	179 (21.6)	147 (30.1)	
Region (n, %)			
North	212 (25.6)	219 (44.8)	<0.001 [†]
Center	465 (56.2)	222 (45.4)	
South	114 (13.8)	34 (7.0)	
Islands	37 (4.5)	14 (2.9)	
Residence (n, %)			
Community-dwelling	807 (97.5)	456 (93.3)	<0.001 [†]
Care homes	21 (2.5)	33 (6.7)	
Marital status (n, %)			
Single, divorced or widowed	395 (47.7)	282 (57.7)	<0.001 [†]
Married or in common-law marriage	433 (52.3)	207 (42.3)	
Schooling (years completed) (n, %)			
0	90 (10.9)	75 (15.3)	0.008 [†]
1–4	137 (16.5)	105 (21.5)	
5–6	433 (52.3)	237 (48.5)	
7–9	31 (3.7)	14 (2.9)	
10–12	55 (6.6)	20 (4.1)	
>12	82 (9.9)	38 (7.8)	
Professional activity (n, %)			
Active	24 (2.9)	6 (1.2)	0.049 [†]
Inactive	804 (97.1)	483 (98.8)	
Household income (n, %)			
≤ 499	125 (15.1)	98 (20.0)	0.004 [†]
500–999€	164 (19.8)	117 (23.9)	
≥ 1000 €	121 (14.6)	49 (10.0)	
Does not know or does not want to answer	418 (50.5)	225 (46.1)	
Ingestion of alcoholic beverages (n, %)			
Does not consume alcoholic beverages	485 (58.6)	328 (67.1)	0.001 [†]
Moderate consumption	256 (30.9)	103 (21.1)	
Excessive consumption	87 (10.5)	58 (11.9)	
Adherence to the Mediterranean Diet (n, %)			
Adhere	369 (44.6)	197 (40.3)	0.130 [†]
Does not adhere	459 (55.4)	292 (59.7)	
BMI (n, %)			
Normal	153 (18.5)	55 (11.2)	<0.001 [†]
Overweight	377 (45.5)	212 (43.4)	
Obese	298 (36.0)	222 (45.4)	

(continued)

Table 1
(continued).

	No polymedication n = 828 (62.9%)	Polymedication n = 489 (37.1%)	Significance
MNA-SF (n, %)			
No undernutrition	720 (87.0)	396 (81.0)	0.010 [†]
At risk of undernutrition	103 (12.4)	86 (17.6)	
With undernutrition	5 (0.6)	7 (1.4)	
Self-perception of health status (n, %)			
Very good/good	322 (38.9)	111 (22.7)	<0.001 [†]
Reasonable	395 (47.7)	264 (54.0)	
Bad/very bad	111 (13.4)	114 (23.3)	
Diseases of the circulatory system			
Yes	311 (37.6)	80 (16.4)	<0.001 [†]
No	517 (62.4)	409 (83.6)	
Musculoskeletal diseases			
Yes	208 (25.1)	87 (17.8)	0.002 [†]
No	620 (74.9)	402 (82.2)	
Endocrine, metabolic, and nutritional diseases			
Yes	503 (60.7)	217 (44.4)	<0.001 [†]
No	325 (39.3)	272 (55.6)	
Frailty (n, %)			
No frailty	706 (85.3)	362 (74.0)	<0.001 [†]
Frailty	122 (14.7)	127 (26.0)	
Vitamin D serum levels (n, %)			
Adequate values	111 (13.4)	48 (9.8)	<0.001 [†]
Insufficiency	189 (22.8)	75 (15.3)	
Deficiency	528 (63.8)	366 (74.8)	
Season of data collection (n, %)			
Autumn/winter	372 (44.9)	290 (59.3)	<0.001 [†]
Spring/summer	456 (55.1)	199 (40.7)	

[†] Chi-square test.

endocrine, metabolic and nutritional diseases, and the season of data collection.” The Wald test values explain the relevance of each variable in the model.³⁹ “Diseases of the circulatory system” has the highest importance of 46.981, followed by region, endocrine, metabolic and nutritional diseases, self-perception of health status, BMI, data collection season, and finally residence.

The older adults living in the Center (OR: 0.50; CI: 0.37–0.66), in the South (OR: 0.26; CI: 0.16–0.41), or in the Islands (OR: 0, 38; CI: 0.19–0.79), compared to those living in the North, were less likely to be polymedicated. In contrast, those living in a care home were more likely to be polymedicated (OR: 1.97; CI: 1.04–3.73) (Table 2).

Regarding lifestyles, those that reported a moderate consumption of alcoholic beverages, compared to those who reported no alcoholic beverage intake, were less likely to be polymedicated (OR: 0.68; CI: 0.48–0.97). On the other hand, compared to the normal weight older adults, those with excess weight (OR: 1.52, CI: 1.03–2.25) or obese (OR: 1.57, CI: 1.06–2.34), were more likely to be polymedicated (Table 2).

Individuals who classified their health status as reasonable (OR: 1.68, CI: 1.25–2.27) or as bad/very bad “(OR: 2.04, CI: 1.37–3.03) were more likely to be polymedicated compared to those who characterized their health status as good/very good.” The older adults whose data collection was performed during spring/summer were more likely to be non-polymedicated (OR: 0.73; CI: 0.54–0.98) (Table 2).

Finally, people with diseases of the circulatory system were more likely to be polymedicated (OR: 2.91; CI: 2.14–3.94). The

same occurred with individuals with endocrine, metabolic, and nutritional diseases (OR: 1.79; CI: 1.38–2.31) (Table 2).

Discussion

The objective of this study was to characterize polymedication in the Portuguese older population. Results revealed that its frequency was 37.1%, which is consistent with the European SHARE study, where the prevalence was 36.9%.²³ An association between polymedication and multiple individual factors was then investigated.

Compared to participants living in the North, those who lived in the Center, South, and in the Islands presented lower odds of polymedication. Living in a care home is also associated with higher polymedication odds. There is little information in the literature regarding polymedication in care homes. Indeed, the focus has been mainly on the population living in the community. However, among the European SHELTER study carried out on individuals living in nursing homes, it was found that the prevalence of polymedication was higher (49.7%)⁴⁰ than present estimates. This may occur because older adults who live in these places suffer from multiple pathologies, have a large number of comorbidities and are dependent, requiring a high number of drugs and/or supplements.

Compared to no consumption of alcoholic beverages, moderate consumption was associated with a lower odd of polymedication. In the literature, the relationship between alcoholic beverages and cardiovascular disease, among others, has been

Table 2
Individual factors associated with polymedication in the Portuguese elders, determined with a binary logistic regression model

	Polymedication OR (95% CI)
Sex	
Women	1
Men	0.81 (0.59–1.11)
Age	
65–79 yrs	1
≥80 yrs	1.12 (0.82–1.53)
Marital status	
Single, divorced, or widowed	1
Married or in common-law marriage	1.02 (0.76–1.36)
Region	
North	1
Center	0.50 (0.37–0.66)*
South	0.26 (0.16–0.41)*
Islands	0.38 (0.19–0.79)*
Residence	
Community-dwelling	1
Care homes	1.97 (1.04–3.73)***
Schooling (years)	
0	1
1–4	1.07 (0.68–1.67)
5–6	0.94 (0.63–1.41)
7–9	0.87 (0.40–1.91)
10–12	1.08 (0.54–2.15)
>12	1.17 (0.66–2.10)
Professional activity	
Active	1
Inactive	1.30 (0.50–3.37)
Household income	
≤499€	1
500–999€	1.21 (0.80–1.82)
≥1000€	0.89 (0.53–1.50)
Does not know or does not want to answer	1.00 (0.69–1.43)
MNA-SF	
No undernutrition	1
At risk of undernutrition	1.04 (0.73–1.50)
With undernutrition	2.06 (0.56–7.53)
Ingestion of alcoholic beverages	
No ingestion of alcoholic beverages	1
Moderate consumption	0.68 (0.48–0.97)***
Excessive consumption	0.91 (0.58–1.42)
BMI	
Normal	1
Overweight	1.52 (1.03–2.25)***
Obesity	1.57 (1.06–2.34)***
Self-perception of health status	
Very good/good	1
Reasonable	1.68 (1.25–2.27)**
Bad/very bad	2.04 (1.37–3.03)*
Frailty	
No frailty	1
Frailty	1.29 (0.91–1.82)
Vitamin D serum levels	
Adequate levels	1
Insufficiency	0.68 (0.42–1.10)
Deficiency	1.02 (0.67–1.54)
Season of data collection	
Autumn/winter	1
Spring/summer	0.73 (0.54–0.98)***
Diseases of the circulatory system	
No	1
Yes	2.91 (2.14–3.94)*

(continued)

Table 2
(continued).

	Polymedication OR (95% CI)
Musculoskeletal diseases	
No	1
Yes	1.02 (0.73–1.42)
Endocrine, metabolic, and nutritional diseases	
No	1
Yes	1.79 (1.38–2.31)*

*, ** and *** *P* values in the logistic regression. **P*<.05, ***P*=.001, ****P*<.001.
BMI=body mass index, MNA-SF=Mini Nutritional Assessment-Short Form.

described as a *U*-curve⁴¹—moderate consumption is associated with a lower probability of having cardiovascular diseases, in comparison with abstinence, or with individuals who have an excessive consumption. This relationship may explain the association displayed in the present study—those with moderate consumption may have a lower number of comorbidities or a better overall health status, which requires a lower number of drugs and/or supplements. However, a recently published study in China has shown that any consumption of alcohol increases blood pressure and the risk of stroke, and that the protective effects detected in previous epidemiological studies could be non-causal.⁴²

Being overweight and obese was associated with higher odds of being polymedicated which can be explained by the complications inherent to these conditions. These are risk factors for numerous pathologies, such as hypertension, diabetes mellitus, osteoarthritis, depression, dyslipidemia, among others.⁴³ Therefore, it is expected that there will be a higher intake of medication and/or supplements. This association has already been observed in previous studies.^{44,45}

The older adults who classified their health status as “reasonable” or “bad/very bad” had higher odds of being polymedicated, which is consistent with the information already available in the literature.¹⁴ Self-perception of health status is a subjective measure, resulting from the confluence of socioeconomic factors and those associated with lifestyle, as well as the expectations that each individual has regarding their physical, mental, and emotional state.^{46,47} Thus, the need to take multiple drugs daily, coupled with the particularities inherent with this practice (the different times, different routes of administration, etc), as well as the adverse effects and interactions that occur between drugs and/or supplements, may impart a notion that the state of health is weak.

Lastly, the presence of circulatory system disorders—arterial hypertension, coronary disease, or heart failure—or the presence of endocrine, metabolic and nutritional diseases, namely diabetes mellitus or dyslipidemia were associated with greater odds of being polymedicated. This finding is expected because, firstly, these groups of pathologies are extremely prevalent in Portugal.⁴⁸ Second, these pathologies require multiple drugs for their control—for example, after the diagnosis of heart failure with reduced ejection fraction, it is imperative to start taking 2 different drugs. The same applies to type 2 diabetes mellitus—a person might have to take 3 different drugs so that they may obtain good glycaemic control.

Several strengths can be pointed out. This study has a high sample size, with the inclusion of older adults living on the mainland and the islands, living at home or in care homes, factors

that contribute to its strength. In addition, all the interviewers were trained to conduct the interview and had a script for the interview and a manual with the procedures to be performed. Also, the analysis of plasma vitamin D values was carried out in a single certified Portuguese laboratory.

Some limitations should also be mentioned. Participants in the study were the ones that were able to answer the questions and perform the tasks and therefore might constitute a group of healthier individuals compared to the Portuguese reality and perhaps less polymedicated. In addition, individuals were excluded due to missing cases, among others, with a selection of participants with distinct sociodemographic and clinical characteristics. Nutrition UP 65 presented a representative sample of the Portuguese population in terms of age, gender, schooling level, and region of the country where they live. Thus, the present sample may differ from reality in other aspects, such as health status, which makes it difficult to generalize the results for the Portuguese older population. Nonetheless, associations were established between the poly medication status and several individual factors.

Another limitation is that the medication, supplements, and pathologies are self-reported, and may not coincide with reality. However, some studies have demonstrated that self-report has high validity, particularly in chronic and non-prescription medication, including supplements.^{49–51} Although it was not the goal of the present study, it would be crucial to distinguish appropriate and inappropriate medication—a high number of drugs does not necessarily imply that their prescription is incorrect, but a careful review of the medication is vital to avoid possible morbidities. Finally, the cross-sectional design makes it impossible to establish a causal link between the associations verified.

The frequency of poly medication was quantified in the Portuguese older population and its associated factors were determined. The results showed that it is present in 3 to 4 out of 10 Portuguese older adults. The intervention in modifiable factors, such as obesity, as well as the monitoring of others may represent an important strategy in health care in the older population.

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Conflicts of interest

The authors declare no conflicts of interest.

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