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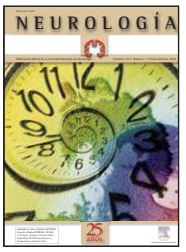

ORIGINAL ARTICLE

Drug consumption and cognitive function in non-institutionalized elderly: A population-based study

X. Planas-Pujol[a,b,*], S. López-Pousa[a,c], J. Vilalta-Franch[a,c], S. Monserrat-Vila[a] and J. Garre-Olmo[a,d], representing the Frailty and Dependence Group of Girona (FRADEGI Group)[◇]

[a] *Unitat de Recerca, Institut d'Assistència Sanitària, Salt (Girona), Spain*
[b] *Programa de Doctorado de Salud Pública y Metodología de la Investigación Biomédica, Universidad Autónoma de Barcelona, Barcelona, Spain*
[c] *Unitat de Valoració de la Memòria i les Demències. Institut d'Assistència Sanitària, Salt (Girona), Spain*
[d] *Departament de Psicologia, Universitat de Girona, Girona, Spain*

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KEYWORDS
Ageing;
Drug consumption;
Prevalence;
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Central nervous system;
Cognitive impairment

Abstract
Background: Drug consumption in the general population is concentrated in the elderly. The aim of this study was to assess the pharmacological profile of elderly people 75 years of age and older, to assess the relationship with the cognitive function and the variables associated with drug consumption.
Methods: This is an epidemiological, cross-sectional, door-to-door study among the non-institutionalised population in a rural area. Participants were inhabitants aged 75 and older from the Anglès Primary Healthcare Area (Girona). Drug prescriptions were recorded from participants' medicine chest. Cognitive function was assessed using the Mini-Mental State Examination.
Results: A total of 875 individuals took part (82%). Participants with mild and moderate cognitive impairment consumed an average of 4.6 (SD=2.9) and 5.2 (SD=3.2) drugs, participants without cognitive impairment consumed an average of 4 (SD=2.7) drugs ($P<0.005$). In the bivariate analysis, taking into account the degree of cognitive impairment, there was a change in drugs acting on the digestive tract and metabolism ($P=0.003$) and nervous system ($P=0.001$). Multivariate analysis identified four variables associated with the central nervous system drugs: age, sex, comorbidity and suspicion of depression ($P<0.05$).

* Corresponding author.
E-mail: xenia.planas@ias.scs.es (X. Planas-Pujol).
◇ Appendix 1 includes a list of the researchers belonging to the FRADEGI Group.

Conclusions: Participants with severe cognitive impairment had a higher frequency of anti-psychotic and antidepressant drug consumption. However, the multivariate analysis shows that advanced age, female sex and suspicion of depression are variables associated with a higher central nervous system drug consumption.

PALABRAS CLAVE
Envejecimiento;
Consumo farmacológico;
Prevalencia;
Polifarmacia;
Sistema nervioso;
Deterioro cognoscitivo

Perfil de consumo farmacológico y función cognoscitiva en edad avanzada: estudio de población general no institucionalizada

Resumen
Introducción: El consumo de fármacos en la población general se concentra en las personas de edad avanzada. El objetivo del presente estudio fue valorar el perfil farmacológico en ancianos de 75 años y mayores, estimar la relación con la función cognoscitiva y las variables asociadas al consumo farmacológico.
Métodos: Estudio epidemiológico transversal y poblacional puerta a puerta de una muestra de población rural no institucionalizada representativa de los habitantes mayores de 74 años del Área Básica de Salud de Anglès (Girona). La prescripción farmacológica se registró a partir de los medicamentos presentes en el domicilio de los participantes. La función cognoscitiva se evaluó mediante el *Mini-Mental State Examination*.
Resultados: Participaron 875 individuos (82%). Los participantes con deterioro cognoscitivo leve y moderado consumían una media de 4,6 (DE = 2,9) y 5,2 (DE = 3,2) fármacos, superior a los 4 (DE = 2,7) fármacos de media consumidos por los que no sufrían deterioro cognoscitivo ($p < 0,05$). En el análisis bivariante, según el grado de deterioro cognoscitivo existía una variación en el consumo de fármacos del aparato digestivo y metabolismo ($p = 0,003$) y del sistema nervioso ($p = 0,001$). El análisis multivariante identificó cuatro variables asociadas al consumo de fármacos del sistema nervioso: edad, sexo, comorbilidad y sospecha de depresión ($p < 0,05$).
Conclusiones: Los participantes con deterioro cognoscitivo grave presentaron una mayor frecuencia de consumo de antipsicóticos y otros antidepresivos. Sin embargo, el análisis multivariante señala que son la edad avanzada, el sexo femenino y la sospecha de depresión las variables asociadas a un mayor consumo de fármacos del sistema nervioso.

Introduction

Demographic projections show that the population is aging and that the group of elderly people will increase throughout the present century.[1]

Gradual and irreversible changes take place in the structure and function of the organism during aging as a consequence of the passage of time.[2] This process is characterised by an increase in interindividual variability of cognitive functions. Despite this variability, adult age and cerebral aging are characterised in population studies by a certain degree of natural decline of cognitive functions.[3]

The phenomenon of polypharmacy is common in aging. Although there are no unified criteria to define it, from age 75 onwards, it is usually defined as the consumption of more than 5 drugs simultaneously. Under normal circumstances, aging involves a degeneration in the function of some organs, leading to changes in metabolism, distribution, and excretion of drugs.[4] Bearing this in mind, polypharmacy represents an increase in the probabilities of pharmaceutical interactions and in the appearance and severity of secondary effects.[5] This increase in consumption of drugs by the elderly compared to other age groups is mostly due to the fact that age increases the incidence of chronic medical conditions and the probability of combining different diseases.[6]

One of the most common clinical manifestations in this age group is alterations of cognitive function. On a global level, more than 25 million people suffer from dementia.[7] Psychological and behavioural symptoms associated to cognitive deterioration appear during the evolution of this disease and have negative repercussions. Elderly individuals with cognitive deterioration have to cope with the typical manifestations of dementia, together with those of other diseases associated with aging. This situation makes this population subgroup more likely to suffer polypharmacy, drug interactions and side effects from some of the drugs.

Although some studies from other countries have revealed a higher drug consumption by the elderly than by any other age group,[8] there is little information in our country about

the prescription of drugs for the non-institutionalised elderly population. Furthermore, there is no recent information about the pharmaceutical profile of patients based on their cognitive capacity.[9,10]

The FRADEGI study (*Fragilidad y Dependencia en Girona* —Frailty and Dependence in Girona) is a population epidemiology study with the primary objective of determining the prevalence of frailty and dependence in a representative sample of elderly individuals over the age of 74.[11] The objectives of the present study are to describe the pharmacological profile in elders aged 75 years or older, to evaluate the relationship with cognitive function, and to determine the clinical and demographic variables associated to drug consumption.

Material and methods

Type of study and participants

This is a door-to-door, population, epidemiological study carried out on a representative sample of inhabitants aged 75 years or older in the reference zone of the Basic Health Area of Angles (Girona, Spain). This zone consists of 8 rural towns (districts) in the province of Girona (Catalonia, Spain) with a total population of 10,986 inhabitants (according to the 2001 census), out of which 22.86% are over the age of 64 and 16.73% are over 74 years old.

Using the municipal register, we selected a representative sample of inhabitants over the age of 75 based on a simple, stratified and randomized sampling divided by age groups (75-84 years; and 85 years or over). The size of the sample was calculated to estimate the prevalence of fragile elders residing in our community, accepting an alpha risk of 0.05 for an accuracy of ±0.02 percentage units in a bilateral contrast, assuming an estimated prevalence of 20% (75-84 group) and of 40% (85 years or over group). The inclusion criteria were "ordinary resident of the municipalities under consideration (annual residency in the community of at least 6 months or more)" and "signature for informed consent". Exclusion criteria were having been institutionalised (in a retirement home) and lack of contact after 5 telephonic attempts in different time slots and 1 home visit. The process of data collection was carried out in the period between 1 November 2006 and 31 May 2007. The study protocol was approved by the Ethics Committee for Clinical Research of the *Institut d'Assistència Sanitària de Girona*.

Study variables and data collection

All participants were interviewed at their home after having arranged the date and time of the visit by telephone. The home interviews were handled by 11 nursing graduates from the Basic Health Area of Anglès. Before beginning the study, the interviewers were trained to administer the protocol and to homogenise the scoring criteria. A pilot test was performed with 5% of the total sample.

The study protocol included a detailed evaluation of biological, psychological and social characteristics of the participants through standardised instruments. Patient age, gender, civil status and educational level were registered. Starting with this information, a variable called "educational level" was elaborated. This coded the level into 3 categories: illiterate, 5 years or less of schooling and 6 years or more of schooling. The consumption of chronic medications was determined through a register of the drugs that the patients were currently taking, based on the drugs found in their homes during the interview; this was then classified following the *Anatomical Therapeutic Chemical Classification* (ATC) scheme.[12] Polypharmacy was defined as the simultaneous consumption of more than 5 drugs.

The presence of depressive symptoms was determined through a reduced version of the 5 items of the *Geriatric Depression Scale* (GDS-5).[13] This version is an adaptation to Spanish, with a proven sensitivity of 81% and specificity of 77% in the screening of suspected depression in the elderly, for which the cut-off is a score of 1 or more.[14]

A new variable called "comorbidity" was created. It was determined through the sum of the number of chronic pathologies that the participants reported.

Four groups were established in accordance with the scoring of the *Mini-Mental State Examination* (MMSE).[15,16] The scores went from 0 to 30 points, and the lower the score, the higher the degree of cognitive deterioration. The MMSE results were adjusted according to age and educational level. This adjustment consisted of increasing by 2 points the direct score obtained by patients older than 75 with an educational level lower than 8 years; increasing 1 point for those older than 75 years with an educational level of 9 to 17 years; and maintaining the scoring in those participants with an educational level above 17 years.[16] Using the MMSE scores and the criteria proposed by Kramer et al,[17] 5 groups were created (30-24: normal cognitive function; 23-15: light cognitive deterioration; 14-8: moderate cognitive deterioration; 7-4 or equal to or lower than 3 points: severe cognitive deterioration.

The primary source of information were the subjects themselves, except for 16.7% (n=146) of cases who presented severe hearing impairments and/or lack of understanding of the question content. In these cases of suspected low reliability of information, family members were questioned. The MMSE was administered to all subjects except for those with severe hearing impairment (3.7%).

Statistical analysis

A descriptive statistical analysis of all the variables in the study was carried out using central tendency and dispersion techniques for quantitative variables and absolute and relative frequencies for qualitative variables. Stratification was carried out based on the severity of cognitive impairment. Bivariate hypothesis testing techniques were applied to determine the presence of statistically significant differences between the sociodemographic characteristics, drug consumption, and cognitive capacity. Proportions were compared through the Chi-square test (with Yates correction when necessary). Means were compared through the Student t test or the Mann-Whitney U test, according to data distribution. The normality of continuous variables was tested with the Shapiro-Wilk test. Logistic regression was used to determine the clinical and demographic variables associated with the drug consumption groups presenting

differences in relation to the cognitive function. The model was constructed using a stepwise procedure and drug consumption (yes/ no) was used as a dependent variable.

Results were expressed as absolute numbers and percentages, means, standard deviations, odds ratios, and 95% confidence intervals (CI). The level of statistical significance considered in hypothesis tests was 0.05. Data was processed and analysed using the statistical program SPSS version 14.0 for Windows.

Results

Out of 1,245 selected inhabitants, 180 did not fulfil the inclusion criteria (46 were institutionalised; 134 could not be located after 5 attempts and were considered census errors, corresponding to individuals who had moved away and were no longer living in the municipality) and 190 did not agree to participate. In all, 82% of the candidates participated in the study. The mean age was 81.8 years (SD=4.8; range=75-100). Women composed 58.74%(n=514) of the total and had a mean age of 82.07 years (SD=5.00), while men had a mean age of 81.36 years (SD=4.57). There were no significant differences in age and gender between participants and non-participants.

More than half of the participants were married (55.2%; n=483), widowers amounted to 39.7%(n=347) and 5.1 were single (n=45). Regarding educational level, 55.6% had studied for 6 years or more (n=484), 38.5%for 5 years or less (n=355) and 5.9 were illiterate (n=51).

The mean score in the MMSE was 23.53 (SD=6.26), and using the criteria of Kramer et al,[17] 3.7% (n=32) of the elderly obtained a score equal to or lower than 3 points; 0.8%(n=7) between 4 and 7 points; 1.9%(n=17) between 8 and 14 points; 33.9%(n=297) between 15 and 23 points; and 59.73%(n=522) of the participants obtained a score higher than 23 points. Due to the small sample size of the group with 4 to 7 points in the MMSE, the two groups with the lowest scores were combined into one, with MMSE scores equal to or lower than 7 points (severe cognitive

Table 1 Clinical and sociodemographic characteristics by the MMSE score

	MMSE≤7 (n=38)	MMSE=8-14 (n=17)	MMSE=15-23 (n=296)	MMSE=24-30 (n=517)
Age, years(SD)[a]	87.18 (6.73)	87.45 (6.19)	82.40 (4.89)	80.83 (4.10)
Age, no. (%)[b]				
75–79 years	5 (12.8)	2 (11.8)	111 (37.4)	255 (48.9)
80-84 years	11 (28.2)	5 (29.4)	99 (33.3)	186 (35.6)
85 years and over	23 (59.0)	10 (58.8)	87 (29.3)	81 (15.5)
Gender, no. (%)[c]				
Male	9 (23.1)	3 (17.6)	97 (32.7)	252 (48.3)
Female	30 (76.9)	14 (82.4)	200 (67.3)	270 (51.7)
Civil status, no. (%)[d]				
Single	1 (2.6)	1 (5.9)	15 (5.1)	28 (5.4)
Married	25 (64.1)	10 (58.8)	138 (46.5)	174 (33.3)
Widowed	13 (33.3)	6 (35.3)	144 (48.5)	320 (61.3)
[e]*Education, no. (%)*[f]				
Illiterate	7 (20.6)	1 (5.9)	36 (12.1)	7 (1.3)
5 years or less	17 (50.0)	9 (52.9)	133 (44.8)	176 (33.7)
6 years or more	10 (29.4)	7 (41.2)	128 (43.1)	339 (64.9)
Comorbidity				
Mean (SD)	4.4 (2.5)	4.5 (2.4)	4.3 (2.2)	4.0 (2.1)
Suspicion of depression				
No. (%)[g]	5 (71.4)	9 (81.8)	149 (52.7)	195 (38.5)
Drug consumption				
Mean (SD)[h]	4.1 (2.9)	5.2 (3.2)	4.6 (2.9)	4.0 (2.7)

[a] Kruskal-Wallis = 61.881; degrees of freedom (df) = 3; $P<.001$.
[b] Chi-square = 68.791; df = 6; $P<.001$.
[c] Chi-square = 28.897; df = 3; $P<.001$.
[d] Chi-square = 27.310; df = 3; $P<.001$.
[e] There was no information on this variable for 5 individuals.
[f] Chi-square = 80.223; df = 3; $P<.001$.
[g] Chi-square = 23.363; df = 3; $P<.001$.
[h] Kruskal-Wallis = 8.642; df = 3; $P=.034$.

deterioration). Regrouping into 4 groups resulted in a percentage of 4.5% (n=39) for participants with a score lower than 8 points. Table 1 shows the sociodemographic characteristics of participants, stratified according to their MMSE scores. The mean scores in MMSE by groups were: 2.51 (SD=1.88) in the group with severe cognitive

Table 2 Drug consumption by ATC groups stratified by MMSE score

	Consumption (number of drugs)	MMSE≤7 (n=38)	MMSE=8-14 (n=17)	MMSE=15-23 (n=296)	MMSE=24-30 (n=517)
Group A. Digestive and metabolism, no. (%) [a]	0	20 (52.6)	8 (47.1)	156 (52.7)	278 (53.8)
	1	11 (28.9)	2 (11.8)	80 (27.0)	175 (33.8)
	2 or more	7 (18.4)	7 (41.2)	60 (20.3)	64 (12.4)
Group B. Blood and haematopoietic organs, no. (%)	0	29 (76.3)	9 (52.9)	229 (77.4)	412 (79.7)
	1	8 (21.1)	7 (41.2)	59 (19.9)	92 (17.8)
	2 or more	1 (2.6)	1 (5.9)	8 (2.7)	13 (2.5)
Group C. Cardiovascular, no. (%)	0	12 (31.6)	3 (17.6)	62 (20.9)	125 (24.2)
	1	15 (39.5)	4 (23.5)	86 (29.1)	155 (30.0)
	2 or more	11 (28.9)	10 (58.8)	148 (50.0)	237 (45.8)
Group D. Dermatological, no. (%)	0	37 (97.4)	17 (100.0)	295 (99.7)	509 (98.5)
	1	1 (2.6)	—	1 (0.3)	8 (1.5)
	2 or more	—	—	—	—
Group G. Genitourinary, no. (%)	0	33 (86.8)	16 (94.1)	268 (90.5)	457 (88.4)
	1	5 (13.2)	1 (5.9)	27 (9.1)	57 (11.0)
	2 or more	—	—	1 (0.3)	3 (0.6)
Group H. Hormonal therapy, no. (%)	0	38 (100.0)	16 (94.1)	277 (93.6)	479 (92.6)
	1	—	1 (5.9)	16 (5.4)	33 (6.4)
	2 or more	—	—	3 (1.0)	5 (1.0)
Group J. Systemic anti-infectious, no. (%)	0	38 (100.0)	17 (100.0)	291 (98.3)	511 (98.8)
	1	—	—	5 (1.7)	6 (1.2)
	2 or more	—	—	—	—
Group L. Antineoplastic and immunomodulators, no. (%)	0	37 (97.4)	17 (100.0)	287 (97.0)	492 (95.2)
	1	1 (2.6)	—	7 (2.4)	20 (3.9)
	2 or more	—	—	2 (0.7)	5 (1.0)
Group M. Skeletal muscle, no. (%)	0	38 (100.0)	17 (100.0)	294 (99.3)	515 (99.6)
	1	—	—	2 (0.7)	2 (0.4)
	2 or more	—	—	—	—
Group N. Nervous system, no. (%) [b]	0	10 (26.3)	7 (41.2)	98 (33.1)	220 (42.6)
	1	8 (21.1)	3 (17.6)	98 (33.1)	170 (32.9)
	2 or more	20 (52.6)	7 (41.2)	100 (33.8)	127 (24.6)
Group P. Anti-parasitic, no. (%)	0	38 (100.0)	17 (100.0)	296 (100.0)	517 (100.0)
	1	—	—	—	—
	2 or more	—	—	—	—
Group R. Respiratory apparatus, no. (%)	0	36 (94.7)	14 (82.4)	247 (83.4)	457 (88.4)
	1	1 (2.6)	1 (5.9)	27 (9.1)	28 (5.4)
	2 or more	1 (2.6)	2 (11.8)	22 (7.4)	32 (6.2)
Group S. Sensory organs, no. (%)	0	33 (86.8)	16 (94.1)	268 (90.5)	469 (90.7)
	1	5 (13.2)	—	21 (7.1)	29 (5.6)
	2 or more	—	1 (5.9)	7 (2.4)	19 (3.7)

[a] Chi-square = 19.696; degrees of freedom (df) = 6, *P*=.003.
[b] Chi-square = 22.544; df = 6, *P*=.001.
No information was available for any of these variables in 7 individuals.

Table 3 Absolute and relative frequencies of individuals who used drugs for the central nervous system by MMSE score

	MMSE≤7 (n=38)	MMSE=8-14 (n=17)	MMSE=15-23 (n=296)	MMSE=24-30 (n=517)
Antiepileptic (N03), no. (%)	1 (2.6)	0 (0.0)	6 (2.0)	10 (1.9)
Anti-Parkinsonian (N04), no. (%)	2 (5.3)	1 (5.9)	11 (3.7)	13 (2.5)
Antipsychotic (N05A), no.(%) [a]	6 (15.8)	0 (0.0)	8 (2.7)	5 (1.0)
Anxiolytic (N05B), no. %)	6 (15.8)	4 (23.5)	54 (18.2)	100 (19.3)
Hypnotic and sedative (N05C), no. (%)	3 (7.9)	1 (5.9)	24 (8.1)	32 (6.2)
Monoamine reuptake inhibitors (N06AA), no. (%)	1 (2.6)	0 (0.0)	7 (2.4)	11 (2.1)
SSRI (N06AB), no. (%)	7 (18.4)	2 (11.8)	30 (10.1)	49 (9.5)
Other antidepressants (N06AX), no. (%) [b]	7 (18.4)	2 (11.8)	20 (6.8)	20 (3.9)
Against dementia (N06D), no. (%) [c]	5 (13.2)	1 (5.9)	18 (6.1)	11 (2.1)

[a] Chi-square = 37.180; degrees of freedom (df) = 3, *P*<.001.
[b] Chi-square = 16.590; df = 3, *P*<.001.
[c] Chi-square = 16.386; df = 3, *P*=.001.
No information was available for any of these variables in 7 individuals.

deterioration, 11.59 points (SD=1.77) in participants with moderate cognitive deterioration, 20.36 points (SD=2.41) in those who suffered light cognitive deterioration, and 27.30 points (SD=2.07) in those with a normal cognitive function.

Regarding drug consumption in general: 94% (n=824) of the participants took some kind of drug, while 64.4%(n=559) habitually consumed 5 or less drugs. The prevalence of polypharmacy was of 29.7%(95%CI =26.6–32.7).

The mean consumption was 4.25 drugs per patient (SD=2.76). The mean number of drugs taken by participants with severe cognitive deterioration was 4.13 (SD=2.91). Participants with moderate cognitive deterioration consumed 5.24 (SD=3.19), those with light cognitive deterioration used 4.56 (SD=2.87) drugs, and the rest 4.05 drugs (SD=2.66). Significant differences were observed in the mean consumption by groups (Kruskal-Wallis=8.642; degrees of freedom=3; *P*=.035). These results were at the expense of the differences in the mean consumption of drugs between participants without cognitive deterioration and participants with a light cognitive deterioration (Mann-Whitney U=68,353.5; *P*=.011).

Using the ATC classification, the group of drugs most commonly consumed was cardiovascular drugs and drugs for the nervous system. Of the participants, 76.7%(CI 95%=73.9-79.6) consumed medication for the cardiovascular system and 61.4% (CI 95%=58.1-64.7) took drugs for the nervous system. Furthermore, 46.8% (CI 95%=43.4-50.2) of participants took drugs that worked on the digestive system and metabolism and 21.8% (CI 95%=19.4-24.6) took drugs for blood and haematopoietic organs.

Drugs for the respiratory system were used by 13.1%(95% CI=10.8-15.4) of the elderly; 10.8% (CI 95%=8.7-13.0) took drugs for their genitourinary system. Groups of drugs under 10% were those that act upon sensory organs, hormonal therapy, and antineoplastic and immunomodulatory drugs. Approximately 1% of participants took anti-infectious agents, drugs for dermatological conditions, or drugs for skeletal muscles. The consumption of different drugs of the ATC classification in relation with the cognitive function of the participants can be seen in table 2.

Of the nervous system drugs, group N of the ATC classification, and using their drug subtype, 18.9% (CI 95%=16.2-21.6) were anxiolytics (group N05B). The second most common group for the nervous system were selective serotonin reuptake inhibitor antidepressants (SSRI, group N06AB) with 10.1%(CI 95%=8.1-12.2), followed by hypnotics and sedatives (group N05C) with 6.9%(CI 95%==5.2-8.7) and other antidepressants (group N06AX) with 5.6%(CI 95%=4.1-7.2). In a lesser proportion, the elderly aged 74 years or older consumed anti-dementia drugs (group N06D) and anti-parkinsonian drugs (group N04) in a percentage of 4.0%(CI 95%=2.7-5.4) and 3.1% (CI 95%==1.6-3.2), respectively. A minimal proportion of the sample, 2.2% (CI 95%=6-3.2) consumed antipsychotics (group N05A), 2.2%(CI 95%=1.6-3.2) took non-selective monoamine reuptake inhibitors (group N06AA), and 2.0%(CI 95%=1.0-2.9) used antiepileptic drugs (group N03). The distribution of drugs used for the

Table 4 Logistic regression model: variables associated with consumption of nervous system drugs

	OR	CI 95%	*P*
Age	1.062	1.022-1.103	0.002*
Gender			
Male	1	—	—
Female	1.825	1.292-2.579	0.001*
Civil status			
Single	1	—	—
Married	0.761	0.376-1.542	0.448
Widowed	1.434	0.986-2.088	0.059
MMSE	1.001	0.967-1.037	0.940
Suspicion of depression	1.566	1.132-2.166	0.007*
Comorbidity	1.315	1.212-1.428	<0.001*

*P<.005.

nervous system in relation with the MMSE scores is shown in table 3.

A logistic regression model for those variables associated with the consumption of nervous system drugs is shown in table 4. The variables associated with the use of nervous system drugs were female gender (OR=1.825; CI 95%=1.292-2.579; *P*=.001), age (OR=1.062; CI 95%=1.22-1.03; *P*=.002), a suspicion of depression (OR=1.566; CI 95%=1.132-2.166; *P*=.007), and comorbidity (OR=1.315; CI 95%=1.212-1.421; *P*<.001). Despite the fact that differences in the consumption of drugs in the N group were observed in the univariate analysis, MMSE scores were not significantly associated in the adjusted logistic regression model (*P*=.940).

Discussion

The objective of this study was to describe the pharmacological profile in an elderly population over the age of 75, to evaluate the relationship with the cognitive function, and to determine the clinical and demographic variables associated with drug consumption. The main strength of this study comes from being a population study, which guarantees the external validity of these results and allows extrapolation to the general rural population. Another principal strength was the reliability of the information, as data collection was carried out at the participants' homes and drug consumption was established based on the drugs found there.

The mean number of drugs consumed by our population was 4, a figure very similar to that observed in other countries,[18] matching the results from a population study in Denmark with patients of similar ages to ours.[19] Other studies carried out in Spain with a population 65 or more years old detected a lower mean consumption rate, which oscillated from 2.3 to 2.6 drugs.[9,10] This difference might be due to the lower mean age of the population sample. In our study, 6% of the participants did not take any drugs, which matches the range observed in other studies,[8,10,18,19] although differences have been observed in other countries. For example, 2% in a study carried out in Poland[18] or 15% of patients in a study in New Zealand.[8] The prevalence of polypharmacy in our study was 30%, similar to that in other studies with a similar methodology, where polypharmacy was observed in a third of their population samples.[9,18]

Cardiovascular drug consumption was 76.7%. This agrees with most studies, where cardiovascular drugs are without doubt the medication used most, with percentages which oscillate from 30% to 70%.[20-22]

In our study, we observed differences in the mean drug consumption by those patients without cognitive deterioration and those with light or moderate cognitive deterioration. Patients with light and moderate cognitive deterioration presented a higher consumption rate, with a mean of 4.6 and 5.2 drugs compared to the 4 medications taken by participants with no cognitive deterioration. No differences were observed in the mean consumption in participants with no cognitive deterioration and those with severe cognitive deterioration. A possible explanation for this is that suspending treatment with some drugs (such as anticholinesterases used to treat Alzheimer) is usually recommended in subjects having an advanced state of dementia.[23]

The bivariate analysis showed differences in the consumption of drugs that act on the digestive system and metabolism and those that the nervous system in relation with the degree of cognitive deterioration. More specifically, a consumption of 2 or more drugs acting on the digestive system and metabolism was observed in patients with a higher degree of cognitive deterioration. However, the analysis of consumption of the different therapeutic subgroups of this category did not show any differences in relation with cognitive function.

The bivariate analysis revealed an increase in consumption of nervous system drugs in patients with light and moderate cognitive deterioration in comparison with those without cognitive deterioration. The higher the degree of cognitive deterioration, the higher the consumption of nervous system drugs. The explanation could be that patients who suffer deterioration may present a higher prevalence of psychological and behavioural disorders such as anxiety, depression, apathy, disinhibition, or irritability compared to the general population.[24] These symptoms have negative repercussions on patients and their families that usually lead to specific pharmacological treatment being prescribed, and which could explain the higher rate of nervous system drug consumption in patients with suspected cognitive deterioration.

A strong association between the consumption of nervous system drugs and a higher age, female gender, a higher comorbidity and suspicion of depression was observed in the logistical regression model. However, there was no association with MMSE scores. There are different hypotheses that could explain this phenomenon. It is possible that the association detected in the bivariate analysis and not confirmed in the adjusted multivariate model could be the product of a confounding effect. It would be plausible to propose that the control of age and gender variables diluted the effect of MMSE scores. In other words, the degree of cognitive deterioration is related to age and gender and perhaps also with pathologies of geriatric type, which are more common in women, so this would determine the characterisation of groups according to MMSE scores. On the other hand, it is possible to think that the inclusion of a scale that evaluates depressive symptoms in the multivariate model has diluted the effect of cognitive deterioration. In that sense, there is abundant literature that has shown the existence of an association between cognitive deterioration and depression.[25,26] These results match those found in other studies with similar characteristics, where the consumption of drugs was associated to female gender,[8-10,19] higher age and an elevated comorbidity.[10]

Our results do not show significant differences between anxiolytic consumption and SSRI or MAOI antidepressant consumption in patients based on the degree of cognitive deterioration. These consumption figures are in accordance with the high frequency of mental disorders among the elderly population, similar to those observed in other studies carried out in Spanish primary care populations. In those studies, there was a high prevalence (46.1%) of psychiatric disorders in the elderly population[27] and in patients of advanced age treated at their homes, where the prevalence of depression was 77.5%.[28]

Significant differences have been found in the consumption of antipsychotics, other antidepressants, and anti-dementia

drugs. It was observed that a higher proportion of individuals consume these drugs as their cognitive deterioration progressed. The higher the degree of mental deterioration, the higher the consumption of drugs in the "other antidepressants" category; this includes drugs such as trazodone, used widely in dementia for its sedative effect.[29]

The elderly population with cognitive deterioration consume more antipsychotic drugs, as they are indicated mostly for treatment of anxiety, psychosis, and other behavioural alterations. Despite the possible risk associated with atypical antipsychotics in older patients, they are still recommended because of their reduced extrapyramidal involvement as opposed to the typical ones.[30] However, it has not been proven that the risk is lower with atypical antipsychotics than with typical antipsychotics.[31-33]

The basic limitations of this study are that it did not record the daily dosage of drugs taken by participants, the time passed since beginning the treatment, or who prescribed such treatment, and that drug consumption was determined by personal interviews, rather than externally endorsed. This information would have allowed us to know the pharmaceutical profile at that age in more detail.

Regarding internal validity, another limitation to be considered is the absence of a study on interobserver agreement. However, a training process was followed to prepare the interviewers for administering the protocol, and the ample experience and knowledge of the questionnaires in routine clinical practice guaranteed that the effect of this possible bias was as small as possible.

Another limitation to be taken into account is the degree of external validity of this study compared to other populations. In this study, we interviewed a population sample selected through the municipal census of 8 municipalities in the Basic Health Area of Anglès. Consequently, the external validity of these results is probably appropriate for rural areas, but doubts may arise about the degree of representation in urban areas.

The exclusion of institutionalised patients represents another limitation of our study. These patients generally show greater comorbidity and more cognitive deterioration. This slant in selection may have decreased the prevalence of drug consumption, resulting in an underestimation of the Odds Ratios.

Our main results indicate that there are 4 variables independently associated to the consumption of nervous system drugs in the elderly population. Among them are age, gender, and comorbidity, which agrees with the literature reviewed. The third variable is the suspicion of depression, which opens up a new patient profile, in which polypharmacy should be monitored. The results make it clear that there is a need for prudent prescription of drugs in people, mainly women, of advanced age with comorbidity and suspicion of depression. It is indispensable to be careful to avoid undesirable drug interactions and adverse reactions

Conflict of interest

The authors declare no conflict of interest.

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Annex 1

The Researchers of FRADEGI group are:

M. Bonet Marull (*Àrea Bàsica de Salut d'Anglès. Centre d'Atenció Primària d'Anglès. Institut d'Assistència Sanitària*); G. Coenders (*Grup de Recerca en Estadística, Economia Aplicada i Salut [GRECS]. Departament d'Economia. Universitat de Girona*); Ll. Coromina (*Grup de Recerca en Estadística, Economia Aplicada i Salut [GRECS]. Departament d'Economia. Universitat de Girona*); R. Feijóo (*Unitat de Valoració de la Memoria i les Demències. Hospital Santa Caterina. Institut d'Assistència Sanitària*); N. Ferrer-Morell (*Àrea Bàsica de Salut d'Anglès. Centre d'Atenció Primària d'Anglès. Institut d'Assistència Sanitària*); C. Ferriol-Busquets (*Àrea Bàsica de Salut d'Anglès. Centre d'Atenció Primària d'Anglès. Institut d'Assistència Sanitària*); J. Garre-Olmo (*Unitat de Recerca. Hospital Santa Caterina. Institut d'Assistència Sanitària*); D. Juvinyà (*Departament d'Infermeria. Universitat de Girona); F. Peris (Servei de Traumatologia. Hospital Santa Caterina. Institut d'Assistència Sanitària*); L. Vall-Ilosera (*Grup de Recerca en Estadística, Economia Aplicada i Salut [GRECS]. Departament d'Economia. Universitat de Girona*); A. Vilà (*Departament de Pedagogia. Grup de Recerca en Gestió i Administració de Polítiques socials i Culturals. Universitat de Girona*).

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