Dementia, Stroke and Parkinson's Disease in Spanish Populations: A Review of Door-to-Door Prevalence Surveys

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Key Words

Dementia · Alzheimer's disease · Stroke · Parkinson's disease · Prevalence · Epidemiology, aged population

Abstract

We identified 14 door-to-door prevalence surveys on dementia, parkinsonism or stroke in Spanish populations fulfilling specific criteria and combined selected age- and sex-specific data using logistic regression and taking Pamplona as a reference. The prevalence of dementia and of Alzheimer's disease varied significantly with space. However, the largest variation was seen for vascular dementia: odds ratio (OR) and 95% confidence interval (CI) for Gerona were 6.42 (3.23–12.3) in women and 2.30 (1.10–4.79) in men. Stroke was particularly frequent among Arevalo's women, with OR 2.10 and 95% CI 1.26–3.49. The prevalence of Parkinson's disease was twofold higher in Cantalejo. Although differences in

methodology make the interpretation of results problematic, the prevalence of stroke and vascular dementia in Spain seems to vary spatially, indicating a space for prevention.

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Introduction

Data on the incidence and prevalence of dementia, Parkinson's disease (PD) and stroke in Spanish populations are sparse. Furthermore, comparability is low due to differences in survey methodology. Data from populations resident in Pamplona, Gerona and Zaragoza [1–3] have been analyzed by EUROPARKINSON and EURODEM groups funded by the EU BIOMED research program and, at a national level, by the Elderly Neurological Disease Research Group (Grupo de Investigación de Enfermedades Neurológicas en los Ancianos) [4–6]. Al-

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Fig. 1. Geographic location of surveys. Numbers from table 1.

though such pioneering studies have furnished data of high quality, they currently constitute only a part of the reported Spanish surveys focusing on similar entities [7–15].

The aim of this study was to compare reported data on the prevalence of dementia, PD, ischemic stroke and the most important etiological subgroups such as Alzheimer's disease (AD) and vascular dementia (VD). It is well known that prevalence counts for frequent, chronic neurological ailments, generated from diagnoses made in the course of clinical services and registered at community or hospital clinics, constitute underestimates due to the large proportion of undiagnosed individuals affected by such diseases. This undiagnosed proportion is identified, at least in part, in so-called door-to-door surveys, where screening instruments are used in order to detect symptoms, signs or limitations frequently seen in the course of such disorders. For instance, in a recent review of international door-to-door studies of parkinsonism, the proportion of cases diagnosed during the study ranged from 24 to 50% [7]. Accordingly, this review focused on reported door-to-door studies conducted on Spanish populations.

Methods

From a Medline search and personal contacts with authors, we identified reports on screening surveys targeting the prevalence of dementia, parkinsonism and stroke. Requirements for classification as screening surveys were explicit mention of: (1) use of an updated population census for a study population geographically defined by residence; (2) use of a screening instrument in the first phase of the study; (3) a description of the clinical procedure and medical specialist responsible for phase II diagnostic ascertainment; (4) a clear classification in diagnostic categories for assignment of a specific prevalence numerator.

Shown in figure 1 and table 1 are geographic/demographic data and the number of cases reported from different studies. There was a lack of surveys covering populations residing in the southern half of the country. Fourteen surveys were identified, focusing on 18 – sometimes geographically overlapping – study populations and different combinations of the above-mentioned pathologies. For example, the NEDICES/EPICARDIAN study covered populations resident in: Lista, a centrally situated Madrid city district; Margaritas, a suburb in the town of Getafe, located on the outskirts of Madrid, and Arévalo, a village in the Province of Ávila. Six of the study populations were urban (Zaragoza, ZARADEMP, Leganés, Pamplona, El Prat de Llobregat and Santiago de Compostela), 3 semi-rural (Alcoi/Bañeres, Cantalejo and La Selva del Camp), 2 rural (Gerona and Vejer de la Frontera) and 3 mixed, sometimes including rural and urban populations in the same denominator (Toledo, NEDICES/EPICARDIAN, Bidasoa). Eight of the surveys reported prevalence counts for different illnesses in populations ranging from 516 to 3,600 individuals. While some studies focused on only one major entity, such as dementia (Toledo) or parkinsonism (Cantalejo), oth-

Table 1. Door-to-door prevalence surveys of dementia, stroke or parkinsonism

Study	Main researchers	Study population's place of residence	Age years	Number of individuals studied	Main target of study	Prevalence year	Number of cases
(1) Pamplona	J.M. Manubens	Pamplona (Navarre)	>70	1,127	Dementia Parkinsonism	1991	199 dementia
(2) NEDICES/EPICARDIAN	F. Bermejo R. Gabriel	Margaritas (Getafe-Madrid) Lista (Madrid) Arévalo (Ávila)	>64	5,166	Dementia Stroke Parkinsonism Vascular risk factors	1994	29 stroke, 7 transient ischemic attack 179 parkinsonism 280 dementia
(3) Gerona	S. López-Pousa	Gerona	>64	1,414	Dementia Stroke Parkinsonism	1990	186 dementia 44 parkinsonism
(4) Zaragoza	A. Lobo	Zaragoza	>64	1,080	Dementia Depression	1992	59 dementia
(5) Cantalejo	L.E. Clavería	Cantalejo (Segovia)	>59	939	Parkinsonism Epilepsy	1994	27 parkinsonism
(6) La Selva del Camp	J. Pi	La Selva del Camp (Tarragona)	>64	516	Dementia	1992	64 dementia
(7) Leganés	Á. Otero	Leganés (Madrid)	>70	527	Dementia	1999	63 dementia
(8) Toledo	F.J. García	Toledo	>64	3,214	Dementia	1994	94 dementia
(9) Bidasoa	A. Bergareche	Hondarribia (Guipúzcoa)	>65	2,000	Tremor Parkinsonism Dementia Epilepsy Vascular pathology	1996	36 parkinsonism 96 essential tremor
(10) El Prat de Llobregat	R. Reñé	El Prat de Llobregat (Barcelona)	>70	1,754	Dementia Nutritional status	2002	(Ongoing)
(11) Santiago de Compostela	R. Mateos	Santiago de Compostela (La Coruña)	>64	800	Cognitive disorders	2000	Cognitive decline Psychiatric disorders (Ongoing)
(12) ZARADEMP	A. Lobo	Zaragoza	>54	4,803	Dementia Depression Stroke Parkinsonism	2000	283 dementia 54 PD
(13) Alcoi/Bañeres	J. Matías-Guiu	Muro, Bañeres, Alcoi (Alicante)	>60	3,500	Migraine Stroke Dementia Parkinsonism Others	1993	96 migraine
(14) Vejer de la Frontera	J. Acosta Varo	Vejer de la Frontera (Cadiz)	>60	768	Movement disorders Hypertension Epilepsy	1988	66 movement disorders 75 epilepsy

ers covered several disorders. For instance, the NEDICES/EPICARDIAN studies included dementia, parkinsonism and stroke as well as other diagnoses such as essential tremor. The study populations were settled in 10 of 17 autonomous regions, yet the reported results nevertheless corresponded to only 6, encompassing 23,105 individuals over the age of 59 years as denominator.

The following 11 studies addressed dementia: Zaragoza, ZARADEMP [3, 5]; Leganés [8]; Gerona, NEDICES/EPICARDIAN [2]; Alcoi/Bañeres; Pamplona [1]; El Prat de Llobregat; Toledo

[9]; Santiago de Compostela and La Selva del Camp [10]. One study, ZARADEMP [5], was excluded from the review, since neither denominators nor age- and sex-specific data were available. Four studies, NEDICES/EPICARDIAN, Alcoi/Bañeres, El Prat de Llobregat and Santiago de Compostela, had collected data but not yet reported results on dementia. Therefore they were excluded from the analysis. Seven surveys focused on parkinsonism, i.e. NEDICES/EPICARDIAN [11], Gerona [4], Alcoi/Bañeres, Pamplona [1], Bidasoa, Cantalejo [7] and ZARADEMP [16], and 5 on stroke, i.e.

Table 2. Methodological aspects of the screening phase

Study	Screening instrument	Participation	Application	Field workers
(1) Pamplona	Dementia: CAMCOG (modified Spanish version; joint administration to patient and carer); cutoff: <74 score Parkinsonism: questions about previous diagnosis, use of antiparkinsonian drugs; neurological examination: tremor, gait disturbances, clinical impressions	CAMCOG: 90.4% Parkinsonism: 82%	Dementia: individual direct Parkinsonism: not specified	Dementia: 3 trained physicians Parkinsonism: physicians
(2) NEDICES EPICARDIAN	Parkinsonism: Spanish ILSA-adapted version [33] Stroke: Monica Project items [42] and O'Mahony et al. [43]	ILSA-adapted version: 89.2% Monica Project items: 85.6% (urban area), 98.1% (rural area)	Parkinsonism: individual direct, telephone or mail Stroke: individual direct	Parkinsonism: medically uneducated interviewers Stroke: general practitioners or nurses
(3) Gerona	Dementia: MEC, Spanish version of the MMSE; cutoff: 23/24 Parkinsonism: questions on tremor, previous diagnosis, antiparkinsonian drugs; neurological examination: tremor, rigidity and bradykinesia Stroke: screening instrument of the Monica Project [42], identification of stroke defined by the WHO	MEC: 92.4% Parkinsonism: 84% Monica Project: 86.3%	Dementia: individual direct Parkinsonism: not specified Stroke: individual direct	Dementia: 18 previously trained general practitioners and nurses Parkinsonism: physicians Stroke: general practitioners
(4) Zaragoza	Dementia: MEC, Spanish version of the MMSE; cutoff: 23/24 GMS [44] (Spanish version); AGE CAT [45]	MEC: 95.2%	Dementia: individual direct	Dementia: 10 trained medical students
(5) Cantalejo	Parkinsonism: validated method of 9 questions [30]	Parkinsonism: 78%	Parkinsonism: individual direct, relatives	Parkinsonism: local expert field worker
(6) La Selva del Camp	Dementia: MMSE of Folstein et al. [20]; cutoff: 23/24	MMSE: 85.3%	Dementia: individual direct, relative, career	Dementia: not specified
(7) Leganés	Dementia: MMSE of Folstein et al. [20], SPMSQ [46], 7-min test [47], test of informant questionnaire [48], bell test, immediate and long-term recall from a short story, apprenticeship of 6 simple figures, trail-making test form A and subtest of similarities from the WAIS	No screening phase; neurological examination in 1999 of survivors of the 1993 prevalence-study population	Dementia: individual direct, career, telephone	Dementia: 1 neurologist and 1 neuropsychologist
(8) Toledo	Dementia: Spanish version of the MMSE from Folstein et al. [20]; cutoff: 17/18 for illiterates, 20/21 for those with less than primary school and 23/24 for those with primary school education	MMSE: 81.7%	Dementia: individual direct	Dementia: 17 trained psychologists

CAMCOG = Cambridge Cognitive Examination; ILSA = Italian Longitudinal Study on Aging; MEC = Mini Examen Cognitivo; MMSE = Mini Mental State Examination; GMS = Geriatric Mental State Schedule; AGE CAT = Automated Geriatric Examination for Computer-Assisted Taxonomy; SPMSQ = Short Portable Mental State Questionnaire; WAIS = Wechsler Adult Intelligence Score.

NEDICES/EPICARDIAN [12–14], Gerona [15], Pamplona [6], Zaragoza [3] and Alcoi/Bañeres. Reports from studies in Vejer de la Frontera (Cadiz) [17] and Alcoi/Bañeres (Alicante) [unpubl. report], focusing on methods where prevalence data were not available, were not included in the methods review. Ongoing surveys in El Prat de Llobregat (Barcelona) and Santiago de Compostela (Coruña), the results of which were either unpublished or in press, such as those from a survey in a Basque population (the Bidasoa study), were excluded from the analysis. Results on prevalence of PD from ZARADEMP, based on self-reported diagnoses, were likewise excluded [16]. Some studies generated prevalence data for other neurological diseases, e.g. transient ischemic attack in Alcoi/Bañeres [18] and essential tremor in Bidasoa [19].

The review of methods focused attention on: type of screening instrument used; type of application, whether direct (individual, or based on a family or institutional informant) or indirect (mail or telephone interview); interviewer or field worker; collaboration level. With regard to methods in phase II, the review emphasized the qualification of the specialist in charge of diagnosis ascertainment and application of diagnostic criteria, and the use of diagnostic protocols and specialist panels for difficult cases. Results were obtained from reported figures in the form of digits or graphs.

Methods in phase I are summarily described in table 2. Instruments purpose-designed to detect specific entities or health status were used in 4 studies, namely cognitive deterioration in Zaragoza, Toledo and La Selva del Camp, and parkinsonism in Cantalejo. Explicit men-

Table 3. Methodological aspects of diagnostic ascertainment phase

Study	Staff	Participation among screened positive subjects	Diagnostic criteria
(1) Pamplona	Dementia: 7 neurologists using a standardized protocol Parkinsonism: neurologist	CAMCOG+: 100% Parkinsonism: not specified	Dementia: CAMDEX for dementia NINCDS-ADRDA for Alzheimer's disease Hachinski ischemic score for vascular and mixed dementia Parkinsonism: 2 of 4 cardinal signs, i.e. resting tremor, rigidity, bradykinesia and impaired postural reflexes
(2) NEDICES/EPICARDIAN	Parkinsonism: neurologist	Parkinsonism: 97.9%	Parkinsonism: 2 of 4 cardinal signs, i.e. resting tremor, rigidity, bradykinesia and impaired postural reflexes and 4 other sets
(3) Gerona	Dementia: clinical psychologist and neurologist Parkinsonism: neurologists	MEC+: 89.45% Parkinsonism: not specified	Dementia: CAMDEX for dementia and dementia subtypes Parkinsonism: 2 of 4 cardinal signs, i.e. resting tremor, rigidity, bradykinesia and impaired postural reflexes
(4) Zaragoza	Dementia: 3 psychiatrists blind to result of screening phase I	MEC+: 71.4%	Dementia: DSM-III-R
(5) Cantalejo	Parkinsonism: 3 neurologists	Parkinsonism: 100%	Parkinsonism: 8 sets; reference: progression of symptoms in the past with 2 of 4 cardinal signs, i.e. resting tremor, rigidity, bradykinesia and impaired postural reflexes; Webster Scale; Hoehn and Yahr index of illness severity
(6) La Selva del Camp	Dementia: neurologist	MMSE+: 96.7%	Dementia: scale of Blessed et al. [49]; cutoff: ≥ 4 For severity of dementia: DSM-III-R
(7) Leganés	Dementia: 2 independent neurologists	Dementia: DSM-IV	
(8) Toledo	Dementia: 1 geriatrician or 1 psychiatrist (for diagnosis of dementia) supported by 1 neurologist and 1 psychologist (CAMCOG)	MEC+: 85.5%	Dementia: CAMCOG Spanish version DSM-III-R for dementia NINCDS-ADRDA for Alzheimer's disease NINCDS-AIREN for vascular dementia CDR [50] for severity of dementia

CAMCOG = Cambridge Cognitive Examination; CAMDEX = Cambridge Mental Disorders of the Elderly Examination; NINCDS = National Institute of Neurological and Communicative Diseases and Stroke; ADRDA = Alzheimer's Disease and Related Disorders Association; AIREN = Association Internationale pour la Recherche et l'Enseignement en Neurosciences; CDR = Clinical Dementia Rating.

tion but sparse description of screening instruments was found in the Pamplona and Gerona parkinsonism surveys. Direct individual screening was most frequent [1, 2, 5, 7–12, 15], and a relative-informant was used in all studies when direct application was not possible due to death or absence, and in 3 studies [7, 8, 10] this was the primary systematic approach. Two surveys conducted complementary mail and telephone searches of potential cases [8, 11, 12].

As can be seen from table 3, the personnel responsible for phase II clinical diagnoses for dementia were psychiatrists [3] and, most frequently, neurologists [1, 2, 8–11], who in certain instances supervised work initially done by psychologists and geriatricians [9]. For parkinsonism and stroke, diagnoses were always issued by board-certified clinical neurologists. Diagnostic criteria [22–28] and participation are also described in table 3.

We excluded the following from the core multivariate analysis for dementia: data from Toledo, since numerators, 94 dementia cases, were obtained from examining a 42% nonrandom sample of screened positive cases; data from Leganés, where only prevalence among both sexes was reported. Appropriate age groups, which varied for different entities in the core analysis, were chosen for efficient combination of part or all the reported data. Logistic regression was used for multivariate analysis of prevalence of dementia, stroke and PD, with prevalence in Pamplona taken as reference in all cases.

Results

Prevalences selected for analysis are depicted in figure 2 for dementia, AD and VD, and in figure 3 for stroke and PD. A remarkably high proportion of mild dementia versus moderate and severe dementia was evident from the data reported for Gerona. In general, the prevalence of dementia and subtypes increased with age across the sexes, but was highest in women. Insofar as stroke was concerned, when ischemic and hemorrhagic subtypes were included, prevalence increased with age and was highest in Arévalo, despite the figures proving unstable when broken down by sex. PD was most frequent in Cantalejo due to the high prevalence in men aged 80–89 years. The remaining studies and age groups registered similar prevalence patterns.

The results of the multivariate analysis are shown in table 4. Taking Pamplona as reference, the prevalence of mild, moderate and severe dementia was significantly

Fig. 2. Age- and sex-specific prevalence of (mild to severe) dementia, AD and VD. Gerona B: only moderate and severe dementia.

lower in Zaragoza and higher in Gerona and La Selva del Camp, albeit not significantly in the latter, with the odds ratio (OR) ranging from 49 to 138% and differences being highest among women. For AD, differences in prevalence were small, with the lowest levels, 44% of reference values, being registered for women in Zaragoza. Although based on sparse data, the most remarkable differences were for vascular dementia, particularly between Gerona and Pamplona, with a fourfold higher prevalence (OR 4.18, 95% confidence interval, CI, 2.59–6.72) for both sexes, but also perceived in women and men, with OR 6.42 and 95% CI 3.23–12.3 and 2.30 and 1.10–4.79, respectively. Stroke prevalence was significantly higher in Arévalo and Gerona, especially among women in Arévalo, i.e. OR 2.10, 95% CI 1.26–3.49. Compared to Pam-

plona, the highest PD prevalence was registered for Cantalejo, resulting in an over twofold increase in both sexes (OR 2.28, 95% CI 1.27–4.09).

Models other than those used in core analyses, which included data for dementia in both sexes in Leganés and Toledo, and data on AD and VD in Toledo, yielded age-controlled OR similar to those shown in table 4 from core analyses for Gerona, La Selva and Zaragoza but low, statistically nonsignificant OR for dementia in Leganés (0.86, 95% CI 0.63–1.16) and Toledo (0.78, 95% CI 0.59–1.01) and higher OR for VD in Toledo (1.58, 95% CI 0.88–2.86). When, in the same model, data for Gerona referred to prevalence of moderate and severe dementia, the OR was significantly lower, i.e. 0.43 (95% CI 0.32–0.57).

Fig. 3. Age- and sex-specific prevalence of stroke and PD.

Discussion

The results of this study reveal that there is a considerably high degree of geographical variability in Spain, both in the reported prevalence of different major neurodegenerative neurological diseases and stroke, as well as in survey research methods. The most relevant and, at times, paradoxical findings pertain to: (1) low prevalence of AD among women in Zaragoza and (2) high prevalence of VD in Gerona, stroke in Gerona and Arévalo, and PD in Cantalejo. Such variations are difficult to interpret for a number of reasons.

There were instances where the methods review revealed specific flaws, such as incomplete examination of the sample screened positive in Toledo or the residual nature of the Leganés study population. This latter population comprised 527 participants selected from 838 survivors, who were in turn drawn from among 1,283 persons interviewed in a cohort study initiated in 1993 on

1,540 persons [8, 29]. Furthermore, the absence of a screening instrument, replaced by direct examination of the above-mentioned 527 participants by a neurologist, renders interpretation of the negative findings difficult. On occasion, methodological differences were shared by a number of studies, inasmuch as a similar combination of screening instrument, application form and diagnostic criteria were present. In such a case, comparability might be higher for specific studies and entities, e.g. MMSE with a cut-off score of 23/24, participation of over 90% in phase I and over 85% in phase II, and DSM-III-R criteria for dementia were shared by the Zaragoza and La Selva studies.

The reported sensitivity of syndrome-specific [30] or non-syndrome-specific screening instruments for parkinsonism, such as the WHO-SNES modified instrument [31], is high, namely 100%, despite the latter being possibly overestimated, as revealed when an elbow rigidity test was included [32]. In addition, the incidence of PD in men has

Table 4. OR and 95% CI (in parentheses) controlled for age (reference: Pamplona)

	Dementia	AD	VD	Stroke	PD
<i>Men</i>					
Pamplona	1	1	1	1	1
NEDICES/EPICARDIAN (Arévalo + Madrid)					0.80 (0.44–1.47)
NEDICES/EPICARDIAN (Arévalo)				1.11 (0.64–1.92)	
NEDICES/EPICARDIAN (Madrid)				0.64 (0.39–1.07)	
Gerona	1.02 (0.71–1.49)	0.97 (0.57–1.66)	2.30 (1.10–4.79)	1.82 (0.98–3.37)	0.77 (0.36–1.63)
Zaragoza	0.71 (0.45–1.13)	1.09 (0.61–1.96)		1.04 (0.72–1.50)	
Cantalejo					2.23 (1.02–4.86)
La Selva del Camp	1.14 (0.68–1.90)				
<i>Women</i>					
Pamplona	1	1	1	1	1
NEDICES/EPICARDIAN (Arévalo + Madrid)					1.04 (0.51–2.12)
NEDICES/EPICARDIAN (Arévalo)				2.10 (1.26–3.49)	
NEDICES/EPICARDIAN (Madrid)				1.05 (0.65–1.70)	
Gerona	1.44 (1.10–1.91)	0.81 (0.56–1.15)	6.42 (3.23–12.73)	1.45 (0.74–2.85)	1.88 (0.89–3.97)
Zaragoza	0.36 (0.23–0.55)	0.44 (0.27–0.72)		1.10 (0.74–1.65)	
Cantalejo					2.34 (0.95–5.72)
La Selva del Camp	1.47 (0.98–2.22)				
<i>Both sexes</i>					
Pamplona	1	1	1	1	1
NEDICES/EPICARDIAN (Arévalo + Madrid)					0.90 (0.57–1.42)
NEDICES/EPICARDIAN (Arévalo)				1.58 (1.09–2.28)	
NEDICES/EPICARDIAN (Madrid)				0.84 (0.60–1.19)	
Gerona	1.30 (1.04–1.62)	0.87 (0.65–1.17)	4.18 (2.59–6.72)	1.64 (1.04–2.58)	1.25 (0.75–2.08)
Zaragoza	0.48 (0.35–0.66)	0.63 (0.43–0.91)		1.06 (0.81–1.39)	
Cantalejo					2.28 (1.27–4.09)
La Selva del Camp	1.33 (0.97–1.84)				

A Stata 8.0 package was used to fit a logistic fixed effect model with 3 independent, dummy variables, survey, sex and age as described in figures 2 and 3.

recently been reported to be double that of women [11, 33]. These two elements are consistent with the high PD prevalence found in Cantalejo as a result of the extraordinary case-finding effort made in the survey. This would in turn suggest that PD prevalence observed in Pamplona and Gerona, as well as that observed in other European populations [4], might constitute undercounts and a higher-than-reported proportion of PD underdiagnosis.

The considerable variation in stroke prevalence between surveys might be difficult to attribute to methodology, despite the low level of collaboration registered in the NEDICES Lista and Margaritas subpopulations, an aspect particularly stressed by the authors [34] since it reached 77% for elderly women. The high stroke prevalence in Arévalo and Gerona is difficult to explain, though in the case of the Arévalo women it may conceivably be related to rural environment. The modest differences in prevalence of stroke between Gerona and Pamplona, with OR 1.64, might, if mainly due to a variation in stroke incidence, be consistent with small differences in VD prevalence, a feature not fully observed in our study.

The large variation of prevalence of VD might constitute this review's most important finding and may explain the variation in prevalence of dementia when data for both entities are available. Since (1) the proportion of prevalent dementia diagnosed before the survey is infrequently reported but nevertheless low, e.g. 30% in Leganés [8], (2) there is a considerably high degree of variation in participation during screening (range 82–95%) [3, 9] or thereafter (range 71–100%) [5, 9], in the choice of screening instrument, with an ensuing wide margin for differential sensitivity, and in diagnostic criteria, (3) there are important limitations on assigning an etiological diagnosis to 'probable dementia', 44% in the Gerona survey, and (4) concordance in AD diagnosis is modest, with a range for κ of 0.51–0.73 in the best-quality studies [35], it might be reasonable for reported differences in prevalence of dementia or etiological subtypes to be attributed to differences in clinical diagnostic methodology or traditions among specialists. The opposite pattern of dementia distribution by AD and VD subtypes seen in 3 surveys, Zaragoza, Pamplona and Gerona, namely AD 78, 61 and

41% versus VD 11.9 [3], 13 and 38%, may suggest that methods, more restrictive diagnosis of VD diagnosis in Zaragoza and, to a lesser extent, geographical variability in vascular risk factors for dementia, as reflected in the higher frequency of stroke in Gerona (fig. 3), explain the major features of reported dementia prevalence in Spain.

Comparison with international data is not a designated aim of this study. However, the stroke prevalence in Zaragoza was found to be similar to that reported in Rotterdam, Stockholm and the multicenter Italian Longitudinal Study on Aging [6], and the proportion of VD in Zaragoza was found to be low compared to that in Pamplona and other European studies [5].

During the last decade, stroke mortality in the northern half of Spain has been similar to and that in the southern half higher than comparable rates for West European populations [36]. This review suffers from a lack of surveys for southern Spain. The geographical stroke mortality pattern would suggest that in southern Spain frequencies of stroke, VD and dementia in general could be assumed to be higher than those described in available reports. Arterial hypertension, a well-known risk factor for stroke which is insufficiently controlled in Spain [37], may also constitute a risk factor for AD and dementia [38, 39] as the relationship between stroke, vascular risk fac-

tors and AD is quite complex [40]. These facts suggest that the simultaneous study of dementia, stroke and vascular risk factors in Spain, particularly in the south, is crucial for an appropriate etiological diagnosis to be made and preventive measures implemented. Lack of PD diagnosis might be corrected by primary-care facility interventions targeted at selected groups [41].

In brief, despite scant information and methodological heterogeneity, the prevalence of stroke and dementia in Spain may vary geographically. Reported figures for prevalence of PD, dementia and stroke should be cautiously assigned to regional or national Spanish populations, due to the small study size and specific nature of the populations surveyed. Coordinated, harmonized and geographically targeted surveys are called for.

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