Detection of Cognitive Impairment in the Population of Persons Older than 64 Years: First Phase of the Cuida’l Project


Objective. To know the proportion of people with positive result in test.

Design. Cross sectional study in 53 health centers.

Setting. Primary care.

Participants. Aleatory sample of non-institutionalised, older than 64 years patients attended in the 53 health centers.

Measurements. Variables: age, sex, civil status, and educational level. The detection of cognitive deterioration (CD) was carried out in primary care units with Folstein’s Mini Mental Test (MMT) and the Isaacs Set-Test in case of illiteracy. Cut-off points 24 and 27 respectively. CD predictor variables analysis with logistic regression.

Main results. The tests were applied to 4,467 individuals (56.1% females). There were found as possible cases of CD 399 patients (72.2% with MMSE). Positive percentage was 7.78% (95% CI, 5.69%-10.99%) in males and 9.45% (95% CI, 7.31%-12.43%) in female, adjusting with indirect method, according to the 1996 Catalonia list of inhabitants. Significant predictor factors were found with the multivariate analyses: primary educational level in front of illiteracy (OR = 1.40, 95% CI, 1.13%-1.74%) and age-groups: 74-79 years, 75-79 years and ≥ 80 years in front of < 70 years old (OR = 1.48, 95% CI, 1.02%-2.14%, OR = 2.29; 95% CI, 1.60%-3.28% and OR = 5.02; 95% CI, 3.59%-7.03% respectively).

Conclusions. The cognitive deterioration prevalence increases with age and it is less frequent in individuals with higher studies. Using MMSE and Set-Test we found several possible cases of cognitive deterioration in our population.

Key words: Prediction. Screening. Cognitive deterioration. Dementia.

DETECCIÓN DEL DETERIORO COGNITIVO EN POBLACIÓN MAYOR DE 64 AÑOS: PRIMERA FASE DEL PROYECTO CUIDAL.

Objetivo. Estudiar la prevalencia de positivos a un test de detección de deterioro cognitivo (DC) en la población > 64 años de Cataluña y sus factores determinantes.

 Diseño. Estudio transversal multicéntrico.

Ámbito. Cincuenta y tres centros de atención primaria.

Sujetos. Muestra aleatoria de 5.300 individuos (100 por centro) de población adscrita, no institucionalizada > 64 años.

Mediciones. La detección de DC se realizó en las consultas de atención primaria mediante el test Mini Mental State Examination de Folstein (MMSE), y el Set-test de Isaacs en caso de analfabetismo.

Puntos de corte, < 24 (MMSE) o < 27 (Set-test). Análisis de variables predictoras (edad, sexo, estado civil y nivel de estudios) de posible DC mediante regresión logística.

Resultados. Se administró el test a 4.467 individuos (56.1%, mujeres). Se diagnosticaron como posibles casos de DC 399 pacientes (72.2% por MMSE). La prevalencia de positivos se estimó en 7,78% (IC del 95%, 5,69-10,99%) en varones y 9,45% (IC del 95%, 7,31-12,43%) en mujeres, ajustando por el método indirecto según el padrón de Cataluña de 1996. En el análisis multivariado resultaron factores predictores los estudios primarios respecto al analfabetismo (OR =1,40; IC del 95%, 1,13-1,74%) y los grupos de edad: 74-79 años, 75-79 años y ≥ 80 años respecto a los < 70 años (OR = 1,48; IC del 95%, 1,02-2,14%, OR: 2,29; IC del 95%: 1,60-3,28% y OR = 5,02; IC del 95%, 3,59-7,03%, respectivamente).

Conclusiones. La prevalencia de posible deterioro cognitivo aumenta con la edad y es menos frecuente en los individuos con mayor nivel de estudios. Mediante el MMSE y Set-test se detecta un gran número de posibles DC en la población.

Introduction

Of the health problems that most often affect the population of older people, cognitive disorders in behavior and dementia are important because of their magnitude and seriousness, as well as because of their impact on the quality of life of patients, their relatives and their care-givers. Because of the steady aging of the population, these problems, and the resources devoted to coping with them, are expected to increase.

Especially in its early stages, dementia syndrome is diagnosed with detailed neuropsychological tests of the patient’s mental state and an evaluation of his or her functional status, in an attempt to rule out reversible causes of cognitive impairment.

Because of the complexities of evaluating mental state, short screening instruments have been developed for use with patients thought to suffer from cognitive impairment. The Mini–Mental State Examination (MMSE), one of the most widely used tests internationally, has been translated and validated for use with Spanish-speaking persons. Depending on which version and cut-off score are used, sensitivity of the test can be very high (close to 100%) and specificity can reach 86%.

For these reasons the National Institute of Neurological and Communicative Disorders and Stroke–Alzheimer’s Disease and Related Disorders Association (NINCDS–ADRDA) recommends the MMSE for use as a screening instrument to detect possible cognitive impairment in epidemiological studies.

The aim of this study was to calculate the prevalence of patients with a positive result on a test used to detect possible cognitive impairment in a sample of persons older than 64 years who received primary care at public health system centers in Catalonia.

Population and method

This study was done as part of the Cuida’l Project, and reports the findings obtained in the first phase of the project.

Design

This cross-sectional study was done in a random sample of persons older than 64 years who were on the list of patients served by 53 primary health care centers in Catalonia.

Inclusion and exclusion criteria

We randomly selected a total of 5300 patients (100 patients per center). Participants were recruited with phone calls (three calls at different times of the day, one on the weekend) or when they came to the center for other reasons. We excluded institutionalized patients and itinerant patients with a temporary home address (and who were expected to be at this address for less than 6 months). Participation in a home care program was not an exclusion criterion.

General scheme of the study

Cross-sectional multicenter study of the prevalence of cognitive impairment in the population older than 64 years in Catalonia.

The number of subjects included allowed us to estimate an expected prevalence of approximately 10% in different subgroups, at a 95% level of confidence and a precision of 2%, based on a study design that stipulated selection by primary care center (design effect).

Measurement of variables

The measurement instrument was the MMSE; for patients who indicated they could not read or write we also used Isaacs Set Test.

Practitioners were trained in the use of these measurement instruments in sessions with standardized cases to ensure that a common set of criteria was used. The tests were given by members of the patient’s usual primary care team (physician or nurse).

Information about age, sex, highest level of education and marital status was also recorded. All data were obtained during the period from January to June, 1999.
Criteria used to determine positive results
Patients were considered to have possible cognitive impairment if their MMSE score was lower than 24. If the patient was illiterate, possible cognitive impairment was considered to exist when the Set Test score was below 27 or when the MMSE score was lower than 19.

Strategy for data analysis
Because participants were selected randomly from the patient lists of each center, the effect of this design was taken into account when we calculated the prevalence of possible cognitive impairment. We defined the variance as the sum of variances within each center. The resulting figure was then adjusted by the indirect method for the population of Catalonia as determined from the 1996 census. Bivariate analysis was done with the chi-squared test and Student’s t test or analysis of variance (ANOVA). Multivariate analysis was based on a logistic regression model with presence of cognitive impairment (code 0, no impairment; code 1, impairment) as the dependent variable and all other variables as prognostic factors. The variables age (with 60-64 years as the reference category), marital status (with married as the reference category) and level of education (with primary education or lower as the reference category) were also included.

Results
Of the 5300 patients selected, 4467 (84%) took part in the study. The reasons for nonparticipation were patient’s refusal or inability to locate the patient (710 persons), death (4 persons), or administrative error (9 persons). Of the 4577 remaining persons, a further 110 were excluded later because of errors in the use of the cognitive impairment detection protocol. Persons who did not participate did not differ significantly in age or sex from participants.

Mean age of the patients was 74.5 (6.4) years. All other characteristics are summarized in Table 1.

With the cut-off scores used for the present study, we detected 399 patients as possible cases of cognitive impairment (72.3% with the MMSE). The percentage of positive results was estimated as 7.8% (95% CI, 5.3%-10.0%) in men and 9.5% (95% CI, 6.9%-12.0%) in women, after adjustment with the indirect method for the 1996 Catalonia census. Table 2 shows the results according to age group and sex.

The results of the multivariate analysis are given in Table 3. The risk of possible cognitive impairment increased with age, and was fourfold as high in the group of participants aged 80 years or older in comparison to the 60-64-year-old group. Persons who had been educated past the primary school level had a lower risk (OR, 0.63; 95% CI, 0.41%-0.98%). For unmarried and widowed persons the odds ratio was greater than 1, which was a statistically significant result for both variables.

### Table 1

<table>
<thead>
<tr>
<th>Characteristics of the patients</th>
<th>Negative (N=4068)</th>
<th>Cognitive impairment (N=399)</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>1799 (44.2%)</td>
<td>161 (40.4%)</td>
<td>1960 (43.9%)</td>
</tr>
<tr>
<td>Married</td>
<td>2548 (63.1%)</td>
<td>195 (49.1%)</td>
<td>2743 (61.8%)</td>
</tr>
<tr>
<td>Unmarried</td>
<td>180 (4.5%)</td>
<td>25 (6.3%)</td>
<td>205 (4.6%)</td>
</tr>
<tr>
<td>Widowed</td>
<td>1260 (31.2%)</td>
<td>173 (43.3%)</td>
<td>1433 (32.3%)</td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>53 (1.3%)</td>
<td>4 (1.0%)</td>
<td>57 (1.3%)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate/Functional illiterate</td>
<td>1988 (49.1%)</td>
<td>171 (43.4%)</td>
<td>2159 (48.6%)</td>
</tr>
<tr>
<td>Primary</td>
<td>1649 (40.7%)</td>
<td>199 (50.5%)</td>
<td>1848 (41.8%)</td>
</tr>
<tr>
<td>Higher than primary</td>
<td>412 (10.2%)</td>
<td>24 (6.1%)</td>
<td>436 (9.8%)</td>
</tr>
<tr>
<td><strong>Screening test: MMSE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMSE</td>
<td>2674 (65.7%)</td>
<td>288 (72.2%)</td>
<td>2962 (66.3%)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65-69 years</td>
<td>1088 (27.2%)</td>
<td>48 (12.3%)</td>
<td>1136 (25.9%)</td>
</tr>
<tr>
<td>70-74 years</td>
<td>1204 (30.2%)</td>
<td>80 (20.5%)</td>
<td>1284 (29.3%)</td>
</tr>
<tr>
<td>75-79 years</td>
<td>938 (23.5%)</td>
<td>97 (24.9%)</td>
<td>1035 (23.6%)</td>
</tr>
<tr>
<td>≥80 years</td>
<td>763 (19.1%)</td>
<td>165 (42.3%)</td>
<td>928 (21.2%)</td>
</tr>
</tbody>
</table>

CI indicates confidence interval.
and it has thus been suggested that a logistic model would best explain the relationship between the frequency of cognitive impairment and age. According to this model the prevalence of dementia should level off at 40% at the age of 95 years.

Some studies have found a greater prevalence of cognitive impairment in women, which might be explained by the greater incidence of dementia, which is relatively independent of age before 80 years, and by the lower mortality in women. However, in our sample the difference between sexes was not statistically significant in any age group.

The role of educational level in the risk of developing dementia is controversial. In the present study possible cognitive impairment was less frequent in persons with schooling past the primary level, compared to the rest of the participants, after adjustment for age, sex and marital status. This finding is consistent with other studies, which found that higher levels of education were associated with lower probabilities of dementia at old age, especially in women. Several different biological mechanisms may that account for this association, but noteworthy among them is the fact that higher educational level and socioeconomic level are related with lower frequencies of cerebral vascular disease. In fact, most patients with dementia have a combination of vascular and Alzheimer-like diseases. It is assumed that persons with more years of education and a higher socioeconomic level have a healthier lifestyle and receive more and better medical care, and that their brains will acquire fewer lesions, especially in the

### Discussion

The prevalence of possible cognitive impairment in our population of persons older than 64 years was 9.5% in women and 7.8% in men. The epidemiological pattern was similar to that seen in other studies of the prevalence of dementia in other populations in our setting. The prevalence increased with age, a finding that was not affected by adjustment for age, marital status or educational level. Jorm et al analyzed this finding and concluded that the prevalence of moderate to severe dementia doubled every 5 years, approximately, according to an exponential model. A systematic review and another Spanish study showed that this tendency toward an exponential increase weakened after the age of 85 years.

### Table 3: Risk factors associated with possible cognitive impairment in a logistic regression model

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>OR (Lower 95% CI)</th>
<th>Upper 95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher than primary</td>
<td>0.63 (0.41)</td>
<td>0.96</td>
<td>0.042</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>1.69 (1.07)</td>
<td>2.66</td>
<td>0.024</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.29 (1.02)</td>
<td>1.63</td>
<td>0.031</td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>1.00 (0.35)</td>
<td>2.82</td>
<td>0.998</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>74-79 years</td>
<td>1.45 (1.00)</td>
<td>2.09</td>
<td>0.050</td>
</tr>
<tr>
<td>75-79 years</td>
<td>2.18 (1.52)</td>
<td>3.12</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>≥80 years</td>
<td>4.29 (3.04)</td>
<td>6.07</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

### Table 4: Prevalence of cognitive impairment and dementia in Spanish studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Population</th>
<th>Screening instrument/Diagnostic instrument</th>
<th>Age (older than)</th>
<th>No.</th>
<th>Prevalence impairment/confirmed dementia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pérez Gómez</td>
<td>1992</td>
<td>Pamplona</td>
<td>MMSE/DSM III</td>
<td>64 no institutionalized</td>
<td>393</td>
<td>24.9/8.9</td>
</tr>
<tr>
<td>Boada</td>
<td>1993</td>
<td>Barcelona</td>
<td>MCE</td>
<td>64 noninstitutionalized</td>
<td>369</td>
<td>8.67</td>
</tr>
<tr>
<td>Pí</td>
<td>1996</td>
<td>La Selva del Camp</td>
<td>MMSE/DSM III</td>
<td>64 institutionalized</td>
<td>363</td>
<td>56</td>
</tr>
<tr>
<td>López Poussá</td>
<td>1995</td>
<td>8 towns in Gerona</td>
<td>MCE/CAMDEX</td>
<td>64 noninstitutionalized</td>
<td>440</td>
<td>30.5/14.9</td>
</tr>
<tr>
<td>Lobo</td>
<td>1995</td>
<td>Zaragoza</td>
<td>DSM III-R</td>
<td>64 noninstitutionalized</td>
<td>244</td>
<td>17.2/13.93</td>
</tr>
<tr>
<td>González Moneo</td>
<td>1997</td>
<td>Barcelona</td>
<td>MMSE</td>
<td>64 noninstitutionalized</td>
<td>1080</td>
<td>5.5</td>
</tr>
<tr>
<td>Vilalta Franch</td>
<td>2000</td>
<td>8 towns in Gerona</td>
<td>MCE/CAMDEX</td>
<td>74 noninstitutionalized</td>
<td>1460</td>
<td>22.9/16.3</td>
</tr>
<tr>
<td>García García</td>
<td>2000</td>
<td>Toledo</td>
<td>MMSE with different cut-off scores</td>
<td>64 noninstitutionalized</td>
<td>3214</td>
<td>22.3/7.6</td>
</tr>
<tr>
<td>Bermejo</td>
<td>2001</td>
<td>Margaritas, Lista, Arévalo</td>
<td>MMSE + Pfeiffer</td>
<td>64 noninstitutionalized</td>
<td>5278</td>
<td>56.4</td>
</tr>
</tbody>
</table>

MMSE indicates Mini-Mental State Examination; DSM III, Diagnostic and Statistical Manual of Mental Disorders; MCE, Mini-Cognitive Examination; CAMDEX, Cambridge Mental Disorders of the Elderly Examination.
What is known about the subject

- The detection of cognitive impairment requires complex testing, which has favored the development of short screening instruments.
- The risk of possible cognitive impairment is associated with age according to an exponential function.
- The frequency of possible cognitive impairment seems to be lower in persons with higher levels of education.

What this study contributes

- The results of our study are similar to those of earlier published studies.
- In an extensive sample, we confirmed the epidemiological pattern reported earlier for possible cognitive impairment.
- Pragmatic, multicenter research done in actual conditions of the primary care setting reveals both the problems and the potential advantages of such studies.

...important methodological differences in the screening instruments used in different studies, in the age of the population, and in the inclusion or exclusion of institutionalized patients. Table 4 summarizes the main findings in these studies.

Limitations of the study

Although it was not a major aim of the Cuida’l Project, the first phase of the study detected possible cases of cognitive impairment that will later need to be verified with detailed neuropsychological examination. However, no patient with a cut-off score on the screening tests above the figure we used to identify possible cases of cognitive impairment was referred for further testing. As a result, the exact likelihood ratio for dementia in our study population cannot be determined.

The range of scores on the MMSE is influenced by the level of education, and is higher for subjects with higher levels of education. If a single cut-off score is used, the number of false negatives among persons with more years of schooling increases, as does the number of false positives among persons with fewer years of schooling. In the present study this effect was offset in part by using two instruments (one specifically for illiterate patients) and two different cut-off scores for the MMSE.

A further limitation might be the large number of researchers involved, and hence interobserver variability, although we tried to reduce this to a minimum with previous training in the administration of the MMSE and the Set Test.

Future lines of research

A number of questions regarding the detection and diagnosis of cognitive impairment remain unanswered: the tests we used are sensitive, but the results we obtained are closely linked to age and educational level. Moreover, because these tests are not designed to diagnose dementia, they cannot take the place of more extensive neuropsychological studies for persons suspected of suffering cognitive impairment. In addition, more reliable tests are needed for the illiterate population; analysis of the agreement between the results of the Set Test and the MMSE might well shed light on this issue.

1Cuida’l Project researchers

References


Dementia, and specifically Alzheimer’s disease, constitutes a twenty-first century epidemic. Editorials like this one are frequent in the press and in scientific journals, and offer a mostly accurate picture of reality, as graying of the population is expected to increase the number of cases of dementia. As a secondary effect we can expect to see an increase in the number of dependent persons, with a consequent rise in social and health service costs. None of this is anything new; however, although this information has been available for some time, social and health programs aimed at providing solutions to the problem have not been developed. For this reason initiatives such as the Cuida’l Project deserve admiration and support, as the results shed light on a number of aspects of the epidemiology of dementias in Spain, and on the efficacy of possible interventions.

The results published by Limón et al confirm data from earlier international studies, but confirmation should not be considered redundant information, as it is important to provide a transcultural view of the situation. It is not a simple matter to identify all general phenomena which occur invariably with aging, or to determine which processes are fomented by age or aging, and how they are affected by socioeconomic conditions. What may be the case for one population within a specific ecosystem may not hold for another population.\(^1\) This is especially important in the study of dementias. Declining cognitive function is a continuous process throughout life, which can give rise to disability or illness when the decline surpasses what are considered the normal thresholds. Multiple protective, predisposing or precipitating factors influence the transformation of a physiological decline in intellectual functioning into disability or dementia.

Epidemiological studies in different populations should help to identify those factors which are essential from those which behave as confounding variables.\(^2\) Education, lifestyle (a difficult factor to define and categorize) and cardiovascular risk factors, all of which are interrelated, have been investigated as independent factors that influence the appearance of dementias. A higher level of education appears consistently as a protective factor in studies of different populations, and the reasons for this have yet to be clarified. Exactly why higher levels of education or previous intellectual work-out protect against cognitive impairment is not known. This may be a characteristic of the cohort effect within a given population; in other words, an effect that reflects exposure of the population to other risk factors in previous years that may or may not influence the development of dementia (the higher the educational level, the fewer unhealthy behaviors). Cognitive impairment may also be more likely to occur in persons whose central nervous system has not been reinforced by prior training. In other words, a situation of «impairment from the non-stimulation of cognitive reserves» might emulate «pathologies arising from disuse» that increase the central nervous system’s susceptibility to the action of other stress factors. Nevertheless, a third hypothesis cannot be ruled out, ac-

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**Key points**

- Dementia is an epidemic that requires the development of coherent intervention programs.
- Epidemiological studies should make it possible to distinguish between factors that are closely related with the development of dementia and factors that behave as confounding variables for a given population.
- Age is invariably associated with the presence of dementia. The precise significance of associations between dementia and level of education or sex are unknown.
- Differences in the methods used and the lack of precision of brief neuropsychological tests are among the greatest problems in epidemiological studies of cognitive impairment.
cording to which the incidence of dementia is lower in pa-
tients with higher levels of education because of their ca-
pacity to perform better on short neuropsychological
tests.\textsuperscript{2,3} Only the results of a series of longitudinal studies
will clarify this issue.

It is no surprise that the results of the study by Limón et
al confirm earlier findings that established a clear rela-
tionship between age and cognitive impairment. Age may
be a factor that determines how much time is necessary for
noxious factors to damage intellectual functioning. How-
ever, the lack of a relationship between cognitive impair-
ment and sex contrasts with earlier findings from other
studies. There is no clear biological evidence to account for
the difference between sexes, or for the differences be-
 tween men (or between women) from different populations.
This raises questions that justify the need for further epi-
demiological studies.

Epidemiological studies are always beset by methodologi-
cal difficulties in establishing a diagnosis of dementia on
the basis of the results of a brief neuropsychological exa-
mination,\textsuperscript{4} and this in turn makes it difficult to compare
findings across studies. Of note is the caution Limón et al
have used to report their results in terms of «possible cog-
nitive impairment», in view of the methodological limita-
tions. We must await the findings for large series of cases
of cognitive impairment diagnosed as dementia, and for all
such persons who subsequently develop dementia on the
basis of different cut-off scores on the Mini-Mental State
Examination. Future stages of the Cuida\'l study should al-
so make it possible to identify other characteristics of the
population, such as the influence of health care branding
on consumer behavior, changes in family and care-giver
profiles, relationships with other risk factors, and the ca-
pacity of the social and health care system to respond to
the need for large-scale screening for dementia in primary
care.

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