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Frailty in the elderly living in the community with and without prior cerebrovascular disease

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KEYWORDS
Ageing;
Frail elderly;
Stroke;
Delivery of health care

Abstract
Objective: To determine the prevalence of frailty in elderly people living in the community with and without cerebrovascular disease (CVD) and describe the main sociodemographic and clinical characteristics of these patients.
Material and method: Descriptive and cross-sectional study carried out between January and July 2016 in elderly people living in two specific areas of northern Portugal. Data were collected using a sociodemographic and clinical questionnaire. The existence of previous CVD was evaluated through an initial assessment and application of the Charlson Comorbidity Index. Frailty was assessed using the criteria of phenotypic methodology.
Results: A total of 435 participants, aged >65 years (mean = 74.3 years), mostly women (62.3%), were studied. Six point nine percent of the elderly people had a history of CVD. The prevalence of frailty syndrome was 60.0% in the elderly people with a history of CVD, and 20.5% in the other cases (p < 0.05). Statistically significant relationships (p < 0.05) were found between CVD and vision problems, fear of falling, hospitalisations in the last year, use of walking aids and perception of health status.
Conclusion: Most of the elderly with a history of CVD were frail. According to the phenotypic theory, frailty is a state that precedes total dependence. The diagnosis and management of frailty may help to prevent adverse events that precipitate the institutionalisation of the elderly with CVD.
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PALABRAS CLAVE
Envejecimiento; Anciano frágil; Accidente cerebrovascular; Prestación de atención de salud

Fragilidad en ancianos que viven en la comunidad con y sin enfermedad cerebrovascular previa

Resumen
Objetivo: Determinar la prevalencia de fragilidad en ancianos que viven en la comunidad con y sin enfermedad cerebrovascular (ECV) y describir las principales características sociodemográficas y clínicas que presentan dichos pacientes.
Material y método: Estudio descriptivo y transversal realizado entre enero y julio de 2016 en personas mayores residentes en 2 zonas concretas del Norte de Portugal. Los datos se han recogido mediante un cuestionario sociodemográfico y clínico. La existencia de ECV previa se evaluó a través de una valoración inicial y aplicación del Índice de comorbilidad de Charlson, y la fragilidad utilizando los criterios de la metodología fenotípica.
Resultados: Se estudiaron 435 participantes, de edad > 65 años (media = 74,3 años), siendo en su mayoría mujeres (62,3%). El 6,9% de los ancianos tenía antecedentes de ECV. La prevalencia del síndrome de fragilidad fue de 60,0% en los ancianos con antecedentes de ECV y 20,5% en los restantes casos (p < 0,05). Relaciones estadísticamente significativas (p < 0,05) fueron encontradas entre ECV y problemas de visión, miedo a caer, hospitalizaciones en el último año, uso de ayudas para caminar y percepción del estado de salud.
Conclusión: La mayoría de los ancianos con antecedentes de ECV eran frágiles. Según la teoría fenotípica la fragilidad es un estado que precede a la dependencia total. El diagnóstico y la gestión de la fragilidad podrán ayudar a la prevención de eventos adversos que precipiten la institucionalización del anciano con ECV.
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Introduction

There has been a demographic shift in Europe marked by the progressive ageing of the population. In Portugal, in particular, the proportion of elderly people in the population structure has significantly increased due to falling birth rates, increased life expectancy and the recent emigration phenomena.1

The ageing population and consequent increase in associated chronic disease pose a major challenge for health and social protection systems. New health policies are based on networked care to promote wellbeing, better management of hospital admissions and discharges, and improving long term care and continuity.2 One of the main objectives of these new policies it to keep elderly people engaged with their families and their communities for as long as possible and with the best possible quality of life.1

Given this scenario, it is important to understand the health-related circumstances in which we can intervene after a correct diagnosis, as in the case of frailty syndrome. The literature defines frailty syndrome as a clinically recognisable state of vulnerability and decline in physiological reserves, which makes these people weak and compromises their ability to cope with everyday stress.3 This state of vulnerability is considered a predictor of adverse events on health, such as institutionalisation or dependency.4 According to this theory, dependency in the elderly is difficult to reverse, and is usually preceded by a state of frailty, in turn preceded by a state of prefrailty.5

The perspective that dependency has preceding conditions opens a real way forward towards its prevention. Frailty, therefore, is understood as a syndrome that can be identified by a frailty phenotype according to the presence of at least 3 of the following clinical criteria: involuntary weight loss, fatigue/exhaustion, low physical activity, slow walking speed and reduced muscle strength.1

There is a wide range of prevalence levels of frailty syndromes in elderly people living in the community (4–59%).5 A study performed in the European context concluded that the prevalence of frailty is greater in the southern countries, indicating rates of 15% in France, 23% in Italy and 27.3% in Spain.6 A research study on the elderly living in rural
Frailty in the elderly with and without prior CVD

Portuguese communities found a prevalence of frailty of 34.9%. The evidence suggests that frailty increases with age, it is more common in women and associated with chronic disease. Early diagnosis and prompt intervention reduce the risk of dependency, institutionalisation, hospitalisation and death.

If there are underlying diseases frailty is increased by a lack of reserves and energy in the various organs and systems, such as the musculoskeletal, endocrine and cardiovascular systems.

Strokes increase in incidence with age and are a major cause of incapacity. With improved health care more patients are surviving and returning home after the acute phase of a stroke, irrespective of its severity and type, many of them requiring continuous care and rehabilitation.

Although most patients with prior cerebrovascular disease (CVD) have functional limitations that are characteristic of the frail elderly, such as difficulty in walking and low muscular strength, frailty has been little studied in this population. Functionality assessment in undertaking activities of daily living and other nursing diagnoses for the elderly could be complemented, and be relevant from a care perspective, by evaluating their state of frailty. Gaining an understanding of this will improve follow-up and healthcare for people with CVD.

In light of all of the above, we undertook a study with the following objectives: (a) to determine the prevalence of frailty in elderly people living in the community with and without CVD; (b) to describe the principle socio-demographic characteristics of these elderly people; and (c) to analyse the existing differences, for each criterion of frailty in both groups.

Material and method

A cross-sectional study performed between January and July 2016, on people over the age of 65 years and resident in the municipalities of Murça and Alfândega da Fé (Province of Trás-os-Montes, Portugal). The total population of elderly people in these municipalities comprises 3334 individuals. The sample size was estimated for a sampling error of 5%, a 95% confidence level an expected proportion of 50%, adding 20% for possible losses. By random sampling stratified by geographical area, the participants were selected from lists provided by the municipal councils, and within each municipal council, a number of participants proportional to its size in the total population. The following inclusion criteria were applied: (a) independent walking, albeit with walking aids; (b) able to imitate exercises and answer simple questions, albeit with the help of family members; and (c) with no major cognitive impairment, assessed by the Short Portable Mental Status Questionnaire.

All the interviews and assessments were undertaken in spaces provided by the municipal councils, according to uniform criteria and procedures, established in a previous meeting with the research group. A socio-demographic questionnaire was used recording variables of age, gender, marital status, level of education, employment and family situation. The sensory assessment covered sight and hearing problems reported by the respondents using dichotomous (yes/no) questions. Other clinical variables were the amount of daily medication, fear of falling, whether they had been hospitalised in the past year, the use of walking aids, and their perception of their state of health. The socio-demographic and clinical questionnaire was created from studies of a similar nature, those of the Galician Society for Geriatrics and Gerontology in particular.

The frailty variable was assessed using Fried’s phenotype, which measures 5 main criteria: unintentional weight loss, self-reported exhaustion, low physical activity, slow walking speed and weakness. Unintentional weight loss (≥4.5 kg in the past year or ≥5% of body weight in a year) was measured using Becken® Musa digital scales, in bare feet and light clothing. We compared the result with that which the elderly person reported for the preceding year and if necessary checked whether the weight loss was intentional.

Fatigue/exhaustion was assessed using 2 items from the Center for Epidemiologic Studies Depression Scale. Applying the items “everything is an effort” and “I don’t feel like doing anything” to the past week, fatigue was considered when the respondents confirmed having these feelings 3 or more days per week, according to methodologies recommended in previous studies.

Physical activity was assessed using the Minnesota Leisure Time Activities questionnaire. The basal metabolic rates were calculated from the frequency and duration of each activity assessed. After these calculations, the elderly people were classified in terms of energy expended as: sedentary, moderately active, active and very active. Those that were classified as sedentary or moderately active were considered to have low physical activity.

Walking speed was assessed by measuring the time needed to walk 4.57 m and adjusting the test results by gender and height. The test was carried out on
Table 2  Association between cerebrovascular disease and socio-demographic and clinical variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Elderly people with CVD (n = 30)</th>
<th>Elderly people without CVD (n = 405)</th>
<th>Sample (n = 435)</th>
<th>p*  **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M ± SD), median [average range]</td>
<td>(76.2 ± 7.2) 77.0 [251.2]</td>
<td>(74.2 ± 7.1) 73.0 [215.5]</td>
<td>(74.3 ± 7.1)</td>
<td>0.134</td>
</tr>
<tr>
<td>Amount of daily medication, mean (±SD) Median [average range]</td>
<td>(6.2 ± 3.8) 5.5 [291.8]</td>
<td>(3.7 ± 2.7) 3.0 [212.6]</td>
<td>(3.9 ± 2.8)</td>
<td>0.001</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>17 (6.3)</td>
<td>254 (93.7)</td>
<td>271 (100.0)</td>
<td>0.509</td>
</tr>
<tr>
<td>Male</td>
<td>13 (7.9)</td>
<td>151 (92.1)</td>
<td>164 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Employment situation, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>28 (7.5)</td>
<td>345 (92.5)</td>
<td>373 (100.0)</td>
<td>0.218</td>
</tr>
<tr>
<td>Working</td>
<td>2 (3.2)</td>
<td>60 (96.8)</td>
<td>62 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Impaired sight, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>27 (8.3)</td>
<td>297 (91.7)</td>
<td>324 (100.0)</td>
<td>0.043</td>
</tr>
<tr>
<td>No</td>
<td>3 (2.7)</td>
<td>108 (97.3)</td>
<td>111 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Impaired hearing, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16 (8.2)</td>
<td>178 (91.8)</td>
<td>194 (100.0)</td>
<td>0.318</td>
</tr>
<tr>
<td>No</td>
<td>14 (5.8)</td>
<td>227 (94.2)</td>
<td>241 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Fear of falling, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26 (8.8)</td>
<td>269 (91.2)</td>
<td>295 (100.0)</td>
<td>0.022</td>
</tr>
<tr>
<td>No</td>
<td>4 (2.9)</td>
<td>136 (97.1)</td>
<td>140 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Hospitalised in the past year, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (15.3)</td>
<td>61 (84.7)</td>
<td>72 (100.0)</td>
<td>0.002</td>
</tr>
<tr>
<td>No</td>
<td>19 (5.2)</td>
<td>344 (94.8)</td>
<td>363 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Help in walking, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16 (15.8)</td>
<td>85 (84.2)</td>
<td>101 (100.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>No</td>
<td>14 (4.2)</td>
<td>320 (95.8)</td>
<td>334 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Self-perceived health, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>2 (2.0)</td>
<td>98 (98.0)</td>
<td>100 (100.0)</td>
<td>0.006</td>
</tr>
<tr>
<td>Average</td>
<td>18 (6.7)</td>
<td>249 (93.3)</td>
<td>267 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>10 (14.7)</td>
<td>58 (85.3)</td>
<td>68 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Family situation, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lives alone</td>
<td>2 (1.7)</td>
<td>113 (98.3)</td>
<td>115 (100.0)</td>
<td>0.011</td>
</tr>
<tr>
<td>Lives with family</td>
<td>28 (8.8)</td>
<td>292 (91.3)</td>
<td>320 (100.0)</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation; CVD: cerebrovascular disease; M: mean.
* Mann-Whitney U test for quantitative variables.
** Chi-squared test for qualitative variables.

firm and even ground, and walking aids were allowed (crutches, sticks and walking frames) for those who used them.

Muscle strength was assessed by grip strength, measured by Jamar® dynamometry. We performed 3 assessments of the dominant hand, interspersed by 1 minute rest, noting the mean value obtained in kg-force adjusted by gender and body mass index, according to the cut-off points described in the literature to identify people with this frailty criterion.3

Three or more of the aforementioned criteria classified the respondents as frail, one or 2 criteria classified them as prefrail, and finally, if they had none of the criteria they were classified as non- frail elderly.3

The CVD dependent variable was classified dichotomously as yes or no, taking into account the elderly people’s response for this specific question, applying Charlson’s Comorbidity Index.21

This research study forms part of a project entitled Perfil de fragilidad en ancianos de Tras-os-Montes y Alto Douro, (frailty profile in elderly people of Tras-os-Montes and Alto Douro) and was approved by the Ethical Committee of the Health Science Research Unit: Nursing (UICSA:E) of the
Frailty shown to be a predictor of CVD, with the study found that the elderly people with a history of CVD were more likely to have fatigue, exhaustion, low physical activity, and slow walking speed compared to those without CVD. The prevalence of the 5 criteria of frailty in older adults with or without previous CVD is shown in Table 3. It can be observed that all the phenotypes are related with the dichotomous CVD variable (p < 0.05).

It was found that reduced grip strength (86.7%), reduced walking speed (63.3%) fatigue or exhaustion (63.3%) were the most prevalent criteria in people with CVD.

In the group without CVD, the prevalence of frailty in this study was 17.5% frail, 47.2% prefrail and 35.3% non-frail (Fig. 1).

In the group with CVD there was a higher prevalence of frailty (60%), and lower rates of prefrailty (33.3%) and non-frailty (6.7%). Using the Chi-squared test we observed that there was a statistically significant association between the levels of frailty and the presence or absence of CVD ($\chi^2 = 32.65; p = 0.000$).

**Discussion and conclusions**

From the results obtained from the sample studied we can confirm that the socio-demographic variables of sex, age and employment situation of the elderly people had no significant relationship with the presence or absence of cerebrovascular disease. Despite the absence of statistical significance, a slight predominance of CVD was observed in the men. The prevalence of CVD in the population studied is similar to that reported in other studies. According to data from the Rotterdam study, the self-reported prevalence of stroke in the elderly was 5.0% in men aged 65–74 years, 8.9% in men from 75 to 84 years and 11.6% in men aged 85 and above. The figures for women were 3.3%, 6.7% and 10.5%, respectively. The incidence of stroke increases with age, is greater in males and in all the age ranges.

With regard to the clinical variables, a statistically significant association was observed between CVD and sensory

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**Table 3: Association between cerebrovascular disease and the 5 phenotypic frailty criteria.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Elderly people with CVD (n = 30)</th>
<th>Elderly people without CVD (n = 405)</th>
<th>Sample (n = 435)</th>
<th>$p^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td></td>
</tr>
<tr>
<td>Unintentional weight loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7 (23.3)</td>
<td>39 (9.6)</td>
<td>46 (10.6)</td>
<td>0.019</td>
</tr>
<tr>
<td>No</td>
<td>23 (76.7)</td>
<td>366 (90.4)</td>
<td>389 (89.4)</td>
<td></td>
</tr>
<tr>
<td>Fatigue/exhaustion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19 (63.3)</td>
<td>114 (28.1)</td>
<td>133 (30.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>11 (36.7)</td>
<td>291 (71.9)</td>
<td>302 (69.4)</td>
<td></td>
</tr>
<tr>
<td>Low physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12 (40.0)</td>
<td>69 (17.0)</td>
<td>81 (18.6)</td>
<td>0.002</td>
</tr>
<tr>
<td>No</td>
<td>18 (60.0)</td>
<td>336 (83.0)</td>
<td>354 (81.4)</td>
<td></td>
</tr>
<tr>
<td>Slow walking speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19 (63.3)</td>
<td>111 (27.4)</td>
<td>130 (29.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>11 (36.7)</td>
<td>294 (72.6)</td>
<td>305 (70.1)</td>
<td></td>
</tr>
<tr>
<td>Poor muscle strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26 (86.7)</td>
<td>203 (50.1)</td>
<td>229 (52.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>4 (13.3)</td>
<td>202 (49.9)</td>
<td>206 (47.4)</td>
<td></td>
</tr>
</tbody>
</table>

CVD: cerebrovascular disease.

* Chi-squared.

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Nursing School of Coimbra, registration number 318/2015. The study participants signed their informed consent, after the voluntary nature of their participation had been explained to them, their right not to answer the questions and to withdraw their collaboration at any time, and the confidentiality of the information obtained. All the procedures outlined in the Declaration of Helsinki for this type of study were respected.

The Statistical Package for Social Sciences, version 20.0 was used for the data analysis. Microsoft Excel was used to make the calculations regarding physical activity. The descriptive analysis is presented as mean and standard deviation for the quantitative variables, and the qualitative variables described by relative and absolute frequencies. The Chi-squared test was used for comparison between qualitative variables and the Mann–Whitney U test for two independent samples. In all the statistical tests the results were analysed for a 95% confidence interval ($p < 0.05$).

**Results**

The sample comprised 435 participants, the majority females (62.3%). The predominant age group was from 65 to 74 (54.9%) and the mean age 76.2 years. The majority were married (59.5%) educated to primary level (83.2%) and lived with their families (73.6%) (Table 1).

Comparison between the elderly people with and without CVD, by socio-demographic and clinical characteristics, is shown in Table 2. We recorded that the elderly people with a history of CVD took more daily medication ($p = 0.001$). CVD was present in 6.3% of the women and 7.9% of the men. The relationships found between CVD and sight problems, fear of falling, hospitalisation in the previous year, the use of walking aids and perceived health status were significant ($p < 0.05$).
impairments of sight and hearing. It is reported in the literature that 30% of people who have suffered a stroke have impaired vision, which increases the risk of falling in people of advanced age with this disease. Given that these sensory deficits make elderly people frail,

\[.\] it is all the more necessary for stroke patients to be included in rehabilitation programmes, and for these deficits to be corrected in the elderly population.

A statistical relationship between CVD and the 5 classic phenotypic criteria of frailty was also observed. With regard to fatigue, the studies indicate that it is one of the symptoms most voiced by people with CVD, which is chronic in 37% of cases and coexists with depression, anxiety and low participation in social activities. In terms of physical activity, one study found this to be low after a stroke, further decreasing at around 6 months, when rehabilitation programmes come to an end. We highlight the importance of maintaining good levels of physical activity in stroke patients, with exercise guidelines appropriate to the disease, taking functionality into account and the prevention of further cardiovascular events. The significant reduction in walking speed observed in the group of elderly people with CVD can be explained by the motor deficits that are commonly present with this disease. In fact the hemiparetic gait pattern limits hip extension, knee flexion and dorsiflexion of the ankle, which reduces walking speed by physiological mechanisms that are not always present in healthy older people. Variable grip strength has been demonstrated to be a good predictor of overall functionality in various studies. Reduced strength interferes with performing motor tasks that are essential for basic and instrumental activities of daily living, although individuals with chronic hemiparesis can relearn how to use the paretic and contralateral upper limb enabling functional independence.

The prevalence of frailty that we found for the total sample was 20.5%, in line with international investigations. However, this is lower compared to that obtained in another study performed in Portugal, which encountered a rate of 34.9%. In the CVD group the frailty rate in our study (60%) exceeded all the findings in the group of elderly people living in the community. These data were reflected in a systematic review based on 21 studies.

This research study has some limitations which must be taken into account when interpreting the results and generalising them to the population. Although the literature indicates that frailty and CVD are closely related, we found no scientific papers that had specifically studied the prevalence of phenotypic frailty in older people after a cerebrovascular accident: this limits comparison of results. Another limitation is the sample size, comprising only 30 elderly people with CVD compared to 405 without CVD, which might limit the comparison of results statistically.

Bearing in mind the objectives of the study, we conclude the socio-demographic and clinical situation of elderly people should be of concern to the social and health services, since a considerable percentage of the subjects included are over the age of 75 years and live alone. Furthermore, many are polymedicated and display a negative perception of their state of health, in addition to impaired sight and vision. These problems are more evident in older adults with a history of CVD. In this subgroup we observed a high amount of phenotypic frailty criteria, which resulted in a high prevalence of frailty.

With regard to the prevalence of frailty, for the total population and for the CVD subgroup, the study findings indicate 2 principal recommendations. The first is the importance of diagnosing this condition in elderly people, with a view to planning health interventions to prevent functional impairment. The second takes into account the fact that many people who survive a stroke now return to their communities in a weakened state that requires continuity of care. Whether or not elderly people are able to remain in their own environments or suffer adverse events which result in their institutionalisation could depend on these recommendations.

Finally, bearing in mind that reduced muscle strength, low walking speed and fatigue are the most common frailty criteria in people with CVD, we recommend rehabilitation programmes that cover these risk factors.

**Conflict of interests**

The authors have no conflict of interests to declare.
References


