Frailty and Related Factors Based On A Multidimensional Assessment In People 70 Years Old Or Over

Abstract

Introduction: The Healthcare Plan for the Elderly (PAM) of the Basque Public Health Service (Osakidetza) determines different typologies of people ≥ 70 years of age based on a multidimensional assessment. The objective is to learn about the prevalence of frailty and its relationship with other variables of the assessment.

Material and methods: Cross-sectional study with a sample of 666 people (569 with a certain typology determined) ≥70 years of age from 7 healthcare centres, selected by random sampling. Different typologies were determined based on functionality (Instrumental Activities of Daily Living - IADL, Lawton-Brody Index; Basic Activities of Daily Living - BADL, Barthel Index), existence of chronic diseases, and life expectancy < 6 months: 'healthy older person', 'with a chronic disease but no relevant alteration of functionality', 'FRAIL' (alteration of IADL, Barthel > 59, life expectancy > 6 months), 'dependent', and 'at the end of life'.

Results: The 19.2% (95% CI 16.1-22.6%) were frail. Frailty was significantly related ($p < 0.001$) to age (66.1% > 80 years old versus 27.2% non-frail), physical inactivity (57.1 versus 15.4%), previous falls (58.4% versus 34.2%) and number of chronic medications (median 13 versus 8). It was also related to certain pathologies (cardiovascular, osteoarticular) and visual deficit. Detection through the assessment of IADL is closely related to the Timed Up and Go Test ($p < 0.001$).

Conclusions: In order to detect frailty, it is important to consider older age, physical inactivity, certain comorbidity (cardiovascular, osteoarticular, sensory) and polypharmacy. IADL and performance-based tests show very good correlation.

Keywords: Frail elderly; Geriatric assessment; Activities of daily living; Primary care

Mini Review

Volume 1 Issue 1 - 2017

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Received: October 28, 2016 | **Published:** February 22, 2017

Introduction

Frailty is a state in which older people are in a situation of instability and with a decrease in their physiological reserves, which causes greater probability of having adverse health events or greater vulnerability to them (hospitalisation, falls, postoperative complications, infections, immobility or other geriatric syndromes, etc.), deterioration in their physical function and functionality, and greater risk of progressing toward dependency and death [1,2]. Functionality and frailty are two closely related concepts.

The prevalence of frailty in people ≥ 65 years old in Spain can be calculated around 10%, according to the major cohort studies conducted [3-6]. Studies in other countries indicate prevalences that are similar or somewhat higher (around 12-15 or even 20%), depending on the criteria of detection used [7,8]. They find that frailty is more prevalent in women [7-9] and with increasing age [4,8].

Currently the most widespread methods used to identify the state of frailty are based on [1,2,7,10,11]:

I. Incipient or early loss of function, through 'performance-based tests' that assess gait, mobility and balance, like the Short Physical Performance Battery (SPPB), or the Gait Speed Test or Timed Up and Go Test; or with scales that assess the Instrumental Activities of Daily Living (IADL), like the Lawton-Brody Index.

II. Fried's clinical phenotype or variants (like the 5-item SHARE-FIt), on the basis of objective clinical criteria (weight loss, weakness, low energy, slow gait, physical inactivity).

III. Multidimensional indices based on accumulation of items of morbidity, disability and mental and social factors, like Rockwood Frailty Index or SHARE-FI scale.

Performance-based tests [1,2,12] and functional assessment are most recommended in the latest consensus and guidelines. In healthcare practice the detection of frailty can and many times should be combined with a multidimensional assessment (comprehensive geriatric assessment, CGA), because for many it provides a definitive diagnosis of this state of frailty, and certainly guides the actions to be taken for its management in a more personalised manner.

The Healthcare Plan for the Elderly (PAM) of the Basque Public Health Service (Osakidetza) is based on a multidimensional assessment focused on functionality and with a preventive nature, to be carried out in primary healthcare for people ≥ 70

years old. Based on functionality, morbidity, and life expectancy, it establishes a classification of older people according to function as: healthy older person, with a chronic disease but no relevant alteration of functionality, frail, dependent, or at the end of life.

The **objective** of this study is to determine the prevalence of frail people ≥ 70 years old, according to PAM criteria based on functionality (alteration in the Lawton-Brody Index, Barthel Index ≥ 60 points), and life expectancy > 6 months; and assess the relationship of frailty with other variables of the multidimensional assessment.

Material and Methods

Study design and location

This is a cross-sectional study based on the PAM multidimensional clinical assessment, encompassed in the pilot period of this programme prior to its extension. It was carried out in 7 healthcare centres of the Basque Autonomous Community in Spain, 4 in urban areas, 1 in a semi-urban area and 2 in rural areas. The assessments were conducted from 11 January to 15 April 2016.

Study population and sample

People ≥ 70 years old were included through random sampling stratified by healthcare centre, excluding those institutionalised in residences with their own healthcare professionals caring for them there. A minimum sample size of 377 subjects was estimated, considering the most unfavourable of the situations to determine the percentages of appearance of an event-variable in the assessment (50%), for a reference population > 20,000 people in the Basque Autonomous Community (higher than this figure the estimated number of subjects needed varies little), precision and level of confidence of 5%. We believed that this figure would be amply exceeded, even though there were a large number of losses. In the global randomisation of the PAM pilot 1,256 people were selected to evaluate the feasibility of assessing all the target population with the programme in an estimated time of 3 years.

Ethical Issues

The study was approved by the Clinical Research Ethics Committee of Euskadi -Basque Autonomous Community- (CEIC-E), and the participants signed an informed consent form prior to their participation.

Study Variables

A series of typologies in older people were established, based on the assessment conducted by the professionals of the healthcare centres, mostly by nurses, who were assigned to them, including the following variables among others:

i. **Functional assessment:** Barthel Index [13], which assesses Basic Activities of Daily Living (BADL), and Lawton-Brody Index [14] for IADL.

ii. **Relevant chronic diseases/conditions:** symptomatic osteoarticular, cardiovascular, hypertension, pulmonary, neurological or dementia, visual or auditory deficit, diabetes, mental disease, alcoholism or other drug addiction, obesity, anaemia, non-cutaneous cancer (except melanoma), and others (specifying which).

iii. **Life expectancy:** based on the professional's judgement, less than 6 months.

iv. **The following typologies were defined thus:**

a. **Healthy older person:** no relevant functional alteration (Barthel ≥ 60 points, Lawton-Brody 4-5 points in males / 6-8 in females) and no chronic diseases.

b. **With chronic disease(s) but no functional alteration**: at least one of the indicated chronic diseases, with no serious functional alteration (Barthel ≥ 60 points, Lawton-Brody 4-5 in males / 6-8 in females), and life expectancy > 6 months.

c. **Frail**: alteration of IADL (Lawton-Brody 0-3 in males / 0-5 in females), with no serious alteration of BADL (Barthel ≥ 60 points), and life expectancy > 6 months.

d. **Dependent:** Barthel < 60 points and life expectancy > 6 months.

e. **At the end of life:** life expectancy < 6 months.

The delimitation of the typologies was automated in the medical history registry, so that when the required data was introduced in the specific form, the consequent typology was obtained automatically.

For the relationship of frailty with other variables we considered: stratified age (70-80 years old or > 80 years old), gender, value and categories of the body mass index (BMI), smoking, alcohol consumption, physical activity evaluated according to a suitable activity standard, visual and auditory capacity, previous falls, number of chronic medications, Timed Up and Go Test, adequate social/family support, pathologies and chronic conditions selected based on greater prediction of deterioration and adverse events and total number of them.

Data Analysis

Univariate analysis through percentages or mean or median and dispersion measures, and statistical inference with confidence intervals at 95% (95% CI) for the main variables (prevalence of typologies). In order to analyse the relationship of variables with frailty (bivariate analysis), the group of frail people was considered on one side and on the other side the typologies of healthy people and those with chronic diseases but with no functional alteration; Dependent people and those at the end of life were excluded from this analysis due to the serious deterioration in BADL and poor life perspective. This bivariate analysis considered the percentages or median and interquartile range (IQR), using the Chi-squared test or Fisher's exact test for the qualitative variables, and Mann-Whitney U-test for the quantitative ordinal variables or Student's t-test if they were continuous. Finally, a logistic regression analysis was established by the enter method, considering the existence of frailty or not as a dependent variable.

The level of statistical significance of $p = 0.05$ was considered significant, and the analysis was conducted with the statistics programme IBM SPSS v22.

Results

Finally, 666 people were assessed with PAM multidimensional assessment, of which the typology was determined in 569 people (in the rest there were different omissions of data that were needed to determine the typology). In the total sample determined for the global pilot (1,256) there were 28.9% of exclusions (unreachable, moved, listing errors, not participating, deceased, etc.), and in 18.1% the assessment was not begun during the time period.

The median age was 79.1 years old (P_{75} = 84 years old), and 59.8% were women. The global prevalence of frail older people was 19.2% (95% CI 16.1-22.6%). The rest of the typologies were: 10.7% healthy older person (95% CI 8.4-13.5%), 60.3% with chronic disease but with no functional alteration (56.2-64.2%), 8.8% dependent (6.7-11.4%), and 1% at the end of life (0.5-2.3%).

Table 1 shows the relationship of frailty with other clinical variables, considering people without a serious alteration in BADL or poor life perspective (frail, 109 people; healthy, 61; with chronic disease but with no functional alteration, 343). Dependent people and those at the end of life were excluded from this analysis. Frailty had a more statistically significant relationship (in all $p < 0.001$) with age over 80 years old, physical inactivity, existence of previous falls, larger number of chronic medications and alteration in the Timed Up and Go Test.

Table 1: Relationship of frailty with other variables, considering healthy older people (61) and those with chronic diseases but with no functional alteration (343) as non-frail.

	Frail n = 109	Non-Frail n = 404	p-Value [1]
Age stratification, n (%) 70-80 years old >80 years old	 37 (33.9%) 72 (66.1%)	 294 (72.8%) 110 (27.2%)	**<0.001**
Gender, n (%) Women, men	 72 (66.1%) 37 (33.9%)	 229 (56.7%) 175 (43.3%)	0,078
Body mass index, BMI Underweight, n (%) Normal weight, Overweight, Obese Mean (SD)	 2 (1.9%) 28 (26.2%) 41 (38.3%) 36 (33.3) 27.68 (5.07)	 2 (0.5%) 98 (24.5%) 190 (47.5%) 110 (17.5%) 28.81 (15.48)	0,189 0,457
Smoking No, n (%) Yes	 68 (90.7%) 7 (9.3%)	 271 (90.9%) 27 (9.1%)	0,941
Alcohol consumption No, n (%) Yes	 46 (64.8%) 25 (35.2%)	 172 (62.8%) 102 (37.2%)	0,754
Physical activity Active, n (%) Inactive	 33 (42.9%) 44 (57.1%)	 225 (84.6%) 41 (15.4%)	**<0.001**
Adequate visual capacity Yes, n (%) No	 94 (88.7%) 12 (11.3%)	 359 (92.5%) 29 (7.5%)	0,203
Adequate auditory capacity Yes, n (%) No	 74 (69.8%) 32 (30.2%)	 290 (74.7%) 98 (25.3%)	0,307
Existence of previous falls No, n (%) Yes	 42 (41.6%) 59 (58.4%)	 231 (65.8%) 120 (34.2%)	**<0.001**
no. chronic medications, median (IQR)	13 (8-17)	8 (4-13)	**<0.001**
Timed Up and Go Test Not altered ≤ 20 sec., n (%) Altered >20 sec.	 57 (53.8%) 49 (46.2%)	 387 (99.5%) 2 (0.5%)	**<0.001**
Adequate social/family support Yes, n (%) No	 63 (94%) 4 (6%)	 158 (97.5%) 4 (2.5%)	0,237

[1]For the relationship of qualitative variables, the Chi-squared test or Fisher's exact test were used, and for the continuous quantitative variables (BMI), Student's t-test (BMI) or Mann-Whitney U-test for the ordinal variables (number of medications).

Table 2 shows the relationship of frailty with the registered comorbidity. In order to compare with the frail, healthy people and those with chronic disease but no functional alteration were considered. In the frailty group, the most prevalent were heart arrhythmia ($p < 0.001$), heart failure ($p = 0.001$), high blood pressure ($p = 0.039$), symptomatic osteoarticular disease ($p = 0.005$), dementia ($p = 0.032$), and serious visual deficit ($p = 0.050$). It is also related to a larger number of conditions considered per patient ($p < 0.001$).

A logistic regression analysis was conducted with the enter method, introducing the variables with a statistically significant relationship in the bivariate analysis (encoded age, physical age, existence of previous falls, number of chronic medications, Timed Up and Go Test). We also introduced the gender variable, as it was a variable related to frailty for many authors. There were 286 cases included in the model, which was significant ($p < 0.001$ in the Omnibus test), explaining 0.356 to 0.533 of the variability, and correctly classifying 87.8% of the cases.

Table 3 shows the Odds Ratios (OR) and the 95% CI obtained. The Timed Up and Go Test showed by far the highest OR (OR 115, 95% CI 14.3-923.2). Gender was the only variable that lacked statistical significance.

Table 2: Relationship of frailty with comorbidity, considering healthy older people and those with chronic diseases but with no functional alteration as non-frail

	Frail N = 109	Non-Frail N = 404	P-Value [1]
Heart arrhythmia, atrial fibrillation	26 (23.9%)	40 (9.9%)	**<0.001**
Heart failure	10 (9.2%)	8 (2%)	**0,001**
Coronary disease	15 (13.8%)	36 (8.9%)	0,133
High blood pressure (HBP)	74 (67.9%)	230 (56.9%)	**0,039**
Stroke - CVA	8 (7.3%)	15 (3.7%)	0,118
COPD - asthma - chronic bronchopathy	15 (13.8%)	47 (11.6%)	0,545
Diabetes mellitus	26 (23.9%)	76 (18.8%)	0,242
Symptomatic osteoarticular disease	31 (28.4%)	67 (16.6%)	**0,005**
Chronic anaemia	6 (5.5%)	15 (3.7%)	0,415
Severe mental disease	8 (7.3%)	19 (4.7%)	0,274
Dementia	3 (2.8%)	1 (0.2%)	**0,032**
Serious auditory deficit	14 (12.8%)	39 (9.7%)	0,331
Serious visual deficit	27 (24.8%)	67 (16.6%)	**0,050**
Non-cutaneous cancer except melanoma	13 (11.9%)	32 (7.9%)	0,190
Number of conditions per patient, median (IQR)	2 (2-4)	1 (1-2.75)	**<0.001**

[1] For the comparison of variables, the Chi-squared test or Fisher's exact test were used, and the Mann-Whitney U-test was used for the number of conditions per patient.

Table 3: Odds Ratio (OR) of the different variables related to being a frail person, according to the logistic regression analysis

	OR Exp (B)	95% CI		P
Older than 80 years	2.404	1.125	5.137	0.024
Physical inactivity	2.582	1.152	5.787	0.021
Existence of previous falls	2.584	1.209	5.522	0.014
No. of chronic medications	1.062	1.014	1.111	0.010
Timed Up and Go Test > 20 sec.	114.929	14.307	923.213	0.000
Gender: Male	1.180	0.539	2.584	0.678

Discussion

We present data for frail older people based on clinical criteria through multidimensional assessment in a large proportion of people 70 years of age or more from different areas, rural and urban, of the Basque Autonomous Community. This was aided by the automation of the diagnostic process in the computerised medical history registry. This is important as it facilitates classification in each typology of older person. The global prevalence of frailty obtained, 19.2%, is higher than that indicated by other authors [3-8]. We think this may be conditioned by the broad criteria of no relevant alteration in BADL permitted in our study (Barthel Index > 60) in frail people. In general, the new consensus and guidelines allow for less functional deterioration in BADL to be considered frailty; for example, the Spanish National Health Service (NHS) Consensus excludes from the classification if the Barthel Index is < 90 points [1].

However, we have increased this limit of permissiveness because we needed the typologies to include all the possibilities and to be excluding, and because we believed that in the BADL alteration range between 60-90 there are still some people with no serious alteration of IADL, which is what most guides the diagnostic criteria of frailty oriented toward functionality. On the other hand, there are few studies that base prevalence on the new concepts of frailty related to alteration in IADL and performance-based tests; in fact, most follow-up studies in Spain have mostly have used Fried's phenotype as a diagnostic criterion [3-6,15].

As mentioned in the literature, our study also finds a relationship between frailty and older age, but unlike that found by other authors, there is not a relationship with gender.

In regard to the rest of the typologies, we must emphasise that most of the population, 90.2% of the total including the healthy, those who have chronic diseases with no functional repercussions, and the frail, have a good overall state of health, based on functionality, which is the best criteria defining health status in the elderly according to WHO [16]. Therefore, we have selected these three typologies upon analysing the relationship of frailty with other variables, not considering the dependent (serious BADL alteration), and those at the end of life (poor life perspective). It is in the other three typologies where professionals are interested in finding and discriminating the frail in common clinical practice.

We have found a prevalence of 1%, which is probably lower than that expected, from patients at the end of life. We think that this may be because the healthcare professionals who had patients in this situation probably did not include them in the PAM assessment at times.

The variable that is most related to frailty, in the bivariate analysis as well as in the multivariate analysis, is the alteration in the Timed Up and Go Test. This is logical, as the criterion currently most used for its definition is the alteration in IADL or performance-based tests, and the relationship between them is widely demonstrated [17-20].

Physical inactivity is another variable related to frailty. We should point out that physical activity, its maintenance and practice, is the most evident general intervention in the management of frailty [21-24]. Previous falls and polypharmacy are also consistently related to frailty.

In regard to the diseases, the greater relationship with cardiovascular, osteoarticular and sensory diseases is also a guide when selectively detecting frail older people in clinical practice. Not all the diseases have the same weight, and even under 80 years old the indicators of frailty and functionality seem to be better predictors than comorbidity itself [25].

The most important limitation of our study is the selection of the sample in a specific region, and this should be considered with precaution when generalising the results. Nevertheless, in general, they are concordant with the studies published, but with some peculiarities; for example, the non-significant relationship of frailty and gender.

Conclusion

Frailty is a frequent syndrome in community-dwelling older people. In order to detect frailty in clinical practice it is important to consider older age, certain comorbidity (cardiovascular, osteoarticular, sensory), polypharmacy and number of comorbidities, as well as physical inactivity. IADL and performance-based tests show very good correlation.

Declaration of Conflicts Of Interest

The authors declare that they have no conflicts of interest concerning this article.

Acknowledgements

We would like to thank all the primary healthcare professionals who participated in the study.

Although the study did not receive grants or specific external funding, Bilbao-Basurto Integrated Health Organisation did release the principal investigator part-time during the months of January to May 2016 for the purpose of conducting it.

We would also like to thank the Basque Institute of Healthcare Research (O+Iker) for help with the translation and style of the document.

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