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Original Article

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Frailty in Portuguese Older Patients From Convalescence Units: A Cross-Sectional Study

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Abstract

Background: Frailty is a common geriatric syndrome, associated with adverse clinical outcomes. Nevertheless, studies about frailty in continuous care units are scarce. In this way, this study aimed to assess frailty in older patients admitted in convalescence units (CUs) and analyze its association with demographic, social and clinical characteristics.

Methods: This cross-sectional study included older patients admitted in eight CUs of the Integrated Continued Care National Network in Northern Portugal. Exclusion criteria were: total ≤ 11 in Glasgow coma scale, < 10 in mini-mental state examination or being unable to communicate. A comprehensive protocol was administered to assess health-related and lifestyle characteristics, comorbidity, dependence on activities of daily living (ADL), depressive and anxiety symptoms, cognition, and socio-familial risk. Frailty was assessed by Tilburg frailty indicator (TFI).

Results: A sample of 165 patients was included (median age = 77; 65% female), with 80% classified as frail, mostly women (P = 0.002), widowed (P = 0.016), shorter (P = 0.005), feeling more tired (P < 0.005) and with less energy (P < 0.005). Also, these patients reported more vision problems (P = 0.006), difficulties in walking (P = 0.022) and climbing stairs (P = 0.029), pain (P = 0.004), falls (P = 0.046), non-alcohol use (P = 0.043) and non-physical activity (P = 0.032). Frail patients had a higher number of previous hospitalizations (P = 0.018), comorbidity (P = 0.006), dependence on instrumental (P < 0.001) and basic (P = 0.006; P < 0.001) ADL, depressive (P < 0.001) and anxiety (P = 0.002) symptoms. After adjusting for covariates, frailty was associated with females (adjusted odds ratio (aOR) = 4.45, P = 0.011), vascular disease (aOR = 4.40, P = 0.040), vision problems (aOR = 10.85, P < 0.001), high dependency on instrumental ADL (aOR = 0.74, P = 0.002), and depressive symptoms (aOR = 1.37, P = 0.001).

Conclusions: Frailty is high among older patients in CUs, particularly in females, with vascular disease, vision problems, instrumental ADL dependence and depressive symptoms. Thus, frailty should be screened, and preventive and therapeutic measures should be considered for those at high risk, in order to minimize possible negative consequences.

Keywords: Aged; Frailty; Activities of daily living; Depression; Anxiety

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Introduction

Frailty is a geriatric syndrome caused by a decline of the physiological multiorgan system, with vulnerability to stressors, conducing to a reduced functioning of body systems. It is associated with adverse health outcomes, such as increase of mortality and hospitalization rates, institutionalization, disability and falls [1-7].

Frailty is considered a dynamic condition, changing over time, depends on age, but also on sociodemographic characteristics (e.g., poverty, social exclusion, and low educational level), lifestyle behaviors (e.g., physical activity) and health conditions (e.g., acute and chronic diseases, polypharmacy, nutritional status deficit, functional and cognitive impairment or psychological distress) [3, 8].

The prevalence of frailty increases with age, independently of the assessment instrument applied, and ranges between 4% and 59% in community-dwelling elderly populations, being higher in women than in men [9, 10].

According to the results of DO-HEALTH study, which aimed at the assessment of frailty prevalence in community-dwelling participants (age > 70 years old) from five European countries (Switzerland, Germany, France, Austria, and Portugal), the prevalence of frailty varied between countries. The highest prevalence was found among Portuguese participants (ranging from 3.1% to 30.3%), and the lowest prevalence was detected among Austrian participants (ranging from 0% to 2.5%) [11].

Results from a systematic review in Europe have shown

the highest rate of frailty (75%) among elderly residents of nursing homes in Poland and primary care patients in Romania, while the lowest rates (2%) were found in longitudinal cohorts in 50+ individuals from Ireland or 65 - 79 years old individuals from Germany [11]. In community-based studies, prevalence rates ranged from 2% (in ≥ 50 years old) to 60% (in ≥ 100 years old). In Portugal, the prevalence of frailty in a population-based sample of patients over 50 years old from Guimaraes (city in northern Portugal), was 34.9%, increasing to 45.1% in 65 - 74 years old individuals and 60.4% in patients aged over 75 [12, 13]. In the Portuguese Nutrition UP 65 cross-sectional observational study, frailty was also prevalent in a large representative sample of community-dwelling older adults. According to frailty phenotype defined by Fried, in this study the frequency of pre-frailty and frailty was 54.3% and 21.5%, respectively [14].

Frailty prevalence rates vary according to different settings (primary care, outpatient geriatric clinics, long-term care, hospitals, public health centers or community-based ones), depending on the assessment instrument applied, and the population's characteristics, including age [7, 15, 16]. Moreover, this prevalence depends on other several factors, such as the presence of chronic diseases, polypharmacy, cognitive impairment, dependence, depression, social risk, nutritional status, inherent socio-economic background and education level [17-21].

Nevertheless, there is a lack of studies regarding frailty in hospitalized elderly, particularly in continuous care [22]. Furthermore, considering the negative outcomes associated with frailty, with impact on patients and caregivers' quality of life, as well as the burden that frailty can have on healthcare systems, it is of utmost importance to screen and adequately assess frailty as part of routine clinical practice. In this sense, it is essential to plan and predict interventions for those who are already unstable or at risk [23-25].

In the light of this, the present study aimed to assess the presence of frailty in older patients admitted to convalescence units (CUs) of the Integrated Continued Care National Network (*Rede Nacional de Cuidados Continuados Integrados* - RNCCI) in Northern Portugal [26]. This research also intends to study the association between frailty and demographic, social and clinical characteristics of these patients.

Materials and Methods

Sample and procedures

This was a cross-sectional study with a sample of older patients admitted into eight CUs of the RNCCI in Northern Portugal. The purpose of CU is to recover, rehabilitate and reintegrate patients under the risk of dependence. The RNCCI is a partnership established between the Ministries of Labor and Social Solidarity and Health.

The study sample enrolled patients aged 60 years old or over, admitted in one of the eight participating CUs and with written informed consent. Patients with a total score of ≤ 11 points on the Glasgow coma scale (GCS) [27, 28], a score < 10 in the mini-mental state examination (MMSE) [29] (severe cognitive impairment) or unable to communicate (e.g., altered language skills or deaf) were excluded.

All procedures regarding ethical approval were obtained from the board of the institutions where the study was carried out. This study was also approved by the Northern Regional Health Administration *(Administracao Regional de Saude do Norte - ARS N*) and was conducted in accordance with the ethical principles of the Declaration of Helsinki.

At enrolment of the study, the written informed consent from all patients and/or from their closest relative or legal representative (if the patient was unable to decide for him/herself) was obtained. All necessary measures have been taken to safeguard participants' anonymity and confidentiality of information.

Data collection was conducted between November 2017 and May 2018 by two trained researchers, in a non-probabilistic estimated sample size of 165 participants.

After obtaining informed consent, all participants were assessed with the research protocol, which includes the following instruments: 1) The Tilburg frailty indicator (TFI) [30, 31] is a self-administered instrument with two parts. The first one contains 10 questions to assess the following determinants of frailty and diseases: sociodemographic factors, multimorbidity, life events and environment. The second part assesses frailty components and includes 15 items divided into physical domain (health, weight loss, difficulty in walking, balance, hearing, vision, gripping and tiredness), psychological domain (cognition, depression, anxiety and coping), and social domain (living alone, social isolation and social support) [31]. The score on total frailty ranges from 0 to 15, and the scores on physical, psychological, and social frailty vary from 0 to 8, 0 to 4, and 0 to 3, respectively. The maximum scores refer to the highest level of frailty. The cutoff of 6 (frail if ≥ 6; non-frail if < 6) obtained in the TFI Portuguese, was considered in this study [30]. 2) The MMSE [29] assesses cognitive functions, including orientation, memory, attention/calculation, language and visual-spatial skills. It is scored in a maximum of 30 points and according to the Portuguese normative values, the following cut-off for cognitive deficit was considered: ≤ 22 points for people with 0 - 2 years of education, ≤ 24 points for people with 3 - 6 years of education and ≤ 27 points for people with ≥ 7 years of education [32]. 3) The Katz index of independence (KI) [33] assesses the functional status of patients according to their ability to perform six basic activities of daily living (BADL): bathing, dressing, toileting, transferring, continence, and feeding. According to this assessment, each elderly is classified as dependent or independent. The following pattern was adopted for the analysis of the results regarding this index: A - independent in all activities; B - independent in all but one activity; C - independent in all except for bathing and another function; D - independent in all except for bathing, dressing and another function; E - independent in all except for bathing, dressing, use of toilet and another function; F - independent in all except for bathing, dressing, use of toilet, transfer and another function; G - dependent in all six functions; H - dependent in two or more functions non-classified in groups C, D, E or F [34]. 4) The Barthel index (BI) [35] assesses the patient's performance in 10 BADL according to their functional

dependency. The items include feeding, bathing, grooming, dressing, continence of bowel, bladder, toilet use, transfers (bed to chair and back), mobility (on level surfaces) and going up and down stairs, with the total score ranging between 0 and 100. The following proposed guidelines for interpreting BI scores were considered in the present study: a score of 0 - 20 indicates "total" dependency, 21 - 60 indicates "severe" dependency, 61 - 90 indicates "moderate" dependency, and 91 - 100 indicates "slight" dependency [36]. 5) The Lawton index (LI) [37, 38] assesses eight instrumental activities of daily living (IADL), particularly the ability to use the telephone, go shopping, prepare food, do housekeeping and do the laundry, mode of transportation, responsibility for own medication, and ability to handle finances. For each activity, the person is classified as dependent, needing help or autonomous. The LI total score ranges from 0 to 16 points. The following cut-off points were considered: 0 - 5 means severe or total dependence, 6 - 11 moderate dependence, and 12 - 16 slight dependence or independence. 6) The hospital anxiety and depression scale (HADS) [39, 40] was designed to assess depressive and anxiety symptoms in hospital setting. The HADS includes 14 items distributed in two subscales to assess anxiety (HADS-A) and depressive (HADS-D) symptoms. Each item is rated on a four-point Likert scale (range 0 - 3), with the total score ranging from 0 to 21 points. A score is obtained for depression and another for anxiety. In the present study, a cut-off point of > 9 was used for presence of depressive and anxiety symptomatology. 7) The Gijon's social-familial evaluation scale (GSFES) [41] is a self-administered scale composed of five items: family situation, economic situation, housing, social relations and social network support. For each item, the scoring scale ranges from 1 to 5 points, with 5 corresponding to the highest risk situation. The global score derives from the sum of each item's scores, with the maximum score being 25 points. The socio-familial risk is classified according to the following categories: low social risk (5 - 9 points), social risk (10 - 14 points), and presence of social problems (scores over 15) [42]. 8) The GCS [27, 28, 43] is a practical method to assess the impairment of conscious level in response to defined stimuli. The scale assesses patients according to three aspects of responsiveness: eye-opening, motor, and verbal responses. The total score can range between 3 (completely unresponsive) and 15 (responsive). Scores between 3 and 4 indicate deep coma, score 7 means intermediate coma, 11 superficial coma and 15 indicates normality. 9) The Charlson comorbidity index (CCI) [44] assesses comorbidities, predicting the risk of mortality, disability and hospitalization in various clinical settings. Comorbidities are graduated in the index, and the higher the score obtained, the higher risk of comorbidity-correlated death. 10) A clinical interview was carried out and a medical chart reviewed in order to collect complete patients' sociodemographic and clinical characteristics, particularly the following health-related parameters: height, weight, body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), number of hospitalizations in the previous year, presence of specific comorbidities and total number of daily medicine intake.

Also, lifestyle behaviors were registered, namely the total number of sleeping hours and daily meals, alcohol consumption (no vs. yes (2 or 3 units - each unit: 8 g or 10 mL of ethanol) per day, if female or male)), smoking habits (yes or no/never) and physical activity (no vs. yes (physically active = walking or equivalent 30 min three times a week before admission). Two questions were also included to assess the patient's perception of their health status (very good, good, regular, bad and very bad), as well as whether they considered themselves to be an autonomous person (no vs. yes).

Statistical analysis

Descriptive results are presented by absolute (n) and relative (%) frequencies, with 95% confidence intervals (CIs) (when applicable) for categorical variables, means (M) and standard deviations (SDs) for variables with symmetrical distribution, and medians and range for continuous variables with non- symmetrical distributions. Symmetry was assessed with skewness coefficients and histograms. Missing values were not replaced and an exploratory subgroup analysis of frailty versus non-frailty population was also conducted. Shapiro test and histograms were used to assess normality of continuous variables.

Patients were divided into frail and non-frail, according to TFI assessment. These two groups were compared regarding all sociodemographic and clinical variables assessed. Differences between frail and non-frail patients were performed using the Chi-square test or Fisher's test, for categorical variables and the Mann-Whitney test for continuous variables. The rate of frailty was presented with 95% CI. Multivariate logistic regression was implemented to assess the likelihood of being frail. Variables were included after a stepwise exploration process, considering $P < 0.10$ as inclusion criteria. Adjusted odds ratios (aORs), 95% CIs for aOR and P-values were calculated.

All statistical tests were two-tailed and a significance level of 5% was assumed. Statistical analysis was performed using SAS® software (version 9.4; SAS Institute Inc., Cary, USA).

Results

In this study, 182 patients were enrolled, of which 17 were excluded, due to the following reasons: incomplete research protocol (n = 16) and MMSE total score ≤ 10 points (n = 1).

Thus, the final sample included 165 patients with median age of 77, ranging from 60 to 96 years old. Most patients (79.3%) had 0 to 4 years of education and approximately half of them were widowed (48.2%) and 55.2% lived in a rural area.

Detailed sociodemographic characteristics of the sample are presented in Table 1, and did not differ significantly between non-frail and frail patients, except for gender and marital status. It was possible to verify that the frail group was mostly comprised of females (70.5% vs. 42.5% in non-frail; P = 0.002) and widowed (45.0% vs. 60.6%; P = 0.016), compared to the non-frail group.

Regarding health-related parameters, it was verified that more than 75% of the patients were hospitalized once in the previous year. Also, 57% of patients referred having felt fre-

Table 1. Sociodemographic Characterization of the Sample

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)	P-value
Gender, n (%)				CS: 0.002
Male	58 (35.2%)	19 (57.6%)	39 (29.5%)	
Female	107 (64.8%)	14 (42.4%)	93 (70.5%)	
Age (years), median (min. - max.)	77.0 (60.0 - 96.0)	76.0 (60.0 - 88.0)	77.0 (60.0 - 96.0)	MW: 0.297
Marital status, n (%)				FT: 0.016[a]
Single	23 (14.0%)	0 (0.0%)	23 (17.6%)	
Married/living with partner	45 (27.4%)	8 (24.2%)	37 (28.2%)	
Separated/divorced	17 (10.4%)	5 (15.2%)	12 (9.2%)	
Widowed	79 (48.2%)	20 (60.6%)	59 (45.0%)	
Living area, n (%)				CS: 0.937
Urban	74 (44.8%)	15 (45.5%)	59 (44.7%)	
Rural	91 (55.2%)	18 (54.5%)	73 (55.3%)	
Educational level, n (%)				FT: 0.118[b]
None	31 (18.9%)	3 (9.1%)	28 (21.4%)	
1 - 4 years	99 (60.4%)	22 (66.7%)	77 (58.8%)	
5 - 6 years	12 (7.3%)	2 (6.1%)	10 (7.6%)	
7 - 9 years	10 (6.1%)	5 (15.2%)	5 (3.8%)	
10 - 12 years	-	-	-	
University	1 (0.6%)	0 (0.0%)	1 (0.8%)	
Other	11 (6.7%)	1 (3.0%)	10 (7.6%)	

[a]Married vs. others. [b]None vs. others. CS: Chi-square test; MW: Mann-Whitney test; FT: Fisher's test.

quently tired 3 months before and 43% having felt full of energy at the moment of the interview. Health conditions most commonly reported were chronic obstructive pulmonary disease (76%) and osteoarticular disease (71.1%), followed by heart failure (67.3%), stroke (57.4%), auricular fibrillation (56.4%) and cardiac disease (50.3%). More than 60% of the sample took more than six daily medicines. Vision problems were reported by 67.3% of patients, difficulty in walking by 86.1%, in climbing stairs by 85.4%, and the use of walking assistance devices by 68.7%. More than half of the patients felt any kind of pain (52.4%) or suffered a fall (63.4%), and 48.5% presented disability due to the latter (Table 2).

The subgroup analysis for frail and non-frail patients for health-related parameters has shown that frail patients were shorter (160.0 vs. 165.0; P = 0.005). Also, almost 64% (P < 0.005) of them referred feeling frequently tired in the previous three months. At the time of the interview, 31.3% of the frail patients did not feel full of energy, compared to 69.7% in the non-frail group (P < 0.005). The distribution of the number of hospitalizations in the previous year showed to be more left skewed in the frail group in comparison to the non-frail one (median = 1.0 (1.0 - 8.0) vs. 1.0 (1.0 - 1.0); P = 0.018). Health conditions presented differences between frail and non-frail patients. In the first group, the following health conditions were the most prevalent: sphincter incontinence (34.8% vs. 9.1%; P = 0.003), heart disease (56.1% vs. 27.6%; P = 0.006), vascular disease (43.8% vs. 21.4%; P = 0.031), respiratory disease (26.0% vs. 6.9%; P = 0.028) and depression/other psychiatric disease (42.2% vs. 17.9%; P = 0.017). Furthermore, frail patients had more vision problems (72.3% vs. 46.9%; P = 0.006), more difficulty in walking (89.4% vs. 72.7%; P = 0.022), and climbing stairs (88.5% vs. 72.7%; P = 0.029), felt more pain (58.0% vs. 72.7%; P = 0.004) and suffered a fall more often (67.2% vs. 48.5%; P = 0.046) than non-frail patients, with statistical significance (Table 2).

In what concerns lifestyle parameters, approximately 61% of patients reported sleeping 5 - 7 h/day and 40.6% referred having five or more meals per day. Alcohol consumption was reported by 36.4% of patients, smoking habits by 5.5%. Only 20% reported regular physical activity. About 44% of the sample considered themselves autonomous and 43% felt healthy (Table 3).

There were no significant differences between groups concerning sleeping hours, number of meals per day or smoking habits. Alcohol consumption and physical activity were most reported by non-frail patients (51.5% vs. 32.6%, P = 0.043; 33.3% vs. 16.7%, P = 0.032, respectively), with statistically significant differences. Also, the non-frail group considered themselves more autonomous than the frail group (69.7% vs. 37.1 %; P < 0.001). In self-reported health, more non-frail patients classified their health as being good (54.5% vs. 22.7%; P < 0.001) in comparison to frail patients. In addition, no non-frail patients classified their health as bad (0% vs. 23.5%) or very bad (0% vs. 9.1%) compared to frail patients (P < 0.001),

Table 2. Health-Related Parameters of the Study

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)	P-value
Weight (kg), mean (SD)	68.62 (14.04)	71.71 (11.42)	67.88 (14.54)	FT: 0.173
Height (cm), median (min. - max.)	160.0 (148.0 - 184.0)	165.0 (148.0 - 175.0)	160.0 (148.0 - 184.0)	MW: 0.005
BMI (kg/m^2), median (min. - max.)	25.5 (13.0 - 42.8)	25.6 (18.3 - 34.3)	25.3 (13.0 - 42.8)	MW: 0.528
Weight loss in the previous year, n (%)	87 (55.4%)	13 (40.6%)	74 (59.2%)	CS: 0.059
SBP (mm Hg), median (min. - max.)	120.0 (86.0 - 181.0)	120.0 (95.0 - 181.0)	120.0 (86.0 - 160.0)	MW: 0.812
DBP (mm Hg), median (min. - max.)	70.0 (40.0 - 100.0)	70.0 (42.0 - 82.0)	70.0 (40.0 - 100.0)	MW: 0.812
Hospitalized in the previous year, n (%)	125 (76.2%)	26 (78.8%)	99 (75.6%)	CS: 0.698
Number of hospitalizations in the previous year, median (min. - max.)	1.0 (1.0 - 8.0)	1.0 (1.0 - 1.0)	1.0 (1.0 - 8.0)	MW: 0.018
Frequently tired in the previous 3 months, n (%)	94 (57.0%)	10 (30.3%)	84 (63.6%)	CS: 0.000
Feeling full of energy at this time, n (%)	71 (43.0%)	23 (69.7%)	48 (31.3%)	CS: 0.000
Sphincter incontinence (urine/feces), n (%)	49 (29.7%)	3 (9.1%)	46 (34.8%)	CS: 0.004
Memory changes, n (%)	65 (39.9%)	10 (30.3%)	55 (42.3%)	CS: 0.208
Pacemaker holder, n (%)	11 (7.0%)	1 (3.2%)	10 (7.9%)	FT: 0.694
Cardiac disease, n (%)	72 (50.3%)	8 (27.6%)	64 (56.1%)	CS: 0.006
Heart failure, n (%)	37 (67.3%)	3 (60.0%)	34 (68.0%)	FT: > 0.999
Auricular fibrillation, n (%)	31 (56.4%)	2 (40.0%)	29 (58.0%)	FT: 0.643
Neurologic disease, n (%)	54 (40.6%)	9 (32.1%)	45 (42.9%)	FT: 0.388
Stroke, n (%)	31 (57.4%)	5 (55.6%)	26 (57.8%)	FT: > 0.999
Parkinson disease, n (%)	1 (1.9%)	-	1 (2.2%)	FT: > 0.999
Mild cognitive impairment, n (%)	15 (27.8%)	4 (44.4%)	11 (24.4%)	FT: 0.244
Vascular disease, n (%)	52 (39.1%)	6 (21.4%)	46 (43.8%)	CS: 0.031
Respiratory disease, n (%)	28 (21.7%)	2 (6.9%)	26 (26.0%)	CS: 0.028
Asthma, n (%)	6 (24.0%)	1 (50.0%)	5 (21.7%)	FT: 0.430
Chronic obstructive pulmonary disease, n (%)	19 (76.0%)	1 (50.0%)	18 (78.3%)	FT: 0.430
Osteoarticular disease, n (%)	96 (71.1%)	17 (58.6%)	79 (74.5%)	CS: 0.094
Gastrointestinal disease, n (%)	25 (18.4%)	3 (10.3%)	22 (20.6%)	CS: 0.208
Diabetes/other metabolic disease, n (%)	55 (37.4%)	8 (25.8%)	47 (40.5%)	CS: 0.132
Depression/other psychiatric disease, n (%)	51 (37.2%)	5 (17.9%)	46 (42.2%)	CS: 0.018
Number of medicines per day, n (%)				FT: 0.088
None	5 (3.1%)	2 (6.1%)	3 (2.3%)	
1 - 5	55 (33.7%)	15 (45.5%)	40 (30.8%)	
> 5	103 (63.2%)	16 (48.5%)	87 (66.9%)	
Vision problems, n (%)	109 (67.3%)	15 (46.9%)	94 (72.3%)	CS: 0.006
Hearing problems, n (%)	40 (24.4%)	5 (15.6%)	35 (26.5%)	CS: 0.198
Difficulty in walking in the previous 3 months, n (%)	142 (86.1%)	24 (72.7%)	118 (89.4%)	FT: 0.022
Difficulty in climbing stairs in the previous 3 months, n (%)	140 (85.4%)	24 (72.7%)	116 (88.5%)	FT: 0.029
Use of walking auxiliary, n (%)	112 (68.7%)	21 (63.6%)	91 (70.0%)	CS: 0.481
Chronic wound, n (%)	6 (3.6%)	-	6 (4.5%)	FT: 0.601
Feeling any kind of pain, n (%)	86 (52.4%)	10 (30.3%)	76 (58.0%)	CS: 0.004
Having suffered a fall, n (%)	104 (63.4%)	16 (48.5%)	88 (67.2%)	CS: 0.046
Disability due to falls, n (%)	49 (48.5%)	8 (53.3%)	41 (47.7%)	CS: 0.686

Missing data: marital status (n = 1), educational level (n = 1), number of medicines per day (n = 2). CS: Chi-square test; MW: Mann-Whitney test; FT: Fisher's test; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure.

Table 3. Lifestyle Parameters Assessment of the Study Sample

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)	P-value
Sleeping hours per day, n (%)				CSeT: 0.270
Less than 5 h	27 (16.4%)	2 (6.1%)	25 (18.9%)	
5 - 7 h	101 (61.2%)	22 (66.7%)	79 (59.8%)	
8 - 10 h	36 (21.8%)	9 (27.3%)	27 (20.5%)	
More than 10 h	1 (0.6%)	-	1 (0.8%)	
Number of meals per day, n (%)				CSeT: 0.979
Two meals	2 (1.2%)	-	2 (1.5%)	
Three meals	30 (18.2%)	6 (18.2%)	24 (18.2%)	
Four meals	66 (40.0%)	14 (42.4%)	52 (39.4%)	
Five or more meals	67 (40.6%)	13 (39.4%)	54 (40.9%)	
Alcohol consumption, n (%)	60 (36.4%)	17 (51.5%)	43 (32.6%)	CS: 0.043
Smoking habits, n (%)	9 (5.5%)	4 (12.1%)	5 (3.8%)	FT: 0.080
Physical activity, n (%)	33 (20.0%)	11 (33.3%)	22 (16.7%)	CS: 0.032
Autonomous person, n (%)	72 (43.6%)	23 (69.7%)	49 (37.1%)	CS: < 0.001
How do you perceive your health status, n (%)				CSeT: < 0.001
Very good	3 (1.8%)	1 (3.0%)	2 (1.5%)	
Good	48 (29.1%)	18 (54.5%)	30 (22.7%)	
Regular	71 (43.0%)	14 (42.4%)	57 (43.2%)	
Bad	31 (18.8%)	0 (0.0%)	31 (23.5%)	
Very bad	12 (7.3%)	0 (0.0%)	12 (9.1%)	

CS: Chi-square test; CSeT: Chi-square exact test; FT: Fisher's test.

as shown in Table 3.

With respect to the assessment instruments included in the research protocol, detailed results are shown in Table 4.

Considering the overall sample, it was possible to verify that 89.7% of patients were in the normal category of the GCS, and the median (range) of the CCI was 1.0 (0.0 - 11.0). Based on the GSFES, most (51.4%) patients had intermediate social risk. With regard to BADL assessed by KI, the most reported categories were A - independent in food, continence, mobility, using the toilet, dressing and bathing (21.2%), F - independent for all the aforementioned functions, except for bathing, dressing, using the toilet, mobility and another additional function (18.8%), and C - independent for all the functions mentioned above, except for showering and another additional function (17.0%). Moreover, 55.2% of the participants had mild dependency in BADL, according to the BI. In addition, 46.5% have shown a moderate dependency in IADL, measured by the LI. The cognitive assessment considered 45.5% of patients with cognitive deficit, based on the results of MMSE. In this sample, 50% presented depressive and 28.1% anxious symptomatology, measured by HADS.

Regarding the comparison between frail and non-frail patients, the median score of the CCI was higher for the frail group (2.0 vs. 1.0; P = 0.006). The KI has shown relevant differences in categories A (independent for all activities) (45.5% for non-frail vs. 15.2%; P = 0.006) and F (independent for all activities except bathing, dressing, going to the bathroom, transfer and one additional function) (22.0% for frail vs. 6.1%; P = 0.006). The median score in LI was higher in non-frail population (12.0 vs. 8.0 in frail; P < 0.001), which showed less dependency.

Also, 53.1% of non-frail patients presented mild dependency/independency, compared to 18.1% of frail patients, and none reported severe/total dependency vs. 35.4% of the frail (P < 0.001). The BI score was also higher in the non-frail group with a median score of 85.0 vs. 61.5 (P < 0.001) in frail patients, and with 75.8% of non-frail patients with mild dependency vs. 50% in the frail group (P < 0.001).

HADS subscales scores were both higher for the frail group, with a median value of 9.0 vs. 4.0 for depressive and 6.0 vs. 4.0 for anxiety symptoms, both with statistical significance (P < 0.001). Also, 60.6% frail individuals had depressive symptoms, as opposed to 9.1% (P < 0.001) of non-frail patients. In this study, 33.9% showed anxiety symptoms in the frail group, against 6.1% in the non-frail one (P = 0.002).

No statistical differences between groups for the total scores of the GCS, GSFES or MMSE were found (Table 4).

According to TFI, frailty was found in 80% (95% CI: 73.9-86.1%) of patients. In the overall sample, the median (range) was 8.0 (0.0 - 15.0) for the total score, 5.0 for physical domain, 2.0 for psychological domain and 1.0 for the social domain (Table 5).

The median values in the domains of the TFI were higher in the group of fragile individuals than in the group of non-

Table 4. Results From Assessment Instruments

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)	P-value
Glasgow coma scale				
Score, median (min. - max.)	15.0 (13.0 - 15.0)	15.0 (14.0 - 15.0)	15.0 (13.0 - 15.0)	MW: 0.793
Category, n (%)				FT: > 0.999
12 - 14 points	17 (10.3%)	3 (9.1%)	14 (10.6%)	
Normal 15 points	148 (89.7%)	30 (90.9%)	118 (89.4%)	
Charlson comorbidity index				
Score, median (min. - max.)	1.0 (0.0 - 11.0)	1.0 (0.0 - 6.0)	2.0 (0.0 - 11.0)	MW: 0.006
Gijon's social-familial scale				
Score, median (min. - max.)	7.5 (3.0 - 15.0)	7. (3.0 - 15.0)	8.0 (3.0 - 15.0)	MW: 0.653
Category, n (%)				CS: 0.560
High social risk	30 (21.7%)	4 (14.3%)	26 (23.6%)	
Intermediate social risk	71 (51.4%)	16 (57.1%)	55 (50.0%)	
Low social risk	37 (26.8%)	8 (28.6%)	29 (26.4%)	
Katz index				
Category, n (%)				CSeT: 0.006
A: Independent for all activities	35 (21.2%)	15 (45.5%)	20 (15.2%)	
B: Independent for all activities except for one	19 (11.5%)	3 (9.1%)	16 (12.1%)	
C: Independent for all activities except for bathing and an additional one	28 (17.0%)	8 (24.2%)	20 (15.2%)	
D: Independent for all activities except for bathing, dressing and an additional one	17 (10.3%)	1 (3.0%)	16 (12.1%)	
E: Independent for all activities except for bathing, dressing, going to bathroom and an additional one	26 (15.8%)	4 (12.1%)	22 (16.7%)	
F: Independent for all activities except for bathing, dressing, going to the bathroom, transfer and an additional one	31 (18.8%)	2 (6.1%)	29 (22.0%)	
G: Dependent for all activities	5 (3.0%)	0 (0.0%)	5 (3.8%)	
H: Dependent for at least two functions, but not classified as C, D, E, and F	4 (2.4%)	0 (0.0%)	4 (3.0%)	
Lawton index				
Score, median (min. - max.)	9.0 (0.0 - 16.0)	12.0 (6.0 - 16.0)	8.0 (0.0 - 16.0)	MW < 0.001
Category, n (%)				CS < 0.001
Severe or total dependency	45 (28.3%)	0 (0.0%)	45 (35.4%)	
Moderate dependency	74 (46.5%)	15 (46.9%)	59 (46.5%)	
Mild dependency or independency	40 (25.2%)	17 (53.1%)	23 (18.1%)	
Barthel index				
Score, median (min. - max.)	65.0 (0.0 - 100.0)	85.0 (35.0 - 100.0)	61.5 (0.0 - 100.0)	MW < 0.001
Category, n (%)				CS < 0.001
Total dependency	7 (4.3%)	0 (0.0%)	7 (5.4%)	
Severe dependency	24 (14.7%)	1 (3.0%)	23 (17.7%)	
Moderate dependency	42 (25.8%)	7 (21.2%)	35 (26.9%)	
Mild dependency	90 (55.2%)	25 (75.8%)	65 (50.0%)	
MMSE				
Score, median (min. - max.)	26.0 (11.0 - 30.0)	26.0 (12.0 - 30.0)	25.0 (11.0 - 30.0)	MW: 0.464
Category, n (%)				CS: 0.434
With cognitive deficit	75 (45.5%)	13 (39.4%)	62 (47.0%)	

Table 4. Results From Assessment Instruments - *(continued)*

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)	P-value
Without cognitive deficit	90 (54.5%)	20 (60.6%)	70 (53.0%)	
HADS				
Score (depression), median (min. - max.)	8.5 (0.0 - 20.0)	4.0 (1.0 - 13.0)	9.0 (0.0 - 20.0)	MW < 0.001
Category (depression), n (%)				CS < 0.001
With depression	80 (50.0%)	3 (9.1%)	77 (60.6%)	
Without depression	80 (50.0%)	30 (90.9%)	50 (39.4%)	
Score (anxiety), median (min. - max.)	6.0 (0.0 - 17.0)	4.0 (0.0 - 10.0)	6.0 (0.0 - 17.0)	MW < 0.001
Category (anxiety), n (%)				CS: 0.002
With anxiety	45 (28.1%)	2 (6.1%)	43 (33.9%)	
Without anxiety	115 (71.9%)	31 (93.9%)	84 (66.1%)	

CS: Chi-square independent test; CSeT: Chi-square exact test; MW: Mann-Whitney test; FT: Fisher's test; MMSE: mini-mental state examination; HADS: hospital anxiety and depression scale. Missing data: Gijon's Social-familial Scale (n = 27), Katz index (n = 5), Lawton index (n = 6), Barthel index (n = 2), HADS depression (n = 5), and HADS anxiety (n = 5).

fragile individuals: physical domain (5.0 vs. 2.0 points), psychological domain (2.0 vs. 1.0 points) and social domain (2.0 vs. 1.0 points). The median value of the final score was also higher in the fragile group (9.0 points) compared to the non-fragile group (4.0 points). The final score varied between 0 and 5 points in the non-fragile group, while in the other group it ranged from 6 to 15 points (Table 5).

After adjusting for covariates, frailty was associated with females (aOR = 4.45, P = 0.011), vascular disease (aOR = 4.40, P = 0.040), vision problems (aOR = 10.85, P < 0.001), lower scores of LI (dependence on IADL) (aOR = 0.74, P = 0.002), and depressive symptoms (assessed by HADS) (aOR = 1.37, P = 0.001) (Table 6).

Discussion

In the present study, a very high percentage (80%) of the 165 patients admitted to CUs was in a frail condition, according to the TFI assessment. A similar percentage was found in a

Table 5. Assessment of Frailty With TFI for the Overall Sample

	Total (n = 165)	Non-frail (n = 33)	Frail (n = 132)
Score B1 (physical domain), median (min. - max.)	5.0 (0.0 - 8.0)	2.0 (0.0 - 5.0)	5.0 (1.0 - 8.0)
Score B2 (psychological domain), median (min. - max.)	2.0 (0.0 - 4.0)	1.0 (0.0 - 2.0)	2.0 (0.0 - 4.0)
Score B3 (social domain), median (min. - max.)	1.0 (0.0 - 3.0)	1.0 (0.0 - 3.0)	2.0 (0.0 - 3.0)
Final score, median (min. - max.)	8.0 (0.0 - 15.0)	4.0 (0.0 - 5.0)	9.0 (6.0 - 15.0)

Frailty	n (%)	95% CI
Non-frail (< 6)	33 (20.0%)	13.90-26.1%
Frail (≥ 6)	132 (80.0%)	73.9-86.1%

TFI: Tilburg frailty indicator; CI: confidence interval; min.: minimum; max.: maximum.

Table 6. Multivariate Logistic Regressions

	aOR	95% CI for aOR	P-value
Age	0.99	0.92 - 1.06	0.719
Sex (female)	4.45	1.40 - 14.14	0.011
Vascular disease	4.40	1.07 - 18.14	0.040
Vision problems	10.85	3.04 - 38.70	< 0.001
Lawton Index	0.74	0.62 - 0.89	0.002
Depressive symptoms (HADS)	1.37	1.37 - 1.64	0.001

aOR: adjusted odds ratio; 95% CI for aOR: 95% confidence interval for adjusted odds ratio; HADS: hospital anxiety and depression scale.

prospective cohort study of Chong et al [45], with 210 elderly patients (mean age 89.4) admitted to a geriatric medicine service, also using the TFI. However, compared to other previous works with samples recruited from a tertiary hospital of patients with chronic diseases, such as heart failure [46] and atrial fibrillation [47], the rate of the present study is lower. In another work on the prevalence of frailty in the context of a tertiary hospital, this syndrome was highly prevalent (48.8%), but still lower than the one found in the current study [16]. Differences were also observed comparing these results with the ones from studies with people living in community, where the observed values ranged from 24.5% to 54.8%, according to the TFI evaluation [48]. For example, in the Survey of Health, Aging, and Retirement in Europe (SHARE), with a cohort of individuals from 11 European countries, the rate of frailty was substantially lower (approximately 29%) [49]. In addition, in a previous Portuguese community-dwelling older population study, the frailty prevalence was lower (54.8%), despite using the same cut-off point for the TFI [30].

Beyond the issues related to sociodemographic and cultural variables among populations included in these studies, there are other possible explanations for the differences in the rates of frailty between studies. First, the high rate of frailty in the present research could be partly explained by the fact that it includes a sample of older patients with multimorbidity, recovering from cerebrovascular diseases, heart disease, orthopedic surgery, diabetes, Parkinson's disease or other clinical conditions. Second, these studies integrated different populations recruited from a variety of settings. Another potential reason may be the different instruments used to assess frailty and cut-offs, as well as the ways of operationalizing the items that make up the instruments in each study.

Regarding the comparison of sociodemographic characteristics between groups of patients with and without frailty, it was possible to verify that the frail group was predominantly comprised of female and widowed individuals. Several investigations including the marital status provided data regarding associations between marital status and frailty among community-dwelling older people [50], which are in agreement with these results, varying according to the instruments used [51]. For example, Kenneth Rockwood concluded that frail patients are usually more likely to be female, cognitively impaired, and incontinent, as well as more likely to have impaired mobility and function and more comorbid illnesses [52]. In addition, findings from the Health Survey, Aging and Retirement in Europe study, with a final sample of 60,816 individuals, concluded that more than 50% of the European population (aged > 50 years) are pre-frail/frail, and frailty prevalence increased along with age, being more frequent among women (56.4%) [12, 14].

The high risk of females concerning frailty may be explained by the greater longevity of women, the fact that they are more affected by osteoporosis and because they have less muscle mass and strength than men [53, 54].

Concerning the health-related parameters assessed, frail patients were significantly more likely to feel frequently tired and less full of energy, to have vision problems, pain [55], difficulty walking and climbing stairs [56], and to suffer a fall [57, 58]. Moreover, sphincter incontinence, cardiac, vascular and respiratory diseases, as well as depression/other psychiatric disease were more prevalent among frail patients [59, 60]. Furthermore, frail patients had a higher number of hospitalizations in the previous year and a higher comorbidity.

Considering that frailty can physically be expressed by weight loss, walking problems and falls, and be enhanced by comorbid conditions and number of medicines taken, the results of this study confirm this assumption and are in line with the findings from several other studies [61, 62].

With respect to the association between frailty and comorbidity, a systematic review and meta-analysis [17] of 48 observational studies found that almost a fifth of adults with multimorbidity also present frailty. Also, it was concluded that this is associated with an increased risk of developing frailty and vice versa, pointing at a bidirectional association between these two conditions. In addition, the complexity of multimorbidity in the context of coexisting conditions, such as frailty and dementia and polypharmacy [61], has a considerable burden at an individual level and with implications from a perspective of health service, social assistance and policies. Bearing in mind the co-existence of frailty and multimorbidity, the National Institute for Health and Care Excellence (NICE) guidelines highlight the need for frailty screening as a way to identify those with multimorbidity who can benefit from a personalized approach to care [62].

Also, with regard to health-related variables, patients with frailty in overall, took more medicines/day, lost more weight in the previous year, were at higher social risk and had more cognitive deficits. However, these differences were not statistically significant between groups.

Regarding lifestyles parameters, non-consumption of alcohol and the absence of physical activity were more frequent in frail patients [63]. In addition, more frail patients considered themselves less autonomous and rated their health as poor or very poor, in the previous year, compared to non-frail patients. In the study by Coelho et al [48] with a sample of older people living in community and using the TFI for frailty assessment, the authors reached similar results regarding lifestyle behaviors. In particular, the perception of their health status may be compromised in frail older people since these patients have a high prevalence of chronic diseases, negatively affecting their health-related quality of life [64].

Another important finding in this study was that more frail patients had depressive and anxiety symptoms, which is in line with previous studies [65, 66]. Evidence suggests that depression and frailty are common syndromes among older people, sharing moderate overlap, which means that they can coexist. Moreover, some studies concluded that depression may increase the risk of frailty, while the opposite relationship was less conclusive [67]. It is hypothesized that depression leads to decreased physical activity and muscle strength, fatigue, and can negatively affect the body's physical functioning [68, 69], which is, are in turn, associated with a higher risk of frailty [70, 71]. On the other hand, frail individuals are at a high risk to develop depression, given their increased physical limitations, lack of independence and high medical comorbidity [72].

Another finding in this study was that frail patients were more dependent on both IADS and BADS, which is in agreement with the results reported in the literature [69, 73]. This

finding is expected since frail older people can have a reduction in gait speed, fatigue, unintentional weight loss and decreased muscle strength, which may in turn compromise the performance of daily activities [71].

After the bivariate analysis, a multivariate logistic regression model was carried out, in order to assess the likelihood of being frail. After adjusting for covariates, frailty was associated with female gender, vascular disease, vision problems, dependence on IADL and depressive symptoms.

To the best of our knowledge, this study is the first work on frailty in older people admitted in CUs in Portugal and appears as a contribution to the characterization of frailty in this specific clinical population, as well as its associated factors. Another strength of this study is the identification of the profile of patients transferred to the CUs. From this knowledge, it may possibly infer and program the services of these units, since admission to discharge schedule, regarding the necessary resources and reducing the costs.

This study has some limitations. First, a convenience sample was used, due to the difficulties of access to the older adults of the target population, which were pointed out in the method section. This strategy especially limits the extrapolation of data on the prevalence of frailty, which means it is important to carry out population-based studies to a best comparison. Second, the cross-sectional design of this study and the fact that the sample was limited to a population referred by acute hospitals to RNCCI CUs for a period of time not exceeding 30 days (usually with the potential for intensive rehabilitation) arise as other limitations and limit the generalizability of the current findings to other clinical populations.

In order to overcome these limitations, future studies are needed to deepen the knowledge in this area of research, particularly including other potential factors that may be associated with frailty in older people. In addition, studies with larger samples recruited from different clinical settings will be required, as well as longitudinal studies, in order to clarify the predicting adverse health outcomes related to frailty. Previous research has investigated the cross-sectional overlap between comorbidity and frailty. Therefore, it will be necessary to develop studies on the temporal relationships between unique long-term conditions, multimorbidity, frailty and disability.

Despite the recent advance in the inclusion of the routine identification of frailty and the management of frail patients, the diagnosis of this syndrome still needs universal consensus to standardize an adequate tool for daily routine in clinical contexts.

In addition, randomized clinical trials will be needed to analyze the effectiveness of traditional and emerging therapies to frailty management. Finally, research is also relevant to understand the stage of clinical frailty that is not remediable and where palliative care would be more appropriate.

In conclusion, the findings of this study support the hypothesis that frailty is high among older patients in CUs, particularly in females, with vascular disease, vision problems, IADL dependence and depressive symptoms. In line with this and due to the high prevalence of frailty in the hospitalized older population, frailty must be routinely screened and assessed, ideally in primary care settings. In this way, it will be possible to develop preventive measures to be considered in the planning of appropriate interventions in individuals at risk of frailty, allowing for the reversion of frailty and improving the quality of life of all these patients, reducing hospital stays, institutionalizations, resort to health care, public expenditure and mortality rates.

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Financial Disclosure

None to declare.

Conflict of Interest

The authors have no potential conflict of interest to disclose.

Informed Consent

Written informed consent from all patients and/or from their closest relative or legal representative (if the patient was unable to decide for him/herself) was obtained.

Author Contributions

Mario Pinto, Sonia Martins and Lia Fernandes participated in the conception and design of the study. Mario Pinto participated in the data collection and drafting the original work. All authors contributed to the analyses and interpretation of the results, as well as to the critical revision of the article. The final manuscript was approved by all authors. Moreover, authors take responsibility for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Data Availability

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Abbreviations

ARS N: *Administracao Regional de Saude do Norte* (Northern Regional Health Administration); BADL: basic activities of daily living; BI: Barthel index; BMI: body mass index; CCI:

Charlson comorbidity index; CUs: convalescence units; DBP: diastolic blood pressure; GCS: Glasgow coma scale; GSFES: Gijon's social-familial evaluation scale; HADS: hospital anxiety and depression scale; IADL: instrumental activities of daily living; KI: Katz index of independence; LI: Lawton index; MMSE: mini-mental state examination; *RNCCI*: *Rede Nacional de Cuidados Continuados Integrados* (Integrated Continued Care National Network); SBP: systolic blood pressure; SHARE: Survey of Health, Aging, and Retirement in Europe; TFI: Tilburg frailty indicator

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