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INTRAHOSPITALAR FRAILTY SCREENING

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INTRAHOSPITALAR FRAILTY SCREENING

Artigo Científico Original

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Table of contents

List of abbreviations and acronyms

CCI – Charlson weighted index of comorbidity

CGA – Comprehensive Geriatric Assessment

CI – Confidence interval

FS – FRAIL scale

P7 – PRISMA—7

RR – Relative risk

SD – Standard deviation

List of figures and tables

Abstract

Background: Frailty defines a state of vulnerability facing a stressor event. Frail admitted patients represent a high-risk group for adverse health outcomes that benefit from a Comprehensive Geriatric Assessment (CGA). Screening instruments are crucial for identifying such patients; however, their potential has never been explored in Portuguese hospitals. The objective of this study is to evaluate the population of Internal Medicine inpatients at risk of frailty.

Methods: Prospective study based on FRAIL scale (FS), PRISMA-7 (P7) (cut-off of 5) and medical records, conducted in a tertiary university hospital in Coimbra, Portugal, involving patients aged 65 and older admitted to Internal Medicine Service. We compared the demographic and clinical characteristics of patients with readmission and mortality within 30 and 90 days after discharge, as well as, the relationship between these outcomes and hospital admission length of stay and inhospital mortality with the state of frailty (defined by FS and P7).

Results: Frailty was assessed in 100 patients. Of these, 69% and 47% were considered frail, through FS and P7, respectively. Independently of the scale, frailty was associated with greater hospital lengths of stay and the only inhospital death was of a frail patient. The patients who died within 90 days of discharge had statistically significant higher P7 score (4.9±1.6 versus 3.4±1.7, p= 0.0144) which translated into a risk of death during this period 5.5 times superior (RR 5.53, CI 95% 1.28 - 23.86, p= 0.0118) compared with the one of the not-frail patients defined by the same scale. No other risk relations, namely with FS, were concluded.

Conclusions: FS and P7 are simple tools that can be used early in clinical admission to select patients to undergo CGA and improve health outcomes. Our study identified a significant percentage of patients that may have frailty. Frailty was associated with longer lengths of stay and presumably higher costs. FS and P7 application in the Portuguese population should be regarded with reservations as both demonstrated little association with readmission and mortality (except for 90 days' mortality with P7). Additional investigation is still required to further clarify this concept.

Keywords: Aging, Frailty, FRAIL Scale, PRISMA-7, Portugal, Comprehensive Geriatric Assessment.

Resumo

Introdução: Fragilidade define o estado de vulnerabilidade aumentado face a fatores extrínsecos de *stress*. Doentes frágeis internados representam um grupo de elevado risco de efeitos adversos que beneficiam de uma Avaliação Geriátrica Global (AGG). Ferramentas de rastreio de fragilidade são cruciais na identificação destes doentes; no entanto, o seu potencial nunca foi devidamente explorado em meio hospitalar português. O objetivo deste estudo é estudar a síndrome de fragilidade no doente agudo idoso internado no serviço de Medicina Interna.

Métodos: Este estudo prospetivo, baseado na escala FRAIL (FS), PRISMA-7 (P7) (*cut-off* de 5) e em registos médicos, ocorreu num hospital universitário terciário em Coimbra, Portugal, e envolveu doentes com idade igual ou superior a 65 anos internados no Serviço de Medicina Interna. Comparámos as características clinicas e demográficas dos pacientes com a readmissão e mortalidade nos 30 e 90 dias após alta, assim como a relação destes *outcomes*, da duração do internamento e da mortalidade intra-hospitalar com o estado de fragilidade do doente (definido pela FS e P7).

Resultados: Fragilidade foi pesquisada em 100 pacientes. Destes, 69% e 47% foram considerados frágeis, usando a FS e P7, respetivamente. Independentemente da escala utilizada, fragilidade associou-se com internamentos mais longos e a única morte intra-hospitalar registada foi de um doente considerado frágil. Os doentes que morreram nos 90 dias após alta tinham *scores* de P7 estatisticamente superiores (4.9±1.6 versus 3.4±1.7, p= 0.0144) o que se traduziu num risco de morte durante esse período 5.5 vezes superior (RR 5.53, CI 95% 1.28 - 23.86, p= 0.0118) quando comparado com o de doentes considerados não frágeis pela mesma escala. Não foram obtidas outras relações de risco, nomeadamente com FS.

Conclusão: FS e P7 constituem instrumentos de rastreio simples de seleção de doentes à admissão para serem sujeitos a AGG com impacto clínico positivo. O nosso estudo identificou uma percentagem significativa de pacientes no serviço de Medicina Interna que poderão ser frágeis. A presença de fragilidade associou-se a internamentos mais longos e presumivelmente com maiores custos. A aplicação destas escalas na população portuguesa deve ser considerada com reserva, ambas demonstraram estar pouco associadas com readmissão e mortalidade (exceto a mortalidade a 90 dias e P7). Investigação adicional continua a ser necessária visando o esclarecimento mais aprofundado deste conceito.

Palavras-chave: Envelhecimento, Fragilidade, Escala FRAIL, PRISMA-7, Portugal, Avaliação Geriátrica Global, Mortalidade, Reinternamento.

Introduction

The current impressive global demographics changes accrue from the scientific advancements and improvement of life conditions resulting in an increase of the older population. (1–3)

Considering European Union and European Free Trade Association countries' population in 2010, it has been estimated that by 2060 the prevalence of persons aged 65 years and older will rise from 13.3% to 29.3%. (1) Portugal is not an exception to the exposed scenery: 2060 projections predict a rise from 124 to 307 elderlies per each 100 young people comparing to 2010 data. (4)

It is now accepted that aging has a distortive effect on diseases and that diseases under these circumstances have a major disabling potential. This calls for function-oriented medicine instead of a disease-oriented medical vision. (3)

In the light of the above emerges frailty, this concept was first described about 2 decades ago. (2,3) Frailty names a state of disproportionate vulnerability to an insufficient individual's reactivity facing a stressor event. This clinical geriatric syndrome is consequent to a decreased biological capacity of homeostasis resistance. Age-related vicious cycle leads to cumulative decline to multiple physiologic systems and progressive loss of reserve, followed by a precipitous risk for adverse health outcomes including falls, delirium, disability, morbidity, dependency, institutionalization, hospitalization and mortality. (2,3,5–10)

Although the theoretical phenomenon is well accepted and widely recognized with the term frailty commonly used in clinical practice, fully understanding of its underlying mechanism is not yet a reality. (5,9) The efforts for refining the theories of frailty have been insufficient since the concept lacks a consensus definition and specific diagnostic criteria. (5,7,9) Its prevalence is highly dependent on the measures that are used to assess it. (2,3,6,7,11) In 2015 a study identified a total of 67 frailty assessment instruments in the literature (9), they include nutritional status, physical activity, mobility, energy, strength, cognition, mood and social

relations and support (6). Recent reviews on the matter call for a clear definition (2) and highlight the necessity of increased reliability and validity testing (9).

Two instruments dominate the panorama of frailty assessment: Physical Frailty Phenotype - developed by Fried and co-workers- and the Frailty Index -developed by Rockwood and co-workers. (2,3,9) Both are dependent on objective measures like grip strength for frailty phenotype or the quantification of deficit presence (in the Frailty Index) (12), which can be difficult to implement due to equipment or space limitations (7).

Identifying frailty in a patient sets the basis for a Comprehensive Geriatric Assessment (CGA), a holistic medical review by a multidisciplinary team, including geriatric specialized physicians, so to deliver an exhaustive assessment orientated care planning and regular reviews. (8) CGA is considered the gold standard for care when facing a frail patient. (13) This type of approach has a positive impact on mortality, reducing the length of stay for hospitalized older adults (3), but it is not feasible for all patients as it is time and resource consuming (10).

Frailty has the potential to be screened, identifying the patients who would benefit from a CGA (3,5,10) more objectively than age-related discrimination (3,10). There is a necessity for a simple screening tool (12), generally, these are self-reported, with a dichotomous scoring system, quick and easy to apply by a non-geriatrician and without complex objective measures (5,8,10).

By applying two validated screening instruments, namely FRAIL Scale (FS) (14,15) and PRISMA—7 (P7) (16), this prospective study aims to evaluate the population of Internal Medicine inpatients at risk of frailty. To the best of knowledge, the developed study in a hospital setting is unique in Portugal.

Methods

Subjects and setting

The study was conducted at Centro Hospitalar e Universitário de Coimbra- Hospitais da Universidade de Coimbra, a tertiary Portuguese hospital. Information was gathered in two temporal moments: between July-September of 2016 and January-February of 2017. The subject of such study were 65 years or older patients admitted to the Internal Medicine Service. The service is constituted of 5 yards, A to E. As the study relies on 2 frailty screening scales and routine medical care records it was determined that individual oral consent, based on clear explanation, was sufficient. The respect of ethical norms was guaranteed.

Measures and data collection

The data was collected by a medical student using a filling form and focusing the pre-admission state reported by the patient.

This form is composed of: (1) routine clinical information and demographic data (age, gender, residence -home, nursing home or long-term care facilities-, number of drugs and admission motive), (2) two self-reported screening instrument (FS and P7) (appendix 1 and appendix 2), (3) comorbidities were measured applying the Charlson weighted index of comorbidity (CCI) and (4) final outcome (hospital admission length of stay, inhospital mortality, readmission and mortality within 30 and 90 days after discharge).

Considering the 8 days of data collection, 120 patients were randomly selected from a universe of 1088 patients. Inpatients in Internal Medicine Service, aged 65 or older, with unimpaired verbal communication and appropriated general orientation were included. Exclusion criteria were: programmed admission, total dependency for daily life activities, advanced demential syndrome, terminally ill patients, transfer to another hospital, discharge against medical advice and data inconsistency. After exclusion, 100 patients were eligible for analysis (Figure 1).

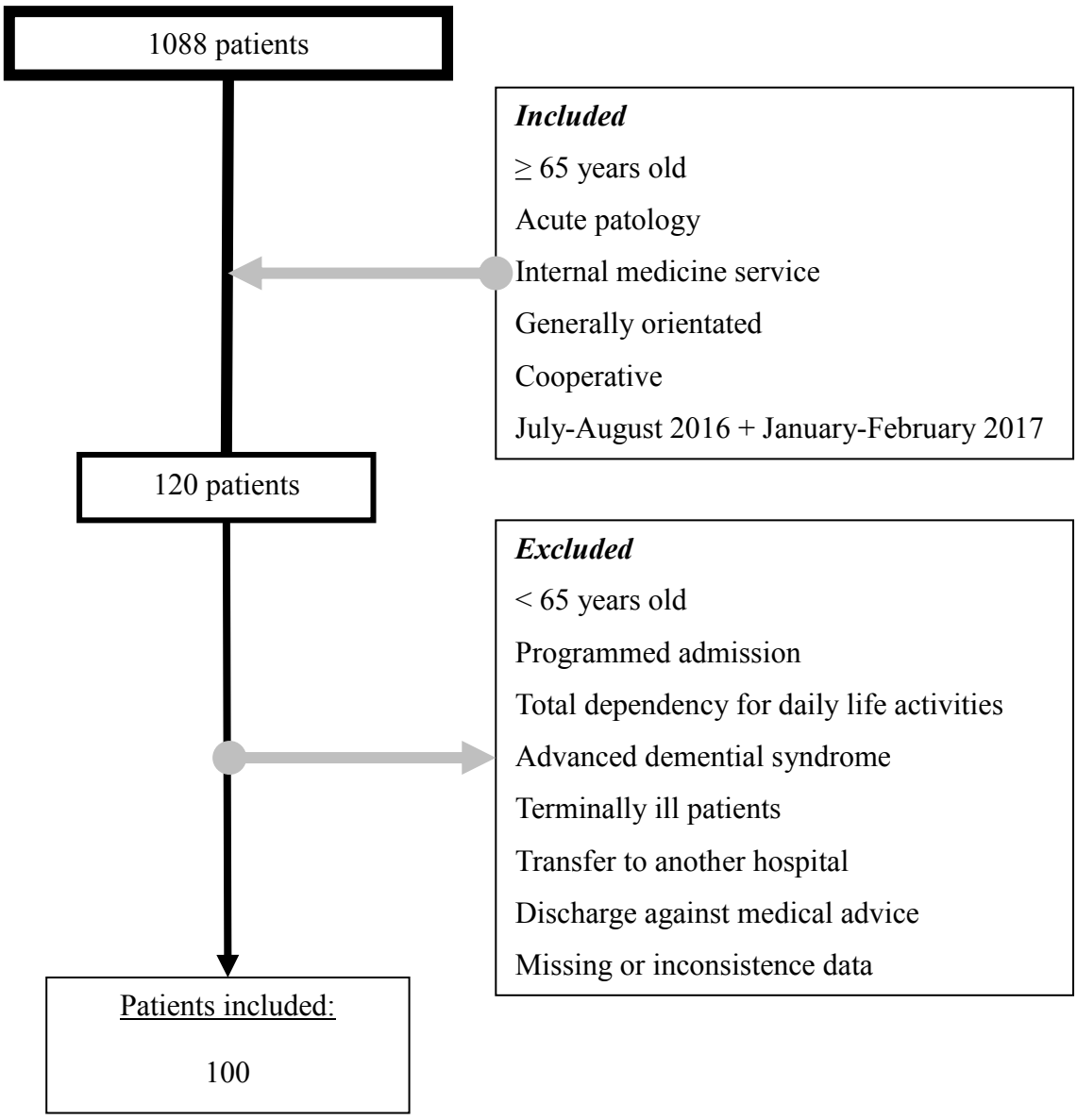

Fig 1. Study population selection procedure.

After discharge outcomes, that is re-admission/death within 30 and 90 days after discharge, were evaluated at a posterior moment with variation in the number of patients assessed due to meanwhile death or time limitations.

Instruments and Statistical Analysis

For means of statistical analysis, the original scores of FS and P7 were collapsed into two groups based on each scale descriptions: patients who were scored at 1-2 in FS or at 0-4 in P7 integrated the not-frail group, and frail group for those scored at 3-5 in FS or at 5-7 in P7.

For the present study FS was used considering its traditional cut-offs: robust if FS score 0, pre-frail if FS score 1-2 and frail if FS score >2; there are few studies addressing this scale validity and all, with considerable limitations, present high sensibility and low specificity (14,15), nevertheless, further investigation is necessary to confirm this data.

As for P7, acknowledging that the most commonly used cut-off for frailty identification is P7 score of 3 (sensitivity and specificity of 78.3% and 74.7%, respectively), in our study the cut-off chosen was P7 score of 5. Defining frailty for patients scored at 5 was analyzed in the original P7 validation study showing that 9.1% of the population had a P7 score ≥5: sensitivity 35.7%, specificity 97.3%, positive predictive value 75.9% and negative predictive value 86.3%. Therefore, for means of comparative analysis between highly probable frail patients and their respective studied outcomes, the cut-off was defined at 5 based on its positive predictive value being significantly superior to the obtained with a cut-off of 3 (75.9% versus 42.7%). (16)

We compared characteristics of patients with or without 30 and 90-day readmission or death, as well as the relationship between these outcomes and the state of frailty (defined by FS and P7) using Chi-square or Fisher's exact test for categorical variables and Student t-test for continuous variables. Statistical significance was set at $p< 0.05$. Descriptive and statistical analysis were performed in SPSS v.23.0 (IBM Corp., Armonk, NY, USA).

Results

Baseline characteristics

Demographic and clinical characteristics of the study population are contemplated in Table 1. One hundred patients were involved in this study, 71.0% were male (n=71) and 29.0% female (n=29). Population average age was 80.6 (±8.3) years old, ranging from 65 to 99. (Figure 2) The mean male age was 79.1 (±8.3) whereas mean female age was 84.2 (±8.4) years. While 90.0% (n=90) lived at own home, 10.0% (n=10) did not live at home (9.0% (n=9) in nursing home and 1.0% (n=1) in long-term care facility). The mean of number of medication was 7.6 (±3.8) drugs per patient, with 78.0% (n=78) using more than 5 medicines. The mean CCI was 2.7 (±2.0). Overall, half of the admissions were motivated by infection- 52.0% (n=52)-, 36.0% (n=36) were due to respiratory infection, 11.0% (n=11) were non-specified infection, 3.0% (n=3) urinary tract infection and 2.0% (n=2) gastroenteritis. Cardiovascular reasoned admission in 18.0% (n=18) (heart failure 10.0% (n=10), cardiac dysrhythmia 5.0% (n=5), pulmonary embolism 2.0% (n=2) and stroke 1.0% (n=1) whereas 12.0% (n=12) were related to renal disease (acute kidney injury in 8.0% (n=8) and acute chronic kidney disease in 4.0% (n=4)). The remaining reasons for admission all had a prevalence inferior to 7% (neoplasm 7.0% (n=7), rheumatological disorder 5.0% (n=5), metabolic/endocrine 3.0% (n=3), hematologic disease 1.0% (n=1), hepatic disorder 1.0% (n=1) and respiratory disease 1.0% (n=1)). The prevalence of the admission reasons is presented in Figure 3.

Table 1. Demographic and clinical characteristics of the study population.

		Total Sample (n=100)
Age, mean (±SD)		80.6 (±8.3)
Age distribuition, n (%)	65-74	26 (26.0%)
	75-84	37 (37.0%)
	≥85	37 (37.0%)
Gender, n (%)	Male	71 (71.0%)
	Female	29 (29.0%)
Residence, n (%)	Home	90 (90.0%)
	Nursing home	9 (9.0%)
	Long-term care facilities	1 (1.0%)
No. of medication, mean (±SD)		7.6 (±3.8)
Patients medicated with ≥5 medicines		78.0 (78.0%)
CCI, mean (±SD)		2.7 (±2.0)
Reasons for admission, n (%)		
Infection, 52 (52.0%)	Respiratory infection	36 (36.0%)
	Non-specified infection	11 (11.0%)
	Urinary tract infection	3 (3.0%)
	Gastroenteritis	2 (2.0%)
Cardiovascular, 18 (18.0%)	Heart failure	10 (10.0%)
	Cardiac dysrhythmia	5 (5.0%)
	Pulmonary embolism	2 (2.0%)
	Stroke	1 (1.0%)
Renal disease 12 (12.0%)	Acute kidney injury	8 (8.0%)
	Acute chronic kidney disease	4 (4.0%)
Neoplasm		7 (7.0%)
Rheumatological disorder		5 (5.0%)
Metabolic/endocrine		3 (3.0%)
Hematologic disease		1 (1.0%)
Hepatic disorder		1 (1.0%)
Respiratory disease		1 (1.0%)

Note. CCI = Charlson weighted index of comorbidity.

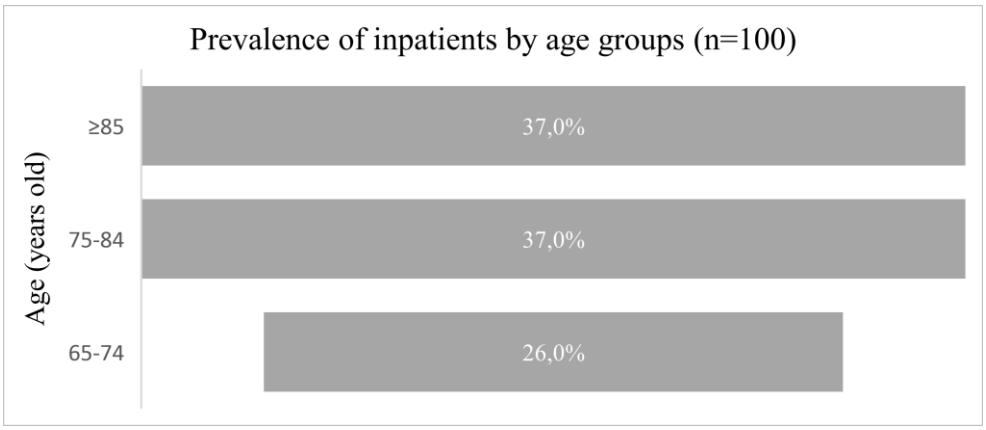

Fig 2. Prevalence of inpatients by age groups.

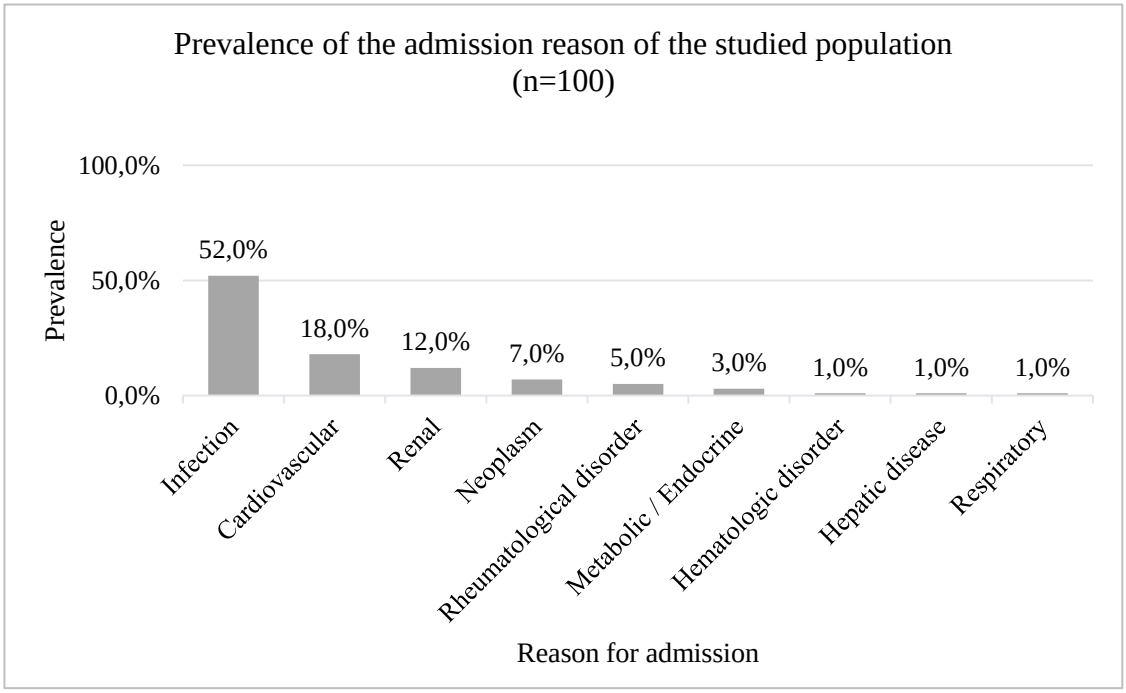

Fig 3. Prevalence of the admission reason of the study population.

Frailty screening instruments (FS and P7) were used in all the study population, each scale took less than 1 minute to apply. FS mean score was 3.0 (±1.1) and 69.0% (n=69) of all patients were classified as frail (FS >2), 30.0% (n=30) pre-frail (FS 1-2) and only 1.0% (n=1) defined as fit (FS 0) as showed in Figure 4; with P7 the mean score was 4.1 (±1.6) and when using the conventional cut-off of 3 -validated in community but never in hospital setting-

79.0% (n=79) of our population would be considered in risk of frailty, while with a cut-off of 5 only 43.0% (n=43) of the patients are identified as potentially frail and 57.0% (n=57) not frail (P7 1-4). Figure 5 presents a comparison of the prevalence determined by each scale.

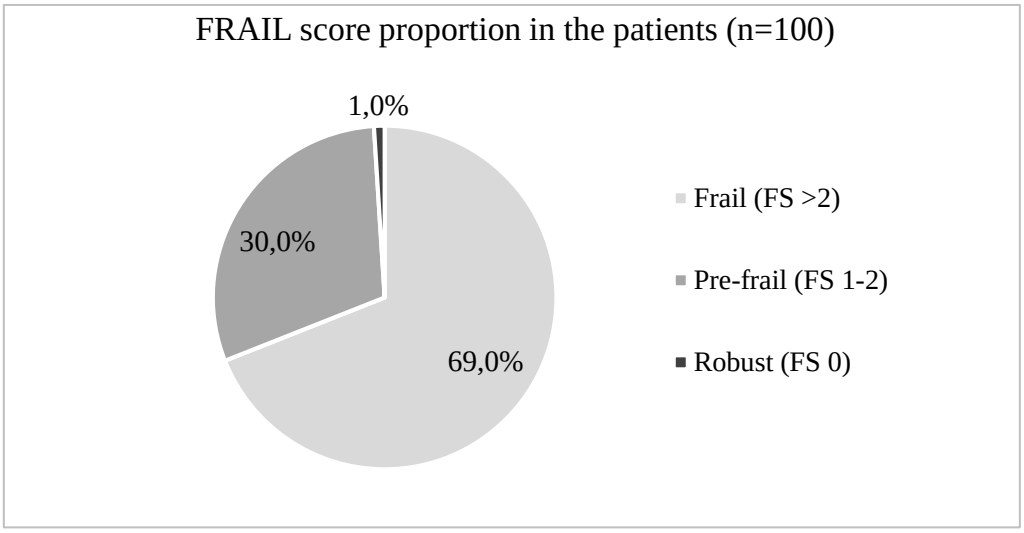

Fig 4. FRAIL scale score proportion in the patients.

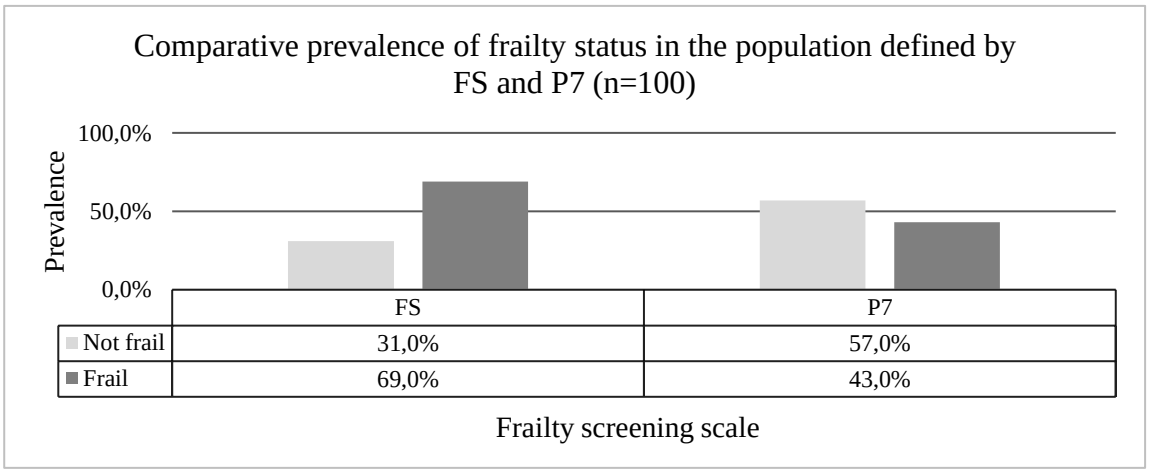

Fig 5. Comparative prevalence of frailty status in the population defined by both scales.

Note. FS = FRAIL scale; P7 = PRISMA-7 (cut-off of 5).

During admission

The mean length of stay was 15.3 days (±14.4, ranging from 3 to 90 days), which was not significantly higher in frail patients considering both FS and P7 classification and not longer for higher frail scores within each scale as illustrated in Figure 7 and 9.

Only one patient has died, who was classified as frail, FS score was 3 and P7 score of 6.

One month

The study population for one-month outcomes was 95 patients. Complementary data is presented in Table 2.

One-month mortality was 5.3% (n=5), its only significant association was with length of stay (32.0±17.5 versus 13.4±14.5, p= 0.0014). Any of the other characteristics (age, gender, residence, number of medication and CCI) showed to be related with the given outcome, including FS (2.6±1.1 versus 3.0±1.1, p= 0.3783) and P7 (5.0±1.6 versus 4.0±1.6, p= 0.1809) (Table 2).

Readmission on the first month after discharge was 17.9% (n=17). Readmission within 30 days was statistically associated with living at an assisted-living or long-term care facility (23.5% versus 7.7%, p= 0.0400), higher CCI (3.7±2.2 versus 2.5±2.1, p= 0.0276) and longer length of stay (21.7±16.0 versus 12.8±14.6, p= 0.0095). There was no significant difference concerning FS score between those readmitted and those not readmitted (3.2±1.1 versus 3.0±1.1, p= 0.5200), the same was observed with P7 (3.8±1.7 versus 4.1±1.6, p= 0.3999), as well as in any of the other baseline characteristics (age, gender and number of medication) (Table 2).

One-month death or unplanned readmission was 20.0% (n=19) and these patients had higher CCI (3.7±2.6 versus 2.5±2.1, *p*= 0.0209) and longer length of stay (20.4±23.6 versus 12.9±14.6, *p*= 0.0228), besides these there were no significant differences in both frail scores, FS (3.0±1.2 versus 3.0±1.1, *p*= 0.9257) and P7 (4.0±1.6 versus 4.1±1.6, *p*= 0.8489), as well as in any of the other baseline characteristics namely age, gender, residence and number of medication (Table 2).

Table 2. Association of demographic and clinical characteristics of the study population, length of stay and frail scales scores with 30 days' outcome.

Patient variable	Overall no. (%) of patients n=100 (100.0%)	Unplanned readmission within 30 days, no (%) of patients			Dead within 30 days, no (%) of patients			Death or unplanned readmission within 30 days, no. (%) of patients		
		No n=78 (82.1%)	Yes n=17 (17.9%)	*p* - value	No n=90 (94.7%)	Yes n=5 (5.3%)	*p* - value	No n=76	Yes n=19	*p* - value
Age mean (±SD)	80.6 (±8.3)	80.4 (±8.3)	79.6 (±8.4)	0.7328	80.2 (±8.4)	81.6 (±8.0)	0.7218	80.5 (±8.3)	79.5 (±8.9)	0.6635
Gender (male %)	71 (71.0%)	57 (73.1%)	11 (64.7%)	0.4881	64 (71.1%)	4 (80.0%)	0.5594	55 (72.3%)	13 (68.4%)	0.7329
Residence Assisted-living facility or long-term care facility (%) Home (%)	 10 (10.0%) 90 (90.0%)	 6 (7.7%) 72 (92.3%)	 4 (23.5%) 13 (76.5%)	0.0400	 9 (10.0%) 81 (90.0%)	 1 (20.0%) 4 (80.0%)	0.6956	 6 (7.9%) 70 (92.1%)	 4 (21.1%) 15 (78.9%)	0.0709
Number of medications, mean (±SD)	7.6 (±3.8)	7.6 (±3.8)	7.5 (±3.6)	0.9187	7.6 (±3.8)	6.8 (±3.5)	0.6545	7.6 (±3.8)	7.6 (±3.2)	0.9790
CCI score, mean (±SD)	2.7 (±2.0)	2.5 (±2.1)	3.7 (±2.2)	0.0276	2.7 (±2.1)	3.0 (±2.2)	0.7527	2.5 (±2.1)	3.7 (±2.6)	0.0209
Length of stay in days, mean (±SD)	15.3 (±14.4)	12.8 (±14.6)	21.7 (±16.0)	0.0095	13.4 (±14.5)	32.0 (±17.5)	0.0014	12.9 (±14.6)	20.4 (±23.6)	0.0228
FS score, mean (±SD)	3.0 (±1.1)	3.0 (±1.1)	3.2 (±1.1)	0.5200	3.0 (±1.1)	2.6 (±1.1)	0.3783	3.0 (±1.1)	3.0 (±1.2)	0.9257
P7 score, mean (±SD)	4.1 (±1.6)	4.1 (±1.6)	3.8 (±1.7)	0.3999	4.0 (±1.6)	5.0 (±1.6)	0.1809	4.1 (±1.6)	4.0 (±1.6)	0.8489

Note: CCI = Charlson weighted index of comorbidity; SD = Standard deviation.

Three-month

The study population for three-month outcomes was 49 patients. The following is based on data presented in Table 3.

Three-month death was 18.4% (n=9). Mortality after 90 days of discharge was statistically associated with higher CCI (4.9±2.2 versus 3.2±2.3, *p*= 0.0381) and longer length of stay (34.0±18.9 versus 13.2±18.8, *p*= 0.0004). The patients who died within 90 days tended to be male (77.8% versus 65.0%, *p*= 0.4602) and had a superior number of medications (9.4±3.8 versus 7.3±3.8, *p*= 0.1283) but this difference was not statistically significant. Both age and residence failed to relate with the outcome. Considering the scales, whereas FS scores were similar (3.0±1.2 versus 3.2±1.2, *p*= 0.6118), P7 score for those who died within 90 days of discharge was significantly higher (4.9±1.6 versus 3.4±1.7, *p*= 0.0144) (Table 3).

Unplanned readmission on the first 3 months was 42.9% (n=21). Although the association was not significant, the patients who were readmitted after 90 days of discharge were older (79.1±8.4 versus 76.8±8.3, *p*= 0.3446), more likely to live at an assisted-living or long-term care facility (14.3% versus 7.1%, *p*= 0.4760) and had a greater number of medications (8.6±3.8 versus 7.0±3.8, *p*= 0.1648). Both the variable CCI (4.4±2.2 versus 2.8±2.3, *p*= 0.0150) and length of stay (22.3±18.9 versus 13.0±18.8, *p*= 0.0549) reached a significant *p*-value with higher values related to readmission within 3 months. There were no statistically significant differences in FS (3.1±1.2 versus 3.3±1.2, *p*= 0.6556) and P7 (3.8±1.6 versus 3.6±1.7, *p*= 0.6752) (Table 3).

Death or readmission within 90 days of discharge was 44.9% (n=22). Respective to this outcome, higher CCI (4.4±2.0 versus 2.7±2.3, *p*= 0.0086) and longer length of stay (23.0±21.8 versus 12.1±18.8, *p*= 0.0232) reached significant statistic association. The number of medications was higher in this group of patients but the variance was not statistically

significant (8.4±3.9 versus 7.1±4.3, p= 0.2710). The remaining baseline characteristics did not relate to this outcome, that is age, gender and residence. Either scales were statistically unrelated with death or readmission, FS (3.1±1.1 versus 3.2±1.2, p= 0.8038) and P7 (3.9±1.6 versus 3.5±2.0, p= 0.4151) (Table 3).

Table 3. Association of demographic and clinical characteristics of the study population, length of stay and frail scales scores with 90 days' outcome.

Patient variable	Overall no. (%) of patients n=100 (100.0%)	Unplanned readmission within 90 days, no (%) of patients			Dead within 90 days, no (%) of patients			Death or unplanned readmission within 90 days, no. (%) of patients		
		No n= 28 (57.1%)	Yes n=21 (42.9%)	*p* - value	No n=40 (81.6%)	Yes n=9 (18.4%)	*p* - value	No n=27	Yes n=22	*p* - value
Age mean (±SD)	80.6 (±8.3)	76.8 (±8.3)	79.1 (±8.4)	0.3446	78.0 (±8.6)	76.8 (±8.4)	0.6967	77.1 (±8.3)	78.6 (±8.9)	0.5216
Gender (male %)	71 (71.0%)	19 (67.8%)	14 (66.7%)	0.9299	26 (65.0%)	7 (77.8%)	0.4602	18 (66.7%)	15 (68.2%)	0.9104
Residence										
Assisted-living facility or long-term care facility (%)	10 (10.0%)	2 (7.1%)	3 (14.3%)	0.4760	4 (10.0%)	1 (11.1%)	0.0691	2 (7.4%)	3 (13.6%)	0.5164
Home (%)	90 (90.0%)	26 (92.9%)	18 (85.7%)		36 (90.0%)	8 (88.9%)		25 (92.6%)	19 (86.4%)	
Number of medications, mean (±SD)	7.6 (±3.8)	7.0 (±3.8)	8.6 (±3.8)	0.1648	7.3 (±3.8)	9.4 (±3.8)	0.1283	7.1 (±4.3)	8.4 (±3.9)	0.2710
CCI score, mean (±SD)	2.7 (±2.0)	2.8 (±2.3)	4.4 (±2.2)	0.0150	3.2 (±2.3)	4.9 (±2.2)	0.0381	2.7 (±2.3)	4.4 (±2.0)	0.0086
Length of stay in days, mean (±SD)	15.3 (±14.4)	13.0 (±18.8)	22.3 (±18.9)	0.0549	13.2 (±18.8)	34.0 (±18.9)	0.0004	12.1 (±18.8)	23.0 (±21.8)	0.0232
FS score, mean (±SD)	3.0 (±1.1)	3.3 (±1.2)	3.1 (±1.2)	0.6556	3.2 (±1.2)	3.0 (±1.2)	0.6118	3.2 (±1.2)	3.1 (±1.1)	0.8038
P7 score, mean (±SD)	4.1 (±1.6)	3.6 (±1.7)	3.8 (±1.6)	0.6752	3.4 (±1.7)	4.9 (±1.6)	0.0144	3.5 (±2.0)	3.9 (±1.6)	0.4151

Note. CCI = Charlson weighted index of comorbidity; SD = Standard deviation.

FRAIL Scale

The comparison between the studied outcomes for frail and non-frail population considering FS, as exposed in Table 4 and represented in Figure 6, revealed that neither groups were associated with a differentiating outcome incidence. Moreover, a greater percentage of 30-day death (6.6% versus 4.6%, *p*= 0.5069) and 90-day dead (25.0% versus 16.2%, *p*= 0.3832) and readmission (50.0% versus 40.5%, *p*= 0.5657) was seen in non-frail patients (F <3). The fact that the only patient who died during admission had a FS score of 3 is noteworthy.

Regarding the length of stay, a trend is noticeable for patients who have higher FS scores to present longer length of stay (Figure 7).

Table 4. Association between frailty classification by FRAIL scale and outcome.

OUTCOME		FS ≥3	FS <3	RR (CI 95%)	*p*-value
Hospital mortality	No, n (%)	68 (98.6%)	31 (100.0%)	-	0.6900
	Yes, n (%)	1 (1.4%)	0 (0.0%)		
30-day					
Readmission	No, n (%)	53 (81.5%)	25 (83.3%)	1.11 (0.43-2.86)	0.8231
	Yes, n (%)	12 (18.5%)	5 (16.7%)		
Death	No, n (%)	62 (95.4%)	28 (93.3%)	0.69 (0.12-3.93)	0.5069
	Yes, n (%)	3 (4.6%)	2 (6.6%)		
90-day					
Readmission	No, n (%)	22 (59.5%)	6 (50.0%)	0.81 (0.41-1.61)	0.5657
	Yes, n (%)	15 (40.5%)	6 (50.0%)		
Death	No, n (%)	31 (83.8%)	9 (75.0%)	0.65 (0.19-1.12)	0.3832
	Yes, n (%)	6 (16.2%)	3 (25.0%)		

Note: RR = Relative risk; CI = Confidence interval.

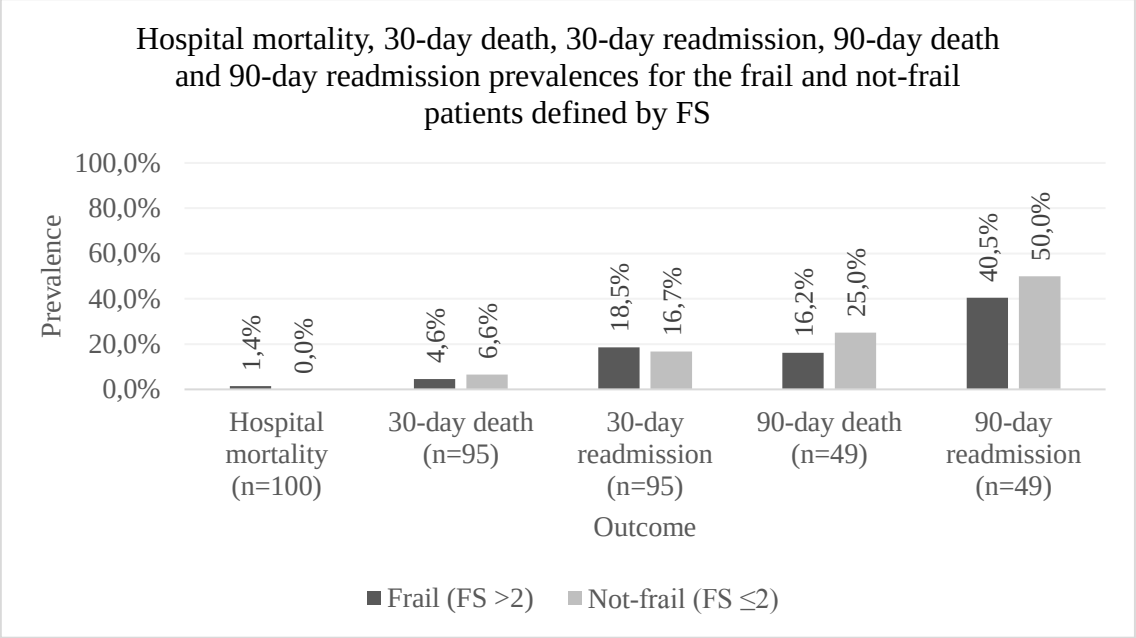

Fig 6. Poor outcome prevalence for the frail and not-frail patients defined by FS.

Note. FS = FRAIL scale.

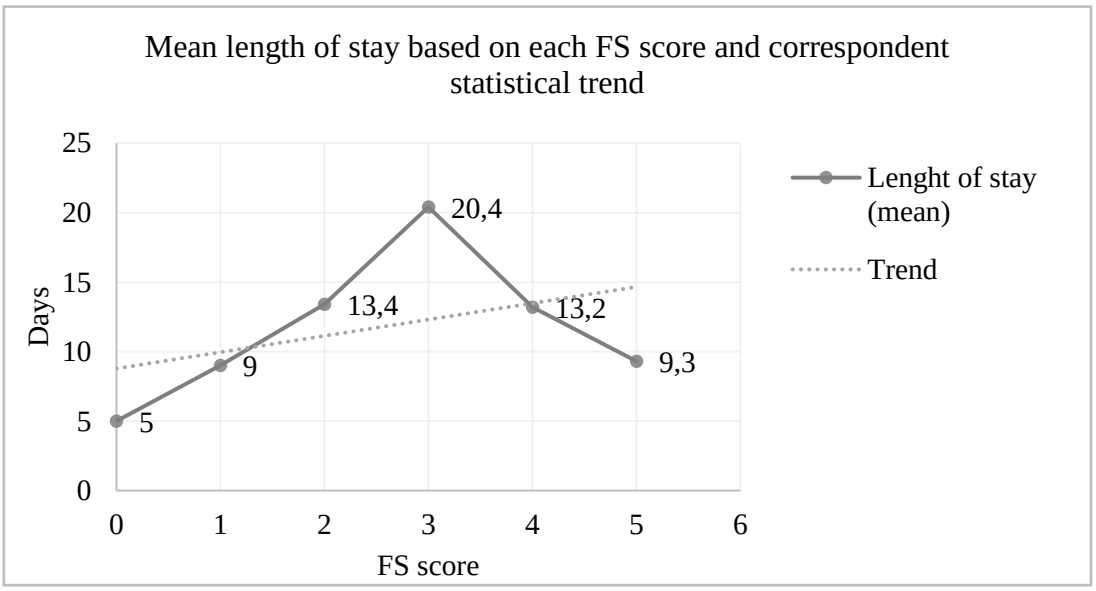

Fig 7. Statistical trend and mean of length of stay for FS determined scores.

Note. FS = FRAIL scale.

PRISMA-7 Scale

Inpatient dead was registered in a patient with a P7 score of 6, therefore considered frail (P7 ≥5). From the comparison of the frail with the non-frail group, defined as such by P7, all the tested outcomes showed no significant relation between them except for 90-day death which was statistically significant (36.8% versus 6.7%, *p*= 0.0118). This analysis associated frailty with a 5.5 times higher risk of death within 90 days after discharge (RR 5.53, CI 95% 1.28 - 23.86, *p*= 0.0118) (Table 5 and Figure 8).

P7 scores have a linear relationship with length of stay, exhibiting a longer length of stay for crescent scores (Figure 9).

Table 5. Association between frailty classification by PRISMA-7 (cut-off of 5) and outcome.

OUTCOME		P7 ≥5	P7 <5	RR (CI 95%)	*p*-value
Hospital mortality	No, n (%)	42 (97.7%)	57 (100.0%)	-	0.4300
	Yes, n (%)	1 (2.3%)	0 (0.0%)		
30-day					
Readmission	No, n (%)	34 (82.9%)	44 (81.5%)	0.92 (0.38-2.21)	0.8625
	Yes, n (%)	7 (17.1%)	10 (18.5%)		
Death	No, n (%)	37 (90.2%)	53 (98.1%)	0.19 (0.02-1.64)	0.1073
	Yes, n (%)	4 (9.8%)	1 (1.9%)		
90-day					
Readmission	No, n (%)	9 (47.4%)	19 (63.3%)	1.44 (0.76-2.71)	0.2713
	Yes, n (%)	10 (52.6%)	11 (36.7%)		
Death	No, n (%)	12 (63.2%)	28 (93.3%)	5.53 (1.28-23.86)	0.0118
	Yes, n (%)	7 (36.8%)	2 (6.7%)		

Note: RR = Relative risk; CI = Confidence interval.

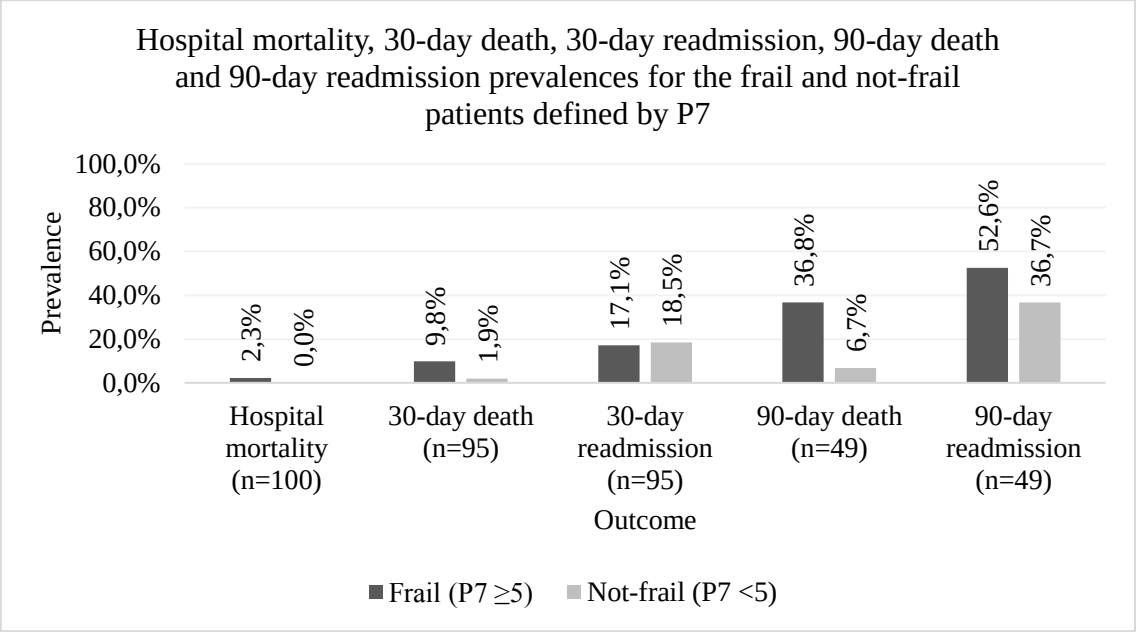

Fig 8. Poor outcome prevalence for the frail and not-frail patients defined by P7.

Note. P7 = PRISMA-7 scale (cut-off of 5).

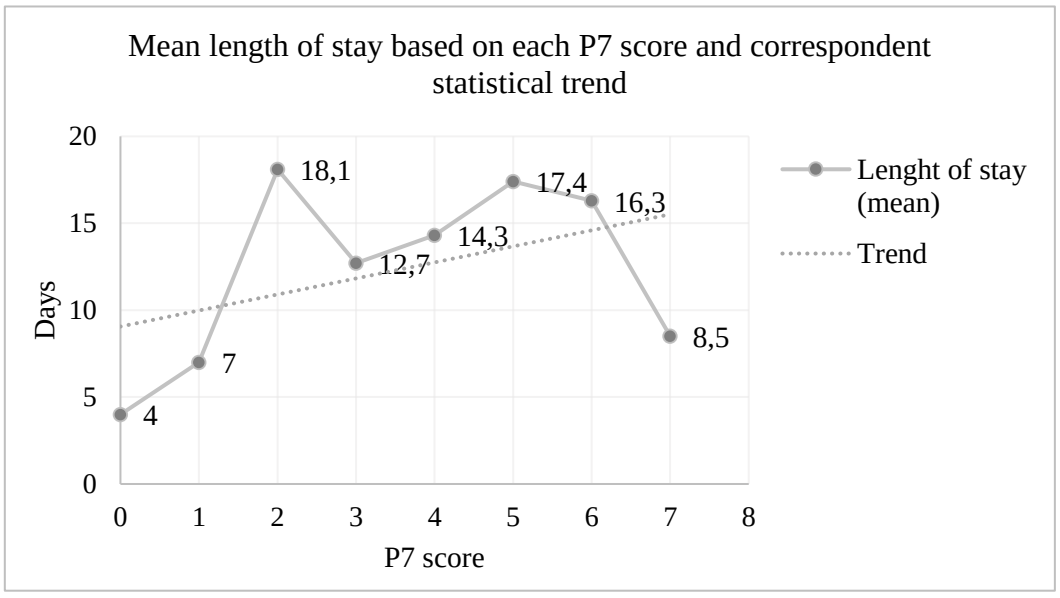

Fig 9. Statistical trend and mean of length of stay for P7 determined scores.

Note. P7 = PRISMA-7 scale (cut-off of 5).

Discussion

Predicted to become a most important geriatric syndrome, frailty is an actual reality inherent to the growing older population of the majority of European countries- Portugal included- and with a significant expected demographic representation.

A larger Portuguese community setting study integrative of a European project for investigation and action upon frailty, that included a total of 338 older people, screened its prevalence and found that more than one-third of the community population was considered frail and half pre-frail. The subsequent implemented interventional programs had a positive impact on the population with a decrease in the prevalence of frail elders and pre-frail elders of 5% and 10%, respectively. (17) A more recent study to characterize the sociodemographic profile of the Portuguese frail elderly demonstrated a high prevalence of this syndrome present in more than one-third of a 339 individuals' population. (18) Both studies were conducted in Guimarães, identifying frailty through Physical Frailty Phenotype of Fried, which requires objective measures.

The adverse health outcomes imposed by frailty- such as hospital admission, mortality (3-5% are preventable deaths) (6), disability, morbidity and falls- determine functional decline and loss of independence with a negative impact on the quality of life of this population (2) as well as an augmented health care resources utilization (7) and economic burden (3).

Even though CGA is perceived as the gold standard for frailty diagnosis, its applicability to the generality of patients is limited as it requires geriatrician input and it is time-consuming. (10)

Hospital admission is a unique opportunity to identify frail patients that would benefit from a CGA and an adapted preventive plan. For that reason, screening tools for frailty are crucial.

FS and P7, internationally validated scales for screening the presence of frailty (14–16), are self-reported – thus not dependent on measures that would be modified due to the effect of

acute illness, making them useful in the acute setting (10)-, quick, cheap and easy-to-use tools feasible by nonspecialized clinician (8,10).

Respective to the study population, exception made for the demented patients excluded, it is regarded as representative of the typical internal medicine hospitalized patient: old patients with comorbidities and polimedicated (≥5 medicines).

This prospective study has identified a very significant number of inpatients in risk for frailty using both scales, 69% through FS and 47% with P7, furtherly, FS considered merely 1% of patients as robust against 30% considered pre-frail, together this data underlines a decidedly significant percentage of patients that may have frailty.

Hypothetically, the frail group, defined as so by these screening scales, constitute the ideal target for a more exhaustive CGA.

The comparative evaluation between the group of frail considered patients and the group of not-frail considered patients, by FS and P7, exposed that frailty (independently of its defining scale) was associated with a greater hospital length of stay- and probable consequent high costs- and that the only registered death was integrated in this first group (frail).

Statistical association between the possible presence of frailty and greater risk of death or readmission after 30 and 90 days of discharge was tested: P7 evidenced that frail patients (P7 ≥5) had 5.5 times higher probability of death within 90 days of discharge; further risk relations, namely with FS, were not concluded - this results can be reactive to the diminutive size of the subjected population- and for this cases, CCI and length of stay exhibited better predictive capacity for death and readmission after 30 and 90 days of discharge.

Some limitations of our study need to be designated. The small size of the study population may be responsible for the lack of stronger associations, as so we believe that an expansion of the database could reveal statistically stronger relationships. We did not evaluate the relative weight of factors like functionality and economical status of the patients, these could have a

role in the study outcomes. The considered admissions for the means of the study were exclusively respective to our hospital, potentially leaving out other than would affect this study results. Neither the causes of death nor the causes and pertinence of readmission were analyzed. The primary care access and follow up consultation were not taken into account, they could have a positive or negative influence on the outcomes.

Conclusion

Simple screening tools for frailty, specifically FS and P7, showed value when used as initial selection criteria to identify patients at risk of frailty requiring a deepened individual geriatric assessment complemented with an integrated plan of action.

In our study, patients defined as frail in FS and P7 had longer lengths of stay with a predictably heavier economical weight.

From the employed scales, only P7 has showed a potential association with mortality within 90 days of discharge.

FS and P7 application in the Portuguese population should be regarded with reservations as both demonstrated little association with readmission and mortality (except for 90 days' mortality with P7), reflecting its scarce individual value when not completed by CGA.

Frailty, for the older population, should always be considered as a baseline condition and as a patient's outcome. For this reason, information about the pre-admission state is vital, not only for care adjustment and prognostic matters, but for prevention of frailty onset or aggravation as well. The answer for this may rely on an alliance with the Primary Care- which might have a key role on the history of frailty.

Additional investigation is needed: (1) to reinforce that CGA and preventive plans in the population selected through this scales have an impact in reducing the number of readmissions and death in such patients and (2) to provide answers to the questions that were raised *de novo* by this study or that were not satisfactorily answered by it.

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Appendix 1

FRAIL scale			
FRAIL scale items	Questions addressed to the patients	Sim Yes	Não No
Fatigue	Sente fadiga/cansaço? Do you feel fatigue/tiredness?		
Resistance	É capaz de subir um lanço de escadas? Are you able to walk up a flight of stairs?		
Ambulation	É capaz de andar 100 meters? Are you able to walk 100 meters?		
Illness[a]	Presença de >5 doenças? Presence of >5 diseases?		
Loss of weight	Perda recente de >5% do peso? Weight loss of >5%?		
Número total de respostas "Sim"/ Total number of "Yes" answers		SCORE	

[a]Answers were confirmed through medical records.

Appendix 2

PRISMA-7		
Questions addressed to the patients	Sim Yes	Não No
Tem mais de 85 anos? Are you more than 85 years old?		
Sexo masculino? Male?		
No geral, tem algum problema de saúde que limite as suas atividade? In general, do you have any health problems that require you to limit your activities?		
Precisa de ajuda no dia-a-dia? Do you need someone to help you on a regular basis?		
No geral, tem algum problema de saúde que o faz ficar em casa? In general, do you have any health problems that require you to stay at home?		
Em caso de necessidade, conta com ajuda de alguém próximo? In case of need, can you count on someone close to you?		
Usa regularmente andarilho, bengala ou cadeira de rodas? Do you regularly use a cane, a walker of a wheelchair to move about?		
Número total de respostas "Sim"/ Total number of "Yes" answers	SCORE	