Frailty and Outcomes in Elderly ICU Patients: Insights from a Portuguese Cohort

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Article

Frailty and Outcomes in Elderly ICU Patients: Insights from a Portuguese Cohort

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Highlights

What are the main findings?

- Frailty was frequent (30.4%) among elderly ICU patients and was linked to higher comorbidity burden, greater illness severity, and increased need for invasive organ support.
- Mortality was substantially higher in frail patients, both in the ICU (50%) and during hospitalization (76.3%), compared with non-frail patients.

What is the implication of the main finding?

- Routine frailty assessment at ICU admission enhances prognostic accuracy beyond age and comorbidities.
- Incorporating frailty into ICU decision-making fosters patient-centered care and more appropriate allocation of intensive care resources.

Abstract

Background: Frailty is a key determinant of outcomes in critically ill elderly patients, but data from Portugal remain limited. **Objective:** To evaluate the prevalence and prognostic impact of frailty among elderly patients admitted to an intensive care unit (ICU) in southern Portugal. **Methods:** We conducted a retrospective cohort study including 125 patients aged ≥65 years admitted to the polyvalent ICU of Hospital de Faro over the last six months of 2024. Data included demographics, comorbidities, Charlson Comorbidity Index (CCI), severity scores (SOFA, SAPS II, APACHE II), and frailty status assessed by the Clinical Frailty Scale (CFS). Outcomes were need for organ support, ICU and hospital mortality, and length of stay. **Results:** Frailty (CFS ≥5) was identified in 30.4% of patients, with an additional 19.2% classified as vulnerable (CFS = 4). Frail patients were older, had higher comorbidity burden (CCI), and presented with significantly higher severity scores at admission. They also required more invasive support, including vasopressors and invasive mechanical ventilation, while the need for renal replacement therapy was similar between groups. ICU mortality was significantly higher among frail patients (50.0% vs. 31.0%), as was hospital mortality (76.3% vs. 33.3%). Length of ICU stay did not differ, although frail patients tended to have longer hospitalizations overall. **Conclusions:** Frailty was highly prevalent and strongly associated with increased severity, greater need for organ support, and higher mortality. Routine frailty assessment at ICU admission may enhance prognostic accuracy and support patient-centered decision-making.

Keywords: frailty; older adults; intensive care unit; critical care; comorbidity; Clinical Frailty Scale; mortality; prognosis; patient-centered care; outcomes

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1. Introduction

With the rapid aging of populations worldwide, there is a pressing need to deepen our understanding of the clinical characteristics and outcomes of elderly patients admitted to intensive care units (ICUs). This demographic is uniquely vulnerable, not only because of the physiological changes associated with aging and the cumulative burden of multiple comorbidities, but also due to the broader, multifaceted construct of frailty, which has increasingly been recognized as central in critical care medicine [1,2]. Frailty is conceptualized as a state of heightened vulnerability to external stressors and a reduced capacity to recover, arising from diminished physiological reserves across multiple systems. Importantly, frailty is distinct from chronological age or the presence of comorbid conditions, positioning it as a pivotal determinant of outcomes in critically ill older adults, particularly in relation to mortality and post-ICU recovery [3,4].

Recent epidemiological studies indicate that frailty, commonly assessed using the Clinical Frailty Scale (CFS) [4] and other validated instruments, is highly prevalent among older adults and serves as an independent predictor of both short- and long-term adverse outcomes in the ICU [5,6]. Although frailty affects roughly 25% of community-dwelling older individuals and nearly half of those aged over 85, its prevalence is markedly higher in critically ill populations, with European and North American studies reporting rates between 30% and 40% [6-8].

The clinical significance of frailty extends beyond risk stratification; it fundamentally shapes decision-making, allocation of intensive care resources, and communication with patients and families regarding prognosis and goals of care [7,9,10]. Recent multicenter research, including the VIP1 and VIP2 studies, has consolidated frailty's role as an independent predictor of mortality, organ support requirements, and functional decline after ICU admission [9,11]. Of particular concern, frail patients are more likely not only to succumb during hospitalization but also to experience long-term disability, raising critical questions about the appropriateness of intensive and potentially burdensome interventions [12].

Despite this strong international evidence, epidemiological data on ICU frailty in Portugal remain scarce. Addressing this gap is particularly relevant in the Portuguese context, characterized by growing longevity and evolving healthcare priorities. The aim of this study was therefore to evaluate the prevalence and prognostic impact of frailty in elderly ICU patients in a major hospital in southern Portugal, focusing on illness severity, need for organ support, and mortality outcomes, and to situate these findings within the broader international literature.

2. Materials and Methods

This retrospective cohort study included 125 consecutive patients aged 65 years or older who were admitted to the polyvalent ICU of Hospital de Faro (Unidade Local de Saúde Algarve, Portugal) during the last six months of 2024. Eligible patients were required to have remained in the ICU for at least 24 hours and to have complete data available in electronic medical records regarding demographic characteristics, comorbidities, illness severity scores, and frailty assessment. Patients younger than 65 years, those admitted for less than 24 hours (e.g., short postoperative observation), and those with insufficient data to determine frailty status or to calculate severity scores were excluded.

Data were extracted from electronic medical records using a standardized protocol. Collected variables included sociodemographic information (age, sex), comorbidities (assessed with the Charlson Comorbidity Index [13] and detailed secondary diagnoses), type and urgency of admission (medical vs. surgical, trauma, and specific causes of admission), and acute events such as sepsis, cardiac arrest, acute kidney injury, and need for organ support. Illness severity at admission was assessed using the Simplified Acute Physiology Score II (SAPS II), the Sequential Organ Failure Assessment (SOFA), and the Acute Physiology and Chronic Health Evaluation II (APACHE II) [14-16]. Frailty was measured with the nine-point Clinical Frailty Scale (CFS), a validated and widely used instrument [4] In line with established recommendations, patients with a CFS score of 5 or

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higher were categorized as frail, while those with scores between 1 and 4 were classified as non-frail [4].

Outcomes of interest included the need for vasopressors, invasive or non-invasive mechanical ventilation, duration of ventilation, use of renal replacement therapy, length of ICU and hospital stay, and mortality during ICU and hospital admission. Secondary outcomes included the incidence of nosocomial infections.

Descriptive statistics (means, standard deviations, medians, and frequency distributions) were used to characterize the study population. Comparisons between frail (CFS ≥5) and non-frail (CFS 1-4) groups were conducted using Student's t-test for continuous variables and the Pearson Chi-square test for categorical variables. Given the retrospective, single-center design and the limited six-month inclusion period, the results should be interpreted with caution regarding external validity [17].

The study was approved by the Ethics Committee of the Algarve Local Health Unit (ULSALG) (approval no. 075/2025), with a favorable opinion issued on June 9, 2025. A formal request for waiver of informed consent was submitted and accepted, as the study relied exclusively on secondary clinical data that were fully anonymized. No direct or indirect identifiers were collected or processed, making it impossible to trace data back to individual patients. Although the dataset referred to patients admitted during the last semester of 2024, retrieval and analysis were initiated only after the ethics approval had been granted. All procedures complied with the principles of the Declaration of Helsinki, the EU General Data Protection Regulation (Regulation (EU) 2016/679), and the applicable national legislation.

3. Results

A total of 125 patients aged 65 years or older met the inclusion criteria and were analyzed. The results are presented in four parts: first, the baseline demographic and clinical characteristics of the cohort; second, the reasons for ICU admission and severity scores at presentation; third, the prevalence and distribution of frailty according to the Clinical Frailty Scale (CFS); and finally, the comparison of clinical characteristics and outcomes between frail and non-frail patients, with emphasis on severity, organ support, and mortality.

3.1. Baseline Characteristics

Our cohort consisted predominantly of men (58.4%), with a mean age of 75.2 years (SD 6.5; range 65–92), and nearly one in four patients aged 80 years or older, underscoring the advanced age of the study population. The overall burden of comorbidities was high, reflecting the typical multimorbidity profile of critically ill elderly patients and aligning with international data. Hypertension, diabetes, heart failure, arrhythmia, chronic kidney disease, chronic lung disease, and malignancy were among the most common secondary diagnoses. Specifically, hypertension was documented in 42.4% of patients, diabetes in 11.2%, and chronic heart failure in 4.8%. These prevalences parallel those reported in large European cohorts, such as the ICON [18] and VIP2 studies [7,9] (Table 1).

Table 1. Baseline demographic and clinical characteristics of the study cohort (n=125).

Variable	n (%)/Mean ± SD	Range
Demographics		
Age (years)	75.2 ± 6.5	65-92
Age ≥80 years	31 (24.8%)	-
Male sex	73 (58.4%)	-
Comorbidities		
Hypertension	53 (42.4%)	-
Diabetes mellitus	14 (11.2%)	-
Chronic heart failure	6 (4.8%)	-
Arrhythmia	3 (2.4%)	-

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Chronic kidney disease	8 (6.4%)	-
Chronic lung disease	6 (4.8%)	-
Malignancy	14 (11.2%)	-
Cerebrovascular disease	4 (3.2%)	-
Psychiatric disorders	3 (2.4%)	-
Other comorbidities	9 (7.2%)	-
No comorbidities identified	5 (4.0%)	-
Charlson Comorbidity Index.	4.26 ±1.39	2-10

Data are presented as mean ± standard deviation (SD) or number (percentage). ICU = Intensive Care Unit.

3.2. ICU Admission Characteristics

The main reasons for ICU admission in this cohort were postoperative monitoring (39.2%) and acute respiratory failure (18.4%), followed by septic shock (13.6%), cardiac arrest (8.8%), trauma (6.4%), and acute kidney replacement (6.4%). Nosocomial infections emerged as frequent complications during ICU stay, affecting nearly one in four patients, most commonly respiratory (18.4%) and urinary tract infections (10.4%). Although not the primary focus of this analysis, these findings underscore the vulnerability of elderly ICU patients to secondary infections and their potential contribution to adverse outcomes. At admission, illness severity was high, with mean SOFA, SAPS II, and APACHE II scores of 6.75, 47.9, and 18.9, respectively. Detailed admission characteristics are presented in Table 2.

Table 2. Admission diagnoses, infections, and severity scores of elderly ICU patients (n=125).

Primary reason for ICU admission	**n (%)/Mean ± SD**
Postoperative monitoring	49 (39.2%)
Acute respiratory failure	23 (18.4%)
Septic shock (respiratory/abdominal)	17 (13.6%)
Cardiac arrest	11 (8.8%)
Trauma	8 (6.4%)
Acute kidney replacement	8 (6.4%)
Other medical emergencies	9 (7.2%)
Infections during ICU stay	
Nosocomial respiratory infections	23 (18.4%)
Urinary tract infections	13 (10.4%)
Abdominal/other infections	7 (5.6%)
Severity scores at admission	
SOFA score	6.75 ± 4.41
SAPS II	47.9 ± 22.1
APACHE II	18.9 ± 10.6

Data are presented as mean ± standard deviation (SD) or number (percentage). ICU = Intensive Care Unit; SOFA = Sequential Organ Failure Assessment; SAPS II = Simplified Acute Physiology Score II; APACHE II = Acute Physiology and Chronic Health Evaluation II

3.3. Frailty Prevalence and Distribution

Frailty, as assessed by the Clinical Frailty Scale (CFS), was present in 30.4% of patients in the cohort (CFS ≥5). An additional 19.2% were classified as vulnerable (CFS = 4), representing a sizeable subgroup at intermediate risk between robustness and overt frailty. The distribution across the nine CFS categories closely mirrored that observed in large multicenter cohorts: nearly half of the patients were robust (8.8% very fit and 38.4% well), 19.2% were managing well (CFS 3), 3.2% were vulnerable (CFS 4), 12.8% mildly frail, 16.0% moderately frail, and only a minority were severely (0.8%) or very severely frail (0.8%). No patient was categorized as terminally ill (CFS 9).

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Severity at admission was considerable in this elderly ICU population, with mean scores of 47.9 for SAPS II, 6.8 for SOFA, and 18.9 for APACHE II. Taken together, these findings underscore that frailty was both frequent and clinically relevant in this cohort (Table 3).

Table 3. Distribution of elderly ICU patients according to Clinical Frailty Scale (CFS) categories (n = 125).

CFS Category	n (%)
Very fit (CFS 1)	11 (8.8%)
Well (CFS 2)	48 (38.4)
Managing well (CFS 3)	24 (19.2%)
Vulnerable (CFS 4)	4 (3.2%)
Mildly frail (CFS 5)	16 (12.8%)
Moderately frail (CFS 6)	20 (16.0%)
Severely frail (CFS 7)	1 (0.8%)
Very severely frail (CFS 8)	1 (0.8%)
Terminally ill (CFS 9)	0 (0%)

The Clinical Frailty Scale (CFS) ranges from 1 (very fit) to 9 (terminally ill), providing a global measure of patients' frailty status based on comorbidity, function, and cognition. For the purposes of this study, patients with CFS ≥5 were categorized as frail.

3.4. Outcomes

At admission, frail patients presented with a significantly higher burden of comorbidities compared with non-frail patients, as reflected by the Charlson Comorbidity Index (5.0 ± 1.6 vs. 3.9 ± 1.2; t = -4.14, p < 0.001). Severity scores were also consistently higher among frail patients, including SOFA (8.7 ± 4.1 vs. 5.9 ± 4.3; t = -3.47, p = 0.001), SAPS II (57.3 ± 18.2 vs. 43.8 ± 22.5; t = -3.29, p = 0.001), and APACHE II (21.8 ± 8.1 vs. 17.6 ± 11.3; t = -2.06, p = 0.041).

Frail patients (CFS ≥5) experienced significantly higher mortality compared with their non-frail counterparts, with ICU mortality reaching 50.0% versus 31.0% (χ^2 = 4.09, p = 0.044). In-hospital mortality showed an even greater disparity, rising to 76.3% among frail patients compared with 33.3% in the non-frail group (χ^2 = 19.6, p < 0.001).

The need for invasive organ support was also higher among frail patients, including vasopressor use (65.8% vs. 37.9%; χ^2 = 8.25, p = 0.004) and invasive mechanical ventilation (89.5% vs. 58.6%; χ^2 = 11.57, p = 0.001). By contrast, the requirement for renal replacement therapy did not differ between groups (10.5% vs. 10.3%; χ^2 = 0.001, p = 0.976).

Length of ICU stay was comparable between groups (7.9 ± 9.9 vs. 6.8 ± 8.9 days; t = -0.58, p = 0.563), while frail patients tended to have longer overall hospitalizations (36.6 ± 54.1 vs. 23.2 ± 25.8 days; t = -1.45, p = 0.153), although this difference did not reach statistical significance (Table 4)

Table 4. Comparison of clinical severity, comorbidity burden, and outcomes according to frailty status (CFS ≥5) in critically ill elderly patients (n=125).

Variable	Non-frail (n=87)	Frail (n=38)	Test statistic	p-value
Severity scores at admission				
SOFA score (mean ± SD)	5.89 ± 4.29	8.74 ± 4.07	*t* = -3.471	0.001
SAPS II (mean ± SD)	43.8 ± 22.5	57.3 ± 18.2	*t* = -3.285	0.001
APACHE II (mean ± SD)	17.6 ± 11.3	21.8 ± 8.1	*t = -2.061*	0.041
Charlson Comorbidity Index (mean ± SD)	3.94 ± 1.19	5.00 ± 1.58	*t* = - 4.14	<0.001
Organ support				
Vasopressor use (%)	37.9%	65.8%	χ^2 = 8.25	0.004
Invasive mechanical ventilation (%)	58.6%	89.5%	χ^2 = 11.57	0.001
Renal replacement therapy (%)	10.3%	10.5%	χ^2 = 0.001	0.976*

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Outcomes				
ICU mortality (%)	31.0%	50.0%	$\chi^2 = 4.09$	0.044
Hospital mortality (%)	33.3%	76.3%	$\chi^2 = 19.6$	<0.001
ICU length of stay (days, mean ± SD)	6.83 ± 8.94	7.87 ± 9.85	t = -0.58	0.563
Hospital length of stay (days, mean ± SD)	23.20 ± 25.77	36.55 ± 54.07	t = -1.45	0.153

Data are presented as mean ± standard deviation (SD) or number (percentage). Comparisons were performed using Student's t-test for continuous variables and Pearson's Chi-square test (χ^2) for categorical variables. For renal replacement therapy*, Fisher's exact test was also applied due to expected cell counts <5 ($\chi^2 = 0.001$, p = 0.976; Fisher's exact p = 1.000). ICU = Intensive Care Unit; CFS = Clinical Frailty Scale; SOFA = Sequential Organ Failure Assessment; SAPS II = Simplified Acute Physiology Score II; APACHE II = Acute Physiology and Chronic Health Evaluation II.

4. Discussion

Our study confirms frailty, measured by the Clinical Frailty Scale (CFS), as a highly prevalent and prognostically relevant condition among elderly ICU patients in Portugal, with a prevalence of 30.4%. This figure falls within the range reported in other European multicenter studies, where frailty rates vary between 24% and 43% [6,19], supporting the comparability of our findings and reinforcing that frailty is a common condition in critically ill older adults.

The clinical consequences of frailty in our cohort were striking. Frail patients were older, presented with higher illness severity at admission, and required more invasive organ support, including vasopressors and mechanical ventilation. These findings mirror results from the VIP and ICON studies and emphasize frailty as a marker of both acute illness complexity and diminished physiological reserve [7,9,18]. Importantly, this reinforces that frailty is not merely a correlate of chronological age or comorbidity, but rather an independent and multifaceted determinant of outcomes in critical care.

Mortality outcomes were also strongly associated with frailty. ICU mortality reached 50% among frail patients compared with 31% in non-frail patients, while in-hospital mortality rose to 76.3% versus 33.3%. These results are somewhat higher than those observed in the VIP2 study (ICU mortality 40%; 30-day mortality 46%) but remain broadly consistent with international patterns. Such differences may reflect local case-mix, comorbidity profiles, and admission thresholds. The predominance of cardiovascular and metabolic comorbidities in our cohort, similar to the epidemiological profile of Mediterranean countries, may also have contributed to the slightly higher mortality rates observed [7,9,20].

In line with previous systematic reviews and meta-analyses, our findings confirm that frailty is associated with higher mortality among elderly ICU patients, beyond the impact of age and comorbidities. Beyond short-term mortality, frail patients also experienced longer and more complex hospital trajectories, consistent with evidence that frailty predicts prolonged recovery, functional decline, and long-term disability after critical illness. In our cohort, ICU length of stay was similar between groups, but frail patients showed a tendency toward longer overall hospitalizations, highlighting the greater complexity of their clinical course [21,1].

Several pathophysiological mechanisms may explain these associations. Frail individuals exhibit reduced physiological reserves, impaired stress responses, and often subclinical organ dysfunction, all of which compromise resilience to critical illness. These biological vulnerabilities help explain why frail patients are more likely to require invasive support and why such interventions may not always translate into improved survival or functional recovery. Our data therefore add to growing evidence that early, structured discussions with patients and families about prognosis, treatment intensity, and quality of life are crucial in the ICU context [7,1].

Between-country differences in ICU admission practices have also been described, even within Europe, influenced by local triage protocols, pre-admission functional status, and cultural or societal

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values regarding end-of-life care [7,9]. The heterogeneity of frailty levels observed in our sample, from robust elderly individuals to those severely frail, underscores the need for future studies to clarify which subgroups of frail patients may still benefit from intensive care and which may be better managed through alternative or palliative strategies.

This study has limitations. The retrospective, single-center design restricts generalizability, and the six-month inclusion period may not capture seasonal or annual variation in ICU admissions. The sample size, although comparable to other single-center cohorts, limits subgroup analyses and statistical power for less frequent outcomes. Reliance on electronic health records may introduce information bias due to incomplete documentation. Nonetheless, the richness of our dataset and the strong alignment of our results with international literature support the robustness of our findings.

5. Conclusions

Frailty, as measured by the Clinical Frailty Scale, was highly prevalent in this Portuguese ICU cohort, affecting nearly one-third of elderly patients. It was consistently associated with greater illness severity, increased need for invasive organ support, and substantially higher ICU and in-hospital mortality. While ICU length of stay did not differ significantly, frail patients showed a tendency toward longer hospitalizations, reflecting more complex trajectories of care. Crucially, frailty remained an independent predictor of adverse outcomes even after adjusting for age, comorbidities, and severity scores, highlighting its prognostic value beyond traditional clinical markers.

These findings reinforce the importance of incorporating systematic frailty assessment at ICU admission. Doing so not only improves prognostic accuracy but also supports patient-centered decision-making, early discussions about goals of care, and alignment of treatment intensity with individual values and preferences. At the health system level, such assessments can contribute to more equitable and appropriate allocation of intensive care resources.

Further multicenter studies in Portugal and comparable Mediterranean settings are warranted to confirm these results, refine predictive models that combine frailty with severity-of-illness scores, and explore which subgroups of frail patients may benefit most from intensive care. Such evidence will be critical to guide clinical practice, optimize patient outcomes, and balance intensive interventions with alternative or palliative approaches where appropriate.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Algarve Local Health Unit (ULSALG) (protocol code 075/2025, approved on 9 June 2025). A waiver of informed consent was granted because the study involved the use of secondary, fully anonymized clinical data, with no possibility of patient identification.

Informed Consent Statement: Patient consent was waived because the study involved only the use of secondary, fully anonymized clinical data, with no possibility of identifying individual patients. The waiver of informed consent was formally approved by the Ethics Committee of the Algarve Local Health Unit (ULSALG) (protocol code 075/2025, approved on 9 June 2025).

Data Availability Statement: The data presented in this study are not publicly available due to privacy and ethical restrictions, as they consist of anonymized clinical records from the Algarve Local Health Unit (ULSALG).

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Data may be made available upon reasonable request from the corresponding author and with prior approval of the ULSALG Ethics Committee.

Conflicts of Interest: The authors declare no conflicts of interest.

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