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ORIGINAL ARTICLE

The clinical frailty scale for the assessment of frailty in octogenarians in the intensive care unit

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ABSTRACT

Objective: Increased frailty is shown to be related to vulnerability to adverse health outcomes. The objective of the study was to assess the usability of frailty identified using the Clinical Frailty Scale (CFS) in patients aged 80 years and older admitted to the intensive care unit (ICU).

Materials and Methods: We conducted a retrospective screening of the octogenarian patients admitted to the ICU between January 1 and October 31, 2023. After excluding the postoperative patients, we recorded the demographic characteristics and comorbidities, APACHE II scores, Charlson Comorbidity Index, CFS scores, general admission reasons, and discharge patterns from ICU.

Results: The median age of the 156 patients in the study was 85, with 51.9% being female. The median APACHE II score was 18 (12–28), and the median CFS score was 5 (1–9). The CFS score categorized 37 patients as non-frail, 37 as pre-frail, and 82 as frail. The frail group exhibited statistically significant elevations in age, albumin levels, APACHE II scores, and comorbidities, including dementia, cerebrovascular disease, and cancer. The CFS score, age of 90 years or older, presence of pressure ulcers, APACHE II score, and acute kidney injury were associated with an increased risk of mortality. However, analysis of survival rates across frailty categories revealed no significant differences among the groups (p: 0.348).

Conclusion: Although the survival analysis revealed no major differences among non-frail, pre-frail, and frail groups, frailty was associated with risk of death in patients aged 80 and older, making it a potentially simple tool for doctors to predict outcomes.

Keywords: frality, octogenarian, intensive care, mortality, geriatrics

INTRODUCTION

Advances in health technology and healthcare have led to longer lifespans, resulting in an increasing proportion of elderly patients in the population. Global life expectancy rose from 34 years in 1913 to 72 years in 2022 and is projected to surpass 77 years by 2050 [1]. Furthermore, according to the Organization for Economic Cooperation and Development (OECD), the average life expectancy of people 65 years old was 19.9 years [2]. The International Monetary Fund (IMF) reports that people over 80 will make up 5% of the population by 2050 [3]. As the population ages, there will be a rise in geriatric health issues to address. In addition, an increase in the number of elderly individuals leads to a corresponding rise in geriatric hospital admissions and admissions to the intensive care unit (ICU).

Frailty is most commonly used to define the deterioration in physical, psychological, and cognitive functions caused by aging [4]. Frail

individuals have been shown to be more susceptible to acute illnesses, more prone to experience complications related to medical interventions, and more likely to face adverse outcomes associated with both surgical and non-surgical issues as well as mortality [4-7]. Whether referred to as a "syndrome" or "state," it is a determinant of both mortality and morbidity, with many scales developed to assess the degree of frailty [8]. The Clinical Frailty Scale (CFS), defined by Rockwood et al. is one of the most widely used tools and is scored on a 9-point scale [9]. It is a comprehensive scale that includes judgments on comorbidities, cognitive status, and disability, making it useful for assessing pre-hospital frailty status [10], predicting surgical outcomes [11], and monitoring critically ill patients [12-14].

It was reported that in patients aged ≥65 years, the CFS is strongly associated with both short- and long-term mortality, length of hospital stay, all-cause readmission, and unfavorable discharge destination [14,15]. A study involving patients from ICUs across European countries found that CFS correlated with in-ICU and short-term mortality in octogenarians [16]. The current study aims to investigate the all-cause in-ICU mortality of octogenarian patients in an ICU in a non-European country with a distinct healthcare system.

MATERIAL AND METHODS

This retrospectively designed study was carried out at the ICU at the Ministry of Health, Etlik City Hospital. The study included patients aged 80 and older who had been admitted to the ICU from January 1, 2023, until October 1, 2023. We excluded those who died within the first 24 hours of ICU admission. Due to the short ICU stays of most postoperative patients, we also excluded them to mitigate potential bias in the data. We used the hospital's data recording system to obtain details on demographics, dates of admission, discharge, or death, and laboratory findings. In addition to the CFS, the APACHE II and Charlson Comorbidity Index scores were computed.

The clinical frailty scale (CFS)

The CFS was originally developed to determine the overall fitness or frailty of older patients [9]. The 9-point tool, based on clinical judgment rather than questions, enables the assessment of the baseline clinical status of the individual at the onset of a new condition (ICU admission in this study) to predict prognosis, risk of death, or the outcomes of the previously defined condition [17-19]. The higher score means the more frailty. While a score of 1 denotes a very fit individual who is robust, active, and energetic and able to exercise regularly, a score of 9 defines a terminally ill person experiencing severe frailty and a life expectancy of less than 6 months [17]. The CFS categorizes scores of 1 to 3 as non-frail, a score of 4 as pre-frail, and scores ranging from 5 to 9 as frail [20]. The patient's acute clinical condition may influence the CFS assessment; therefore, baseline frailty status was obtained from their caregivers. Frailty assessments were conducted by a 3-year experienced geriatrician using the Turkish validated version of CFS [19].

Ethics approval

The study protocol adhered to the principles of the Declaration of Helsinki. The hospital's local ethics committee approved the study protocol (AESH-EK1-2023-764).

Statistical analysis

Descriptive statistics were made for the demographics, clinical scores, and laboratory. Pearson's chi-square test was used. The Kruskal-Wallis test analyzed the frailty categories, and a pairwise comparison test compared distinct variables. Post-hoc pairwise comparisons between the three groups were conducted using the Bonferroni correction to adjust for multiple testing.

Cox regression analysis was done to investigate the relationship between independent variables and mortality. For 30-day survival, we performed a Kaplan-Meier survival analysis. The sample size was determined to be 126 based on the existing literature on CFS in the intensive care unit, using the Spearman Correlation Test, assuming an expected moderate correlation (0.3) and a significance threshold (α) of 0.05, to achieve a statistical power (β) of 0.80. We used a p-value of less than 0.05 to indicate statistical significance. IBM SPSS software version 26.0 was utilized for statistical analysis.

RESULTS

After reviewing 208 subjects ≥80 years old, excluding those who passed away within the first 24 hours of ICU admission and those admitted for postoperative care, the study comprised 156 patients. The median age was 85 years (min-max: 80-101), and 81 (51.9%) of the participants were female. 106 patients (67.9%) were transported from the emergency room (ER), while 50 patients (31.1%) were transferred from the ward. The median length of stay (LOS) in ICU was 6 days (min-max: 1-49). The median APACHE II score was 18 (min-max: 12-28), the median Charlson comorbidity index score was 7 (min-max: 15), and the median CFS was 5 (min-max: 1-9). Upon ICU admission, the laboratory reported a mean hemoglobin value of 10.7 g/dL (SD: ±2.57) and a median albumin value of 29.3 g/L (min- max 16.9-44.3) (Table 1).

The most common causes for ICU admission were infections and respiratory failure (84.6% and 54.5%, respectively). Of the patients with an infection, 99 (75%) had pneumonia, 44 (33.3%) had urinary tract infections (UTI), 7 (5.3%) had cholecystitis, and 5 (3.2%) had central catheter infections. The gastrointestinal system (11, 73.3%) was the major site for bleeding. 111 (71.6%) individuals had acute kidney injury (AKI) either on admission or during the ICU stay. 44 (28.2%) of them suffered from pressure injuries. During the ICU stay, 76 (48.7%) of the patients required invasive mechanical ventilation, of whom 9 (11.8%) were extubated, and 9 (11.8%) had percutaneous dilatational tracheostomy. The in-ICU mortality rate was 37.2%. Among patients discharged from ICU, 72 (46.1%) were transported to the ward and 26 (16.7%) to the palliative care service. Considering the relationship between mortality and follow-up parameters, being ≥ 90 years old (p:0.029), the APACHE II score (p:0.004), the CFS score (p:0.004), having a pressure injury (p:0.003), and having AKI were found to be significantly correlated with mortality (Table 2).

The study population was compared based on the CFS classification as non-frail, pre-frail, or frail. The frail group was significantly older (p:0.039). Cerebrovascular disease, dementia, and cancer were more common in the frail group (p:0.001, p<0.001, p:0.037, respectively). Cardiovascular disorders and AKI as an acute illness were more common in the frail group (p:0.035, p:0.044, respectively) (Table 2).

Table 1. Demographics and basal measurements

Parameters, (n=156)	
Age	85 (80-101)
Gender, female n (%)	81 (51.9%)
APACHE II score (med, min-max)	18 (12-28)
Charlson Comorbidity Index (med, min-max)	7 (1-15)
CFS (med, min-max)	5 (1-9)
Albumin at hospitalization (g/L) (med, min-max)	29.3 (16.9-44.3)
Hemoglobin at hospitalization (g/dL) (mean±SD)	10.77±2.57
Site of transfer to the ICU	
Emergency room:	106 patients (67.9%)
Ward:	50 patients (32.1%)
Comorbidities	
Hypertension	86 (55.1%)
Diabetes mellitus	57 (36.5%)
Coronary artery diseases	44 (28.2%)
Heart failure	49 (31.4%)
Chronic lung diseases	31 (19.9%)
Chronic kidney diseases	23 (14.7%)
Dementia	37 (23.7%)
Cerebrovascular diseases	20 (12.8%)
Cancer	35 (22.4%)
Acute problems during ICU stay	
Respiratory failure	85 (54.5%)
Cardiovasculary problems	32 (20.5%)
Oral intake disorders	45 (28.8%)
Cerebrovascular problems	12 (7.7%)
Bleeding	15 (9.6%)
Acute kidney injury	111(71.6%)
Infections	132(84.6%)
Pneumonia	99(63.5%)
Urinary tract infections	44(28.4%)
Biliary tract infections	9(6.8%)
Meningitis	3 (2.2%)
Others	8(6.0%)
Endotracheal intubation	76 patients (48.7%)
Duration of ICU stay	6 days (min:1-max:49)
Exitus	58 (37.2%)
To palliative service	26 (16.7%)
To ward	72 (46.1%)

CFS: Clinical Frailty Scale, med: median, min: minimum, max: maximum, SD: standard deviation, g: gram, dL: desiliter, L: liter, ICU: intensive care unit

Table 2. Comparison of the patients according to frailty categories

	NON-FRAIL (37)	PRE-FRAIL (37)	FRAIL (82)	p
Age (median, min-max)	83 (80-94)	85 (80-97)	85,5 (80-101)[a]	0.039
Age category, n(%)				
80-89	33 (89.2)	29 (78.4)	57 (69.5)	0.062
≥ 90	4 (10.8)	8 (21.6)	25 (30.5)	
Gender, female, n (%)	16 (43.2)	22 (59.5)	43 (52.4)	0.374
APACHE II score	14 (12-18)	18 (12-28) [a]	18.5 (12-28) [a]	0.001
Haemoglobin (median, min-max)	11.5 (6.6-18.1)	10.8 (5.6-14.3)	10.4 (4.7-15.7)	0.193
Plasma albumin, (median, min-max)	31.9 (16.9-44.3)	30.2 (21-41.4)	26.8 (17.4-43.0) [a]	0.002
Charlson comorbidity index, (median, min-max)	6 (4-11)	6 (5-15)	8 (5-15) [a,b]	<0.001
Endotracheal intubation, n (%)	14 (37.8%)	18 (48.6%)	44 (53.7)	0.279
Mortality, n (%)	11 (29.7)	11(29.7)	36 (43.9)	0.188
Comorbidities				
Hypertension, n (%)	15 (40.5)	20 (54.1)	51 (62.2)	0.088
Diabetes mellitus, n (%)	14 (37.8)	14 (37.8)	29 (35.4)	0.950
Coronary artery disease, n (%)	12 (32.4)	9 (24.3)	23 (28.0)	0.740
Heart failure, n (%)	11 (29.7)	14 (37.8)	24 (29.3)	0.627
Chronic lung disorder, n (%)	8 (21.6)	8 (21.6)	15 (18.3)	0.873
Chronic kidney disease, n (%)	3 (8.1)	4 (10.8)	16 (19.5)	0.198
Dementia, n (%)	1 (2.7)	6 (16,2)	30 (36.6)[a]	<0.001
Cerebrovascular disease, n (%)	1 (2.7)	1 (2.7)	18 (21.9)[a,b]	0.001
Cancer, n (%)	8 (21.6)	3 (8.1)	24 (29.7)[b]	0.037
Acute problems during ICU stay				
Acute respiratory failure, n (%)	21 (56.8)	21 (56.8)	43 (52.4)	0.864
Cardiovascular, n (%)	3 (8.1)	12 (32.4)[a]	17 (20.7)	0.035
Impared oral intake , n (%)	6 (16.2)	10 (27.0)	29 (35.4)	0.099
Neurological , n (%)	3 (8.1)	3 (8.1)	6 (7.3)	1.000
Bleeding, n (%)	4 (10.8)	3 (8.1)	8 (9.8)	1.000
Infections, n (%)	31 (83.8)	28 (75.7)	73 (89.0)	0.172
Acute kidney injury, n (%)	27 (73.0)	37 (100)	52 (63.4)[b]	0.044

n: number, min: minimum, max: maximum

ab: intragroup Bonferoni post hoc test value

a: signifcant diferences to non- frail

b: signifcant diferences to pre-frail

The survival rate did not differ significantly between groups (p:0,348) (Figure 1).

Cox regression analysis revealed that age, presence of a pressure injury, presence of AKI, APACHE II score, and CFS were independently associated with mortality (Table 3). The overall model was statistically significant according to the Omnibus Test of Model Coefficients (χ^2 = 41.997, df = 6, p <0.001), and the –2 Log Likelihood value for the final model was 436.156, demonstrating an adequate fit to the data.

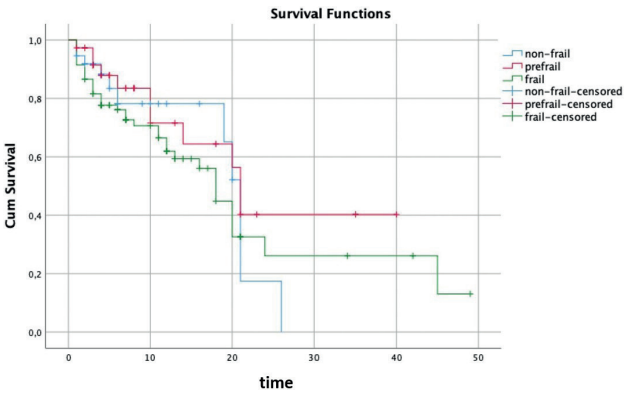

Figure 1. Mortality rates between groups

Table 3. Results of Cox regression analysis

Parameters	Sig.	Hazard ratio	95,0% CI
Age (80-89) (90-99)	0.029	2.233	1.088-4.585
Pressure injury	0.003	2.682	1.384-5.198
APACHE II	0.004	1.112	1.035-1.194
Acute kidney injury	0.023	2.443	1.132-5.270
CFS	0.004	1.256	1.076-1.466

CFS: Clinical Frailty Scale

DISCUSSION

The current study indicated that a higher CFS is linked to an increased risk of mortality, despite the lack of a statistically significant difference in ICU mortality rates among non-frail, pre-frail, and frail patients. Furthermore, we found a significant relationship between age, pressure injury, high APACHE II score, concurrent AKI, and mortality.

Frailty is a clinical condition that refers to an increased vulnerability to external stressors, which is determined by age, comorbidities, and environmental and genetic factors [21]. While age is an important component of frailty, frailty is associated with increased mortality independent of age [22,23]. It is well known that the ICU population contains many frail patients, or frail patients are more prone to being hospitalized in the ICU. A comprehensive systemic review analyzing 10 observational studies noted that approximately 30% of individuals admitted to the ICU were frail [24]. Considering the relationship between age and frailty, it is expected that the likelihood of admission to ICUs will increase in individuals over the age of 80. Indeed, in a multicenter cohort study by Muessig et al. involving octogenarian patients, it was observed that 53.6% of those in intensive care were frail [17]. Similarly, Bruno and colleagues reported that 42% of octogenarians and 58% of nonagenarians (≥90 years old) were frail in the ICU [25]. In the same way, 52.5% of the patients were frail, and 23.7% were pre-frail in our study.

It is vital to know how we measure frailty severity and outcomes, in addition to knowing that frail elderly patients are more likely to be in the ICU. The CFS is a user-friendly instrument for routine application that offers vital insights into the mortality risk of patients in the ICU. De Geer et al. indicated that frailty is a reliable indicator of 30-day mortality (hazard ratio: 2.12) in unselected ICU patients. A multicenter study including 308 patients revealed that an increase in CFS was associated with a risk of 30-day mortality (OR: 1.44 per point increase) [17]. They also reported a 17.3% in-ICU rate that was significantly lower than ours (37.2%). This reduction may be due to the inclusion of planned postoperative admissions to the ICU following elective surgeries with low death rates. Despite our emphasis on lower mortality rates in postoperative patients, it was demonstrated that discharge rates are lower in frail octogenarians compared to their non-frail counterparts admitted to the ICU following surgery [26]. From this perspective, physicians should be aware of their patients' frailty regardless of the reason for admission to the ICU. To us, one additional potential cause of higher mortality in our study population may be the absence of hospices in our country, which contributes to the majority of deaths occurring in ICUs. A study examining the places of death among patients with respiratory diseases, predominantly elderly individuals, indicated that an increase in the number of nursing homes or facilities correlated with a decrease in hospital deaths over time [27]. Moreover, although individuals showing increased frailty face a greater mortality risk, the absence of significant differences across groups may be attributed to the limited sample size and the unequal distribution among the groups.

The APACHE II score is a widely used tool to determine mortality in both young and old individuals in the ICU [28]. The higher the APACHE II score, the higher the mortality. In our study, the average APACHE II score was 18, which corresponds to approximately a 25% risk of death [29]. The APACHE II score was significantly higher in the frail group compared to the non-frail group in our study. Consistent with our findings, Kalaiselvan and colleagues reported that frail patients had higher APACHE II scores in their study that included people aged 50 and beyond [23]. Similarly, it was shown that there is a correlation between frailty and the APACHE II score in elderly patients admitted to

ICU following surgery [30]. Considering that the APACHE II score requires extensive data, including detailed laboratory results, the assessment of frailty using CFS can provide clinicians with an effortless and quick assessment.

The common comorbidities among geriatric patients include diabetes mellitus (DM), hypertension, chronic obstructive pulmonary disease (COPD), cancer, and dementia [31]. Similar to existing literature, hypertension, DM, and coronary artery disease were the leading comorbidities, followed by cancer, COPD, and dementia in our study. In addition, comparative analysis between groups revealed that the frail group had a significantly higher prevalence of dementia, cerebrovascular disease, and malignancy. This increase may be due to dementia and cerebrovascular diseases causing mobility issues, as well as cancer inducing fatigue and weight loss [32,33]. Additionally, we also recorded the acute illnesses detected during the ICU stay. In our study group, the most frequent acute problems detected during ICU stay were infections, AKI, and acute respiratory failure, respectively. Further analysis revealed that AKI and cardiovascular diseases are significantly more common in the frail group. Given that the majority of patients have multiple comorbidities, it is arguably unsurprising that they experience numerous acute issues throughout their ICU stay. Also, these issues are known to worsen each other during or after hospitalization. In line with our data, a recent comprehensive review reported that hypertension, coronary artery disease, heart failure, and DM are the most common disorders, and the majority of patients face acute problems, including cardiovascular, renal, and respiratory complications and infections [34].

Acute respiratory failure is a common problem during ICU stays. Laporte et al. indicated that the number of elderly patients admitted to the ICU for acute respiratory failure has risen over the years [35]. De Lange and colleagues observed that 50% of their octogenarian patients were intubated during their ICU stay, and 7% underwent tracheostomy. In another cohort of 1,220 patients aged 80 years and older, 5.9% of patients admitted to ICU for respiratory failure required invasive mechanical ventilation, whereas 29.1% required non-invasive mechanical ventilation [36]. Approximately fifty percent of our patients needed invasive mechanical ventilation, with 11.8% successfully extubated and 11.8% undergoing tracheostomy. Differences in intubation rates may be attributed to variations in patient characteristics and variances among clinics about intubation and end-of-life decisions.

A significant limitation of our study was the small number of patients, which restricts its generalizability to the general population. The retrospective design resulted in some limitations, such as the inability to include comprehensive geriatric assessments in the study. Additionally, since the frailty assessment was performed by only one researcher, there may be potential bias in it due to a lack of data on inter-rater reliability. On the other hand, the inclusion of real-life data from unselected intensive care patients strengthened our study. Furthermore, there is very little research about octogenarians in the literature, so we believe that this study will make a significant contribution to readers' knowledge.

In conclusion, frailty assessment provides critical insights on elderly patients admitted to the ICU. The association with the APACHE II score and its predictive capacity for death make CFS a rational alternative instrument in routine ICU practice.

Author contribution

Study conception and design: AMK, PU; data collection: AMK; analysis and interpretation of results: AMK and PU; draft manuscript preparation: AMK. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the ethics committee for clinical research of Ministry of Health, Etlik City Hospital, Ankara, Türkiye. (AESH-EK1-2023-764/27.12.2023).

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Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

[1] United Nations Department of Economic and Social Affairs Population Division. World population prospects 2022: summary of results. Available at: https://www.un.org/development/desa/pd/content/World-Population-Prospects-2022 (Accessed on Sep 2, 2024).

[2] OECD. Life expectancy and healthy life expectancy at age 65. In: Health at a glance 2021: OECD indicators. Paris: OECD Publishing; 2021.

[3] Bloom DE, Zucker LM. Population aging is the top global demographic trend; the pandemic can teach us how to prepare for it. In: Aging Is the real population bomb. Washington: International Monetary Fund; 2023.

[4] Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet 2013;381(9868):752-62. https://doi.org/10.1016/S0140-6736(12)62167-9

[5] Li Y, Pederson JL, Churchill TA, et al. Impact of frailty on outcomes after discharge in older surgical patients: a prospective cohort study. CMAJ 2018;190(7):E184-90. https://doi.org/10.1503/cmaj.161403

[6] Rothenberg KA, Stern JR, George EL, et al. Association of frailty and postoperative complications with unplanned readmissions after elective outpatient surgery. JAMA Netw Open 2019;2(5):e194330. https://doi.org/10.1001/jamanetworkopen.2019.4330

[7] Hoogendijk EO, Stolz E, Oude Voshaar RC, Deeg DJH, Huisman M, Jeuring HW. Trends in frailty and its association with mortality: results from the longitudinal aging study Amsterdam, 1995-2016. Am J Epidemiol 2021;190(7):1316-23. https://doi.org/10.1093/aje/kwab018

[8] Kim DH, Rockwood K. Frailty in older a. N Engl J Med 2024;391(6):538-48. https://doi.org/10.1056/NEJMra2301292

[9] Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173(5):489-95. https://doi.org/10.1503/cmaj.050051

[10] Cords CI, Spronk I, Mattace-Raso FUS, Verhofstad MHJ, van der Vlies CH, van Baar ME. The feasibility and reliability of frailty assessment tools applicable in acute in-hospital trauma patients: a systematic review. J Trauma Acute Care Surg 2022;92(3):615-26. https://doi.org/10.1097/TA.0000000000003472

[11] Aucoin SD, Hao M, Sohi R, et al. Accuracy and feasibility of clinically applied frailty instruments before surgery: a systematic review and meta-analysis. Anesthesiology 2020;133(1):78-95. https://doi.org/10.1097/ALN.0000000000003257

[12] Church S, Rogers E, Rockwood K, Theou O. A scoping review of the Clinical Frailty Scale. BMC Geriatr 2020;20(1):393. https://doi.org/10.1186/s12877-020-01801-7

[13] Brummel NE, Bell SP, Girard TD, et al. Frailty and subsequent disability and mortality among patients with critical illness. Am J Respir Crit Care Med 2017;196(1):64-72. https://doi.org/10.1164/rccm.201605-0939OC

[14] Falk Erhag H, Guðnadóttir G, Alfredsson J, et al. The association between the clinical frailty scale and adverse health outcomes in older adults in acute clinical settings - a systematic review of the literature. Clin Interv Aging 2023;18:249-61. https://doi.org/10.2147/CIA.S388160

[15] Moïsi L, Mino JC, Guidet B, Vallet H. Frailty assessment in critically ill older adults: a narrative review. Ann Intensive Care 2024;14(1):93. https://doi.org/10.1186/s13613-024-01315-0

[16] Wozniak H, Beckmann TS, Dos Santos Rocha A, Pugin J, Heidegger CP, Cereghetti S. Long-stay ICU patients with frailty: mortality and recovery outcomes at 6 months. Ann Intensive Care 2024;14(1):31. https://doi.org/10.1186/s13613-024-01261-x

[17] Muessig JM, Nia AM, Masyuk M, et al. Clinical Frailty Scale (CFS) reliably stratifies octogenarians in German ICUs: a multicentre prospective cohort study. BMC Geriatr 2018;18(1):162. https://doi.org/10.1186/s12877-018-0847-7

[18] Pulok MH, Theou O, van der Valk AM, Rockwood K. The role of illness acuity on the association between frailty and mortality in emergency department patients referred to internal medicine. Age Ageing 2020;49(6):1071-9. https://doi.org/10.1093/ageing/afaa089

[19] Aşık Z, Kılınç Ş, Kurşun Ö, Özen M. Validation of the Clinical Frailty Scale version 2.0 in Turkish older patients. Geriatr Gerontol Int 2022;22(9):730-5. https://doi.org/10.1111/ggi.14445

[20] Rockwood K, Theou O. Using the clinical frailty scale in allocating scarce health care resources. Can Geriatr J 2020;23(3):210-5. https://doi.org/10.5770/cgj.23.463

[21] McDermid RC, Stelfox HT, Bagshaw SM. Frailty in the critically ill: a novel concept. Crit Care 2011;15(1):301. https://doi.org/10.1186/cc9297

[22] Rockwood K, Howlett SE. Age-related deficit accumulation and the diseases of ageing. Mech Ageing Dev 2019;180:107-16. https://doi.org/10.1016/j.mad.2019.04.005

[23] Kalaiselvan MS, Yadav A, Kaur R, Menon A, Wasnik S. Prevalence of frailty in ICU and its impact on patients' outcomes. Indian J Crit Care Med 2023;27(5):335-41. https://doi.org/10.5005/jp-journals-10071-24456

[24] Muscedere J, Waters B, Varambally A, et al. The impact of frailty on intensive care unit outcomes: a systematic review and meta-analysis. Intensive Care Med 2017;43(8):1105-22. https://doi.org/10.1007/s00134-017-4867-0

[25] Bruno RR, Wernly B, Kelm M, et al. Management and outcomes in critically ill nonagenarian versus octogenarian patients. BMC Geriatr 2021;21(1):576. https://doi.org/10.1186/s12877-021-02476-4

[26] Hill A, Heyland DK, Rossaint R, et al. Longitudinal outcomes in octogenarian critically ill patients with a focus on frailty and cardiac surgery. J Clin Med 2020;10(1):12. https://doi.org/10.3390/jcm10010012

[27] Cross SH, Ely EW, Kavalieratos D, Tulsky JA, Warraich HJ. Place of death for individuals with chronic lung disease: trends and associated factors from 2003 to 2017 in the United States. Chest 2020;158(2):670-80. https://doi.org/10.1016/j.chest.2020.02.062

[28] Capuzzo M, Valpondi V, Sgarbi A, et al. Validation of severity scoring systems SAPS II and APACHE II in a single-center population. Intensive Care Med 2000;26(12):1779-85. https://doi.org/10.1007/s001340000715

[29] Beck DH, Smith GB, Taylor BL. The impact of low-risk intensive care unit admissions on mortality probabilities by SAPS II, APACHE II and APACHE III. Anaesthesia 2002;57(1):21-6. https://doi.org/10.1046/j.1365-2044.2002.02362.x

[30] Ruiz de Gopegui Miguelena P, Martínez Lamazares MT, Claraco Vega LM, et al. Evaluating frailty may complement APACHE II in estimating mortality in elderly patients admitted to the ICU after digestive surgery. Med Intensiva (Engl Ed) 2022;46(5):239-47. https://doi.org/10.1016/j.medine.2022.02.019

[31] Beil M, Flaatten H, Guidet B, et al. The management of multi-morbidity in elderly patients: ready yet for precision medicine in intensive care? Crit Care 2021;25(1):330. https://doi.org/10.1186/s13054-021-03750-y

[32] Handforth C, Clegg A, Young C, et al. The prevalence and outcomes of frailty in older cancer patients: a systematic review. Ann Oncol 2015;26(6):1091-101. https://doi.org/10.1093/annonc/mdu540

[33] Woo J, Yu R, Wong M, Yeung F, Wong M, Lum C. Frailty screening in the community using the FRAIL scale. J Am Med Dir Assoc 2015;16(5):412-9. https://doi.org/10.1016/j.jamda.2015.01.087

[34] Suh JM, Raykateeraroj N, Waldman B, et al. Correction: characteristics, outcomes, and complications among nonagenarian and centenarian patients admitted to the intensive care unit: a scoping review. Crit Care 2025;29(1):370. https://doi.org/10.1186/s13054-025-05611-4

[35] Laporte L, Hermetet C, Jouan Y, et al. Ten-year trends in intensive care admissions for respiratory infections in the elderly. Ann Intensive Care 2018;8(1):84. https://doi.org/10.1186/s13613-018-0430-6

[36] Guillon A, Hermetet C, Barker KA, et al. Long-term survival of elderly patients after intensive care unit admission for acute respiratory infection: a population-based, propensity score-matched cohort study. Crit Care 2020;24(1):384. https://doi.org/10.1186/s13054-020-03100-4