FRAILTY AND ASSOCIATED FACTORS AMONG OLDER ADULTS HOSPITALIZED WITH SEVERE COMMUNITY-ACQUIRED PNEUMONIA

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Abstract

Objectives: To determine the prevalence of frailty and its associated factors among older adults hospitalized with community-acquired pneumonia (CAP). ***Methods:*** A cross-sectional study was conducted among 117 older adults admitted with pneumonia. Baseline characteristics, comorbidities, and functional status were collected. Frailty was assessed using the Clinical Frailty Scale (CFS) and categorized into frail vs. non-frail. ***Results:*** Patients had a mean age of 79.5 ± 10.9 years, and 42.7% were female. Hypertension (67.5%), diabetes (28.2%), and heart failure (21.4%) were the most common comorbidities; 40.2% had ≥ 2 comorbidities. Frailty was highly prevalent, affecting 88.0% of participants. In logistic regression, female sex was an independent predictor of frailty (OR = 3.31; 95%CI: 1.13 - 9.64; p = 0.029). ***Conclusion:*** Frailty was highly prevalent and was independently associated with female sex among older adults hospitalized with CAP.

Keywords: Frailty; Severe pneumonia; Older adults.

INTRODUCTION

Frailty is a common geriatric syndrome characterized by decreased physiological reserve and increased vulnerability to stressors. This condition is associated with an elevated risk of adverse health outcomes such as hospitalization, functional impairment, and mortality. It is particularly prevalent among older adults with acute severe illnesses, including CAP, which remains a major cause of morbidity and mortality in this population. Despite its clinical significance, data regarding frailty among hospitalized older adults in low- and middle-income countries, especially in Vietnam, remain limited.

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Previous studies have identified several potential contributors to frailty [1]. However, the relative impact of these factors in older patients with severe pneumonia is not well understood. Identifying the prevalence and determinants of frailty in this population is essential for risk stratification and the development of targeted interventions to improve patient outcomes. Therefore, this study aimed to: *Determine the prevalence of frailty and its associated factors among older adults hospitalized with CAP.*

MATERIALS AND METHODS

1. Subjects.

The study included older adults aged 60 years or above who were hospitalized with severe pneumonia. Information on the study population is essential for contextualizing the research and generalizing findings. Key characteristics recorded included age, sex, ethnicity, educational level, marital status, occupation, and living arrangement.

* *Inclusion criteria:* Age ≥ 60 years; diagnosis of cap; hospitalized patients with Pneumonia Severity Index (PSI) class IV-V and CURB-65 class 3-5 [2, 3]; Clinical signs (fever, cough, dyspnea, tachypnea) and paraclinical findings (chest X-ray, arterial blood gas, inflammatory markers such as CRP or procalcitonin); Ability to undergo frailty assessment using standardized tools: Clinical Frailty Scale (CFS) and Hospital Frailty Risk Score (HFRS); Agreement to participate in the study (written informed consent from patients or legal representatives).

* *Exclusion criteria:* Severe acute conditions unrelated to pneumonia (e.g., acute stroke, acute myocardial infarction, decompensated heart failure); advanced malignancy or terminal illness; chronic end-stage organ failure (e.g., end-stage renal disease, advanced liver cirrhosis); inability to complete frailty assessment or refusal to participate.

* *Study setting and duration:* The research was conducted at Emergency and Stroke Department, National Geriatric Hospital, Hanoi, Vietnam between April 2025 and December 2025.

2. Methods

* *Study design:* This was a cross-sectional descriptive study. Data collection was conducted both prospectively and retrospectively. This design allowed for the assessment of frailty prevalence and its associated factors at a defined point during hospitalization.

* *Sample size and sampling:* The sample size was calculated using the formula:

$$n = \frac{Z^2 \,.\, p.\,(1 - p)}{d^2}$$

In which, Z = 1,96 (α = 0,05); p = 0,7 (based on Nguyen Trung Anh 2021(4) and Zhao 2023(5)); d = 0,084. The calculated minimum sample size was 115. Ultimately, 117 patients were included in the study.

* *Research tools:* Factors interfering with study participation included patient or legal representative refusal, unstable condition preventing follow-up or withdrawal during the study period. Frailty assessment: CFS [6]: Frailty at admission was assessed by two geriatricians using the CFS, based on patients' self-reported ability to perform basic and instrumental activities of daily living two weeks prior. Patients with scores 1 - 3 were classified as non-frail, and ≥ 4 scores as frail; final status was confirmed by consensus, HFRS [7]: Frailty was assessed using the HFRS, calculated from ICD-10 codes in patients' medical records and prior hospitalizations. Scores < 5 were classified as non-frail, and scores ≥ 5 as frail; physical function: Short Physical Performance Battery (SPPB); activities of daily living: Katz ADL scale; clinical and paraclinical indicators of pneumonia: Vital signs (respiratory rate, heart rate, SpO_2, temperature), CRP, procalcitonin, chest X-ray findings, arterial blood gas (PaO_2/FiO_2); outcomes: length of hospital stay, complications (respiratory failure, sepsis, multi-organ failure), mortality, and 30-day readmission.

* *Data collection procedures:* Identification and screening of eligible patients based on inclusion and exclusion criteria; Obtaining informed consent from patients or legal representatives; collection of demographic and baseline clinical information from medical records and interviews; frailty assessment using standardized scales (CFS and HFRS); physical function and nutritional assessment through direct observation and structured questionnaires; recording clinical and laboratory parameters from patient charts; monitoring treatment outcomes during hospitalization and tracking 30-day readmission for survivors.

* *Data management:* Data were entered into STATA (version 17.0) and cross-checked for accuracy; categorical variables were coded; missing values were addressed by exclusion or imputation when appropriate. Outliers were verified and handled based on clinical plausibility. Descriptive analysis: Continuous variables were expressed as mean ± standard deviation ($\overline{X} \pm SD$) or median (IQR) while categorical variables were presented as frequencies and percentages. Comparative analysis was performed using continuous variables such as Student T-test or Mann-Whitney U test (two groups) and ANOVA or Kruskal-Wallis test (multiple groups). For categorical variables, Chi-square test or Fisher's exact test were applied. Correlation: Pearson or Spearman coefficients. Regression analysis: Logistic regression for binary outcomes (e.g., mortality, complications); Linear regression for continuous outcomes (e.g., length of hospital stay); Kaplan-Meier survival analysis for time-to-event outcomes, if applicable; independent variables included age, sex, BMI, comorbidities,

nutritional status, and cognitive function; dependent variables included frailty status, complications, length of stay, mortality, and 30-day readmission.

3. Ethics

The study was approved by the Ethics Committee of the National Geriatric Hospital (Approval No. 478/QĐ-BVLKTW, dated 18/04/2025). The research was conducted in accordance with the regulations of the National Geriatric Hospital as the managing institution. The dataset used in this study was permitted for use and publication by the National Geriatric Hospital, ensuring full compliance with institutional and national data protection requirements. The authors declare that there are no conflicts of interest related to this research.

RESULTS

Table 1. Baseline characteristics of the study population (n = 117).

Characteristics	n	%	$\overline{X}$ ± SD
Age (years)	–	–	79.5 ± 10.9
Sex			–
Male	67	57.3	–
Female	50	42.7	–
Education			–
Below primary school	67	57.3	–
Secondary and above	50	42.7	–
Marital status			–
Married	84	71.8	–
Widowed	33	28.2	–
Living arrangement			–
With family/24h support	112	95.7	–
Alone/limited support	4	4.3	–
BMI (kg/m^2)	–	–	20.7 ± 3.9

The study population consisted predominantly of older adults, with over half aged ≥ 80 years. Male patients accounted for a higher proportion of the study population (57.3%). Most participants had low educational levels. The mean BMI was 20.7 ± 3.9 kg/m^2, indicating a generally normal to slightly low nutritional status typical for this age group. The majority lived with family and received full-time support.

Table 2. Comorbidities and functional scores.

Variables	n	%
Hypertension	79	67.5
Diabetes mellitus	33	28.2
COPD	0	0.0
Heart failure	25	21.4
Chronic kidney disease	4	3.4
Dementia	21	17.9
≥ 2 comorbidities	47	40.2

Hypertension was the most common comorbidity (67.5%), followed by diabetes (28.2%) and heart failure (21.4%) while dementia was present in 17.9% of the cases. Roughly 40% of participants had two or more comorbidities.

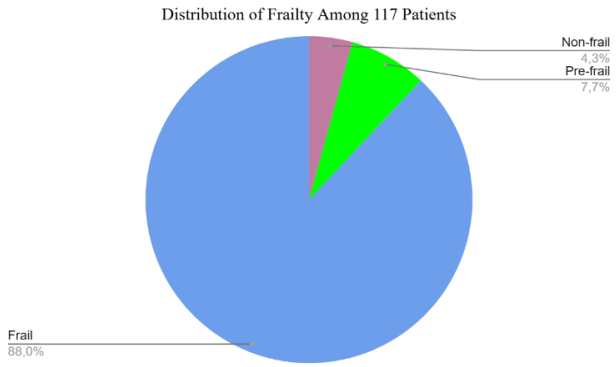

Figure 1. Distribution of frailty categories among 117 patients.

The pie chart shows the distribution of frailty among 117 patients. Most patients were frail (88.0%), while pre-frail and non-frail accounted for 7.7% and 4.3%, respectively. These results indicate a high prevalence of frailty in this population.

Table 3. Frailty classification and comparison between frail and non-frail groups.

Characteristics	Frail (n = 103)	Non-frail (n = 14)	p
Age (years)	79.77 ± 10.75	78.27 ± 11.91	0.594
Female (%)	45 (47.9%)	5 (21.7%)	0.042
BMI (kg/m^2)	20.56 ± 3.94	22.71 ± 1.01	0.102
Number of comorbidities	1.53 ± 0.91	1.35 ± 0.98	0.420

Frailty was highly prevalent, with 88.0% classified as frail. Female sex was significantly associated with frailty (p = 0.042), while age, BMI, and number of

comorbidities did not differ significantly between frail and non-frail groups. This highlights that sex may be an independent factor in frailty among older adults with severe pneumonia.

Table 4. Prevalence of frailty according to pneumonia severity.

Pneumonia severity	Frail n (%)	Non-frail n (%)	p
PSI IV	50 (83.3%)	10 (16.7%)	0.048
PSI V	53 (92.9%)	4 (7.1%)	

Frail prevalence was higher in PSI V compared to PSI IV ($p < 0.05$), indicating that more severe pneumonia was associated with increased likelihood of frailty.

Table 5. Logistic regression of factors associated with frailty.

Factors	OR	95%CI	p
Age ≥ 80 years	1.41	0.57 - 3.52	0.461
Female sex	3.31	1.13 - 9.64	0.029
Malnutrition (BMI < 18.5)	201,452,581.40	0.00 - ∞	0.999
≥ 2 comorbidities	1.14	0.46 - 2.87	0.774
Dementia	3.22	0.40 - 26.12	0.274

Logistic regression identified female sex as the only independent factor associated with frailty (OR 3.31; 95%CI 1.13 - 9.64; p = 0.029). Other factors, including age ≥ 80 years, malnutrition, multiple comorbidities, and dementia, were not statistically significant. This finding emphasizes the importance of considering sex in assessing frailty risk in this population. Malnutrition (BMI < 18.5) was not included in the regression model due to sparse data.

DISCUSSION

Our study demonstrated a remarkably high prevalence of frailty among older adults hospitalized with severe pneumonia, with 88.0% classified as frail. This rate is substantially higher than that reported in studies from high-income countries, such as the Australia-New Zealand ICU cohort (42%) [8], potentially reflecting the older mean age of our population (79.5 years) and the burden of severe acute illness. These findings highlight the marked vulnerability of very old adults with pneumonia.

Female sex emerged as the only independent factor significantly associated with frailty (OR = 3.31, 95%CI: 1.13 - 9.64, p = 0.029). These findings are consistent with a systematic review of 6,482 screened articles, which showed that women exhibited higher levels of frailty than men across all age groups [9]. Biological explanations include lower muscle mass, hormonal changes post-menopause, while longer life expectancy in women may increase cumulative exposure to frailty-related risk factors. Social determinants may also contribute.

Contrary to expectations, several traditional factors commonly linked to frailty did not emerge as independent predictors within this cohort [10]. This may reflect the advanced age and severity of illness within our study population, where sex differences outweighed other baseline characteristics.

Our cohort had a substantial burden of comorbidities, with hypertension (67.5%), diabetes (28.2%), and heart failure (21.4%) being the most prevalent, and 40.2% of patients had two or more comorbidities. Despite this high comorbidity burden, the number of comorbidities was not an independent predictor of frailty. This observation aligns with the concept that frailty reflects cumulative multisystem physiological decline rather than the mere presence of chronic diseases. Therefore, frailty assessment offers additional prognostic value beyond conventional comorbidity indices and should be integrated into the routine clinical evaluation of older adults with severe pneumonia.

Our findings suggest that frailty is not only highly prevalent among older adults hospitalized with severe pneumonia but also correlates with pneumonia severity. Patients with higher PSI scores were more likely to be frail. This relationship highlights that frailty may amplify vulnerability to acute infections while severe pneumonia may, in turn, exacerbate underlying frailty. Therefore, clinicians should consider both frailty status and pneumonia severity for risk stratification, early intervention, and discharge planning.

This study has several strengths. We utilized validated frailty assessment tools, including the CFS and HFRS, combined with direct assessment of physical function and nutritional status. Data were collected comprehensively through medical records, structured interviews, and direct patient evaluation, providing a multidimensional view of frailty in hospitalized older adults.

Nevertheless, certain limitations should be considered. As a single-center study, generalizability to other settings may be limited. Convenience sampling may introduce selection bias, and the cross-sectional design prevents causal inference between risk factors and frailty. The sample size, particularly for malnourished

or cognitively impaired subgroups, may have limited statistical power. Furthermore, frailty was assessed during acute illness, which may not fully reflect baseline frailty, and transient functional impairment due to pneumonia could have influenced the results. Future longitudinal studies are needed to evaluate the dynamic nature of frailty and its impact on recovery and long-term outcomes.

Overall, our study emphasizes that frailty is common among older adults hospitalized with severe pneumonia and that female sex is a key factor associated with frailty. Recognizing frailty in this patient population is critical for risk stratification, individualized care, and targeted intervention planning. Further research is warranted to explore interventions to reduce frailty-related complications and to investigate the mechanisms underlying sex differences in frailty susceptibility.

CONCLUSION

Frailty was highly prevalent among older adults hospitalized with CAP, and female sex was independently associated with frailty in this population.

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