



Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger



Hospital Frailty Risk Score Predicts Outcomes in Chronic Obstructive Pulmonary Disease Exacerbations

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ARTICLE INFO

Keywords:

Prognosis
Chronic obstructive pulmonary disease
Hospital frailty risk score
Frailty
Japan

ABSTRACT

Introduction: Patients with chronic obstructive pulmonary disease (COPD) are at high risk for frailty and prone to complications after admission for an acute exacerbation. We aim to investigate the association between frailty risk and functional outcomes in patients with acute exacerbations of COPD, using a nationwide database.

Methods: This retrospective cohort study included patients with acute exacerbations of COPD who were admitted by ambulance. We assessed frailty using the Hospital Frailty Risk Score (HFRS) and compared the outcomes between low frailty risk (HFRS < 5) and frailty at risk (HFRS ≥ 5) groups. The primary outcome was prolonged hospitalization (≥30 days). The secondary outcomes were in-hospital mortality, readmission (≤90 days), poor activities of daily living (ADL) at discharge, and difficulty in returning home.

Results: There were 3,396 eligible patients (mean age, 75.9 ± 11.2 years; 20.4% female). The rate of frailty at risk patients was 14.0%. Frailty at risk patients were significantly higher rates of prolonged hospitalization (32.9% vs. 17.5%), more in-hospital mortality (16.4% vs. 12.5%), more difficulty in returning home (34.6% vs. 22.9%), and poorer ADL at discharge (8.7% vs. 12.4%) than those of low frailty risk. Multivariate analysis with adjusted covariates showed that HFRS was independently associated with prolonged hospitalization (odds ratio, 2.0; 95% confidence interval, 1.4–2.9).

Conclusions: HFRS can be used to predict the outcome of patients with acute exacerbations of COPD. This finding supports the validity of using the HFRS in clinical practice with patients with acute exacerbations of COPD.

1. Introduction

Worldwide, chronic obstructive pulmonary disease (COPD) has been known for its high morbidity and mortality (Halpin et al., 2019 Nov 1). It has been identified as the third leading cause of death worldwide (3.23 million deaths in 2019 (World Health Organization 2021)), causing significant economic burden (Global Initiative for Chronic Obstructive Lung Disease 2021). In the United States, the direct costs of COPD are \$32 billion and the indirect costs \$20.4 billion (Guarascio, Ray and Finch, 2013). Acute exacerbation of COPD is defined as an acute worsening of respiratory symptoms that requires additional therapy. It adversely affects health status, rates of admission and readmission, and disease progression (Global Initiative for Chronic Obstructive Lung Disease 2021). The more COPD acute exacerbations have occurred in the past, the greater the risk of recurrence (Stallberg et al., 2021). Therefore,

it is important to predict functional outcomes and complications in patients with acute exacerbations of COPD.

The prevalence of frailty in COPD patients is 57.8% (Park et al., 2013 May-Jun). Frailty is commonly characterized by a decline in an individual's homeostasis (Cesari, Calvani and Marzetti, 2017 Aug) and is strongly associated with adverse outcomes in older adults: falls, disability, hospitalization, care home admission, and mortality. Thus, it is highly significant to identify frailty in patients in medical settings (Clegg et al., 2013 Mar 2). Systemic inflammation in COPD may cause muscle weakness (Spruit et al., 2003 Sep) that may contribute to the exacerbation of frailty. Furthermore, older people with frailty have been determined to be at greater risk of developing acute exacerbations of respiratory diseases in the future (Vaz Fragoso et al., 2012 Jan). Thus, early diagnosis and intervention are necessary.

Two of the major modern models of frailty are the phenotypic model

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<https://doi.org/10.1016/j.archger.2022.104658>

Received 23 November 2021; Received in revised form 9 February 2022; Accepted 10 February 2022

Available online 11 February 2022

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(Fried et al., 2001 Mar) and the accumulated deficit model (Rockwood et al., 2005 Aug 30). Both are significant as a basis for detecting patients with frailty. Usually, frailty assessment is conducted face-to-face by a medical professional. However, to adapt to acute diseases, it is preferable to use an automatic and simple assessment of existing data, rather than a face-to-face assessment that requires time and personnel. Therefore, we focused on the Hospital Frailty Risk Score (HFRS) devised by Gilbert et al. (Gilbert et al., 2018 May 5).

HFRS is a measure of the frailty risk, using a weighted score based on the International Statistical Classification of Diseases, 10th revision (ICD-10) codes for inpatients. For every inpatient, HFRS can be calculated based on routine data (Gilbert et al., 2018 May 5). HFRS has sufficient validity, as it shows fair-to-moderate overlap with assessments based on the phenotypic and accumulated deficit models (Gilbert et al., 2018 May 5). It can predict mortality and prolonged hospitalization for patients with stroke, cardiovascular disease, pneumonia, vascular surgery, in-hospital cardiac arrest, and COVID-19 (Kundi et al., 2020 Dec, Aitken et al., 2021 Jun 22, Kilkenny et al., 2021 Aug, Mowbray et al., 2021 Jun 21, Nghiem et al., 2021 Sep 11, Ramos-Rincon et al., 2021 Oct, Szakmany et al., 2021 Jun 28).

To the best of our knowledge, there has been no study on whether HFRS can predict outcomes in patients with acute exacerbations of COPD. Therefore, in this study, we aimed to investigate the utility of HFRS as a predictor of functional outcomes in patients with acute exacerbation of COPD, using the Japanese nationwide database.

2. Materials and Methods

2.1. Study design and ethics

This retrospective cohort study used data from a hospital-based database created by the Japan Medical Data Center (JMDC). This database is generally available, so the ethics committee of Mie University determined that no ethical review was required. Furthermore, the requirement for informed consent was waived because the data provided by JMDC is de-identified and unlinked.

2.2. Data source

The JMDC is a database of data collected from health insurance associations in Japan, including insured ledgers, insurance claims, and health examination results (Nagai et al., 2020 Nov). The JMDC includes a Diagnostic Procedure Combination (DPC) database of acute care hospitals in Japan, which was introduced in Japan in 2003 as a system to pay for medical care (Yasunaga et al., 2005 Sep). The DPC database includes patient demographics and selected clinical information, admission and discharge statuses, diagnoses, surgeries and procedures performed, medications, and special reimbursements for specific conditions (Yamana et al., 2017 Oct).

We extracted data from the DPC database regarding consecutive admissions for COPD from April 2014 to August 2020. All diagnoses in the DPC database are coded with ICD-10 codes, as recorded by the attending physician. The database contains the following detailed information: diagnosis; use of ambulance service; gender; age; Hugh-Jones dyspnea scale score (grades I to V); height; weight; level of consciousness at admission, assessed using the Japan Coma Scale (JCS); smoking index; use of ventilator; use of vasopressor; intensive care unit (ICU) admission during hospitalization; Barthel Index (BI) at admission and discharge; pre-admission residence; Charlson Comorbidity Index (CCI) at admission; number of beds; year of admission; length of hospital stay; in-hospital mortality; readmission; and discharge residence. The variables for use of ventilator and vasopressor were the numbers of patients who used them from the day of admission to the next day.

The CCI uses comorbidities for assessment: each of the 19 comorbid primary diseases is weighted and scored; then, the total score is calculated (Charlson et al., 1987). The Hugh-Jones dyspnea scale score is a

five-level classification based on motor function and dyspnea (Hugh-Jones and Lambert, 1952 Jan 12). The JCS is a widely used tool in Japan to assess the level of consciousness; it consists of Alert (0), Dull (1-digit code: 1, 2, 3), Somnolence (2-digit code: 10, 20, 30), and Coma (3-digit code: 100, 200, 300). The BI is used to assess a patient's activities of daily living (ADL); a higher BI score indicates greater independence in ADL (Mahoney and Barthel, 1965 Feb). The smoking index is a number obtained by multiplying the number of cigarettes smoked per day by the number of years smoked (Brinkman and Coates, 1963 May). Older adults were classified into pre-old (65–74 years), old (75–89 years), and oldest-old (≥ 90 years), based on the definition of the Japanese Geriatrics Society (Ouchi et al., 2017 Jul). Body mass index (BMI) was classified as <18.5 , 18.5 – 24.9 , 25.0 – 29.9 , and ≥ 30.0 (Kopelman, 2000 Apr 6).

2.3. Participants

We included patients admitted by ambulance with COPD (ICD-10 codes: J41–J44) from April 1, 2014, to August 31, 2020.

2.4. Calculation of the HFRS

The HFRS is calculated by summing points assigned to each of the 109 ICD-10 codes (Gilbert et al., 2018 May 5). The code F00 (Alzheimer's disease) has the highest score (7.1 points), whereas the code R50 (unexplained fever) has the lowest score (0.1 points). The HFRS in this study was calculated from the comorbidities of each patient at admission. Frailty risk was classified into two groups: low frailty risk (HFRS < 5) and frailty at risk (HFRS ≥ 5).

2.5. Outcomes

The primary outcome was length of stay (LOS), with LOS of >30 days defined as prolonged hospitalization (Fransoo et al., 2005). Secondary outcomes were in-hospital mortality, readmissions, poor ADL at discharge, and difficulty in returning home. Readmission was defined as admissions within 90 days after discharge (Bernabeu-Mora et al., 2017 Oct). Poor ADL at discharge was defined as BI gain (BI at discharge – BI at admission) < 0 points. Difficulty in returning home included transfer to other wards in the hospital, transfer to other hospitals, and death.

2.6. Statistical analysis

Baseline data and outcomes were compared between the low frailty risk group and the frailty at risk group. Categorical data are presented as absolute values and rates; the χ^2 test was used to test for differences between the two groups. Continuous data are presented as mean \pm standard deviation; the t-test was used to test for differences between the two groups. We then conducted a multivariate logistic analysis to analyze the trend of frailty risk, with primary and secondary outcomes, using a forced entry method. The covariates adjusted were the following variables: gender, age, BMI, Hugh-Jones dyspnea scale score, JCS at admission, smoking index, use of ventilator at admission, use of vasopressor at admission, ICU admission during hospitalization, BI at admission, CCI at admission, number of beds, and year of admission. To investigate the prediction performance of HFRS, we calculated the area under the curve (AUC) of HFRS and CCI for outcomes. Statistical analyses were performed using SPSS software (version 25.0; IBM Japan, Tokyo, Japan). Statistical significance was set at $P < 0.05$.

3. Results

We have examined the data from 3,396 COPD patients (mean age, 75.9 ± 11.2 years; 20.4% female) admitted by ambulance.

Based on the HFRS, 2,919 patients (86.0%) were classified as low frailty risk and 477 (14.0%) as frailty at risk. Table 1 shows the

Table 1
Demographic characteristics of the study group

	Low risk (Hospital Frailty Risk Score < 5)	At risk (Hospital Frailty Risk Score ≥ 5)	P- value
Number of patients, n	1,627	217	
Female sex, n [%]	316 [19.4]	61 [28.1]	0.003
Age, years, n [%]			<0.001
- 65–74 (pre-old)	508 [31.2]	50 [23.0]	
- 75–89 (old)	957 [58.8]	125 [57.6]	
- ≥90 (oldest-old)	162 [10.0]	42 [19.4]	
Hugh-Jones dyspnea scale score, n [%]			0.126
- 1	132 [8.1]	14 [6.5]	
- 2	174 [10.7]	19 [8.8]	
- 3	203 [12.5]	24 [11.1]	
- 4	426 [26.2]	47 [21.7]	
- 5	692 [42.5]	113 [52.1]	
Body mass index, n [%]			0.627
- <18.5	593 [36.4]	80 [36.9]	
- 18.5–24.9	653 [40.1]	89 [41.0]	
- 25.0–29.9	154 [9.5]	16 [7.4]	
- ≥30.0	22 [1.4]	1 [0.4]	
- Missing	205 [12.6]	31 [14.3]	
Japan coma scale at admission, n [%]			<0.001
- 0 (Alert)	1,349 [82.4]	140 [64.5]	
- 1–3 (Dull)	208 [12.8]	54 [24.9]	
- 10–30 (Somnolence)	31 [1.9]	13 [6.0]	
- 100–300 (Coma)	18 [1.1]	5 [2.3]	
- Missing	21 [1.3]	5 [2.3]	
Smoking index, mean ± SD	770.9 ± 766.0	641.4 ± 804.8	0.031
Use of ventilator at admission, n [%] *1	205 [12.6]	37 [17.1]	0.068
Use of vasopressor at admission, n [%] *1	38 [2.3]	6 [2.8]	0.697
Intensive Care Unit admission, n [%]	82 [5.0]	16 [7.4]	0.150
Barthel index at admission, mean ± SD	56.0 ± 36.8	31.0 ± 33.7	<0.001
Pre-admission residence (home, nursing care facilities and welfare facilities), n [%]	1,588 [97.6]	207 [95.4]	0.057
Charlson Comorbidity Index at admission, mean ± SD	1.7 ± 1.2	2.5 ± 1.3	<0.001
Number of beds, n [%]			0.105
- 20–99	33 [2.0]	4 [1.8]	
- 100–199	410 [25.2]	45 [20.7]	
- 200–299	249 [15.3]	38 [17.5]	
- 300–499	596 [36.6]	96 [44.2]	
- ≥500	339 [20.8]	34 [15.7]	
Year of admission, n [%]			0.068
- 2014	73 [4.5]	9 [4.1]	
- 2015	173 [10.6]	11 [5.1]	
- 2016	216 [13.3]	24 [11.1]	
- 2017	266 [16.3]	43 [19.8]	
- 2018	379 [23.3]	54 [24.9]	
- 2019	376 [23.1]	48 [22.1]	
- 2020	144 [8.9]	28 [12.9]	

demographic characteristics. Compared with those at low frailty risk, patients with frailty at risk had the following characteristics: more females (26.0%), higher proportion of oldest-old (19.4%), lower proportion of Alert JCS (59.5%), lower smoking index (552.9 ± 728.7), higher proportion of ICU admission (8.6%), lower BI at admission (26.2 ± 34.3), and higher CCI score (2.4 ± 1.5).

Table 2 shows the results of the comparison of primary and secondary outcomes based on the HFRS. Patients with frailty at risk were noted to have significantly higher rates of the following than those of low frailty risk: prolonged hospitalization (n = 157; rate within group, 32.9%; P < 0.001), in-hospital mortality (n = 78; rate within group, 16.4%; P = 0.023), difficulty in returning home (n = 165; rate within group, 34.6%; P < 0.001), and poor ADL at discharge (n = 40; rate

Table 2
Comparison of outcomes between two groups

	Low risk (Hospital Frailty Risk Score < 5)	At risk (Hospital Frailty Risk Score ≥ 5)	P- value
Prolonged hospitalization (Length of stay ≥ 30 days), n [%]	244 [15.0]	59 [27.2]	<0.001
In-hospital mortality, n [%]	22 [1.4]	2 [0.9]	0.599
Readmission (≤ 90 days), n [%]	385 [24.0]	53 [24.7]	0.831
Difficulty in returning home, n [%]	183 [11.2]	53 [19.4]	0.001
Poor ADL at discharge (Barthel index gain < 0), n [%]	750 [46.3]	166 [76.9]	<0.001

within group, 12.4%; P = 0.038). On the other hand, no significant difference was noted in readmission (n = 92; rate within group, 23.1%; P = 0.531) between the two groups.

Table 3 shows the results of multivariate logistic analysis for the primary and secondary outcomes. After adjustment for confounders, frailty risk was determined to be independently associated with prolonged hospitalization (odds ratio [OR], 2.0; 95% confidence interval [CI]: 1.4–2.9; P < 0.001).

Table 4 shows the results of AUC of HFRS and CCI. The ability of the HFRS to predict prolonged hospitalization was slightly higher than that of the CCI.

4. Discussion

We have investigated the association between frailty risk, calculated based on ICD-10 codes, and functional outcomes in patients with acute exacerbations of COPD, using nationwide data from Japan. The results showed that those with high frailty risk had significantly higher rates of prolonged hospitalization (32.9%), more in-hospital mortality (16.4%), more difficulty in returning home (34.6%), and poorer ADL at discharge (12.4%). HFRS was also found to be predictive of prolonged hospitalization (OR, 2.0) in patients with acute exacerbation of COPD.

Our findings are consistent to those of previous studies, which show that HFRS can predict functional outcomes in patients with cerebrovascular disease, cardiovascular disease, pneumonia, vascular surgery, in-hospital cardiac arrest, and COVID-19 (Kundi et al., 2020 Dec, Aitken et al., 2021 Jun 22, Kilkenney et al., 2021 Aug, Mowbray et al., 2021 Jun 21, Nghiem et al., 2021 Sep 11, Ramos-Rincon et al., 2021 Oct, Szakmany et al., 2021 Jun 28). Although assessing the frailty of patients with acute exacerbations of COPD may be useful for prognosis and treatment,

Table 3
Association between frailty at risk and outcomes in multivariate logistic analysis

Variables	Odds ratio	95% CI	P- value
Prolonged hospitalization (Length of stay ≥ 30 days)	1.9	1.2–3.0	0.003
In hospital mortality	0.6	0.1–3.5	0.585
Readmission (≤ 90 days)	0.9	0.6–1.3	0.455
Difficulty in returning home	1.1	0.6–1.7	0.812
Poor ADL at discharge (Barthel index gain < 0)	2.4	1.5–4.0	<0.001

Footnotes: The covariates adjusted were the following variables: gender, age, BMI, Hugh-Jones dyspnea scale score, JCS at admission, smoking index, use of ventilator at admission, use of vasopressor at admission, ICU admission during hospitalization, BI at admission, CCI at admission, number of beds, and year of admission.

Table 4

Area under the curve of Hospital Frailty Risk Score and Charlson Comorbidity Index

Variables	Hospital Frailty Risk Score	Charlson Comorbidity Index
Prolonged hospitalization (Length of stay \geq 30 days)	0.609	0.548
In-hospital mortality	0.543	0.543
Readmission (\leq 90 days)	0.497	0.552
Difficulty in returning home	0.589	0.555
Poor ADL at discharge (Barthel index gain $<$ 0)	0.594	0.539

the commonly used frailty assessment requires face-to-face assessment by medical staff, which may be inconvenient in clinical practice for the treatment of acute diseases. On the other hand, the HFRS is a simple assessment, calculated from a weighted score based on ICD-10 codes; it can be easily introduced into clinical practice. Our findings suggest that assessing HFRS in patients with acute exacerbations of COPD may lead to shorter LOS, improved ADL after discharge, and reduced healthcare costs.

We have found that frailty risk is associated with prolonged hospitalization. HFRS includes diseases based on ICD-10 codes that affect functional outcomes, such as dementia and gait/movement abnormalities (Gilbert et al., 2018 May 5). Therefore, patients with a high frailty risk may be at greater risk of prolonged hospitalization due to the impact of having more comorbidities-associated disability.

We expected that patients at higher risk of frailty might have a higher risk of in-hospital mortality due to the impact of having more comorbidities. However, multivariate analysis adjusting for covariates did not reveal a statistically significant difference, suggesting that the association between HFRS and mortality may have been weak because the HFRS is composed mainly of diseases that cause disability rather than those that cause death.

The ability of the HFRS to predict prolonged hospitalization based on AUC results was slightly higher than that of the CCI. CCI, commonly used as an assessment tool for comorbidities, assigns high scores to diseases with high mortality rates, such as renal disease and tumors (Charlson et al., 1987). The HFRS, on the other hand, assigns high scores to diseases with low mortality but high disability, such as Alzheimer's disease and abnormalities in gait and mobility (Gilbert et al., 2018 May 5). Thus, the HFRS may have had a slightly higher predictive ability because diseases associated with disability are more likely to result in prolonged hospitalization.

This study has several limitations that are common to database studies. First, data acquisition was limited to data available from the hospital information system; thus, we could not obtain detailed parameters, such as cognitive function, mobility, and muscle strength. Second, the HFRS is based on ICD-10 codes; therefore, coding accuracy could be a potential cause of bias. However, the criterion-related validity of medical records based on ICD-10 codes has been validated in Japan (Yamana et al., 2017 Oct), and there may have been minimal bias due to coding inaccuracy. Third, unlike previous studies (Gilbert et al., 2018 May 5), this study only used ICD codes at the time of a single hospitalization and at outpatient visits where the start of the hospital visit was unknown, which may have led to an underestimation of the disease.

5. Conclusions

The HFRS, which assesses frailty risk using medical records routinely collected in clinical practice, can predict functional outcomes in patients with acute exacerbations of COPD. This finding supports the validity of using HFRS in routine clinical practice to improve functional outcomes in patients with acute exacerbations of COPD.

6. Author Contributions

All the authors have met the ICMJE authorship criteria and contributed to the conception of this work.

Kenta Ushida: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. Akio Shimizu: Conceptualization, Methodology, Writing – review & editing. Shinsuke Hori: Conceptualization, Methodology, Writing – review & editing. Yoshinori Yamamoto: Conceptualization, Methodology, Writing – review & editing. Ryo Momosaki: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing – review & editing. All the authors read and approved the final manuscript.

CRedit authorship contribution statement

Kenta Ushida: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Akio Shimizu:** Conceptualization, Methodology, Writing – review & editing. **Shinsuke Hori:** Conceptualization, Methodology, Writing – review & editing. **Yoshinori Yamamoto:** Conceptualization, Methodology, Writing – review & editing. **Ryo Momosaki:** Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Sources

This study was supported by grants from Mitsui Sumitomo Insurance Welfare Foundation.

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Update

Archives of Gerontology and Geriatrics

Volume 103, Issue , November - December 2022, Page

DOI: <https://doi.org/10.1016/j.archger.2022.104780>

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Corrigendum

Corrigendum to 'Hospital Frailty Risk Score Predicts Outcomes in Chronic Obstructive Pulmonary Disease Exacerbations' [Archives of Gerontology and Geriatrics, Volume 100C (2022) 104658]

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The authors regret the errors presented in [Tables 1–3](#) and part of Result in the paper.

There were errors in the number of patients, baseline values, and outcome values shown in [Tables 1–3](#). Please refer to below corrected [Tables 1–3](#).

Also, in the “Results” section, it was noted that the higher proportion of oldest-old was indicated as 19.4%, however, the correct proportion should have been 18.9%.

The authors would like to apologise for any inconvenience caused.

DOI of original article: <https://doi.org/10.1016/j.archger.2022.104658>.

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<https://doi.org/10.1016/j.archger.2022.104780>

Available online 21 July 2022

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Table 1
Demographic characteristics of the study group.

	Low risk (Hospital Frailty Risk Score < 5)	At risk (Hospital Frailty Risk Score ≥ 5)	P- value
Number of patients, n	2,919	477	
Female sex, n [%]	569 [19.5]	124 [26.0]	0.001
Age, years, n [%]			< 0.001
- < 65	243 [8.3]	12 [2.5]	
- 65–74 (pre-old)	744 [25.5]	88 [18.4]	
- 75–89 (old)	1,597 [54.7]	287 [60.2]	
- ≥ 90 (oldest-old)	335 [11.5]	90 [18.9]	
Hugh-Jones dyspnea scale score, n [%]			< 0.001
- 1	177 [6.1]	17 [3.6]	
- 2	220 [7.5]	25 [5.2]	
- 3	241 [8.3]	28 [5.9]	
- 4	544 [18.6]	56 [11.7]	
- 5	992 [34.0]	157 [32.9]	
- Missing	745 [25.5]	194 [40.7]	
Body mass index, n [%]			0.164
- <18.5	1,105 [37.9]	178 [37.3]	
- 18.5–24.9	1,091 [37.4]	172 [36.1]	
- 25.0–29.9	231 [7.9]	36 [7.5]	
- ≥30.0	43 [1.5]	2 [0.4]	
- Missing	449 [15.4]	89 [18.7]	
Japan coma scale at admission, n [%]			< 0.001
- 0 (Alert)	2,282 [78.2]	284 [59.5]	
- 1–3 (Dull)	429 [14.7]	124 [26.0]	
- 10–30 (Somnolence)	94 [3.2]	28 [5.9]	
- 100–300 (Coma)	70 [2.4]	19 [4.0]	
- Missing	44 [1.5]	22 [4.6]	
Smoking index, mean ± SD	732.0 ± 753.0	552.9 ± 728.7	< 0.001
Use of ventilator at admission, n [%] ^{*1}	463 [15.9]	89 [18.7]	0.124
Use of vasopressor at admission, n [%] ^{*1}	117 [4.0]	18 [3.8]	0.900
Intensive Care Unit admission, n [%]	168 [5.8]	41 [8.6]	0.023
Barthel index at admission, mean ± SD	47.8 ± 39.0	26.2 ± 34.3	< 0.001
Pre-admission residence (home, nursing care facilities and welfare facilities), n [%]	2,847 [97.5]	459 [96.2]	0.122
Charlson Comorbidity Index at admission, mean ± SD	1.7 ± 1.3	2.4 ± 1.5	< 0.001
Number of beds, n [%]			0.137
- 20–99	54 [1.8]	9 [1.9]	
- 100–199	721 [24.7]	113 [23.7]	
- 200–299	462 [15.8]	77 [16.1]	
- 300–499	1,025 [35.1]	192 [40.3]	
- ≥500	657 [22.5]	86 [18.0]	
Year of admission, n [%]			0.115
- 2014	124 [4.2]	19 [4.0]	
- 2015	292 [10.0]	31 [6.5]	
- 2016	404 [13.8]	63 [13.2]	
- 2017	471 [16.1]	97 [20.3]	
- 2018	655 [22.4]	112 [23.5]	
- 2019	693 [23.7]	108 [22.6]	
- 2020	280 [9.6]	47 [9.9]	

^{*1} From the day of admission to the next day**Table 2**
Comparison of outcomes between two groups.

	Low risk (Hospital Frailty Risk Score < 5)	At risk (Hospital Frailty Risk Score ≥ 5)	P- value
Prolonged hospitalization (Length of stay ≥ 30 days), n [%]	511 [17.5]	157 [32.9]	< 0.001
In-hospital mortality, n [%]	365 [12.5]	78 [16.4]	0.023
Readmission (≤ 90 days), n [%]	628 [24.6]	92 [23.1]	0.531
Difficulty in returning home, n [%]	668 [22.9]	165 [34.6]	< 0.001
Poor ADL at discharge (Barthel index gain < 0), n [%]	175 [8.7]	40 [12.4]	0.038

Table 3
Association between frailty at risk and outcomes in multivariate logistic
analysis.

Variables	Odds ratio	95% CI	P-value
Prolonged hospitalization (Length of stay ≥ 30 days)	2.0	1.4 - 2.9	< 0.001
In hospital mortality	1.0	0.6 - 1.7	0.974
Readmission (≤ 90 days)	0.8	0.5 - 1.2	0.339
Difficulty in returning home	1.1	0.8 - 1.6	0.596
Poor ADL at discharge (Barthel index gain < 0)	1.6	0.9 - 3.0	0.090

The covariates adjusted were the following variables: gender, age, BMI, Hugh-Jones dyspnea scale score, JCS at admission, smoking index, use of ventilator at admission, use of vasopressor at admission, ICU admission during hospitalization, BI at admission, CCI at admission, number of beds, and year of admission.