Research Square

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Frailty and outcome after hospital discharge in two populations aged 80 years and above in 2012 and 2022 using the Hospital Frailty Risk Score

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Abstract

Background: To study the impact of frailty on outcomes in two cohorts of patients ≥ 80 years admitted to a tertiary hospital in Bergen Norway in 2012 and 2022

Methods: A retrospective study of data from patient journals in the two cohorts regarding frailty measured using the Hospital Frailty Risk Score (HFRS) and demographic data: age, sex, hospital length of stay (LOS) and one year survival post hospital discharge. One-year outcomes were studied using Kaplan Mayer plots.

Results: There was an increase in patient admissions from 5112 (2012) to 6232 (2022) with a female majority. Half of both cohorts were classified as frail (HFRS >15), with no significant sex difference. Non- frail patients had the highest one-year survival (87%) compared to 69% in the high frailty group. A higher mortality was found in frail males (65%) compared with females and in the age group ≥ 90 years. The combination of high frailty (HFRS >15), age ≥90 years and male had the lowest survival of all sub-group analyzed (60%).

Conclusion: Frailty is a key clinical factor for understanding outcomes in elderly hospital patients. HFRS was able to identify vulnerable patient groups with significantly increased mortality. There was no increase in frailty over the 10-year period in the two cohorts.

Background

Frailty is defined as the age-related decline in an individual's ability to cope with stressors such as disease and trauma [1]. In recent years, it has gained increasing attention, particularly in the assessment of patients aged ≥65 years. Frailty has been shown to outperform both chronological age and comorbidity as a prognostic factor [2].The concept was developed by geriatricians as a clinical tool for assessing patients admitted to geriatric wards or outpatient clinics [3]. Over the past decades, its use has expanded to nearly all clinical settings, including emergency care [4–7], and it has become an important standard for outcome assessment. However, the application of frailty assessment in large cohorts of general hospital patients has been limited by the fact that most tools for frailty assessment require manual evaluation, involving direct patient contact and/or input from relatives. Consequently, alternative approaches have been developed. One such method is the use of electronic patient records and previously registered diagnostic codes [8]. These codes may reflect frailty-related conditions, and the use of diagnostic codes from the International Classification of Diseases (ICD) has emerged as an "automated" indirect method for frailty assessment in large populations [8].The Hospital Frailty Risk Score (HFRS) is one such method [9] . HFRS has been compared with direct clinical frailty assessments and found to be correlated, although not sufficiently accurate for individual prognostication [10].

At present, our hospital does not routinely perform direct frailty assessment at admission. To get such information, although in retrospect, we chose to evaluate the HFRS as a tool to predict outcomes retrospectively in a large cohort of elderly patients acutely admitted to our hospital.

Methods

Patient data

All patients aged ≥80 years who were acutely admitted to somatic departments at our hospital during the years 2012 and 2022 were included in this retrospective study (Table 1). For this purpose, we used baseline data from all hospital admissions retrieved from electronic patient files. We noted also whether an admission were a readmission, defined for this purpose within 3 months after the index admission. Vital status (alive or deceased] was obtained up to 365 days after hospital discharge using data from the Norwegian Population Registry, where all national deaths are recorded.

The HFRS was calculated according to the original method [11]. In that study, a specific subset of ICD-10 codes was identified as being associated with frailty and adverse outcomes. These codes were weighted according to their relative contribution to frailty. In our study, HFRS was hence calculated retrospectively using ICD-10 data extracted from the electronic patient records. From the HFRS patients were categorizes into risk groups based on score: low risk (<5), intermediate risk (5–14), and high risk (≥15).

Statistical analysis

Analyses were performed separately for the years 2012 and 2022. Length of stay (LOS) was calculated as the difference between discharge and admission times, expressed in days. Thirty-day readmission was defined at the patient-year level, based on whether the patient had at least one admission coded as a readmission during that year. The last admission for each patient within each year was retained. Outcome variables included: in-hospital mortality 30-day mortality from admission and 1-year mortality from admission.

Summary tables were generated for the full cohort and stratified by frailty group (HFRS <5, 5–15, >15) (table 1). Reported variables included number of patients, proportion of males, LOS, mortality outcomes, and readmission rates. For comparisons between years, p-values were calculated. Binary outcomes were compared using Pearson's chi-square test, while Fisher's exact test was used when expected cell counts were low. Length of stay was compared using the Mann-Whitney U test.

Survival analyses were conducted using Cox proportional hazards regression implemented with the *lifelines* package [12]. Time-to-event was defined from admission to death.

Frailty was included as a continuous HFRS variable. The model also included age, sex, and readmission status, as well as interaction terms between age and readmission**,** age and frailty and frailty and readmission**.** Model outputs included hazard ratios and log-likelihood ratio tests. The proportional hazards assumption was assessed using Schoenfeld residuals and graphical inspection.

Kaplan–Meier analyses were performed as supplementary non-parametric analyses, stratified by frailty group and combinations of age group((80–89 vs ≥90 years), sex, and readmission status.

Results

A total of 6,232 patients aged ≥80 years were admitted in 2022 an increase from 5,112 in 2012. Baseline characteristics for both cohorts are shown in **Table 1**. The proportion of patients with high frailty (HFRS ≥15) increased slightly but not significantly from 49% in 2012 to 50.3% in 2022. **Table 2** reveals details and significance of outcomes in the three HFRS groups between 2012 and 2022 cohorts. In the overall cohort with patients from both 2012 and 2022, patients with low frailty had the highest one-year survival compared to both the intermediate group and in the high frailty group (**Figure 1**). Subgroups with particularly high mortality included patients with both frailty and readmission (**Figure 2**) and patient age ≥90 years with frailty (**Figure 3**). A clear sex difference was observed in males with high frailty had the lowest survival in both age groups (**Figure 4**).

Ethical considerations

The study was approved by the Regional Committee for Medical and Health Research Ethics, Western Norway ((ID 12394). As the analyses were based on registry data already reported to the Norwegian Patient Registry, informed consent was not required.

Discussion

Frailty is considered an important determinant of outcomes in elderly hospital patients and has been shown to be more predictive than traditional outcome markers such as age, sex, and comorbidity [13, 14]. Two main approaches are used for frailty assessment: direct clinical assessment and the indirect method based on administrative data (11). Direct assessment is generally considered superior [15,16], as this more accurately captures frailty at the individual level. The Clinical Frailty Scale (CFS) is currently the most widely used bedside tool for direct frailty assessment [17]. However, direct assessment requires trained healthcare personnel and usually with patient interaction, although persons with good knowledge of the patient may also be a reliable information source. In contrast, the HFRS is calculated retrospectively from large datasets using routinely collected administrative data of specific ICD-10 codes.

The HFRS has been widely validated and increased score is associated with increased mortality, longer hospital stays, and higher readmission rates across various clinical populations, mainly in patients above 65 years [7,10,11,18,19] . Using the HFRS in 539 patients ≥ 75 years with first time admittance to a medical ward in UK, severe frailty was present in 25% and admission mortality was 19% [20]. In a study from Ireland in acute surgical patients the mean LOS was 12.5 days (65-74 years), 13.3 days (75-84 years) and 12.5 days (85+) respectively [REF].
In our study, the HFRS could predict important clinical outcomes in a large cohort of very elderly patients. Patients with high HFRS (>15) had significantly increased mortality, particularly in males and in patients with a hospital readmission. However, the HFRS is less suitable for individual prognostication due to substantial overlap between groups as shown in the Kaplan–Meier analyses. Exceptions were found in nonagenarians with high frailty and in males with high frailty where both groups demonstrated significantly increased one-year mortality.

Notably, even among frail patients aged ≥90 years, a majority survived to one-year after index admission, indicating that overall survival should be considered acceptable for this age group. However, we lack data on quality-of-life data in our study, which may be more relevant than survival alone in this population [23, 24].

Recent studies have shown that HFRS correlates only moderately with clinical frailty assessment such as the Fried phenotype and Rockwood scale and suggests that HFRS may reflect comorbidity more than frailty per se [24]. However, in the absence of direct frailty assessment, the HFRS can give an impression of the burden of frailty in large patient groups and their associated risk, both mortality and morbidity, and it may predict length of stay across all ages [24, 25, 26]. The score may also predict hospital length of stay in adults [27]. As our data shows, use of HFRS allow a simple follow up with regards to development over time in large patient cohorts. It is interesting that we can document no increase of frailty over a 10-year timespan assessed with HFRS.

Over the decade, hospital length of stay was significantly reduced in 2022 versus 2012 for all HFRS groups. Likewise, also hospital mortality was reduced in the three groups. However, the one-year mortality is only reduced in the non-frail group (HFRS < 15) not in the two frail groups, underlining the importance of frailty as a predictor for short as well as long-term outcome.

Strengths and limitations

A key strength of this study is the complete one-year follow-up of two large cohort of elderly patients. Additionally, the use of routinely collected diagnostic data to estimate frailty makes the method highly feasible.

The main limitation is the lack of precision at the individual level, where direct clinical frailty assessment remains superior.

Conclusions

Frailty is a key clinical factor for understanding outcomes in very old hospital patients. Using HFRS in this retrospective cohort, we identified vulnerable patient groups with significantly increased mortality. This approach to frailty may be useful in future healthcare planning, particularly given the expected increase in hospital admissions among octo- and nonagenarians. It may also support clinical decision-making regarding admission and level of care in very elderly patients.

Declarations

Competing interests

The authors declare that they have no competing interests

Authors contribution

HF initiated the study and was the major contributor in writing the manuscript

JK read the manuscript and gave feedback

BS had access to the hospital patient database and extracted the necessary information

EH was responsible for data-analysis and statistical testing and contributed to manuscript

Acknowlegdement

Not applicable

Data availability

Data sharing is not applicable to this article as no datasets were generated. The current study data analysis was performed directly on the hospital patient database.

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Tables

Table 1
Baseline characteristic of the two cohorts: 2012 and 2022

		Univariate		Multivariate	
Year	Variable	HR (CI)	p-value	HR (CI)	p-value
2012	Age	1.07 (1.05–1.08)	< 0.001	1.08 (1.06–1.09)	< 0.001
	Frailty	1.01 (1.01–1.01)	< 0.001	1.01 (1.01–1.01)	< 0.001
	Readmission	0.00 (0.00-inf)	0.984	0.00 (0.00-inf)	0.984
	Sex	0.69 (0.61–0.78)	< 0.001	0.64 (0.56–0.73)	< 0.001
2022	Age	1.06 (1.05–1.08)	< 0.001	1.07 (1.05–1.08)	< 0.001
	Frailty	1.01 (1.01–1.01)	< 0.001	1.01 (1.00-1.01)	< 0.001
	Readmission	0.00 (0.00-inf)	0.975	0.00 (0.00-inf)	0.983
	Sex	0.71 (0.63–0.79)	< 0.001	0.66 (0.59–0.75)	< 0.001

Table 2
Comparison of the two cohorts regarding HFRS groups

	2012				2022				p-value (2012 vs 2022)			
	All	HFRS < 5	HFRS 5–15	HFRS > 15	All	HFRS < 5	HFRS 5–15	HFRS > 15	All	HFRS < 5	HFRS 5–15	HFRS > 15
Number of patients	5112	1853	754	2505	6232	2198	901	3133				
Male %	2065 (40.4%)	748 (40.4%)	290 (38.5%)	1027 (41.0%)	2843 (45.6%)	995 (45.3%)	397 (44.1%)	1451 (46.3%)	< 0.001	0.002	0.021	< 0.001 [1]
LOS (days)	5.4 (6.5)	4.5 (5.8)	5.1 (5.4)	6.0 (7.0)	3.9 (5.3)	3.1 (4.2)	3.4 (3.9)	4.4 (5.9)	< 0.001	< 0.001	< 0.001	< 0.001 [2]
median (Q1,Q3)	3 (1.0,7.0)	3 (1.0,6.0)	4 (2.0,7.0)	4 (2.0,7.0)	3 (1.0,5.0)	2 (1.0,4.0)	2 (1.0,4.0)	3 (1.0,5.0)				
Hosp mort	357 (7.0%)	95 (5.1%)	56 (7.4%)	206 (8.2%)	294 (4.7%)	52 (2.4%)	42 (4.7%)	200 (6.4%)	< 0.001	< 0.001	0.018	0.008 [1]
30d mort, ift indate	580 (11.3%)	151 (8.1%)	79 (10.5%)	350 (14.0%)	623 (10.0%)	110 (5.0%)	84 (9.3%)	429 (13.7%)	0.020	< 0.001	0.432	0.763 [1]
1 year mort, indate	1278 (25.0%)	349 (18.8%)	156 (20.7%)	773 (30.9%)	1437 (23.1%)	290 (13.2%)	184 (20.4%)	963 (30.7%)	0.016	< 0.001	0.893	0.922 [1]
Readmission (30 d)	753 (14.7%)	107 (5.8%)	73 (9.7%)	573 (22.9%)	932 (15.0%)	104 (4.7%)	80 (8.9%)	748 (23.9%)	0.737	0.137	0.574	0.378 [1]

[1] Chi-Square, [2] Mann-Whitney U

Figures

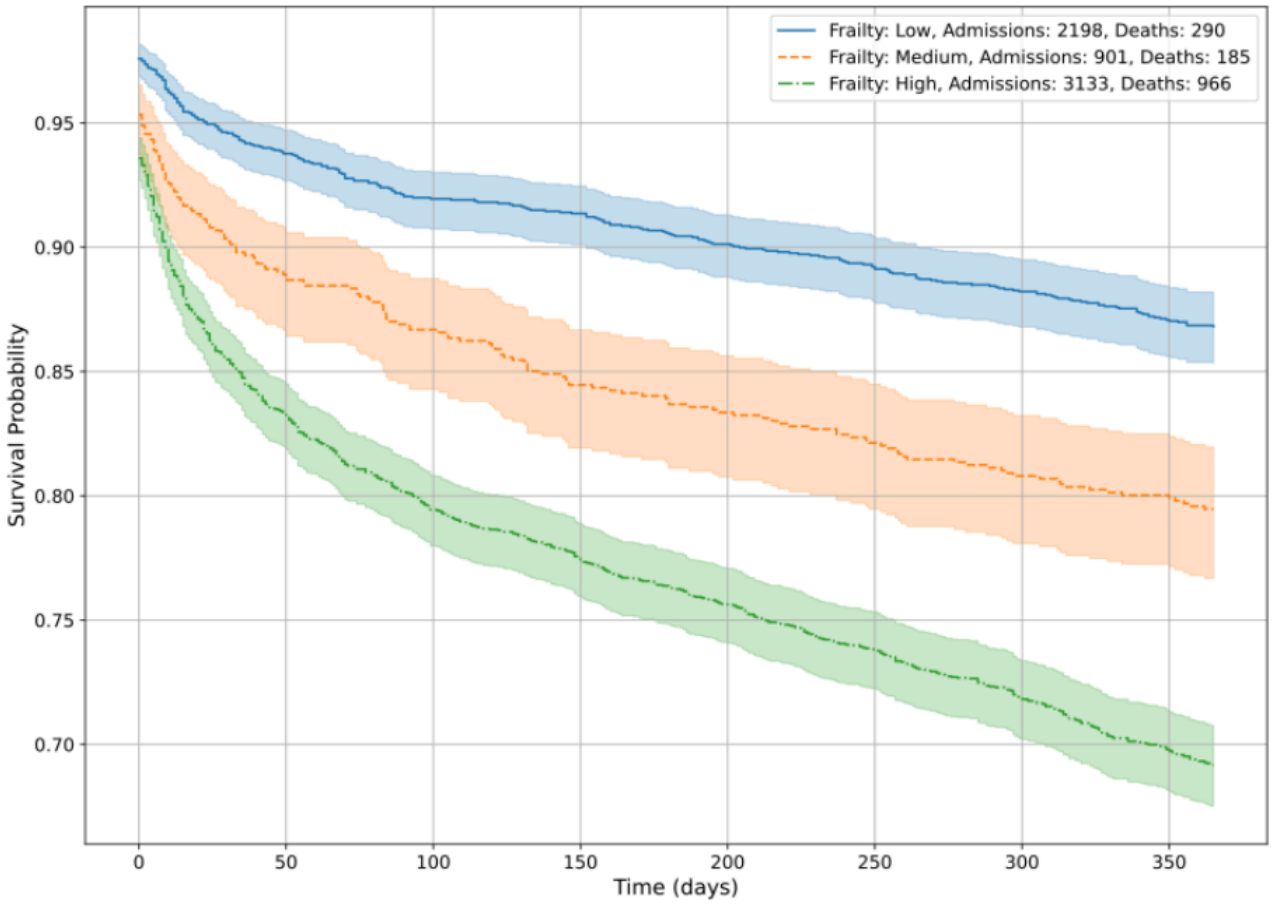


Figure 1

Frailty and survival

The effect of frailty: low, medium and high on survival in the first 365 days in the combined cohort. Shaded areas are 95% confidence intervals.

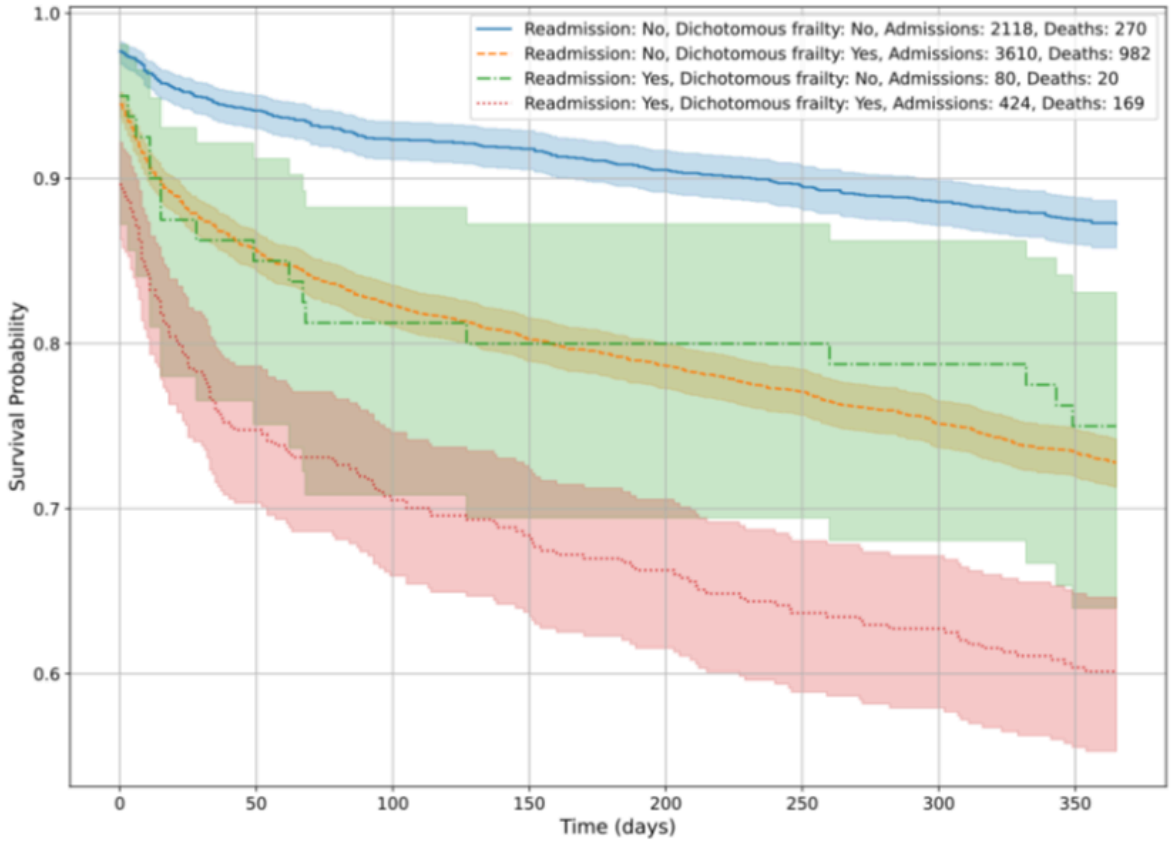


Figure 2

Frailty and readmission

The effect of frailty on readmission the first 365 days in the combined cohort. Shaded areas are 95% confidence intervals

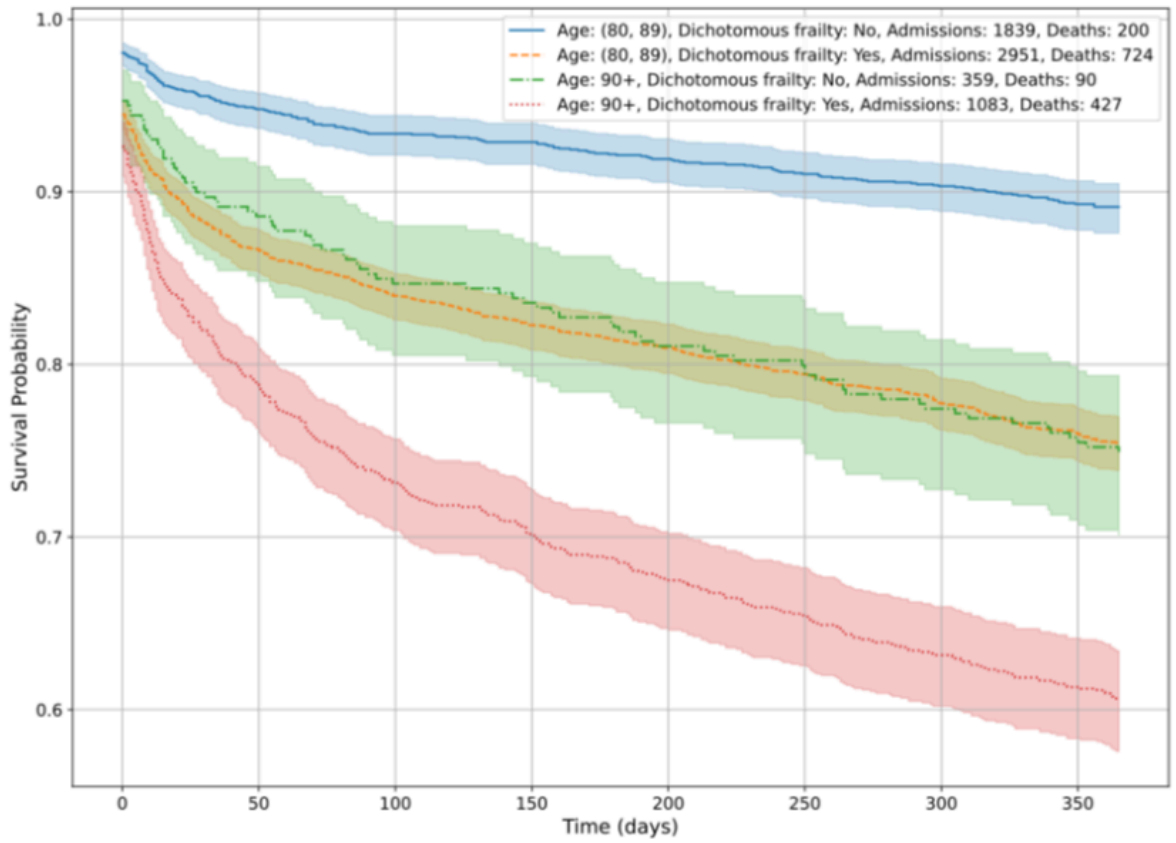


Figure 3

Age group and and frailty

The effect of age and frailty (yes or no) on survival the first 365 days in the combined cohort. Shaded areas are 95% confidence intervals

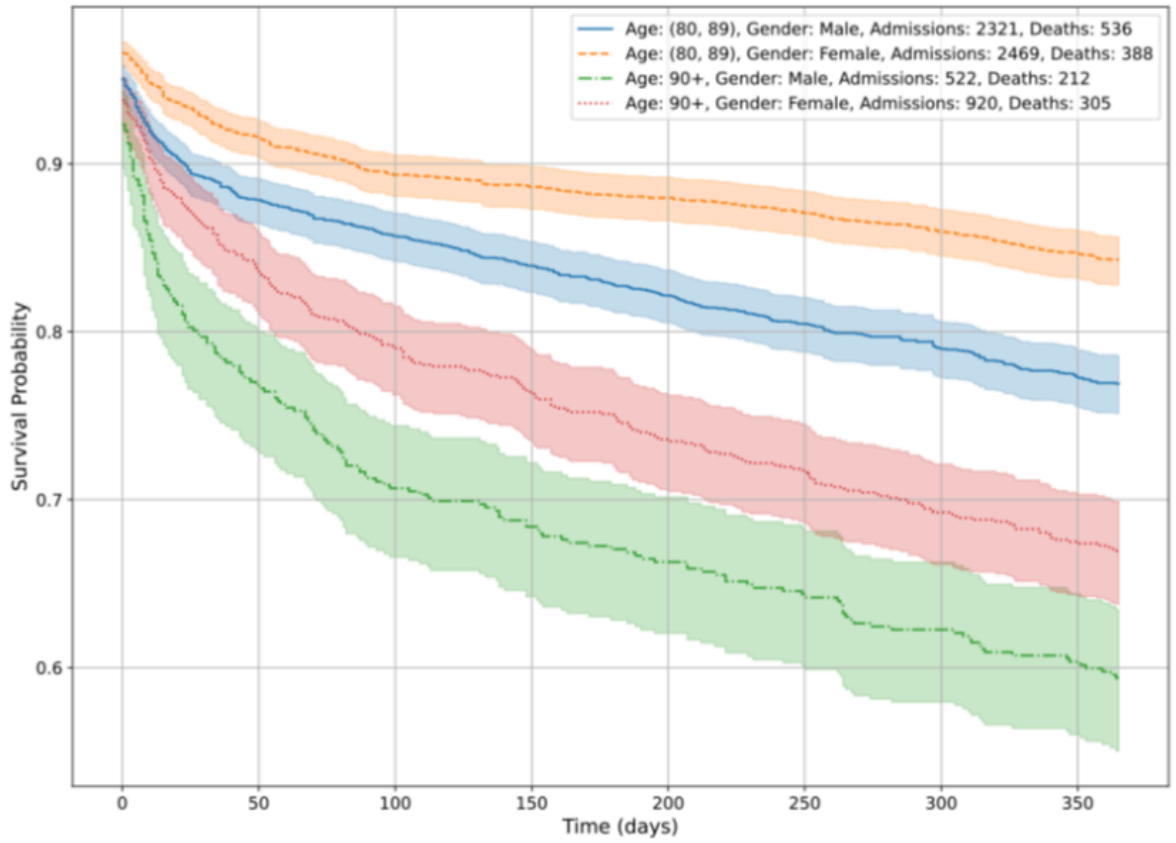


Figure 4

Age group and sex

The effect of age (80-89 and 90+) and sex (male or female) on survival the first 365 days in the combined cohort. Shaded areas are 95% confidence intervals