

Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.

eMethods. Categorizing Reasons for Critical Illness Admissions and Other Hospitalizations and Types of Major Surgical Procedure

The reasons for critical illness admissions and other hospitalizations were grouped into distinct diagnostic categories using a revised version of the protocol described by Ferrucci et al.¹ This protocol included the following diagnoses: cancer, diabetes, dehydration, coronary heart disease, peripheral arteriopathy, pneumonia, chronic obstructive pulmonary disease, gastrointestinal bleeding, hip fracture, congestive heart failure, arthritis or osteoporosis, and dementia. Because our cohort was considerably smaller than that analyzed by Ferrucci et al. (754 vs. 6070), we chose to group critical illness admissions and other hospitalizations into their most common diagnostic categories, respectively. For critical illness, these categories included: cardiac, infection, respiratory, gastrointestinal, neurologic, cancer, musculoskeletal and trauma, vascular, metabolic, renal and immunologic, other injury and poisoning, and other. For other hospitalizations, these categories included: infection, cardiac, respiratory, stroke, dementia and other psychiatric, fall-related injury, gastrointestinal bleeding, dehydration, cancer, musculoskeletal, other medical, and minor surgery. As described in an earlier report,² we categorized each major surgery into the most common types, which included: musculoskeletal, abdominal, vascular (for endovascular surgeries, noncoronary bypass grafts, and amputations), cardiothoracic, neurologic (for brain and spine surgeries), and other (including thyroidectomies, major breast operations, extensive lymph node excisions, burn debridements, and skin grafts).

1. Ferrante LE, Murphy TE, Leo-Summers LS, Gahbauer EA, Pisani MA, Gill TM. The combined effects of frailty and cognitive impairment on post-ICU disability among older ICU survivors. *Am J Respir Crit Care Med*. 2019;200:107-110.
2. Stabenau HF, Becher RD, Gahbauer EA, Leo-Summers L, Allore HG, Gill TM. Functional trajectories before and after major surgery in older adults. *Ann Surg*. 2018;268:911-917.

eTable 1. Reasons for Critical Illness Admissions (N=471) *

	n (%)
Cardiac	153 (32.8)
Infection	85 (18.0)
Respiratory	44 (9.3)
Gastrointestinal	41 (8.7)
Neurologic	39 (8.3)
Cancer	31 (6.6)
Musculoskeletal and trauma	27 (5.7)
Vascular	19 (4.1)
Metabolic, renal and immunologic	15 (3.2)
Other injury and poisoning	9 (1.9)
Other	8 (1.7)

* These admissions were identified from 313 participants.

The reasons are presented in order of highest to lowest rates.

eTable 2. Types of Major Surgical Procedure *

	All Major Surgeries (N=616) †	Elective Surgical Procedure (N=396)	Non-elective Surgical Procedure (N=220)
	n (%)	n (%)	n (%)
Musculoskeletal	233 (37.8)	131 (33.1)	102 (46.4)
Abdominal	111 (18.0)	63 (15.9)	48 (21.8)
Vascular	101 (16.4)	74 (18.7)	27 (12.3)
Cardiothoracic	44 (7.1)	30 (7.6)	14 (6.4)
Neurologic	27 (4.4)	22 (5.6)	5 (2.3)
Other ‡	100 (16.2)	76 (19.2)	24 (10.9)

* The first 5 types are presented in order of highest to lowest rates for all major surgeries.

† These surgeries were identified from 352 participants: 220 for elective and 166 for non-elective.

‡ Includes thyroidectomies, major breast operations, extensive lymph node dissections, burn debridements, and skin grafts.

eTable 3. Reasons for Other Hospitalizations (N=2642) *

	n (%)
Infection	608 (23.0)
Cardiac	529 (20.0)
Respiratory	138 (5.2)
Stroke	123 (4.7)
Dementia and other psychiatric	107 (4.1)
Fall-related injury	98 (3.7)
Gastrointestinal bleeding	81 (3.1)
Dehydration	78 (3.0)
Cancer	63 (2.4)
Musculoskeletal	60 (2.3)
Other medical	709 (26.8)
Minor surgery	48 (1.8)

* These admissions were identified from 646 participants.

The reasons are presented in order of highest to lowest rates except for Other medical.

eTable 4. Active and Disabled Life Expectancy According to Age and Number of Admissions for Critical Illness, Major Surgical Procedure and Other Hospitalization

Age, y	Number of Admissions	Critical Illness *		Major Surgical Procedure *		Other Hospitalization †	
		Active Life Expectancy, y	Disabled Life Expectancy, y	Active Life Expectancy, y	Disabled Life Expectancy, y	Active Life Expectancy, y	Disabled Life Expectancy, y
		Mean (95% CI)		Mean (95% CI)		Mean (95% CI)	
70	0	14.6 (13.9-15.2)	3.4 (3.0-3.7)	13.7 (13.1-14.3)	3.0 (2.7-3.3)	19.4 (18.0-20.8)	4.4 (3.5-5.8)
	1	11.3 (10.3-12.2)	2.2 (1.8-2.5)	14.0 (13.0-14.9)	2.9 (2.4-3.4)	13.5 (12.2-14.7)	3.4 (2.8-4.1)
	2	8.1 (6.3-9.9)	1.4 (1.0-1.9)	12.8 (11.3-14.1)	2.3 (1.8-2.9)	10.0 (8.9-11.2)	3.4 (2.7-4.2)
	3 or more	4.0 (2.6-5.7)	1.4 (0.8-2.3)	10.6 (8.9-12.2)	2.7 (1.9-3.5)	7.0 (6.1-7.9)	2.3 (1.9-2.8)
75	0	10.7 (10.3-11.2)	3.4 (3.0-3.7)	9.9 (9.5-10.4)	2.9 (2.6-3.3)	15.5 (14.3-16.9)	4.5 (3.4-5.9)
	1	7.9 (7.1-8.6)	2.1 (1.8-2.5)	10.2 (9.4-10.9)	2.8 (2.4-3.3)	10.3 (9.3-11.2)	3.4 (2.8-4.2)
	2	5.4 (4.2-6.7)	1.4 (1.0-1.9)	9.3 (8.2-10.3)	2.3 (1.8-2.9)	7.3 (6.5-8.1)	3.4 (2.7-4.2)
	3 or more	2.5 (1.6-3.6)	1.4 (0.8-2.2)	7.4 (6.2-8.5)	2.7 (2.0-3.5)	4.9 (4.4-5.5)	2.3 (2.0-2.7)
80	0	7.4 (7.1-7.8)	3.3 (3.0-3.7)	6.7 (6.4-7.1)	2.9 (2.6-3.2)	12.0 (10.9-13.3)	4.5 (3.4-6.1)
	1	5.1 (4.7-5.6)	2.1 (1.8-2.4)	6.9 (6.4-7.5)	2.8 (2.4-3.2)	7.6 (6.8-8.3)	3.5 (2.8-4.2)
	2	3.4 (2.6-4.2)	1.4 (1.0-1.8)	6.2 (5.5-7.0)	2.3 (1.8-2.8)	5.1 (4.5-5.7)	3.4 (2.7-4.1)
	3 or more	1.5 (1.0-2.1)	1.4 (0.9-2.1)	4.8 (4.0-5.5)	2.6 (2.0-3.4)	3.3 (3.0-3.7)	2.3 (2.0-2.6)
85	0	4.8 (4.5-5.1)	3.3 (2.9-3.7)	4.3 (4.0-4.6)	2.8 (2.5-3.2)	8.9 (7.9-10.2)	4.5 (3.3-6.2)
	1	3.2 (2.8-3.5)	2.0 (1.7-2.3)	4.4 (4.0-4.8)	2.7 (2.3-3.2)	5.4 (4.8-5.9)	3.5 (2.8-4.4)
	2	2.0 (1.6-2.6)	1.3 (0.9-1.7)	3.9 (3.4-4.5)	2.2 (1.8-2.7)	3.4 (3.0-3.9)	3.4 (2.7-4.2)
	3 or more	0.9 (0.6-1.3)	1.4 (0.9-2.1)	2.9 (2.4-3.5)	2.5 (1.9-3.3)	2.2 (2.0-2.4)	2.3 (2.0-2.6)
90	0	2.9 (2.7-3.1)	3.2 (2.7-3.7)	2.6 (2.4-2.8)	2.7 (2.4-3.2)	6.4 (5.5-7.5)	4.5 (3.3-6.3)
	1	1.9 (1.6-2.1)	1.9 (1.6-2.2)	2.6 (2.3-2.9)	2.6 (2.2-3.1)	3.6 (3.2-4.2)	3.6 (2.8-4.5)
	2	1.2 (0.9-1.5)	1.3 (0.9-1.6)	2.3 (2.0-2.7)	2.2 (1.7-2.8)	2.2 (1.9-2.6)	3.4 (2.7-4.2)
	3 or more	0.5 (0.4-0.7)	1.3 (0.8-2.0)	1.7 (1.4-2.0)	2.4 (1.8-3.2)	1.4 (1.3 1.6)	2.3 (2.0-2.6)

Abbreviation: y, years; CI, confidence interval.

* Values are adjusted for sex.

† As described in the Methods, values are adjusted for sex and for time-varying exposure to critical illness or major surgery.

eTable 5. Total Life Expectancy According to Age and Number of Admissions
for Critical Illness, Major Surgical Procedure and Other Hospitalization

Age, y	Number of		Other	
	Admissions	Critical Illness *	Major Surgical Procedure *	Hospitalization †
Mean Years (95% CI)				
70	0	17.9 (17.0-18.8)	16.6 (15.8-17.5)	24.2 (21.8-26.9)
	1	13.4 (12.2-14.6)	16.9 (15.5-18.1)	16.4 (14.7-18.2)
	2	9.5 (7.4-11.7)	15.1 (13.2-16.9)	12.9 (11.1-14.8)
	3 or more	5.5 (3.4-7.7)	13.3 (11.1-15.5)	8.5 (7.3-9.8)
75	0	14.1 (13.4-14.9)	12.8 (12.1-13.6)	20.4 (18.1-23.2)
	1	10.0 (9.0-11.0)	13.0 (11.9-14.0)	13.4 (12.0-14.9)
	2	6.8 (5.3-8.3)	11.6 (10.0-13.0)	10.3 (8.9-11.9)
	3 or more	3.9 (2.5-5.5)	10.0 (8.3-11.8)	6.6 (5.8-7.4)
80	0	10.7 (10.1-11.3)	9.6 (9.0-10.2)	17.0 (14.7-19.7)
	1	7.2 (6.5-7.9)	9.7 (8.8-10.6)	10.8 (9.7-12.3)
	2	4.8 (3.7-5.8)	8.5 (7.5-9.7)	8.2 (7.1-9.6)
	3 or more	2.9 (1.9-4.0)	7.4 (6.0-8.8)	5.1 (4.6-5.7)
85	0	8.1 (7.4-8.7)	3.3 (2.9-3.7)	14.0 (11.7-16.8)
	1	5.2 (4.6-5.9)	7.1 (6.4-7.9)	8.7 (7.7-10.2)
	2	3.3 (2.6-4.2)	6.1 (5.3-7.1)	6.7 (5.7-7.9)
	3 or more	2.3 (1.5-3.2)	5.4 (4.4-6.5)	4.1 (3.8-4.5)
90	0	6.1 (5.4-6.7)	5.3 (4.8-5.9)	11.6 (9.3-14.5)
	1	3.8 (3.3-4.3)	5.2 (4.5-5.9)	7.2 (6.1-8.7)
	2	2.4 (1.9-3.1)	4.5 (3.8-5.4)	5.6 (4.7-6.8)
	3 or more	1.9 (1.2-2.7)	4.1 (3.3-5.1)	3.5 (3.1-3.8)

Abbreviation: y, years; CI, confidence interval.

* Values are adjusted for sex.

† As described in the Methods, values are adjusted for sex and for time-varying exposure to critical illness or major surgery.

eTable 6. Active and Disabled Life Expectancy According to Age and Number of Admissions for Elective and Non-Elective Major Surgical Procedure *

Age, y	Number of Admissions †	Elective		Non-Elective	
		Active Life Expectancy, y	Disabled Life Expectancy, y	Active Life Expectancy, y	Disabled Life Expectancy, y
		Mean (95% CI)		Mean (95% CI)	
70	0	13.4 (12.8-14.1)	2.9 (2.6-3.2)	13.9 (13.3-14.5)	2.9 (2.6-3.1)
	1	14.6 (13.5-15.5)	2.6 (2.2-3.0)	11.7 (10.5-12.8)	2.8 (2.3-3.4)
	2 or more	12.6 (11.5-13.8)	2.9 (2.3-3.5)	9.2 (7.4-11.0)	2.8 (1.8-4.0)
75	0	9.7 (9.3-10.1)	2.9 (2.6-3.2)	10.1 (9.7-10.5)	2.8 (2.6-3.1)
	1	10.7 (9.8-11.5)	2.5 (2.2-2.9)	8.2 (7.3-9.1)	2.7 (2.3-3.3)
	2 or more	9.0 (8.1-9.9)	2.8 (2.3-3.5)	6.2 (4.9-7.7)	2.8 (1.8-4.0)
80	0	6.5 (6.2-6.8)	2.9 (2.6-3.1)	6.9 (6.6-7.2)	2.8 (2.5-3.1)
	1	7.3 (6.7-7.9)	2.5 (2.1-2.9)	5.4 (4.8-6.0)	2.7 (2.2-3.2)
	2 or more	6.0 (5.3-6.7)	2.8 (2.3-3.4)	4.0 (3.1-5.0)	2.8 (1.9-3.9)
85	0	6.5 (6.2-6.8)	2.9 (2.6-3.1)	4.4 (4.2-4.7)	2.7 (2.4-3.0)
	1	7.3 (6.7-7.9)	2.5 (2.1-2.9)	3.3 (2.9-3.7)	2.5 (2.1-3.0)
	2 or more	6.0 (5.3-6.7)	2.8 (2.3-3.4)	2.4 (1.8-3.1)	2.7 (1.9-3.8)
90	0	2.4 (2.2-2.6)	2.7 (2.3-3.1)	2.7 (2.5-2.9)	2.6 (2.3-3.0)
	1	2.8 (2.5-3.1)	2.3 (1.9-2.7)	1.9 (1.7-2.2)	2.4 (2.0-2.9)
	2 or more	2.2 (1.8-2.5)	2.6 (2.1-3.3)	1.4 (1.1-1.8)	2.7 (1.9-3.7)

Abbreviation: y, years; CI, confidence interval.

* Values are adjusted for sex.

† As described in the Methods, the exposure had to be categorized into three groups because the models with four groups did not converge due to small cell sizes for 3 or more admissions. Overall, the exposure rates (95% CI) per 1000 person-months for elective and non-elective major surgery were 4.6 (4.1-5.1) and 2.5 (2.2-3.0), respectively.

eTable 7. Total Life Expectancy According to Age, Sex and Number of Admissions for Critical Illness, Major Surgical Procedure and Other Hospitalization

		Critical Illness		Major Surgical Procedure		Other Hospitalization *	
Age, y	Number of Admissions	Women	Men	Women	Men	Women	Men
		Mean Years (95% CI)		Mean Years (95% CI)		Mean Years (95% CI)	
70	0	18.7 (17.5-19.7)	16.7 (15.3-18.1)	17.3 (16.1-18.3)	15.6 (14.2-16.9)	25.4 (22.2-29.6)	22.8 (19.3-27.1)
	1	12.8 (11.0-14.4)	14.0 (12.0-15.9)	17.7 (15.7-19.5)	15.8 (13.9-17.6)	16.5 (14.0-18.8)	17.0 (14.3-19.6)
	2	9.3 (6.5-11.9)	9.8 (6.4-13.1)	15.4 (13.2-17.6)	14.8 (11.7-17.7)	13.0 (10.6-15.5)	13.5 (10.3-16.4)
	3 or more	5.8 (2.8-9.0)	4.8 (2.0-8.2)	12.7 (10.0-15.6)	15.0 (11.1-18.7)	8.8 (7.2-10.5)	8.5 (6.5-10.6)
75	0	14.8 (13.9-15.6)	13.0 (11.8-14.2)	13.5 (12.6-14.4)	11.9 (10.8-13.0)	21.7 (18.6-26.1)	18.6 (15.1-23.6)
	1	9.4 (8.2-10.7)	10.4 (9.0-12.1)	13.8 (12.3-15.3)	11.9 (10.3-13.4)	13.7 (11.6-15.6)	13.1 (10.9-15.3)
	2	6.7 (4.7-8.7)	7.1 (4.3-9.9)	11.8 (10.0-13.7)	11.2 (8.8-13.5)	10.5 (8.6-12.5)	10.1 (7.9-12.6)
	3 or more	4.3 (2.1-6.6)	3.3 (1.6-5.6)	9.6 (7.5-11.9)	11.2 (8.0-14.4)	7.0 (5.9-8.1)	6.0 (4.8-7.2)
80	0	11.4 (10.6-12.2)	9.8 (8.9-10.9)	10.2 (9.4-11.1)	8.7 (7.8-9.6)	18.2 (15.2-22.7)	15.4 (12.2-19.9)
	1	6.8 (6.0-7.7)	7.6 (6.5-8.7)	10.5 (9.3-11.8)	8.6 (7.5-9.9)	11.3 (9.5-13.3)	10.6 (8.6-12.8)
	2	4.7 (3.4-6.3)	5.0 (3.1-7.0)	8.8 (7.4-10.3)	8.0 (6.3-10.0)	8.5 (6.8-10.2)	8.1 (6.2-10.4)
	3 or more	3.2 (1.8-5.0)	2.3 (1.2-4.1)	7.2 (5.7-9.0)	8.0 (5.6-10.8)	5.6 (4.9-6.3)	4.8 (4.0-5.7)
85	0	8.6 (7.9-9.4)	7.3 (6.3-8.6)	7.6 (6.9-8.5)	6.3 (5.4-7.2)	15.3 (12.2-19.7)	12.4 (9.2-17.3)
	1	4.9 (4.2-5.6)	5.4 (4.6-6.3)	7.8 (6.8-9.0)	6.1 (5.2-7.2)	9.3 (7.6-11.4)	8.3 (6.4-10.5)
	2	3.4 (2.5-4.5)	3.3 (2.2-4.7)	6.5 (5.3-7.7)	5.7 (4.3-7.4)	7.0 (5.5-8.6)	6.4 (4.8-8.3)
	3 or more	2.6 (1.5-3.9)	1.8 (1.0-3.0)	5.5 (4.2-7.0)	5.6 (3.8-7.6)	4.6 (4.1-5.1)	3.7 (3.1-4.5)
90	0	6.5 (5.8-7.4)	5.5 (4.5-6.9)	5.8 (5.1-6.7)	4.7 (3.8-5.9)	12.7 (9.7-11.5)	10.0 (6.7-15.0)
	1	3.6 (3.0-4.2)	3.9 (3.2-4.9)	5.9 (5.0-7.0)	4.4 (3.5-5.4)	7.8 (6.1-10.1)	6.6 (4.8-9.3)
	2	2.5 (1.8-3.5)	2.3 (1.5-3.3)	4.8 (3.8-5.9)	4.1 (3.0-5.4)	5.9 (4.5-7.5)	5.2 (3.7-7.3)
	3 or more	2.1 (1.1-3.3)	1.5 (0.8-2.5)	4.3 (3.2-5.5)	3.9 (2.7-5.5)	3.9 (3.5 4.4)	3.1 (2.5-3.9)

Abbreviation: y, years; CI, confidence interval.

* As described in the Methods, values are adjusted for time-varying exposure to critical illness or major surgery.