

# Impact of Frailty in Critically Ill Patients: Does It Add Any Value?

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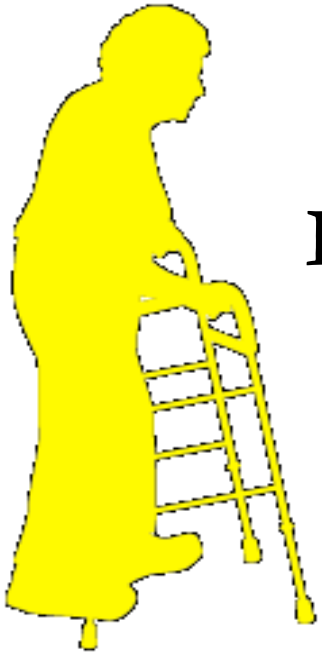
# 2016 Disclosures

- **Salary support:** Canada government
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- **Data Safety Monitoring Committee:** LJPC
- *I am not a geriatrician – nor necessarily an expert in frailty*

# Objectives

1. Define and review the biologic concept of “frailty”
2. Understand the tools to capture frailty and identify a vulnerable population
3. Understand the impact of frailty on outcomes after acute stress and critical illness

**FRAILITY** is a multi-dimensional “syndrome” or “state” related to ageing first described in elderly patients



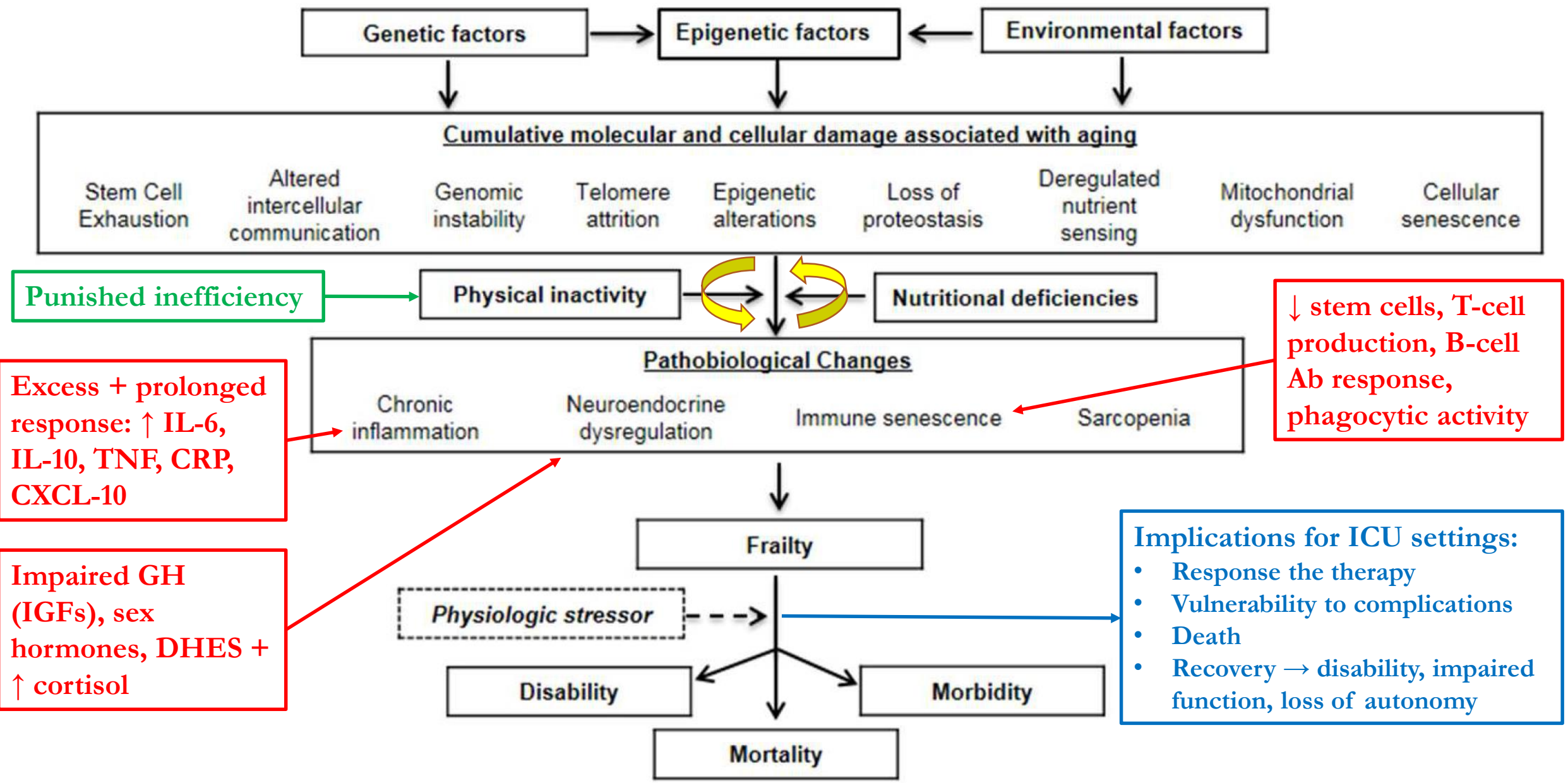
Characterized by:

Loss of reserve (energy, physical, cognitive, health) and the accumulation of “deficits”

(individually reversible but collectively insurmountable)

Consequence:

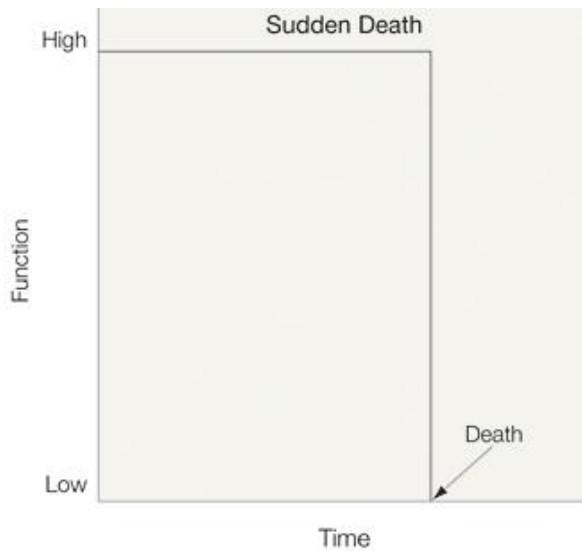
Heightened vulnerability or “state-at-risk” to adverse outcomes



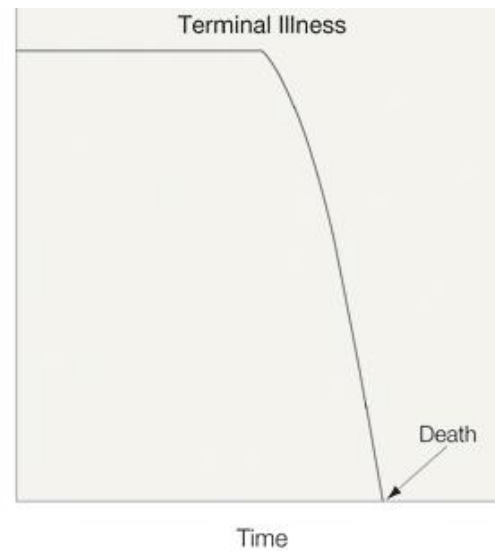
# Patterns of Functional Decline at End of Life



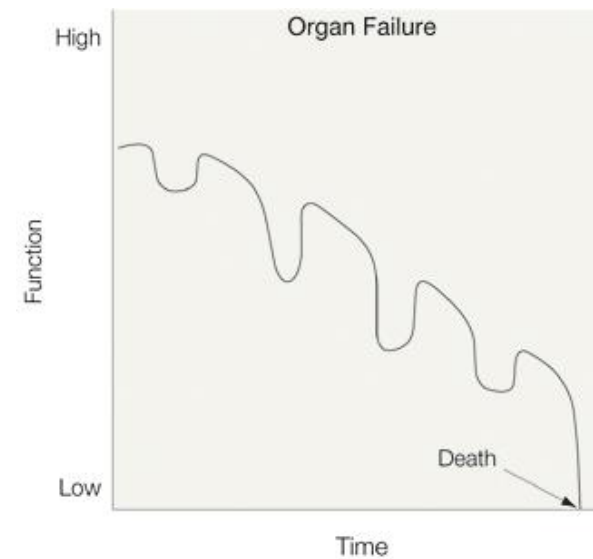
## Sudden Death



## Terminal Illness



## Organ Failure



## Frailty

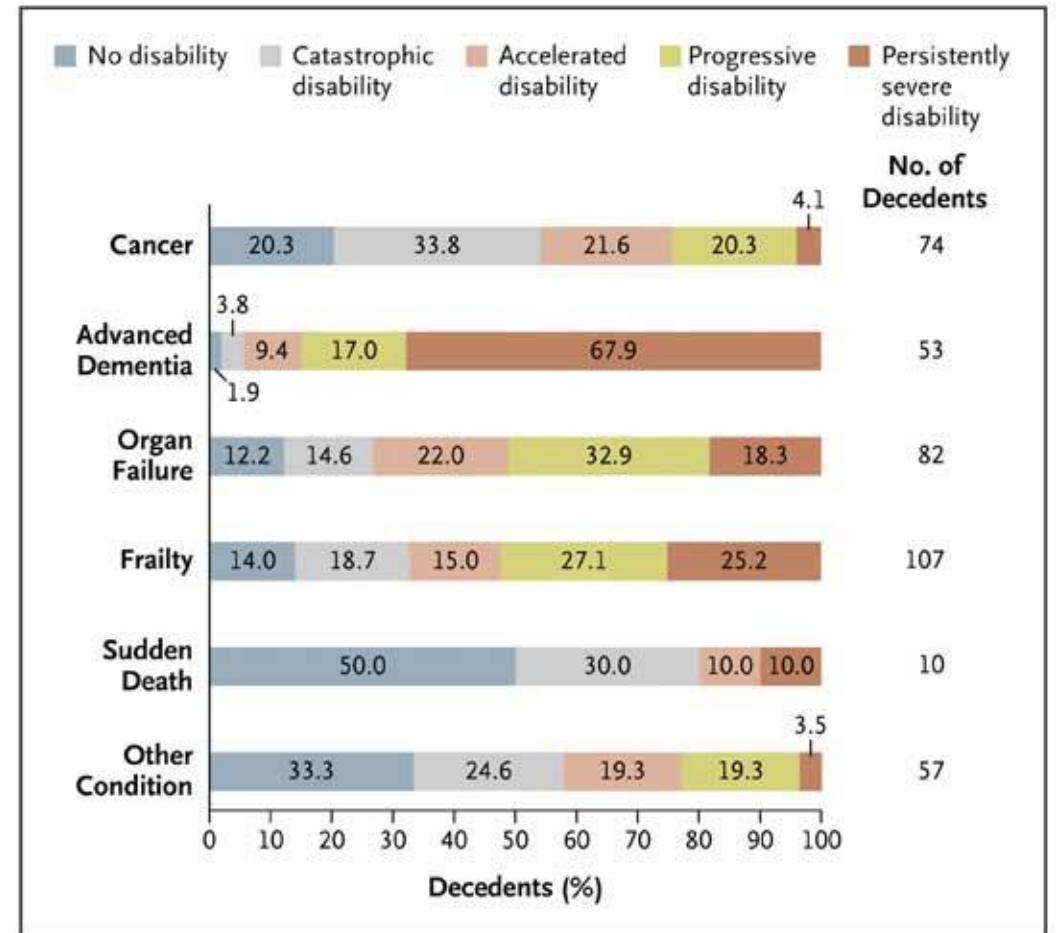
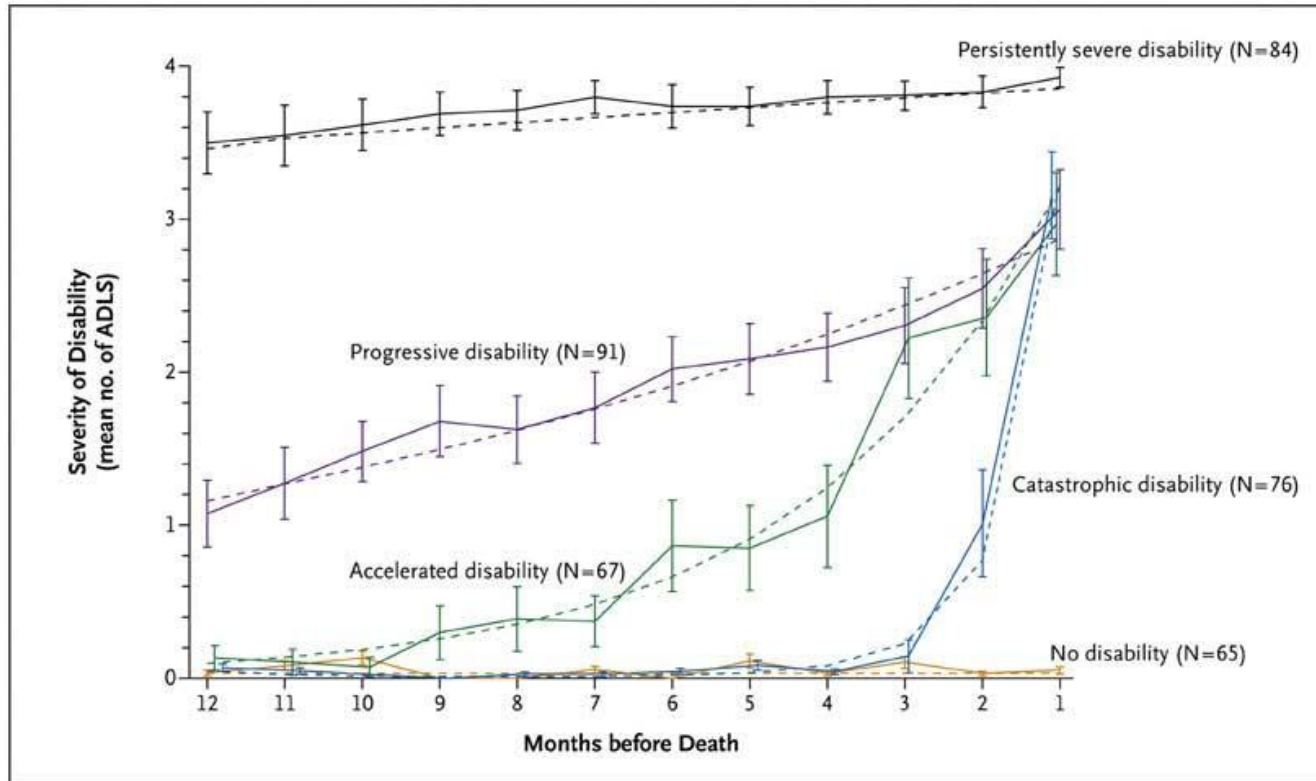


**Definitions:** Sudden death = cardiac arrest or trauma; Terminal illness = cancer; Organ failure = HF/COPD;  
Frailty: residence in nursing home

# Trajectories of Disability in the Last Year of Life

Thomas M. Gill, M.D., Evelyne A. Gahbauer, M.D., M.P.H., Ling Han, M.D., Ph.D., and Heather G. Allore, Ph.D.

n=383 elderly decedents



FRAILITY ~ most common condition leading to death

# Cumulative Deficit Model

CSHA captured 92 variables such as symptoms, signs, laboratory values, disease states and disabilities – collectively termed **“deficits”**

- Changes in everyday activities
- Head and neck problems
- Poor muscle tone in neck
- Bradykinesia, facial
- Problems getting dressed
- Problems with bathing
- Problems carrying out personal grooming
- Urinary incontinence
- Toileting problems
- Bulk difficulties
- Rectal problems
- Gastrointestinal problems
- Problems cooking
- Sucking problems
- Problems going out alone
- Impaired mobility
- Musculoskeletal problems
- Bradykinesia of the limbs
- Poor muscle tone in limbs
- Poor limb coordination
- Poor coordination, trunk
- Poor standing posture
- Irregular gait pattern
- Falls
- Mood problems
- Feeling sad, blue, depressed
- History of depressed mood
- Tiredness all the time
- Depression (clinical impression)
- Sleep changes
- Restlessness
- Memory changes
- Short-term memory impairment
- Long-term memory impairment
- Changes in general mental functioning
- Onset of cognitive symptoms
- Clouding or delirium
- Paranoid features
- History relevant to cognitive impairment or loss
- Family history relevant to cognitive impairment or loss
- Impaired vibration
- Tremor at rest
- Postural tremor
- Intention tremor
- History of Parkinson's disease
- Family history of degenerative disease
- Seizures, partial complex
- Seizures, generalized
- Syncope or blackouts
- Headache
- Cerebrovascular problems
- History of stroke
- History of diabetes mellitus
- Arterial hypertension
- Peripheral pulses
- Cardiac problems
- Myocardial infarction
- Arrhythmia
- Congestive heart failure
- Lung problems
- Respiratory problems
- History of thyroid disease
- Thyroid problems
- Skin problems
- Malignant disease
- Breast problems
- Abdominal problems
- Presence of snout reflex
- Presence of the palmomental reflex
- Other medical history

**Frailty Index (FI) = # deficits / total variables**

Frailty represents the “cumulative effects of individual deficits”

Reinforces the concept of “physiologic/homeostatic reserve” and “biological gradation”

FI strongly correlates with risk of death and institutionalization



# Physical Phenotype Model

Frailty Characteristics	CHS Measure
Shrinking, weight loss (unintentional), sarcopenia	>10 lb lost unintentionally in prior 1 year
Weakness	Grip strength: lowest 20% (by sex, BMI)
Poor endurance, exhaustion, slowness	“exhaustion” (self-reported); walking time/15 ft: slowest 20% (by sex, height)
Low activity	Kcal/week: lowest 20% (males <383 Kcal/wk; females <270 Kcal/wk)

1. **Shrinking:** weight loss, unintentional, of  $\geq 10$  lbs in prior year)
2. **Weakness:** grip strength in lowest 20% at baseline (age/BMI)
3. **Poor endurance/energy:** self report of exhaustion (CES-D scale)
4. **Slowness:** slowest 20% at baseline for time to walk 15 ft (sex/height)
5. **Low physical activity:** lowest quintile of physical activity (gender)

**Frail  $\geq 3$**   
**Vulnerable 1-2**  
**Not Frail 0**

# Domains to Define, Measure and Operationalize

Domain	Operational Measures
<b>General Health Status</b>	Hospitalizations, global assessment of functioning scale, self-rated health
<b>Physical Function</b>	BADL, IADL, functional independence measure (FIM)
<b>Cognitive Function</b>	MMSE, Montreal Cognitive assessment, clock drawing test
<b>Mobility</b>	Short physical performance battery, gait speed, TGUG, chair rise, mobility aid
<b>Strength</b>	Grip strength, stair climb, subjective assessment of weakness
<b>Energy</b>	Fatigue severity scale, subjective assessment of exhaustion or fatigue
<b>Nutritional Status</b>	BMI, weight, albumin/prealbumin, mini-nutritional assessment, weight loss
<b>Skeletal Muscle Mass</b>	Anthropometry, bioelectrical impedance, MRI/CT/ultrasound
<b>Mood</b>	Geriatric depression scale, HADS, self-reported depression/anxiety
<b>Social relations/support</b>	Availability of social resources, subjective assessment of loneliness or isolation
<b>Laboratory Markers</b>	Inflammatory mediators (IL-6, IL-1, TNF, CRP), oxidized LDL, creatinine

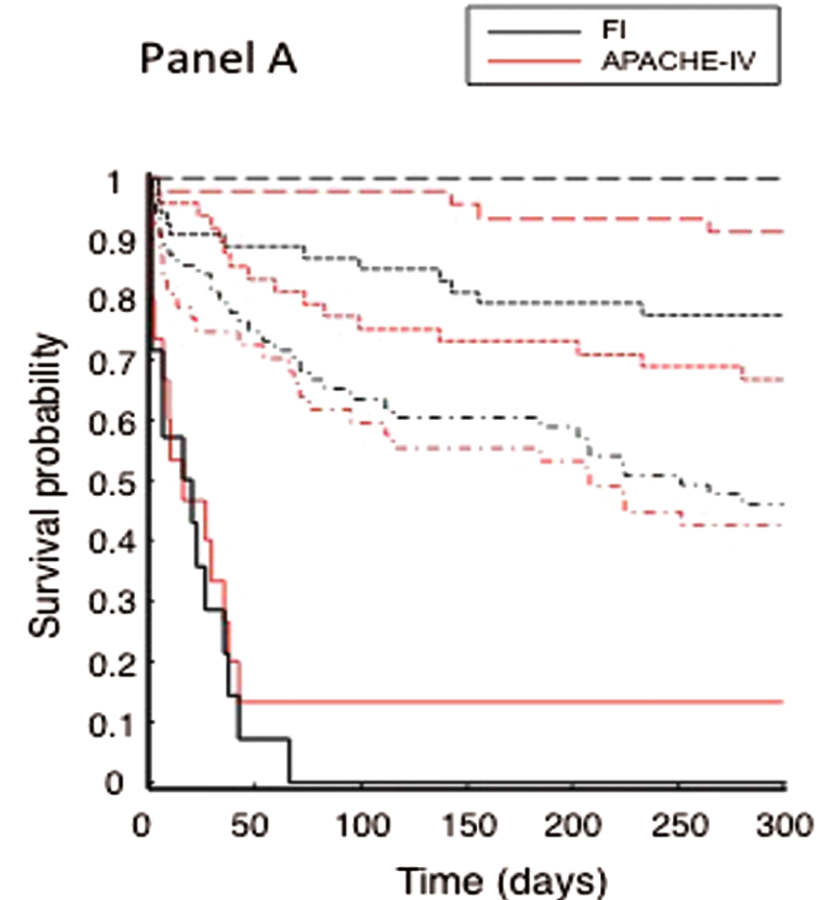
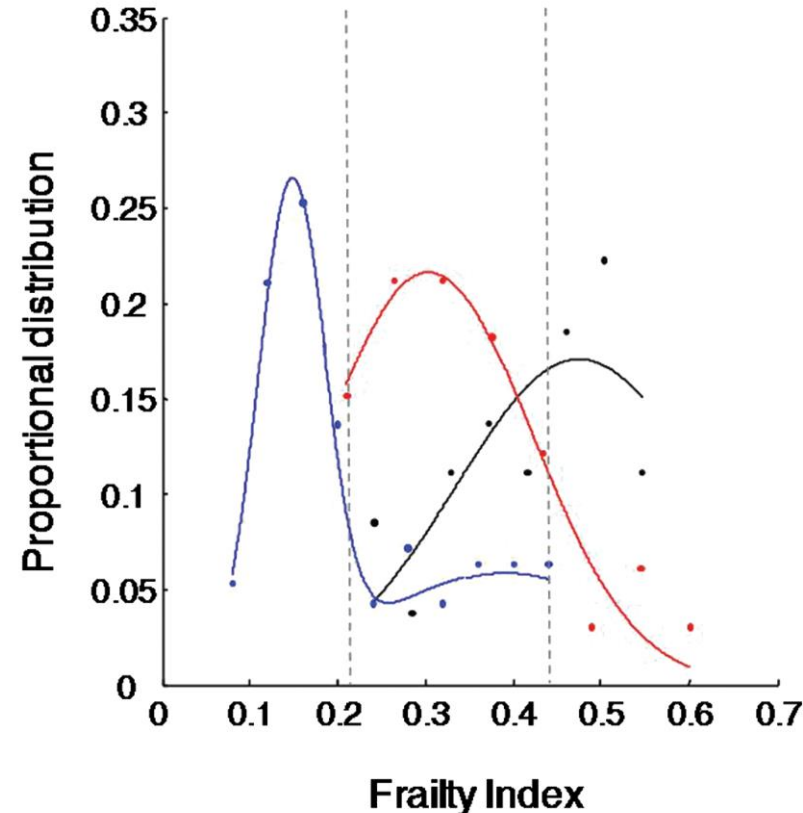
# Methods to Screen and “Diagnose” Frailty

Method	Description	Items	Example	Evaluated in ICU
<b>Frailty Index (FI)</b>	Deficit accumulation	30-70	CSHA FI (70 items)	YES
<b>Physical phenotype</b>	≥ 3 physical features	3-5	Fried (CHS) criteria	YES
<b>Physical performance measures</b>	Single measure	1	Gait speed, grip strength, chair stand	NO
<b>Judgement-Based tools</b>	Global subjective assessment	1	Clinical Frailty Scale	YES
<b>Multidimensional tools</b>	Battery of assessments across domains	5-20	EFS, FRAIL, CAF, Groningen Frailty Indicator	NO
<b>Sarcopenia</b>	Imaging to assess skeletal muscle	1	CT scan psoas or rectus femoris	YES

**Gold Standard:** Comprehensive Geriatric Assessment (CGA)

# Mortality in Relation to Frailty in Patients Admitted to a Specialized Geriatric Intensive Care Unit

- Single “geriatric” ICU in China (mean age 82 yr)
- Novel FI based on 52 variables (23 chronic + 31 acute)
- All patients who died had FI > 0.46
- All patients who survived 30-days had FI < 0.22



Each 1% ↑ in FI associated with 11% ↑ in 30-day mortality (OR 1.11; 95% CI, 1.07-1.15)

# Frailty as a Predictor of Surgical Outcomes in Older Patients

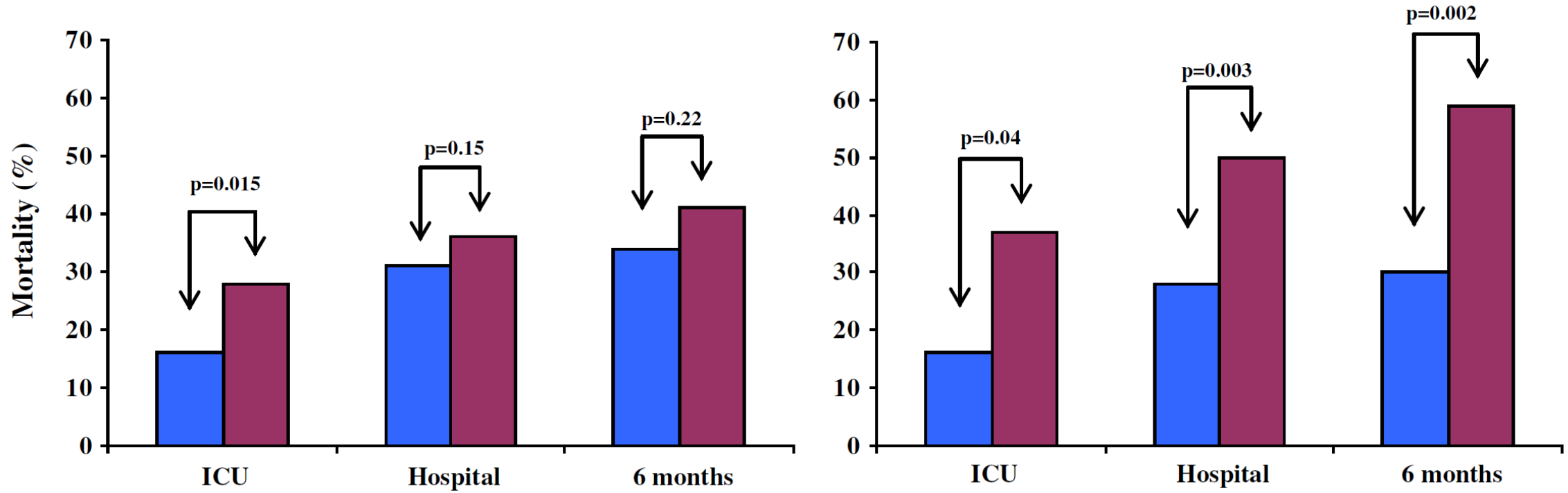
n=594	Non-Frail (58.2%)	Intermediate (31.3%)	Frail* (10.4%)
Age (yr)	71 (67-94)	75 (65-92)	76 (65-94)
Female Sex (%)	67.6	52.7	41.9
Post-operative complications	1.0	2.06 (1.2-3.6)	<b>2.54 (1.1-5.8)</b>
Length of stay	1.0	1.49 (1.2-1.8)	<b>1.69 (1.3-2.2)</b>
Institutionalized	1.0	3.2 (1.0-9.9)	<b>20.5 (5.5-76)</b>

# Prevalence and impact of frailty on mortality in elderly ICU patients: a prospective, multicenter, observational study

n=196

■ FP < 3     ■ FP ≥ 3

■ CFS < 5     ■ CFS ≥ 5



# A global clinical measure of fitness and frailty in elderly people

## Clinical Frailty Scale\*



**1 Very Fit** – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.



**2 Well** – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g. seasonally.



**3 Managing Well** – People whose **medical problems are well controlled**, but are **not regularly active** beyond routine walking.



**4 Vulnerable** – While **not dependent** on others for daily help, often **symptoms limit activities**. A common complaint is being "slowed up", and/or being tired during the day.



**5 Mildly Frail** – These people often have **more evident slowing**, and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.



**6 Moderately Frail** – People need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.



**7 Severely Frail** – **Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).



**8 Very Severely Frail** – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.



**9. Terminally Ill** - Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise evidently frail**.

### Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia. Common symptoms in mild dementia include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In moderate dementia, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In severe dementia, they cannot do personal care without help.

\* 1. Canadian Study on Health & Aging, Revised 2008.  
2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005; 173:489-495.

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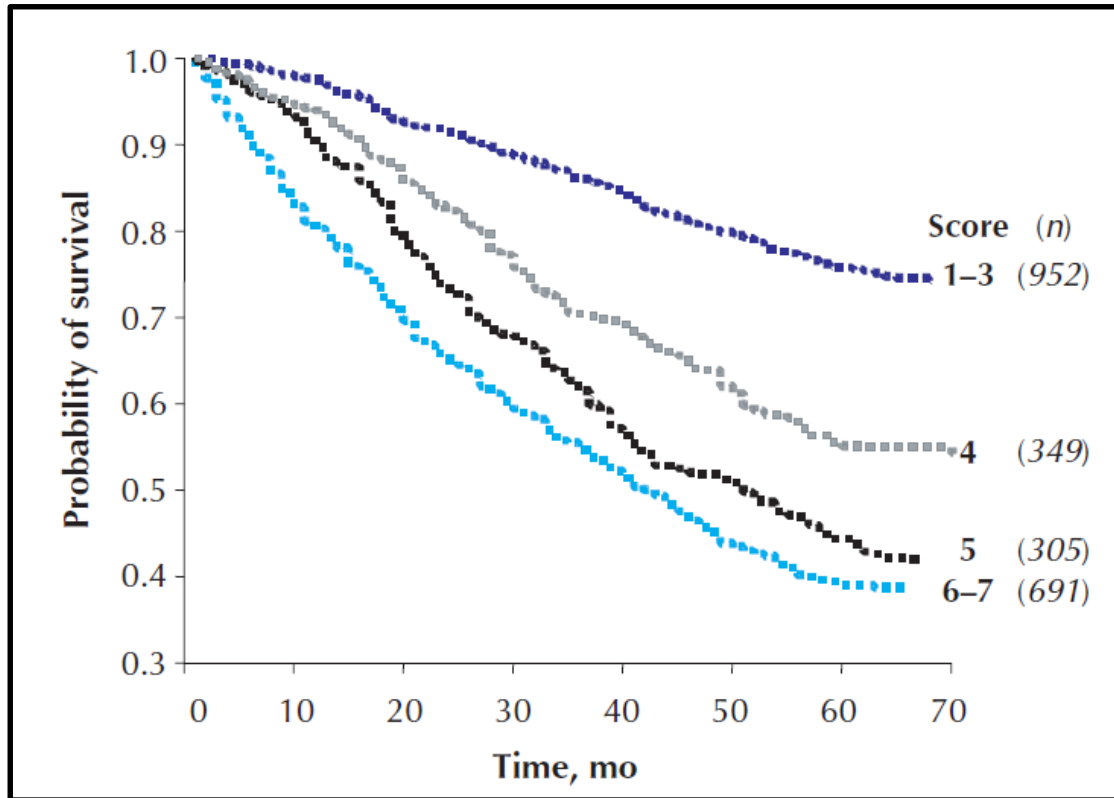
**Table 2: Cox proportional hazard ratios (HR) for time until death and until the requirement for institutional care**

Factor	Death, HR (95% CI)	Entry into institution, HR (95% CI)
Age	1.08 (1.07–1.08)	1.15 (1.10–1.13)
Sex	0.83 (0.78–0.89)	1.38 (1.21–1.58)
Education level*	0.98 (0.97–0.99)	0.98 (0.97–0.99)
Modified Mini-Mental State Examination	0.84 (0.82–0.86)	0.65 (0.60–0.70)
Cumulative Illness Rating Scale	1.14 (1.11–1.17)	1.22 (1.16–1.27)
CSHA measuring tools		
Rules-based definition of frailty	1.17 (1.13–1.20)	1.27 (1.19–1.35)
Frailty Index	1.26 (1.24–1.29)	1.56 (1.48–1.65)
Function Scale	1.16 (1.13–1.20)	1.29 (1.20–1.39)
Clinical Frailty Scale	1.30 (1.27–1.33)	1.46 (1.39–1.53)

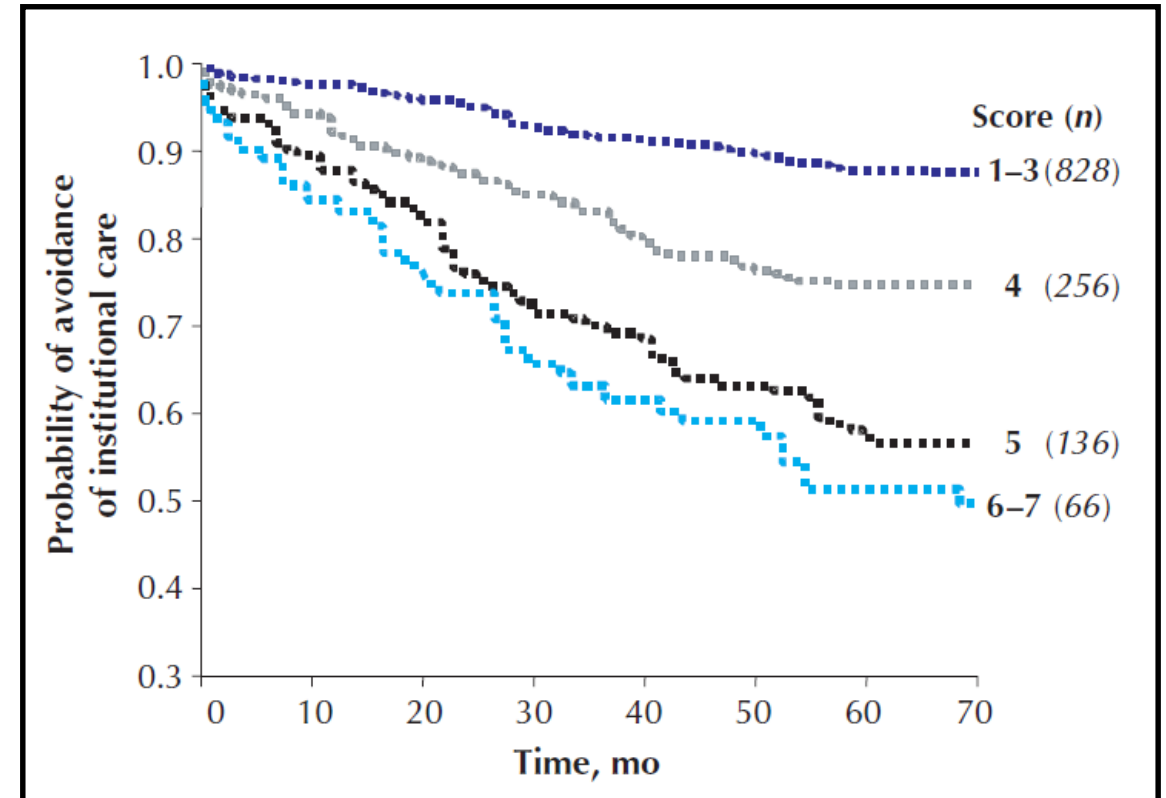
CFS score and mathematically derived FI highly correlated (Pearson 0.80,  $p < 0.01$ )

# A global clinical measure of fitness and frailty in elderly people

## Survival



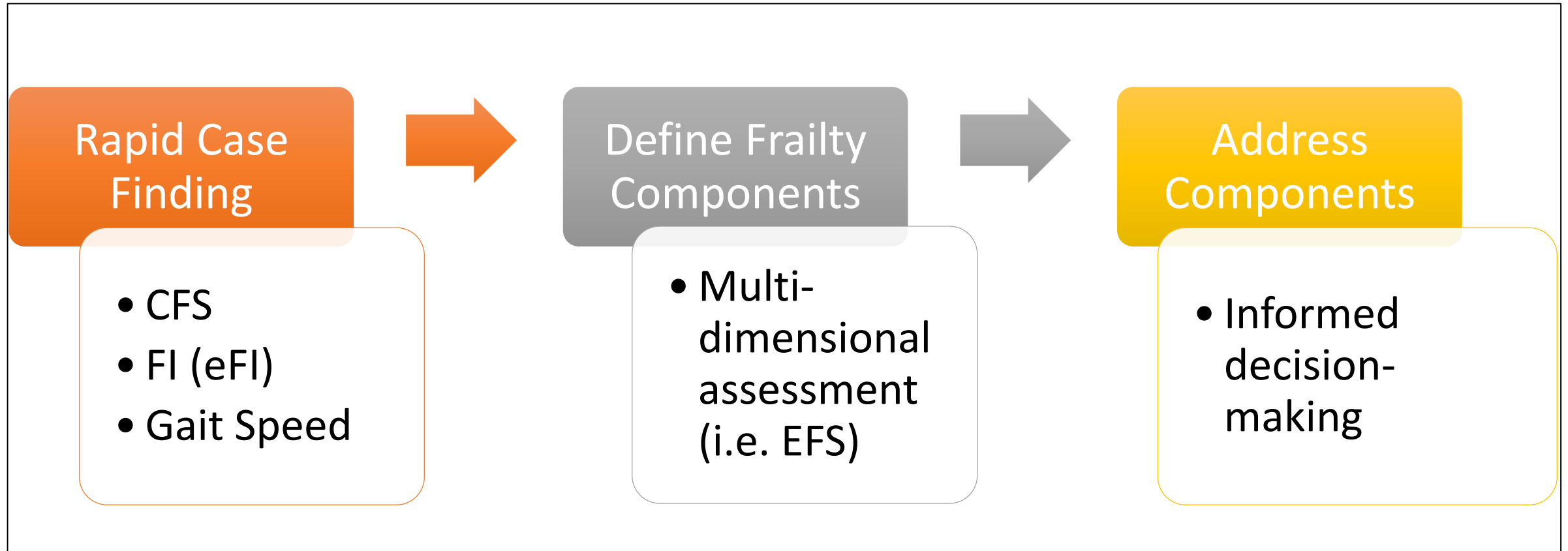
## Institutionalization



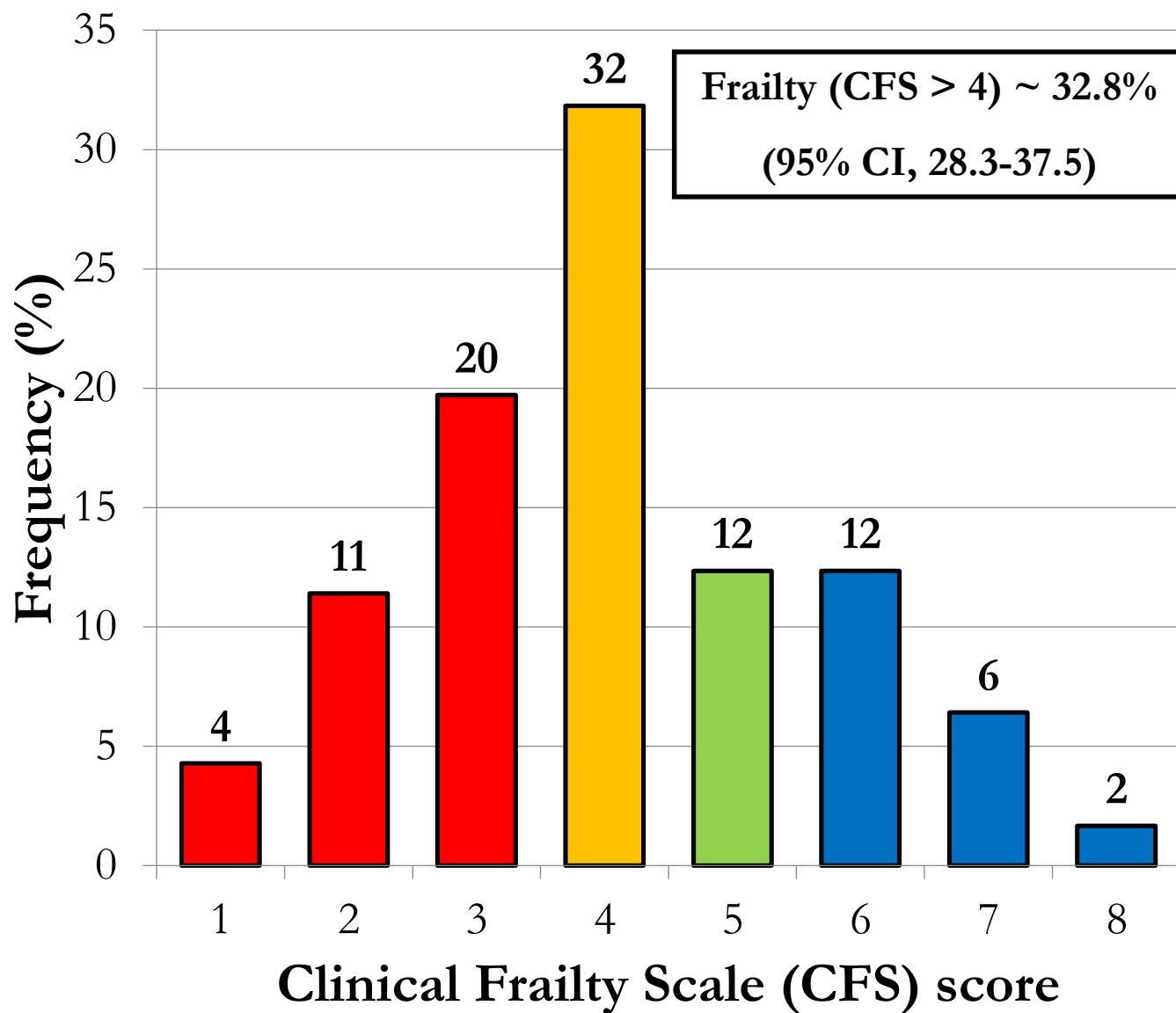
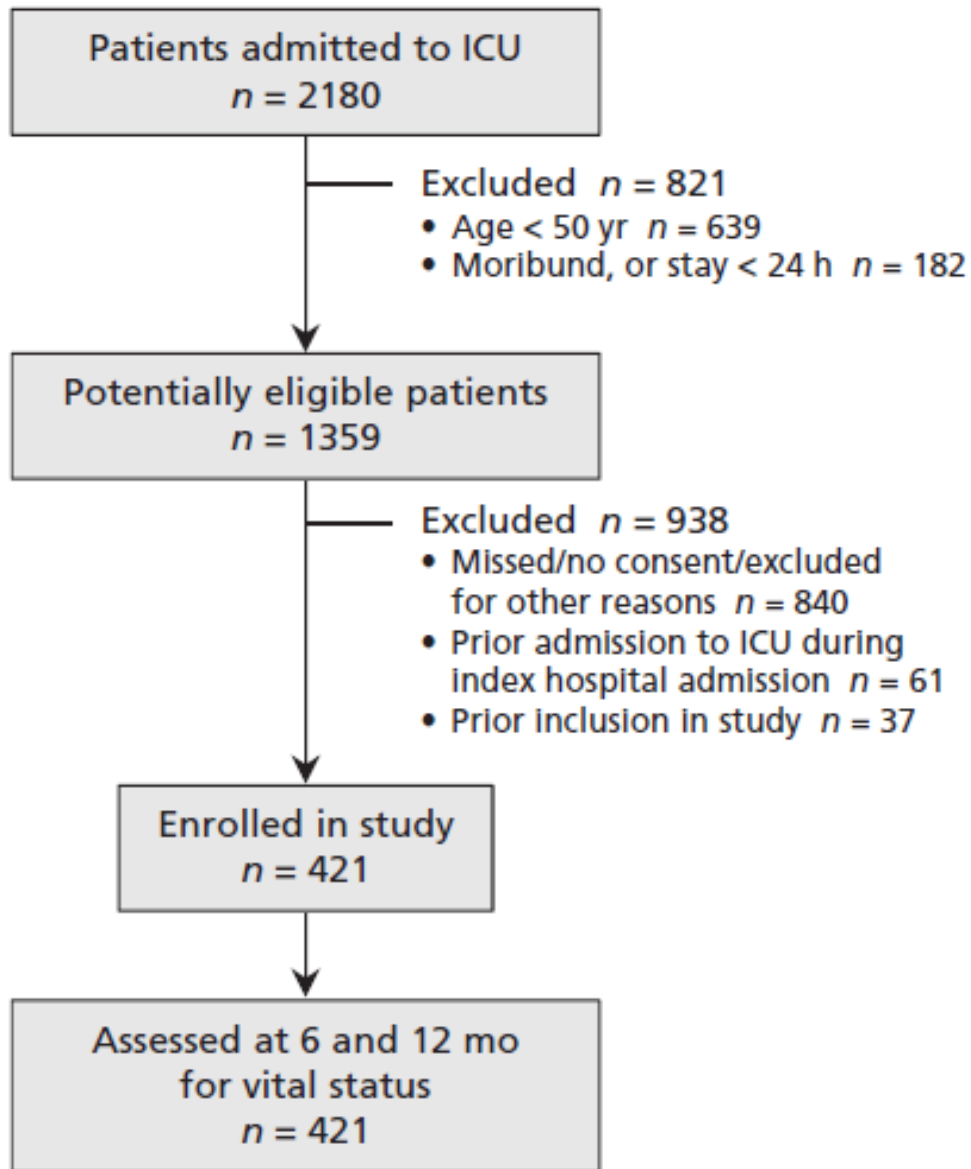
For each 1-category  $\uparrow$  in CFS score  $\sim 21.2\%$   $\uparrow$  death and  $23.9\%$   $\uparrow$  institutionalization



# Frailty – The “What” and “When”



ICU admission → → Identify Contributors → → Precision Recovery

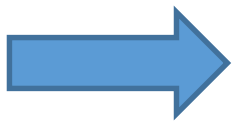


	Group; no. (%) of patients*		Association, OR (95% CI) or difference in medians ( <i>p</i> value†)
	Frail <i>n</i> = 138	Not frail <i>n</i> = 283	
Outcome			
Adverse event‡	54 (39.1)	83 (29.3)	1.54 (1.01–2.37)
Death			
In ICU	16 (11.6)	27 (9.5)	1.37 (0.72–2.62)
In hospital	44 (31.9)	45 (15.9)	1.81 (1.09–3.01)
Duration of stay, d, median (IQR)			
In ICU	7 (4–13)	6 (3–10)	1 d (0.02)
In hospital	30 (10–64)	18 (10–40)	12 d (0.02)
Discharge disposition§	<i>n</i> = 91	<i>n</i> = 235	
Home, living independently	20 (22.0)	104 (44.3)	0.35 (0.20–0.61)
Home, living with help	33 (36.3)	58 (24.7)	1.67 (1.00–2.81)
Other¶	38 (41.8)	73 (31.1)	1.51 (0.92–2.48)
Discharged newly dependent**	24 (70.6)	96 (51.6)	2.25 (1.03–4.89)
Hospital readmission§	51 (56.0)	92 (39.1)	1.98 (1.22–3.23)

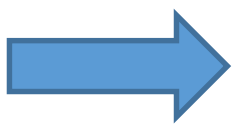
↑ vulnerability



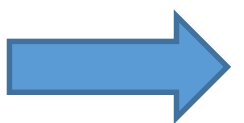
↑ risk for death



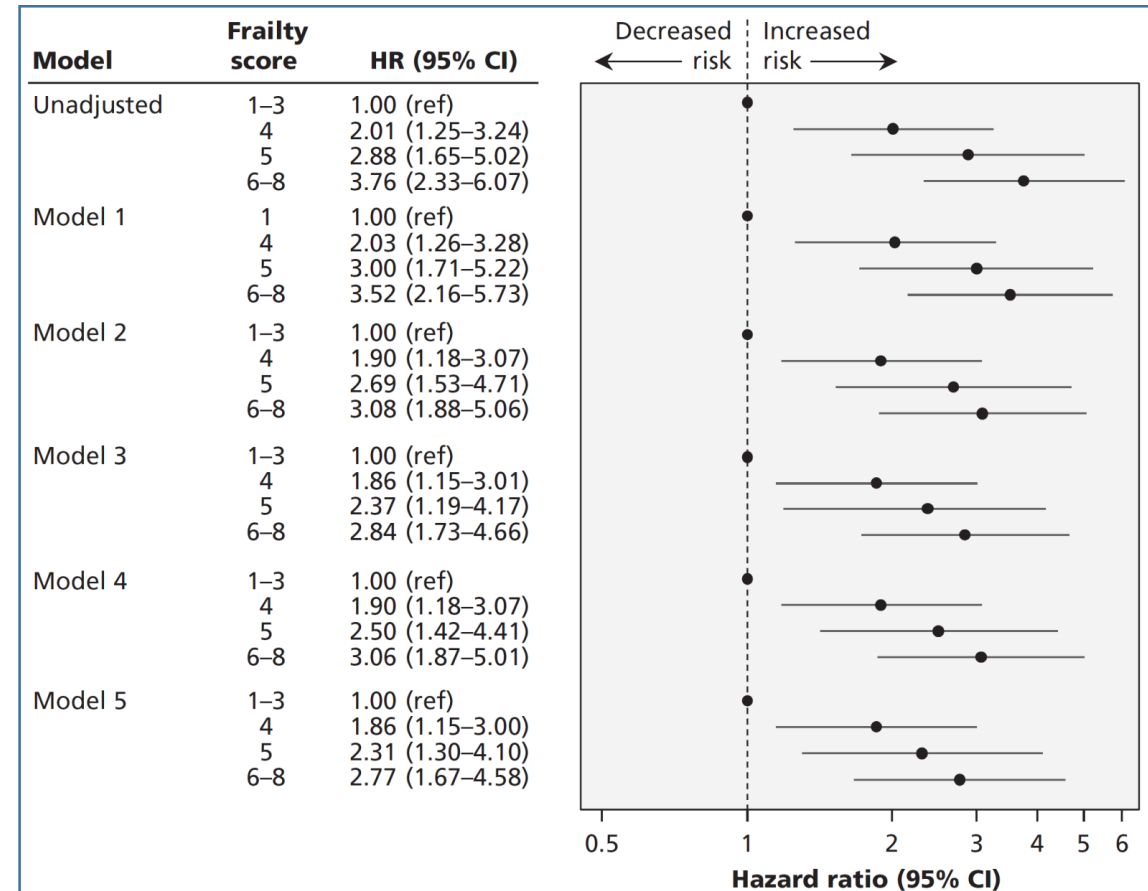
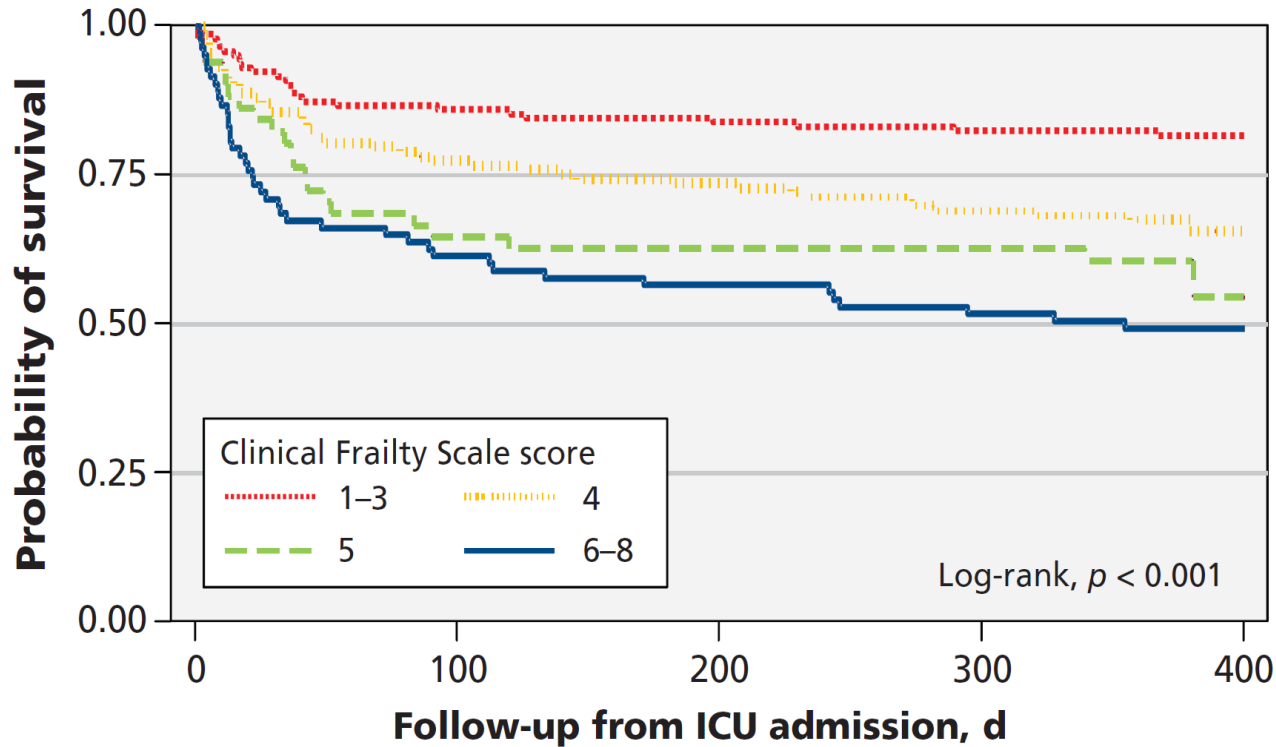
↑ time for recovery



↑ functional impairment

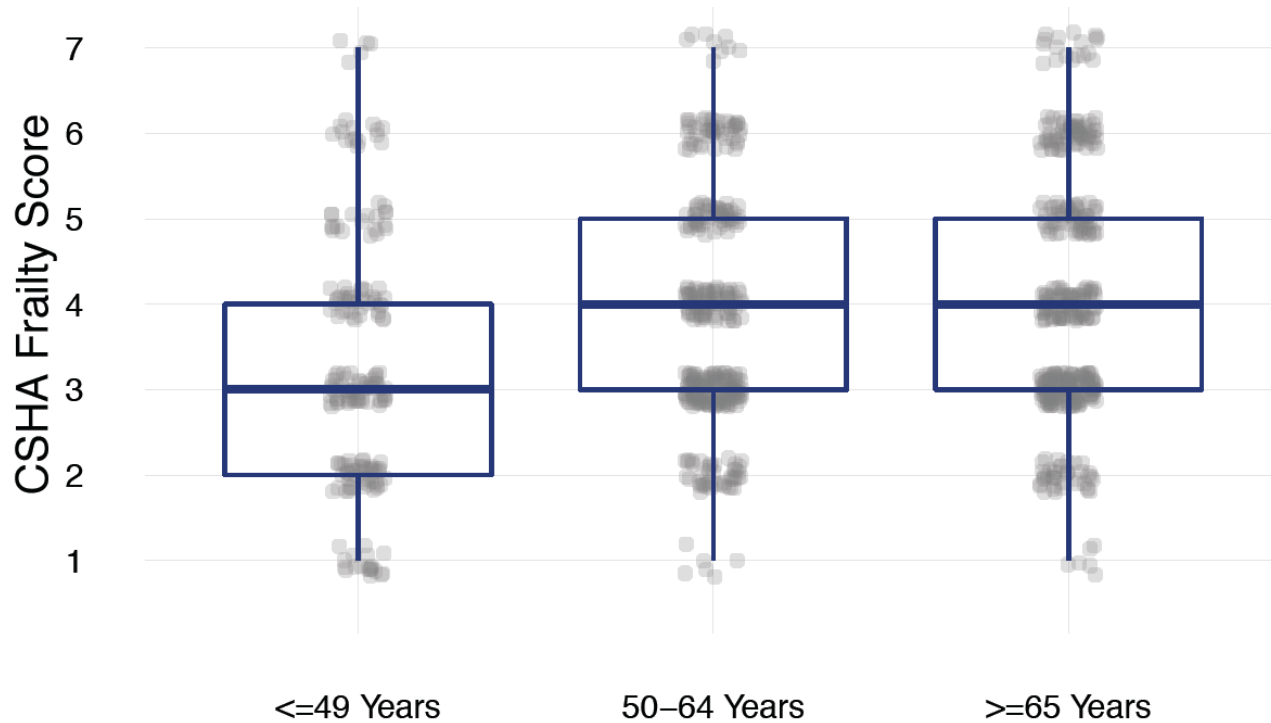


# Survival 1-year after ICU Admission

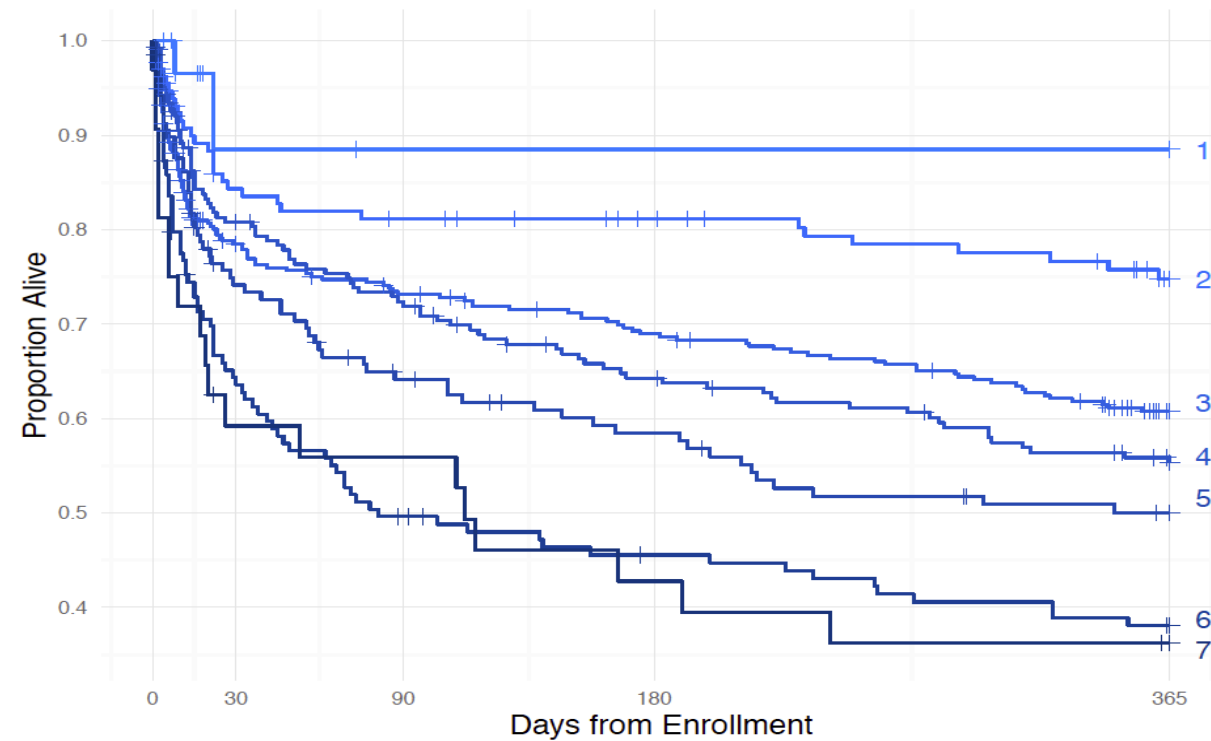


# Secondary Analysis of BRAIN/MIND ICU Studies

## CFS Scores Stratified by Age



## Mortality Stratified by CFS Score



Prevalence of frailty 30% (n=307) (50% age < 65 years)

↑ CFS score associated with ↑ mortality, ↑ disability in IADL and worse physical (not mental) HRQL

CFS scores not associated with disability in BADL or cognition

# But...Does It Add Value?

## 1. Better informed triage decisions ~

- Regarding to suitability and likely benefit for ICU support

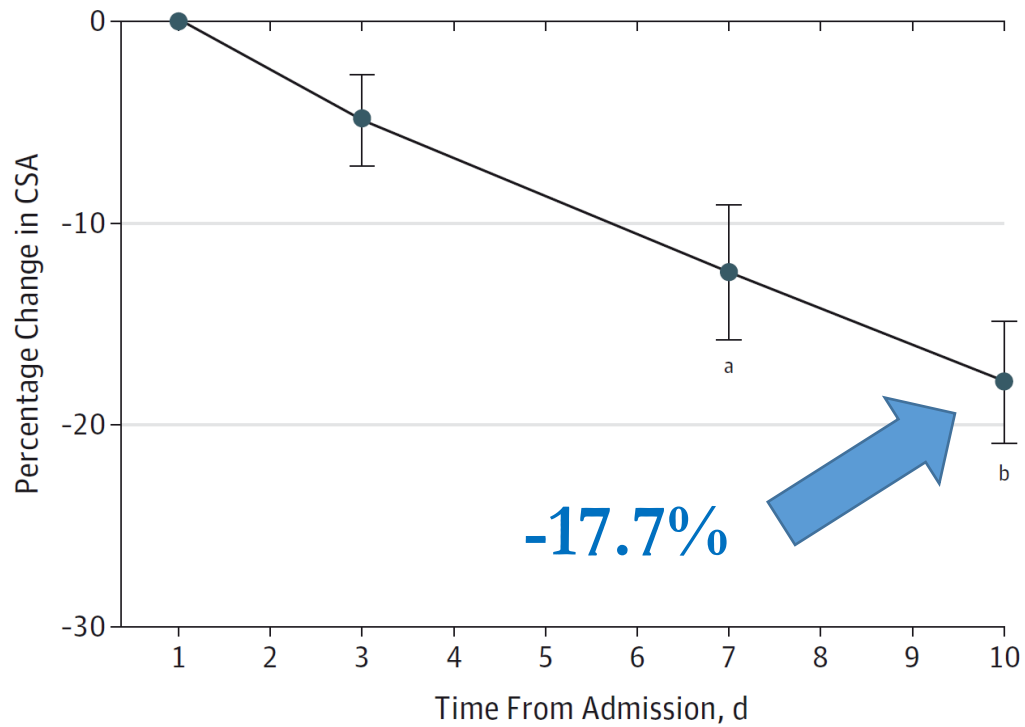
## 2. Guide and inform patient-centered decision-making ~

- Regarding scope/duration of ICU support (i.e., time-limited trials)
- Regarding establishing/revisiting goals of care
- Regarding managing post-ICU survivorship expectations and experience (i.e., impact on HRQL, new disability, institutionalization, rehospitalization)

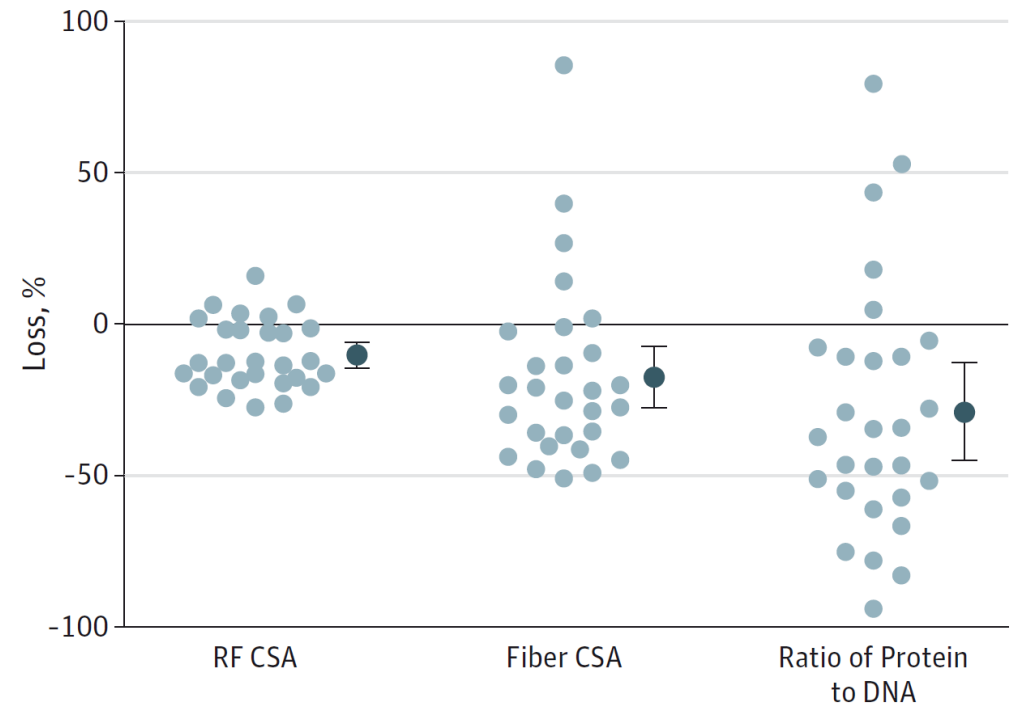
# Acute Skeletal Muscle Wasting in Critical Illness

63 critically ill mechanically ventilated patients (age 54.7; APACHE II 23.5)

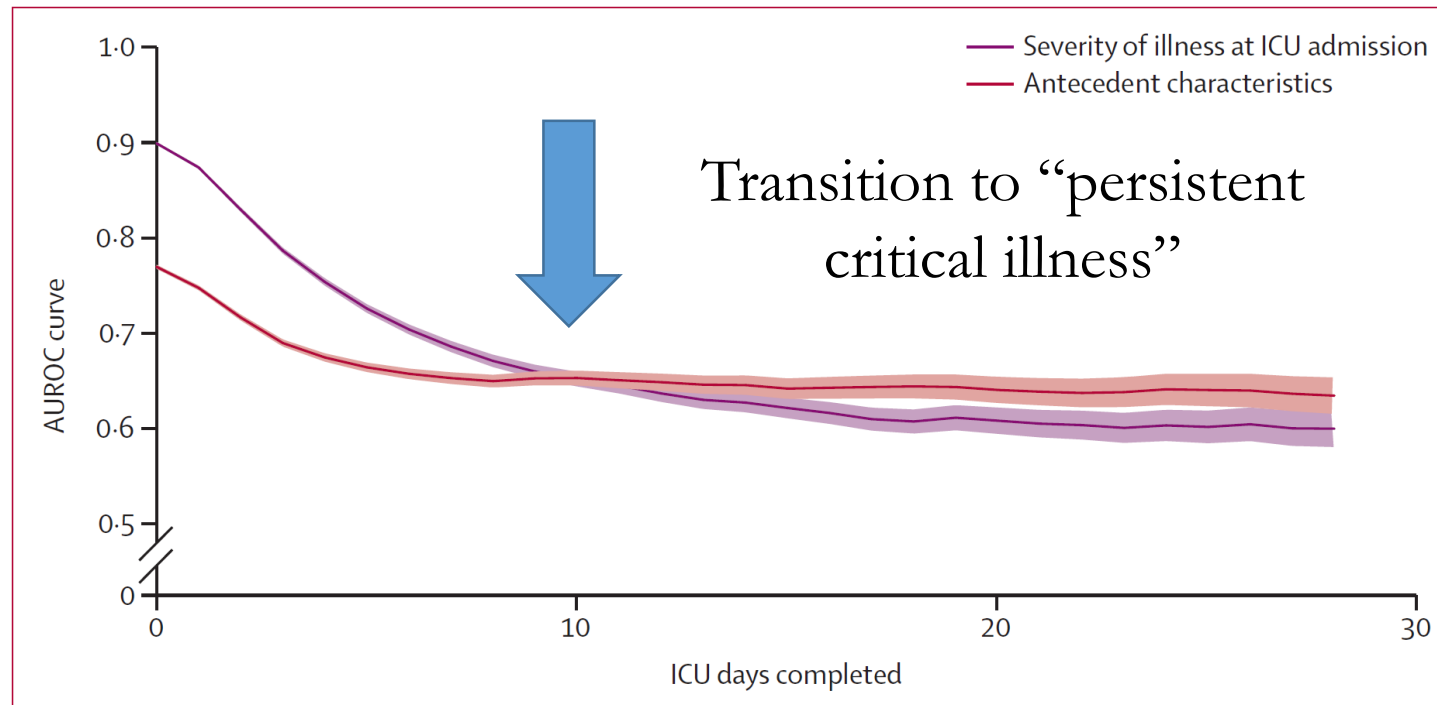
**A** Change in rectus femoris (RF) cross-sectional area (CSA) over 10 d



**B** Measures of muscle wasting in patients assessed by all 3 measures on both day 1 and day 7 (n=28)



# Timing of onset and burden of persistent critical illness in Australia and New Zealand: a retrospective, population-based, observational study



At ~ 10 days after ICU admission, acuity did not predict mortality better than antecedent characteristics (age, sex, comorbid disease) (variable transition point by case-mix and acuity)

Prevalence only 5.0% but accounted for 32.8% of ICU-bed days and only 46.5% returned home



# And...How Else May It Add Value?

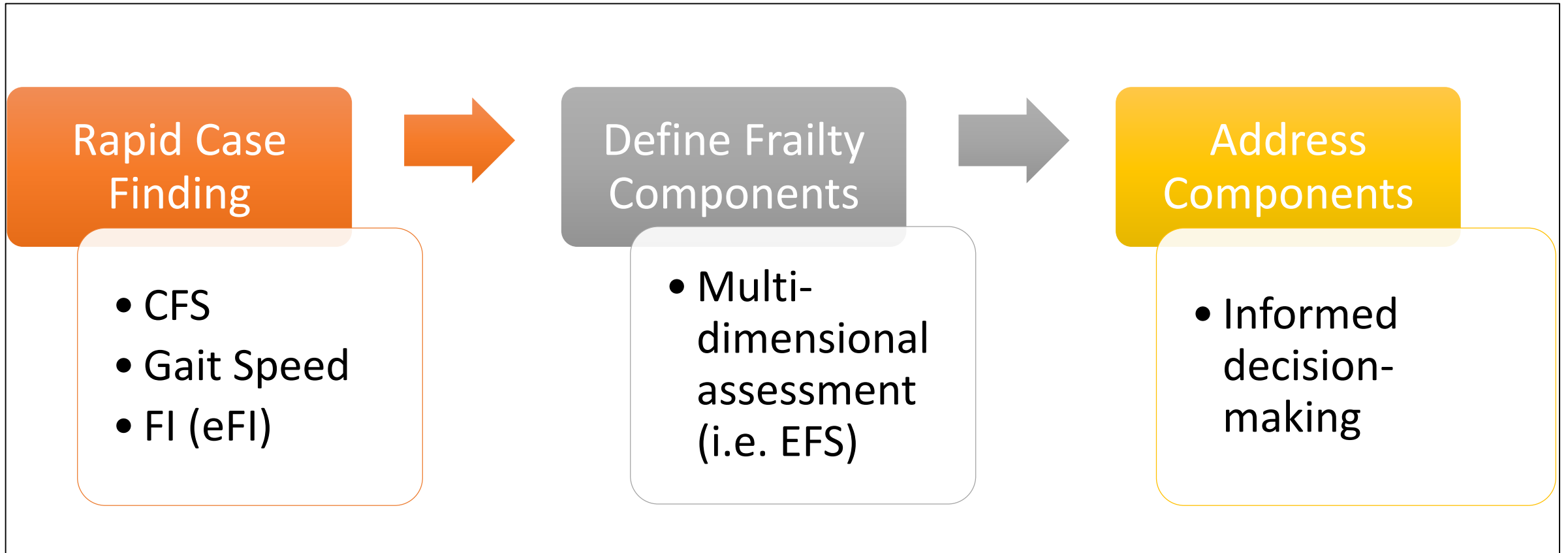
## 3. Transitions of care ~

- Priorities/specialized needs for transition from ICU to ward setting
- Priorities/specialized needs for hospital to community (i.e., CGA)

## 4. Interventions (recognizing vulnerability)~

- Focused on maximizing physical recovery (i.e., minimizing avoidable disability)
- Focused on cognitive, psycho-social, and emotional recovery
- Focused on care-giver burden/experience
- Focused strategy towards palliation

# Frailty – An Integrated Model



ICU admission → → ICU Transition → → Community Transition

# Summary

- **Frailty** is a multi-dimensional syndrome contributing to vulnerability to adverse events:
  - can be measured in critically ill patients
  - is associated with ↑ risk adverse events, death, re-hospitalization
  - is associated with ↓ HRQL, new disability and ↑ functional dependence
  - identifies a vulnerable population
- **Frailty Assessment**
  - at ICU admission should focus on “case-finding” for near-term prognostication, guiding clinical care and decision-making and
  - after ICU should start to focus more comprehensive assessments, care transitions and specialist referral

## Acknowledgements:

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## Questions?

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