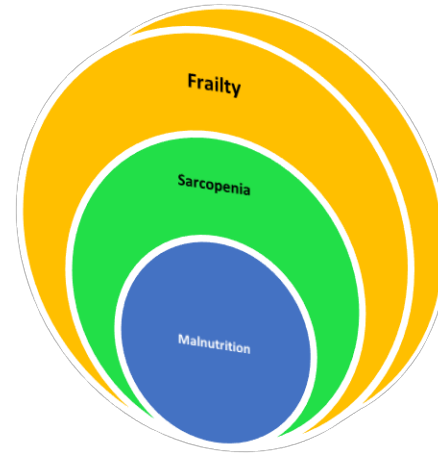


# The role of nutrition in prevention and management of frailty



Dr Sanjay Suman MD FRCP (Ed) FRCP (Lon)  
Consultant Geriatrician and Clinical Director  
**Medway NHS FT**  
**Kent**

This session has no direct conflict of interest

# Session Outline

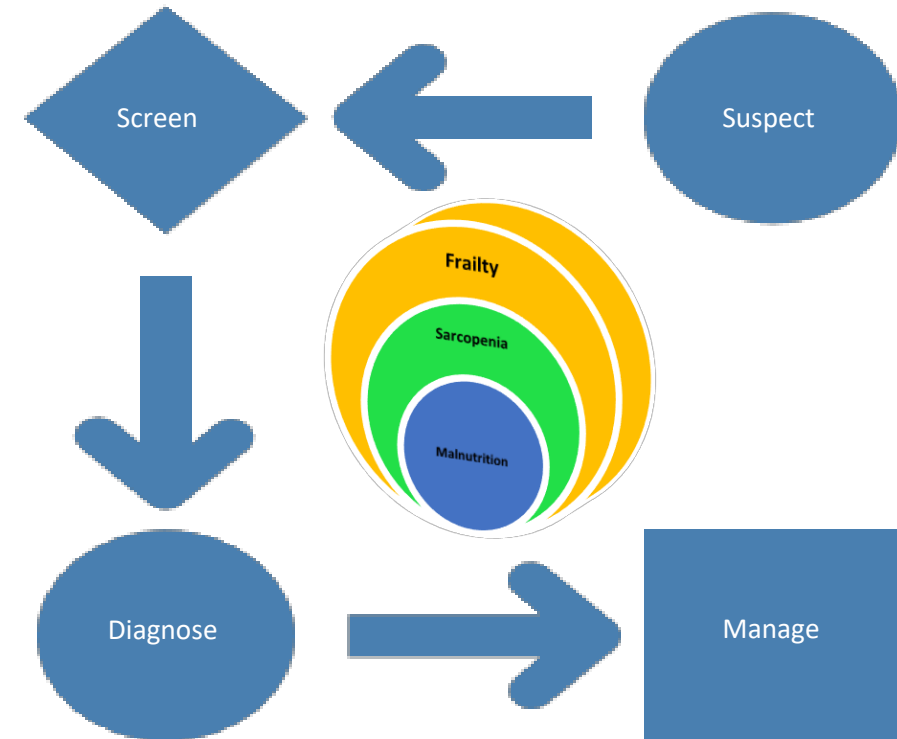
## *Focus on Malnutrition in context of Frailty & Sarcopenia*

- 1 Pathophysiology and adverse impact
- 2 Clinical Assessment Tools
- 3 Multidisciplinary Management
  - **CGA:** Comprehensive Geriatric Assessment
  - **Nutrition:** adequate protein intake
  - **Exercise:** preserving and building muscle strength

### Key Principle

Individually tailored interventions that preserve and enhance:

- Independence
- physical function
- cognition



# UK has an ageing population with a significant burden of comorbidities



Action today for all our tomorrows

## 1 in 5 of the UK population > 65 years old

- **11 million people aged  $\geq 65$  currently**
- In 10 years' time this will have  $\uparrow$  to 13 million people, 22% of the population<sup>1</sup>



## Major comorbidities are highest in older individuals

- 9.1 million people in England are projected to be living with major illness (2019 data)
- Projected  $\uparrow$  of 2.5 million by 2040
- 80% (2 million people) of the projected  $\uparrow$  in major illness will affect people aged 70

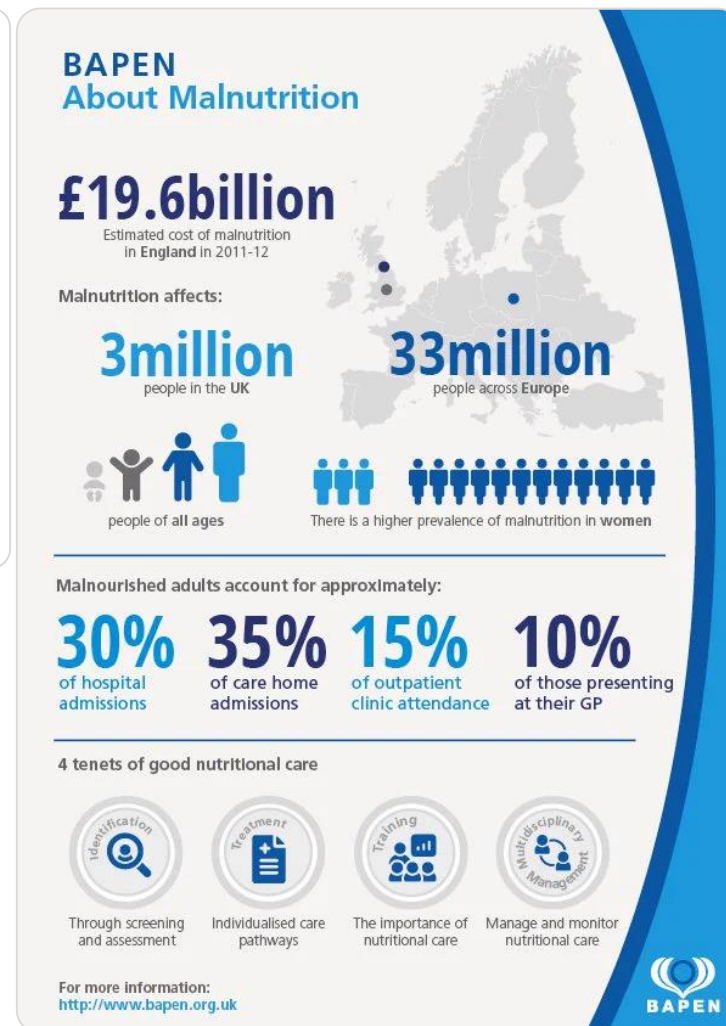
<sup>1</sup>. Ageing Better responds to new report warning one in five people in England will have a major illness by 2040 | Centre for Ageing Better ([ageing-better.org.uk](https://ageing-better.org.uk))

<sup>2</sup>. <https://www.health.org.uk/news-and-comment/news/25-million-more-people-in-england-projected-to-be-living-with-major-illness-by-2040>

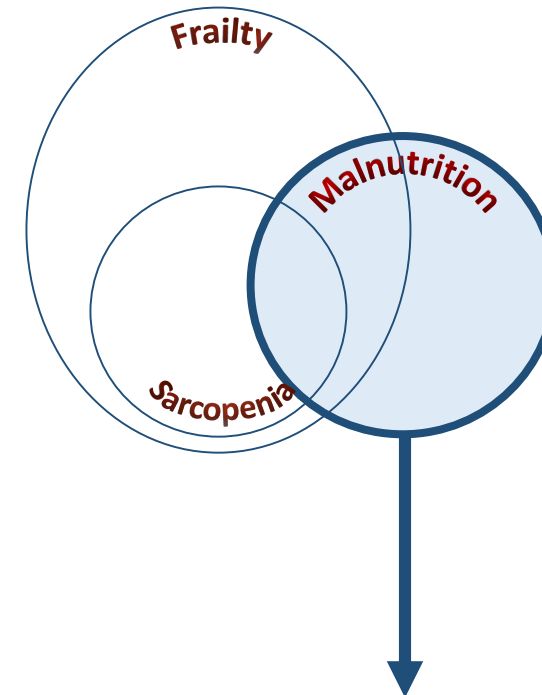
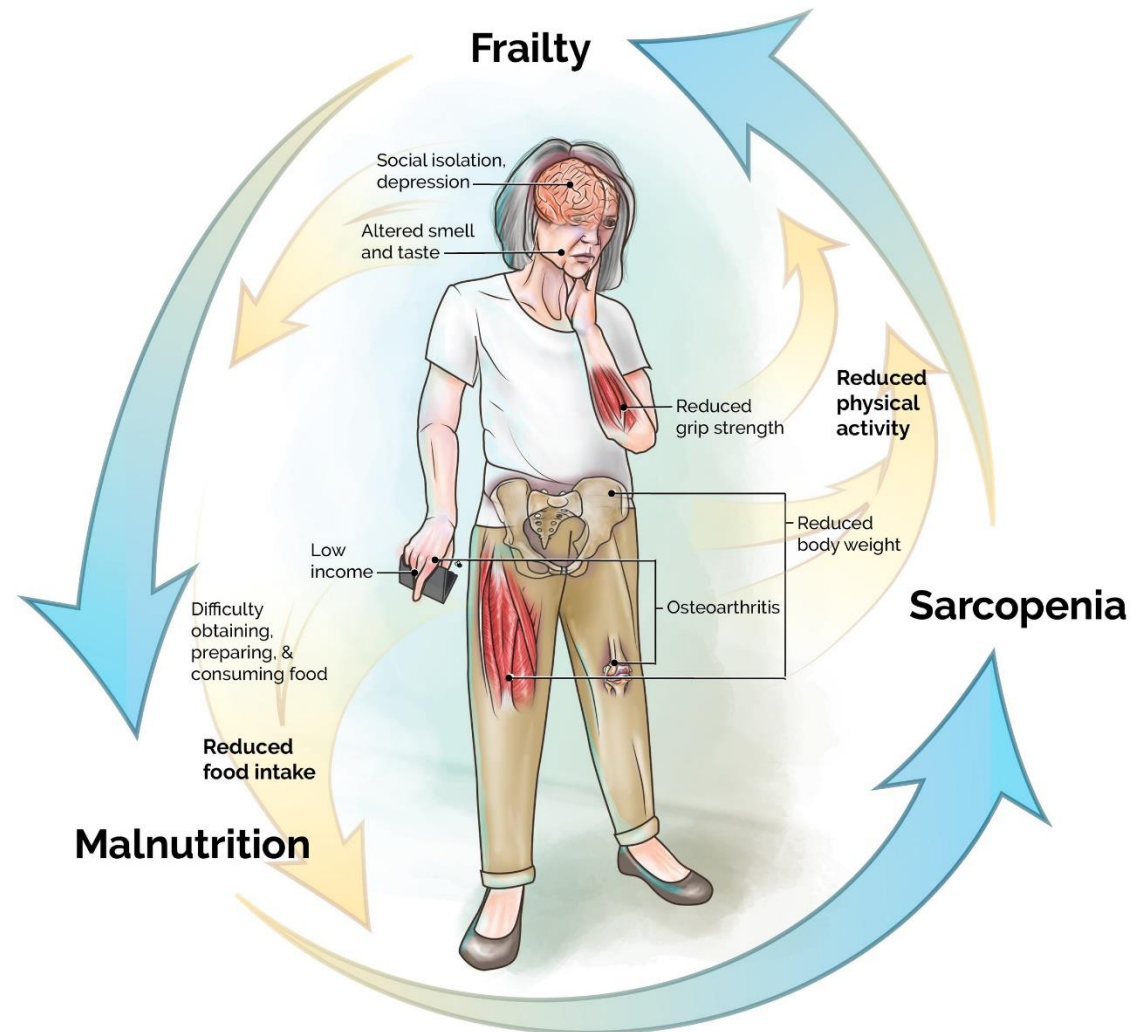
# Malnutrition definition and scale of problem

## Malnutrition definition<sup>1</sup>

1. **Results from** lack of uptake or intake of nutrition
2. **leads to**
  - altered body composition and body cell mass
  - diminished physical and mental function
  - impaired clinical outcome from disease.”



# Malnutrition leads to sarcopenia and drives progression of frailty

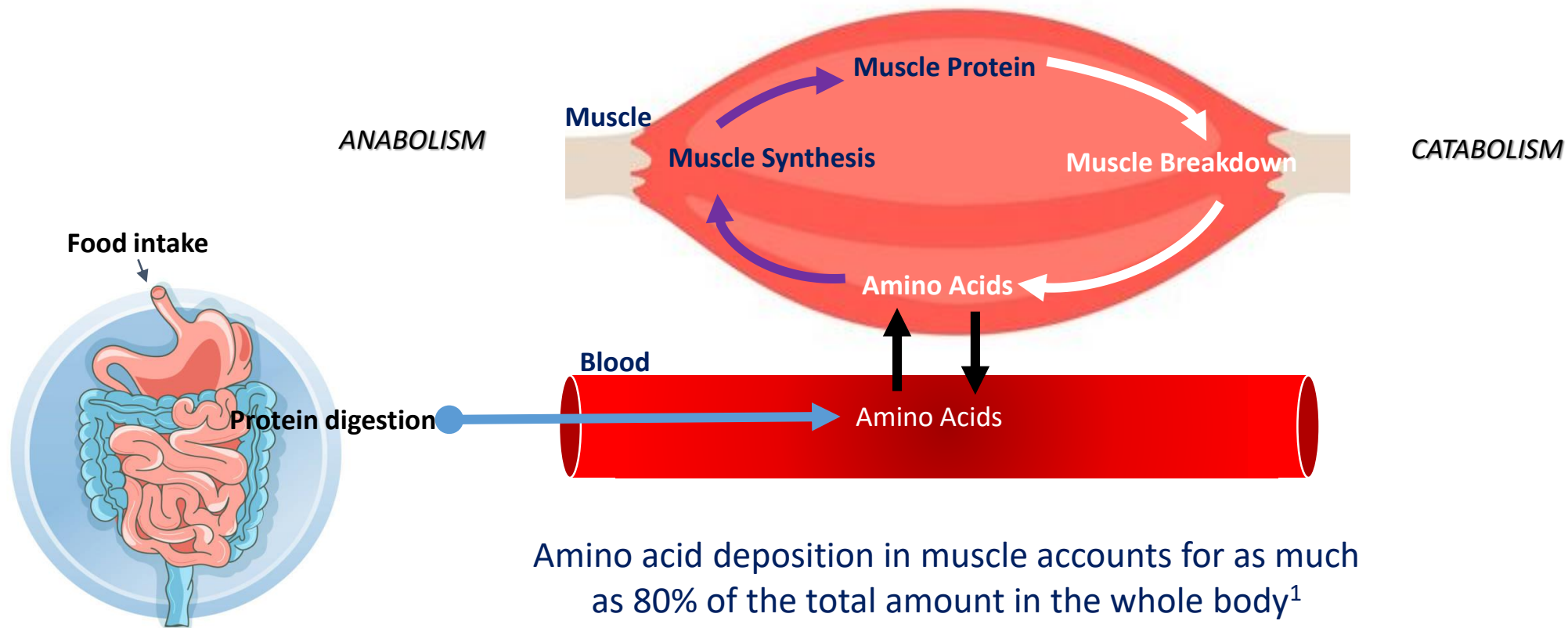


**Malnutrition is a significant risk factor for Developing Sarcopenia (Nearly X 4 risk )<sup>1</sup>**

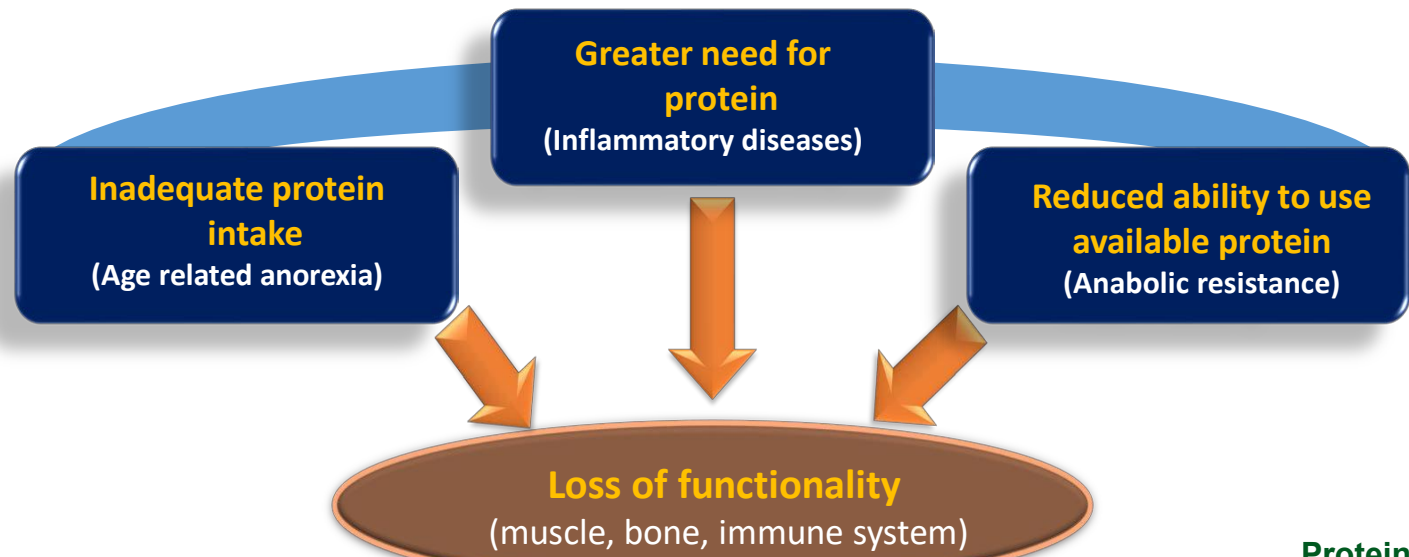
**Adjusted HR = 3.86 (95% CI 1.29–11.54)]**

# Muscle is a dynamic tissue

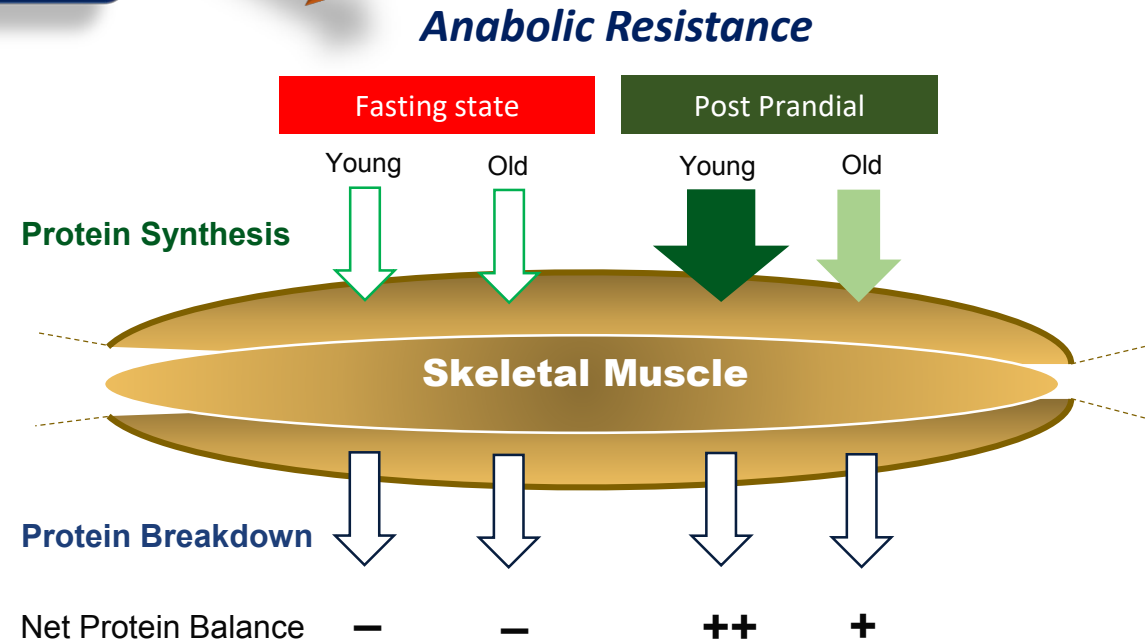
**Muscle protein synthesis = muscle protein breakdown  
(as long as adequate protein ingested)**



# Protein shortfall impairs Muscle Protein Synthesis in old age

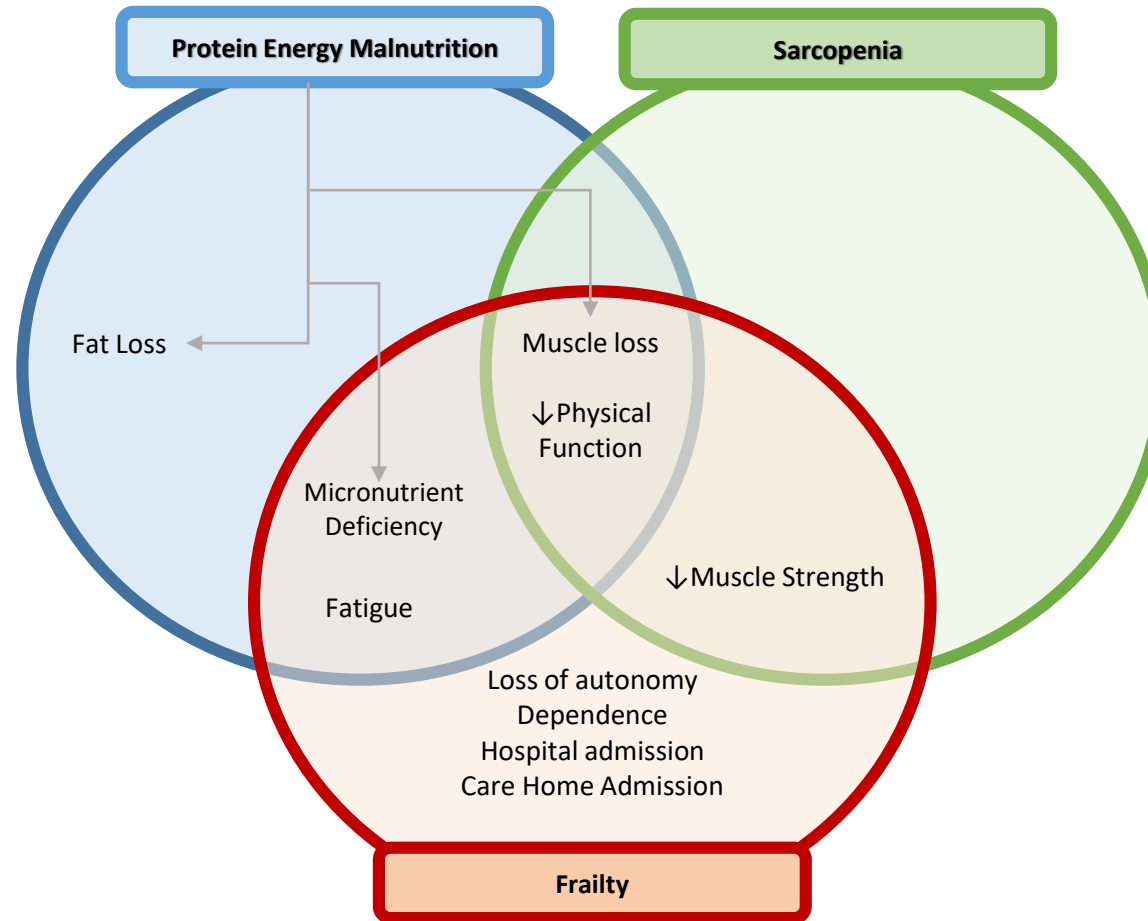


<https://doi.org/10.1016/j.jamda.2013.05.021>



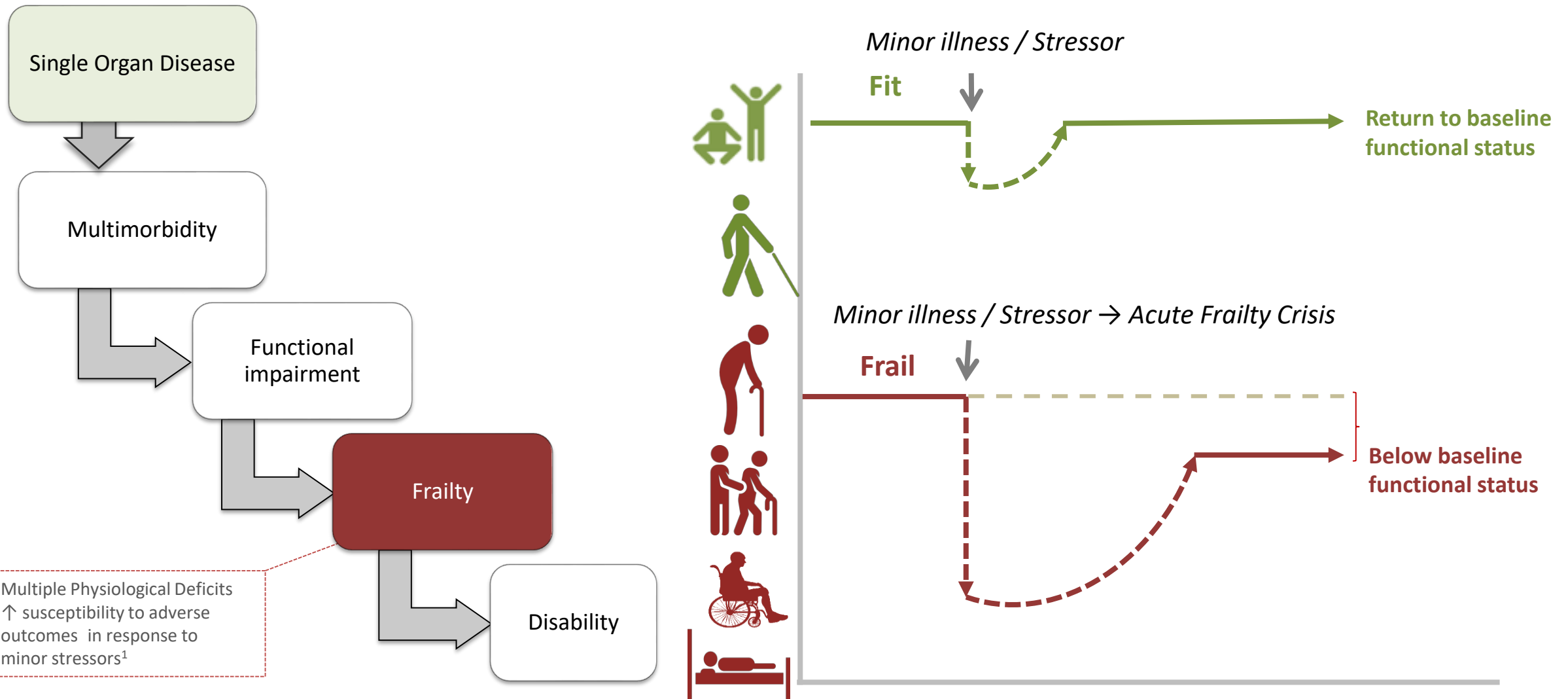
<http://dx.doi.org/10.1007/s00726-012-1438-0>

# Protein shortfall impairs Muscle Protein Synthesis in old age

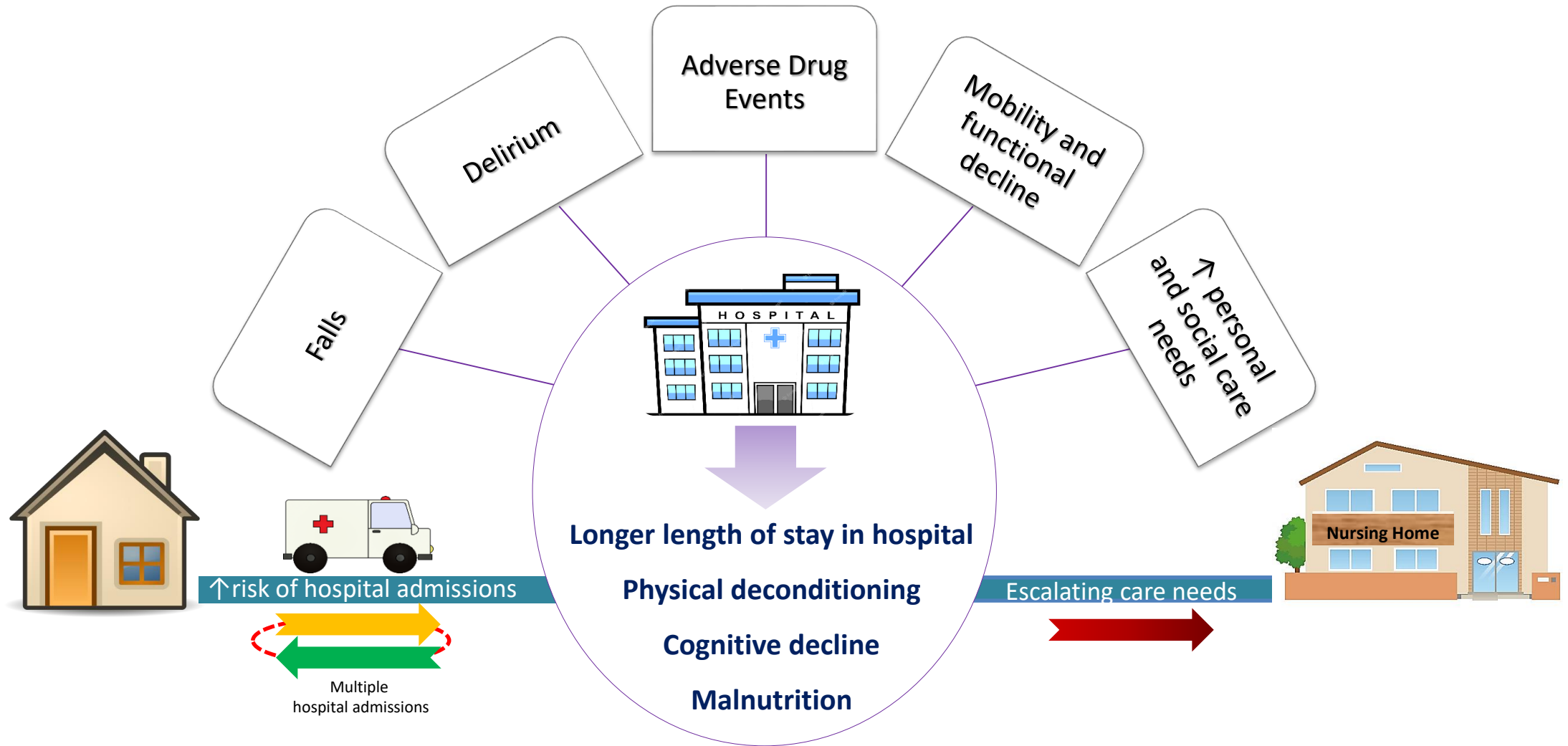




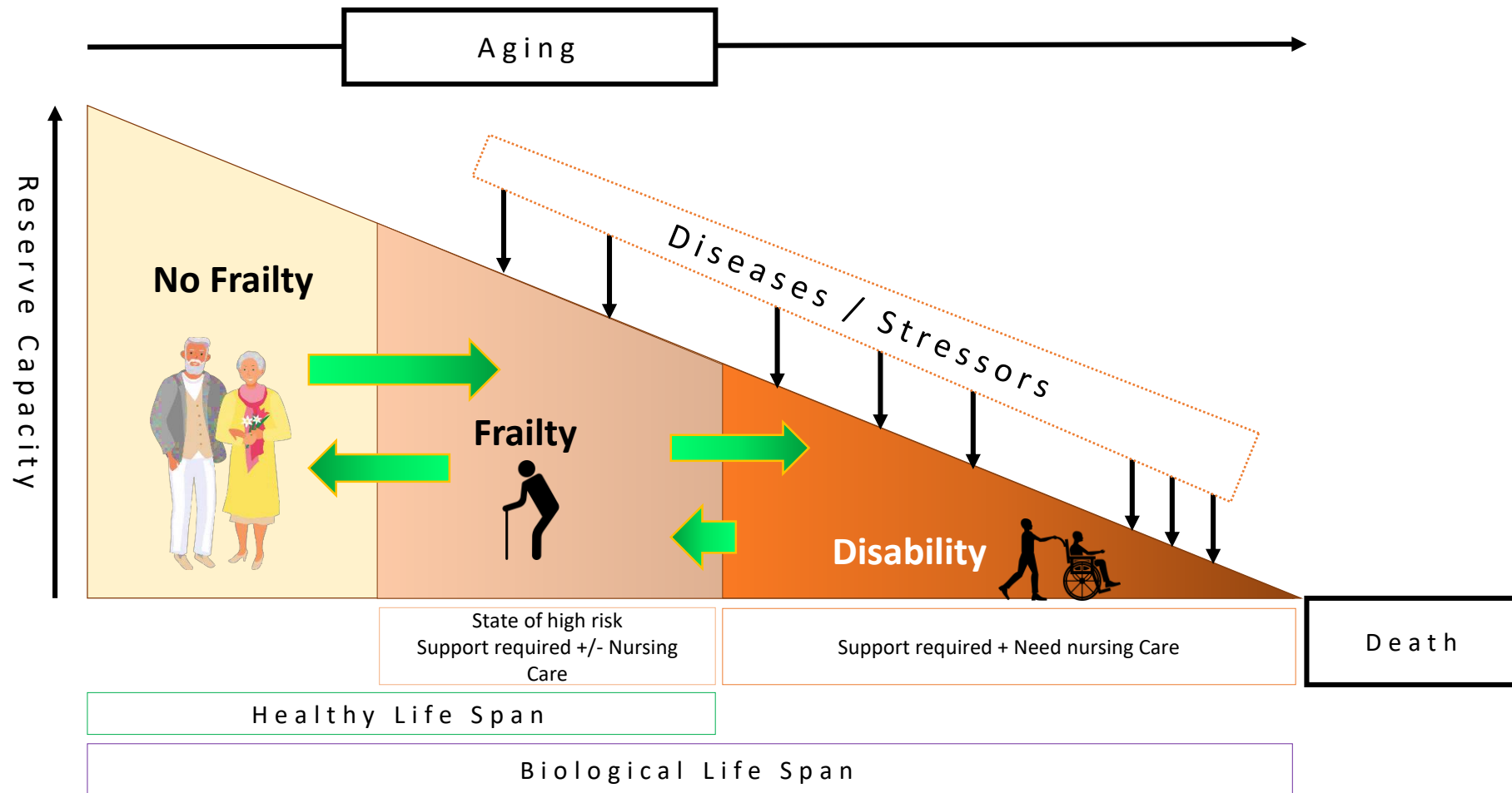
# Frailty Conceptualised



# Acute Frailty Crisis

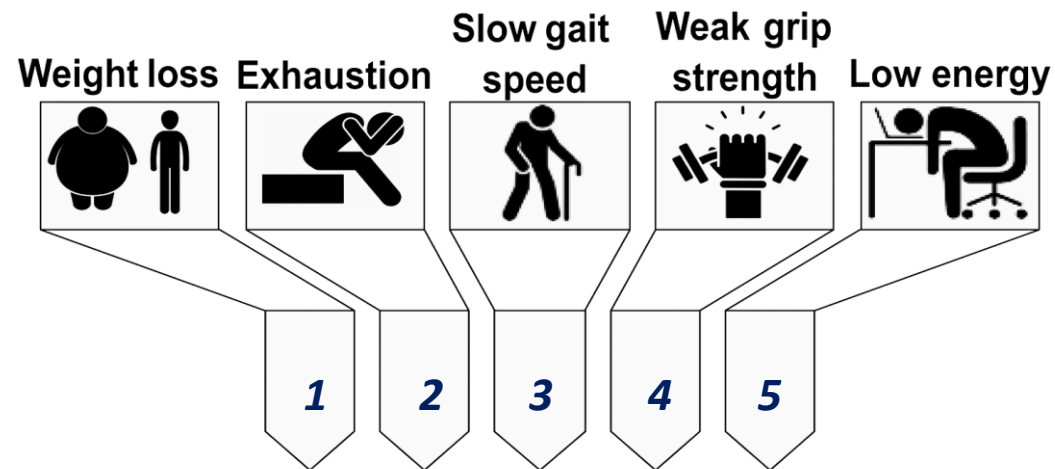


# Frailty: A Long Term Condition



# Frailty: Approaches to objective identification

## A. Phenotypic Model



## FRIED FRAILTY PHENOTYPE

1. Weight loss (unintentional) > 5kg/year
2. Exhaustion Depression scale CES-D (2 points)
3. Slow gait speed Time taken to walk 5m (slowest 20%)
4. Weak grip strength lowest 20%
5. Low energy expenditure Kcal spent /week (lowest 20%)

**Frailty:  $\geq 3$  criteria met**

**Pre-frailty: 1-2 criteria met**

**Robust: No criteria met**

Published in 2001, this tool standardized frailty assessment & fueled research on frailty

# Frailty: Approaches to objective identification

## B. Cumulative deficit model

REDUCING ACTIVITY	CLINICAL FRAILTY SCALE			INCREASING DEPENDENCE
		<b>1</b>	<b>VERY FIT</b> People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.	
		<b>2</b>	<b>FIT</b> People who have <b>no active disease symptoms</b> but are less fit than category 1. Often, they exercise or are very active occasionally, e.g., seasonally.	
		<b>3</b>	<b>MANAGING WELL</b> People whose medical problems are <b>well controlled</b> , even if occasionally symptomatic, but often are <b>not regularly active</b> beyond routine walking.	
		<b>4</b>	<b>LIVING WITH VERY MILD FRAILTY</b> Previously "vulnerable," this category marks early transition from complete independence. While <b>not dependent</b> on others for daily help, often <b>symptoms limit activities</b> . A common complaint is being "slowed up" and/or being tired during the day.	
		<b>5</b>	<b>LIVING WITH MILD FRAILTY</b> People who often have <b>more evident slowing</b> , and need help with <b>high order instrumental activities of daily living</b> (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework.	
		<b>6</b>	<b>LIVING WITH MODERATE FRAILTY</b> People who need help with <b>all outside activities</b> and with <b>keeping house</b> . Inside, they often have problems with stairs and need <b>help with bathing</b> and might need minimal assistance (cuing, standby) with dressing.	
		<b>7</b>	<b>LIVING WITH SEVERE FRAILTY</b> <b>Completely dependent for personal care</b> , from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months).	
		<b>8</b>	<b>LIVING WITH VERY SEVERE FRAILTY</b> <b>Completely dependent for personal care and approaching end of life</b> . Typically, they could not recover even from a minor illness.	
		<b>9</b>	<b>TERMINALLY ILL</b> <b>Approaching the end of life</b> . This category applies to people with a <b>life expectancy &lt;6 months</b> , who are <b>not otherwise living with severe frailty</b> . (Many terminally ill people can still exercise until very close to death.)	

### SCORING FRAILTY IN PEOPLE WITH DEMENTIA

The degree of frailty generally 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. In **very severe dementia** they are often bedfast. Many are virtually mute.



Clinical Frailty Scale ©2005–2020 Rockwood, Version 2.0 (EN). All rights reserved. For permission: [www.geriatricmedicine.ca](http://www.geriatricmedicine.ca)  
Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489–495.

TOP TIPS!

### Tips for using Clinical Frailty Scale (CFS) in clinical practice

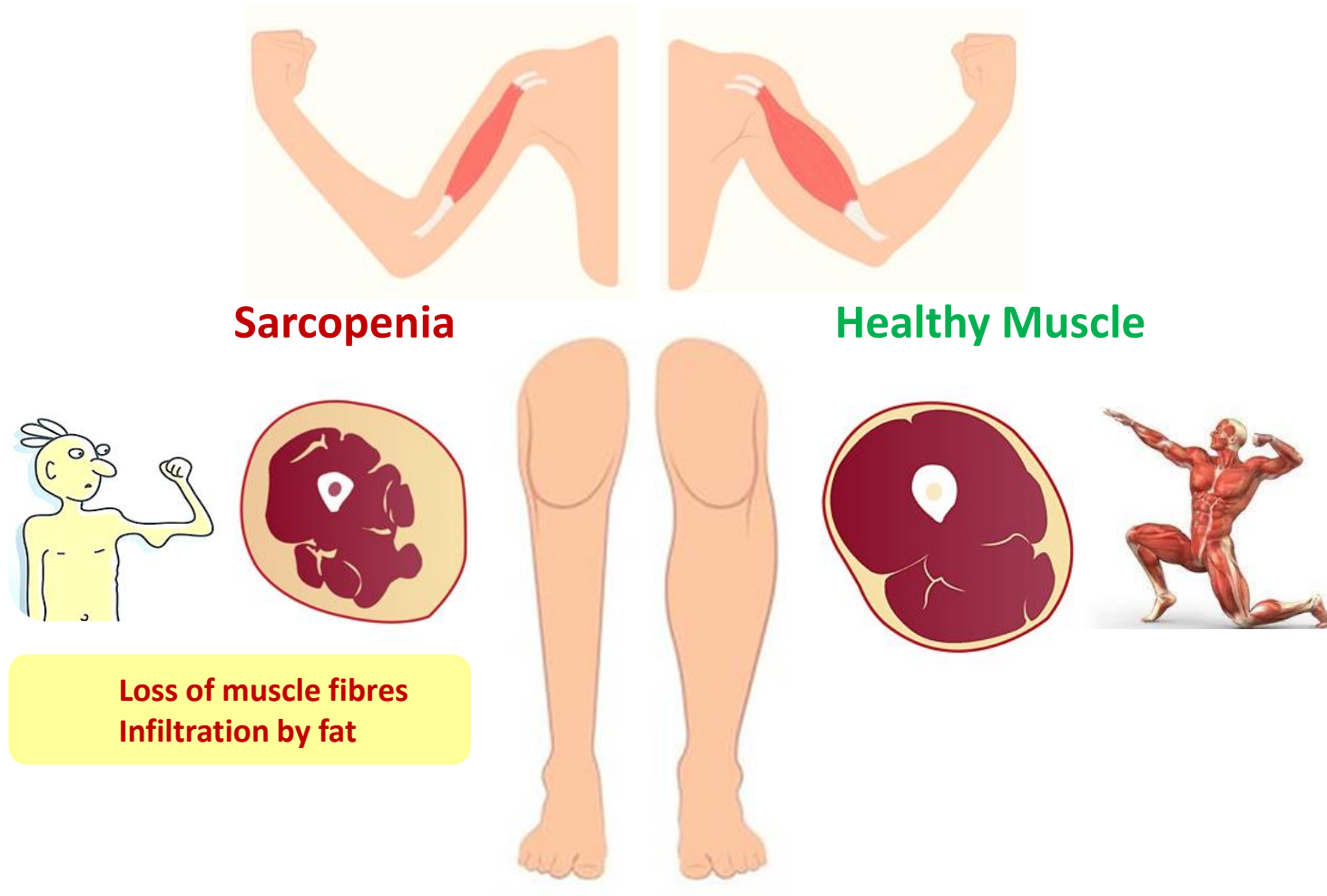
- CFS parameters for what the individual was like 2 weeks ago
- Obtain a good history from patient but verify from a relative or a carer
- Ascertain trajectory of decline in physical and cognitive function
- Free app for apple and android smartphones



# Sarcopenia:

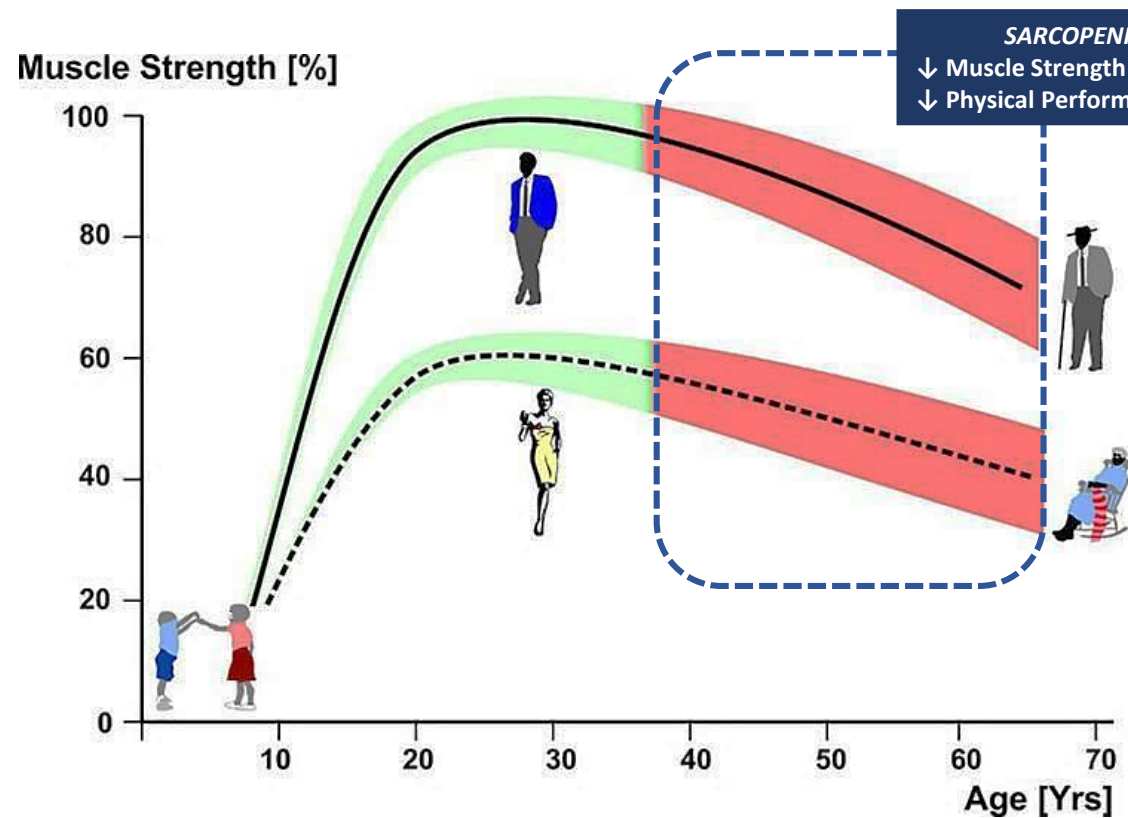
The term Sarcopenia is derived from Greek word **sarx** (“flesh”) and **penia** (“lacking”)

Characterized by progressive and widespread skeletal muscle loss leading to poor muscle strength and performance

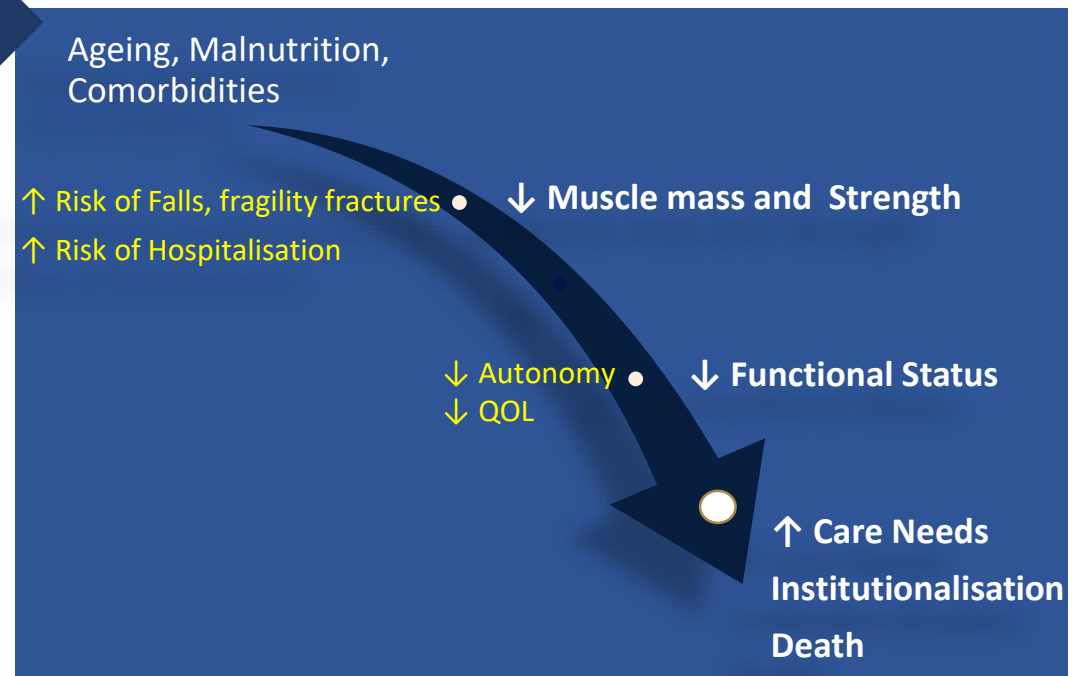


# Sarcopenia:

Ageing is a significant risk factor <sup>1</sup>



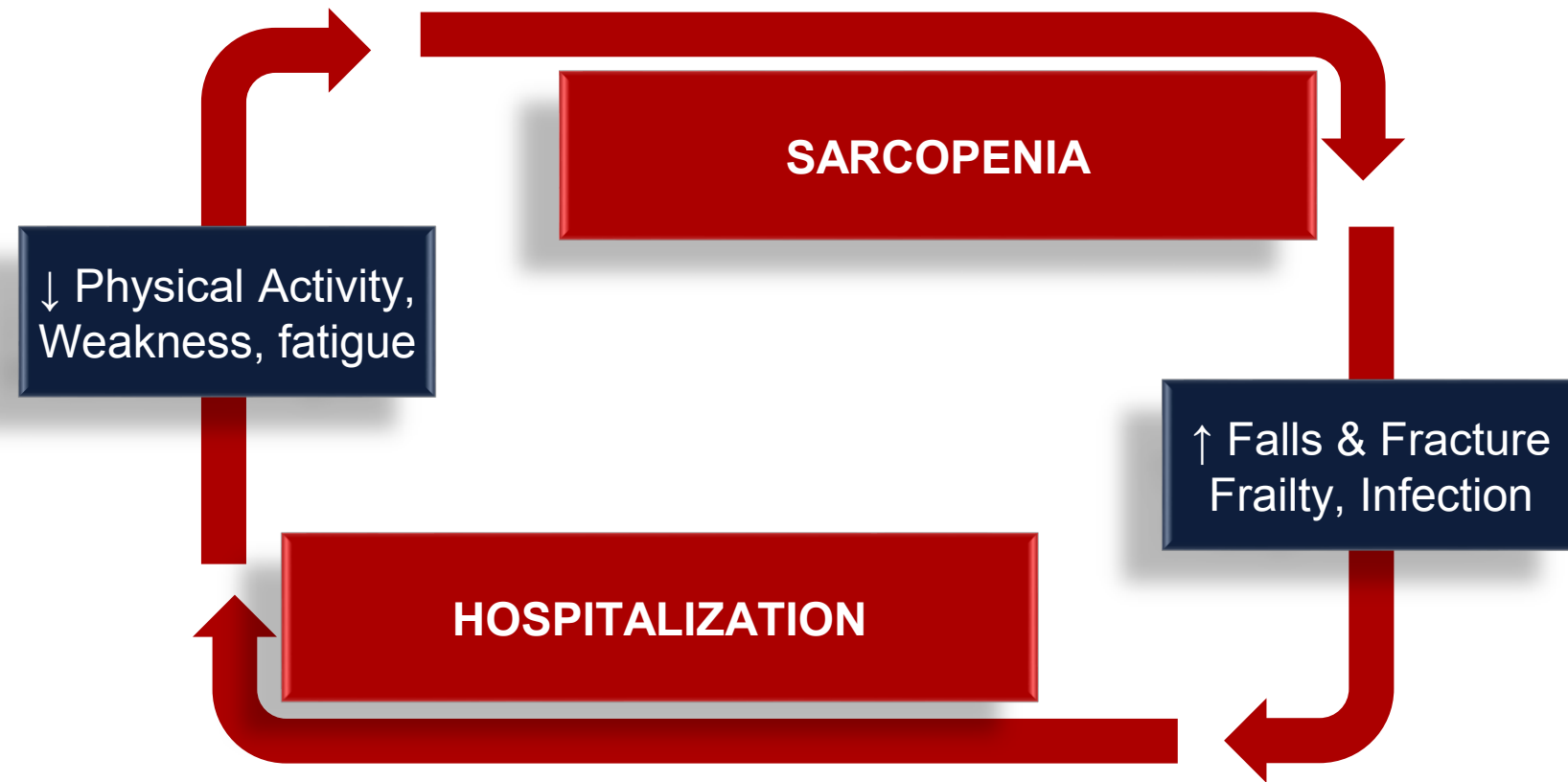
Associated with negative health outcomes <sup>2</sup>







1. DOI: 10.3233/OER-170250 <https://content.iospress.com/journals/occupational-ergonomics>

2. <https://doi.org/10.1371%2Fjournal.pone.0169548>

## Sarcopenia: complications correlate to severity<sup>1</sup>



Loss of lean body mass	Associated complications
-10% 	↓ Immunity ↑ Risk of infection
-20% 	↓ Wound Healing ↑ Muscle Weakness ↑ Risk of infection
-30% 	Difficulty sitting Pressure Ulcers Pneumonia Poor healing
-40% 	↑ risk of death, usually from pneumonia



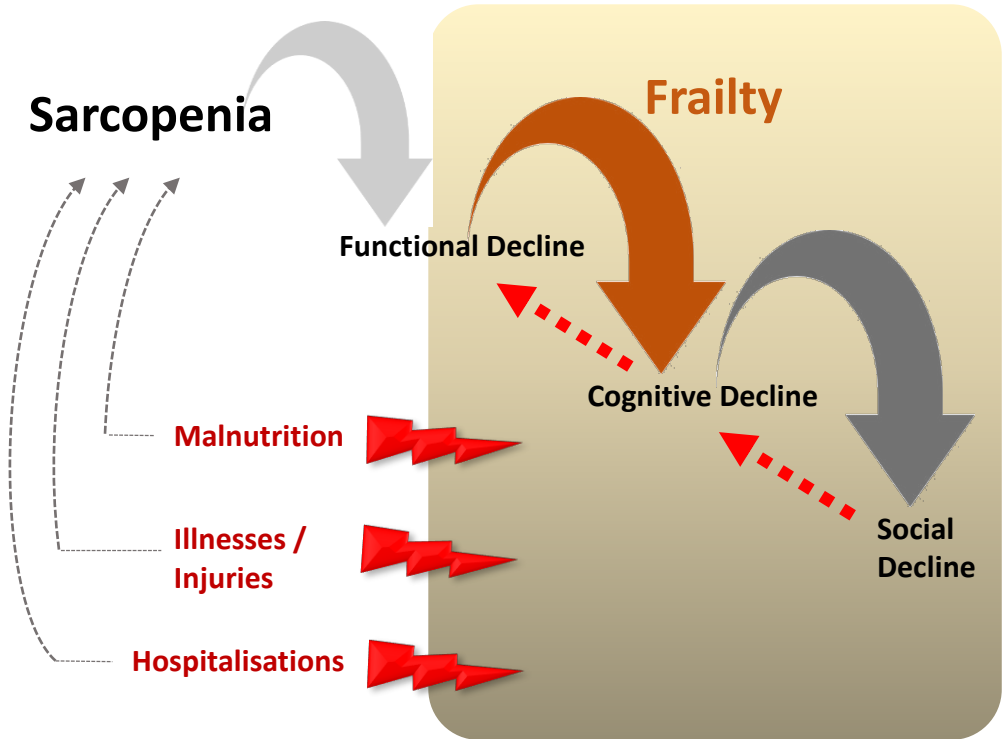
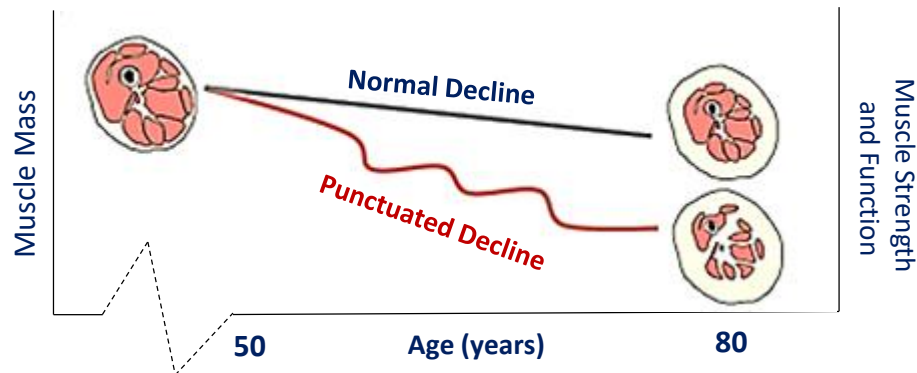
# Sarcopenia: Multifactorial aetiology<sup>1</sup>

## Factors affecting Muscle loss due to normal ageing

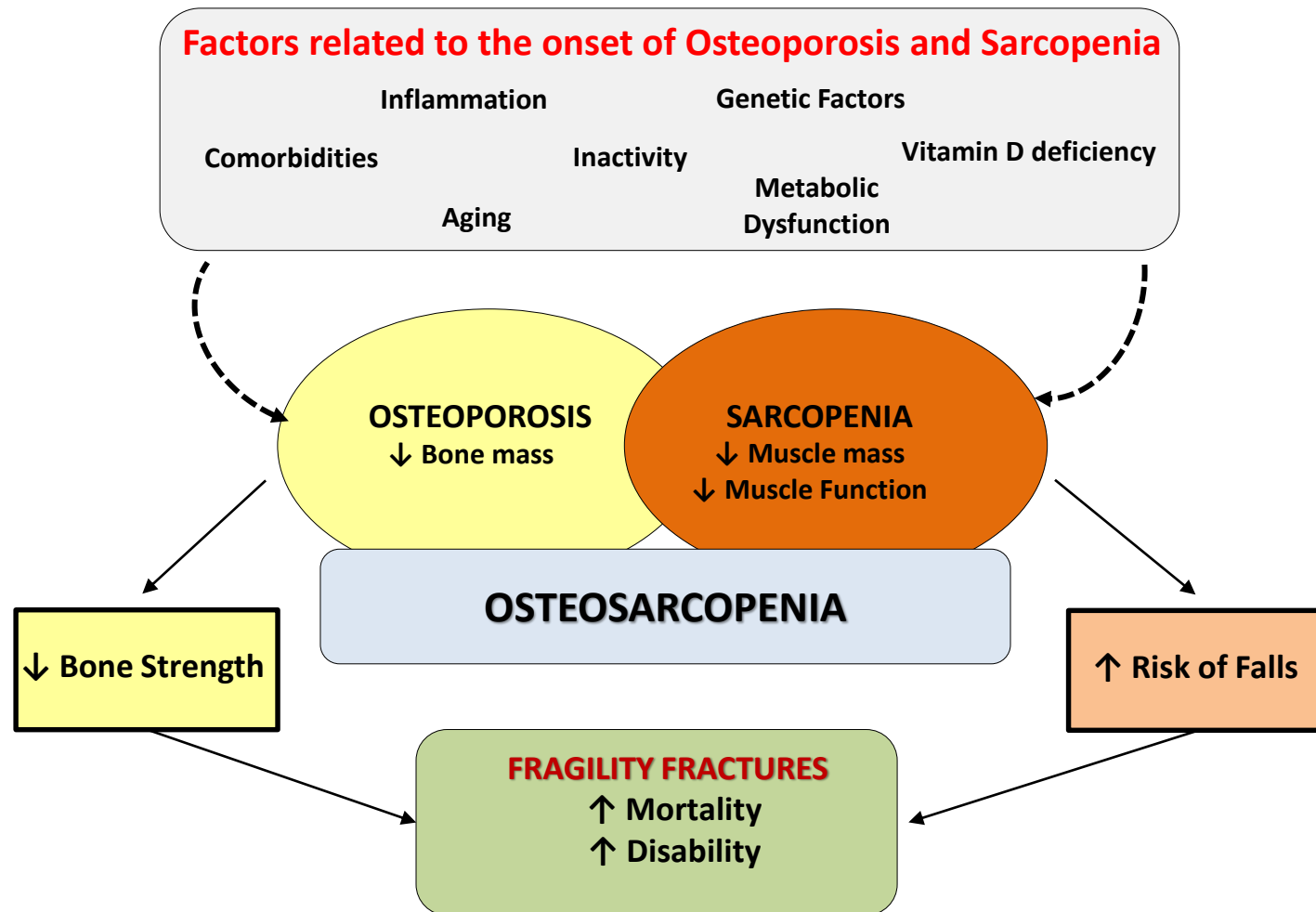
- Reduced Muscle Protein Synthesis
- Satellite Cell Dysfunction
- Mitochondrial Dysfunction
- Neuronal Degeneration
- Inflammation
- Ageing endocrine system
- Obesity – Muscle fat infiltration

## Factors accelerating a punctuated decline

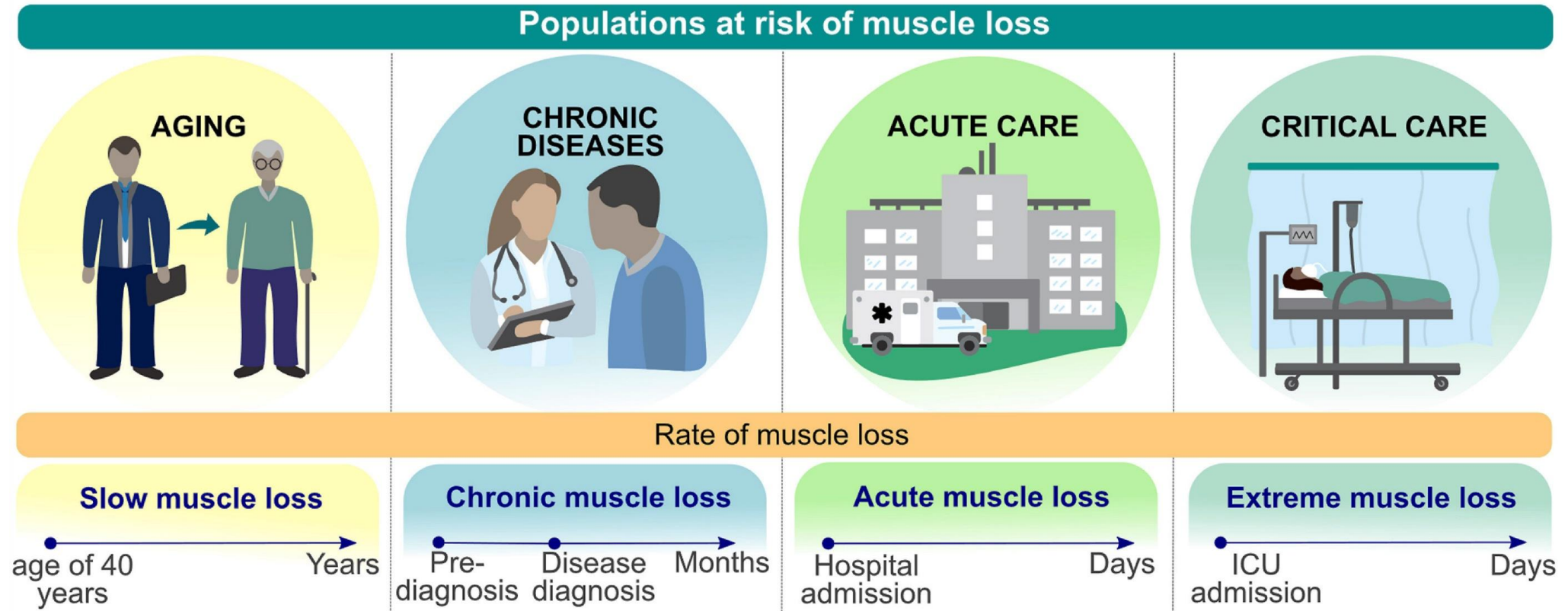
- Malnutrition
- Acute Illnesses
- Comorbidities
- Lifestyle: ↓ Activity, smoking, alcohol misuse
- Periods of Immobilisation
- Hospital admissions



# Sarcopenia and osteoporosis occur together = OSTEOSARCOPENIA



# Sarcopenia: Who is at risk?



# Diagnosing poor muscle health in practice – Algorithm<sup>1,2</sup>



Find cases



Assess Muscle  
Strength



Assess Severity

## Screen for Sarcopenia

Particularly if C/O:

- Falls
- Easily fatigued
- Reduced mobility
- Subjective weakness
- Difficulty with activities of daily living

## SARC-F Questionnaire for finding cases

Component	Question	Scoring
Strength	How much difficulty do you have in <b>lifting and carrying</b> 10 pounds?	None = 0
		Some = 1
		A lot or unable = 2
Assistance in walking	How much difficulty do you have <b>walking</b> across a room?	None = 0
		Some = 1
		A lot or unable = 2
Rise from a chair	How much difficulty do you have <b>transferring</b> from a chair or bed?	None = 0
		Some = 1
		A lot or unable = 2
Climb stairs	How much difficulty do you have <b>climbing</b> a flight of 10 stairs?	None = 0
		Some = 1
		A lot or unable = 2
Falls	How many times have you <b>fallen</b> in the past year?	None = 0
		Some = 1
		A lot or unable = 2

**Score  $\geq 4$**  is predictive of poor muscle health

1. Cruz-Jentoft AJ, et al. *Age Ageing*. 2019;48(1):16-31.

2. Malmstrom TK, Morley JE. *JAMDA*. 2013;14:531-532.

# Diagnosing poor muscle health in practice – Algorithm<sup>1,2</sup>



Find cases

SARC- F Questionnaire



Assess Muscle Strength

Grip Strength Dynamometry



< 27 Kg Men  
< 16 Kg Women

Sit to stand 5 times in row



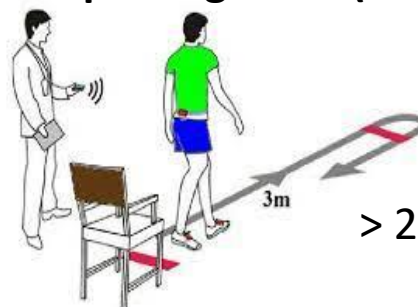
> 15 seconds

Probable  
Sarcopenia



Assess Severity

Timed up and go test (TUAG)



> 20 seconds

Severe  
Sarcopenia

1. Cruz-Jentoft AJ, et al. *Age Ageing*. 2019;48(1):16-31.

2. Malmstrom TK, Morley JE. *JAMDA*. 2013;14:531-532.



ESPEN FACT-SHEET

# SARCOPENIC OBESITY

ESPEN and EASO consensus statement on definition and diagnostic criteria

## 3 STEPS IDENTIFICATION



1. Screening

1

- a. **HIGH BMI or WC** (based on ethnic cut-points)
- b. **SURROGATE PARAMETERS FOR SARCOPENIA** (clinical symptoms, clinical suspicion or questionnaires (e.g. SARC-F in older subjects))

Both conditions (a+b) must be present to proceed with diagnosis



2. Diagnosis

2

- c. **ALTERED SKELETAL MUSCLE FUNCTIONAL PARAMETERS** (Hand grip strength, chair stand test). **If yes, go to d.**
- d. **ALTERED BODY COMPOSITION:** ↑%fat mass (FM) and ↓muscle mass (MM: ALM/W by DXA or SMM/W by BIA)

Both conditions (c+d) must be present to assess the presence of sarcopenic obesity (SO).



3. Staging

3

- A two-level STAGING based on complications from ↑ FM and ↓MM
  - **STAGE I:** NO complications
  - **STAGE II:** at least one complication attributable to SO (e.g. metabolic diseases, functional disabilities, cardiovascular and respiratory diseases)



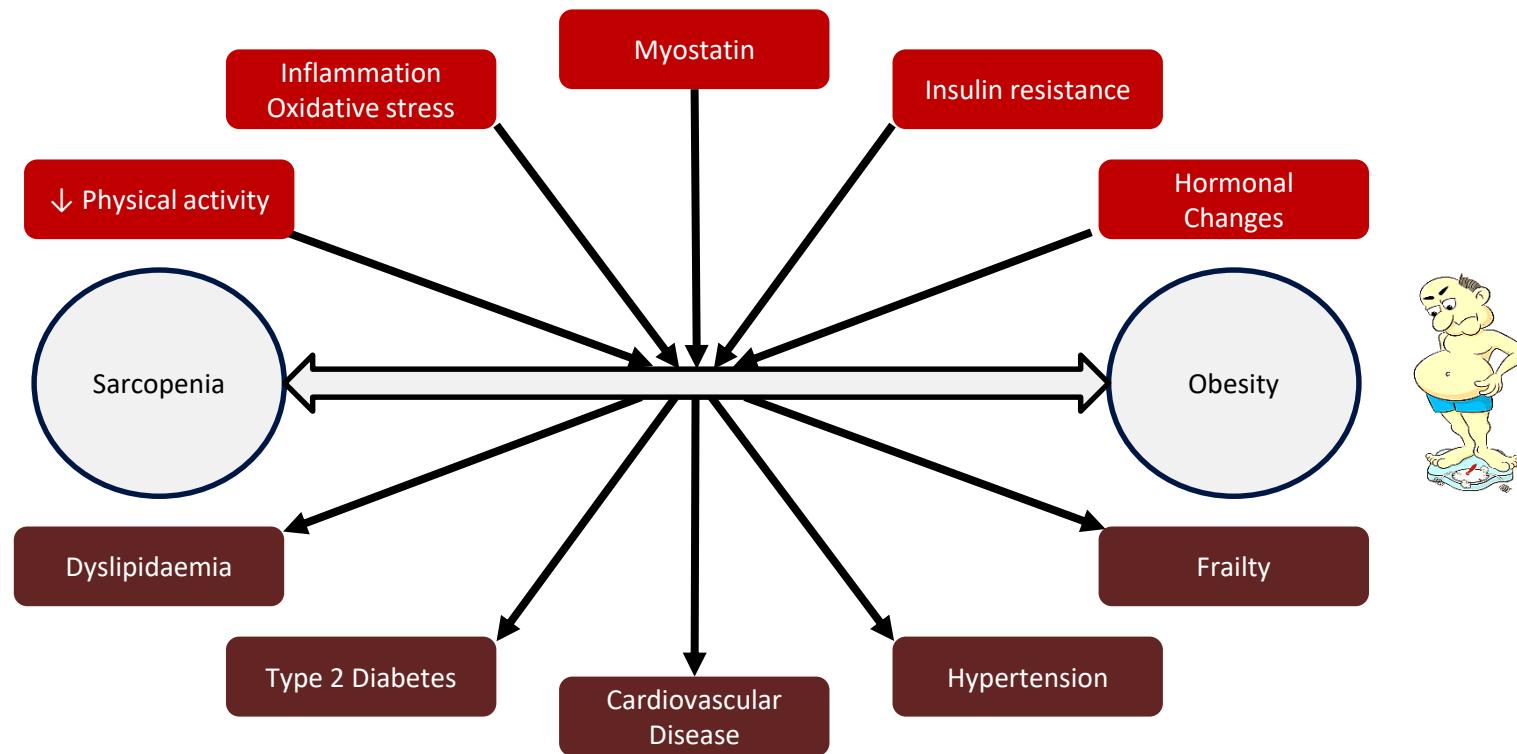
**Abnormal  
and excessive fat  
accumulation**

+



**Loss of  
skeletal muscle mass  
and function**

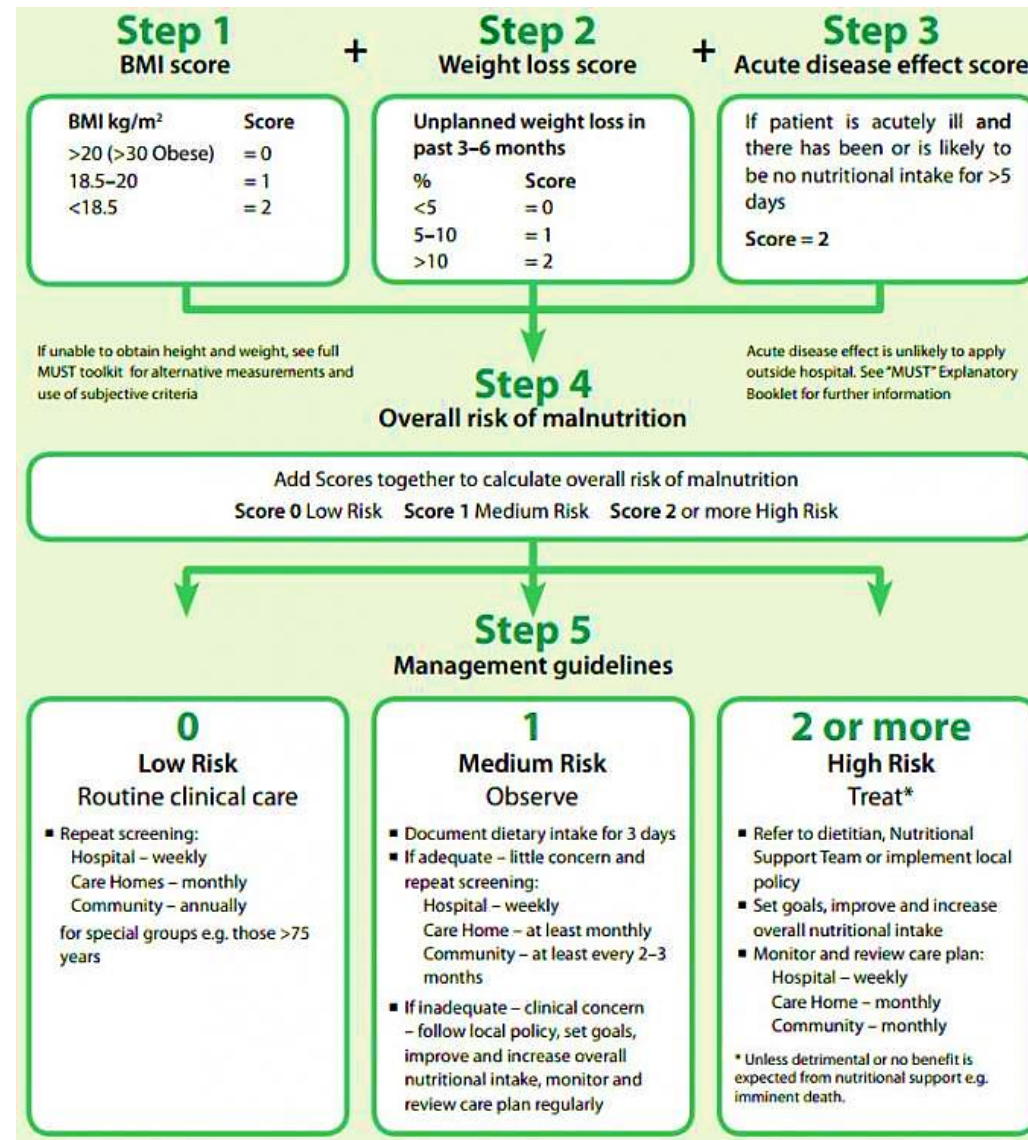
## Mechanisms and consequences of sarcopenia and obesity





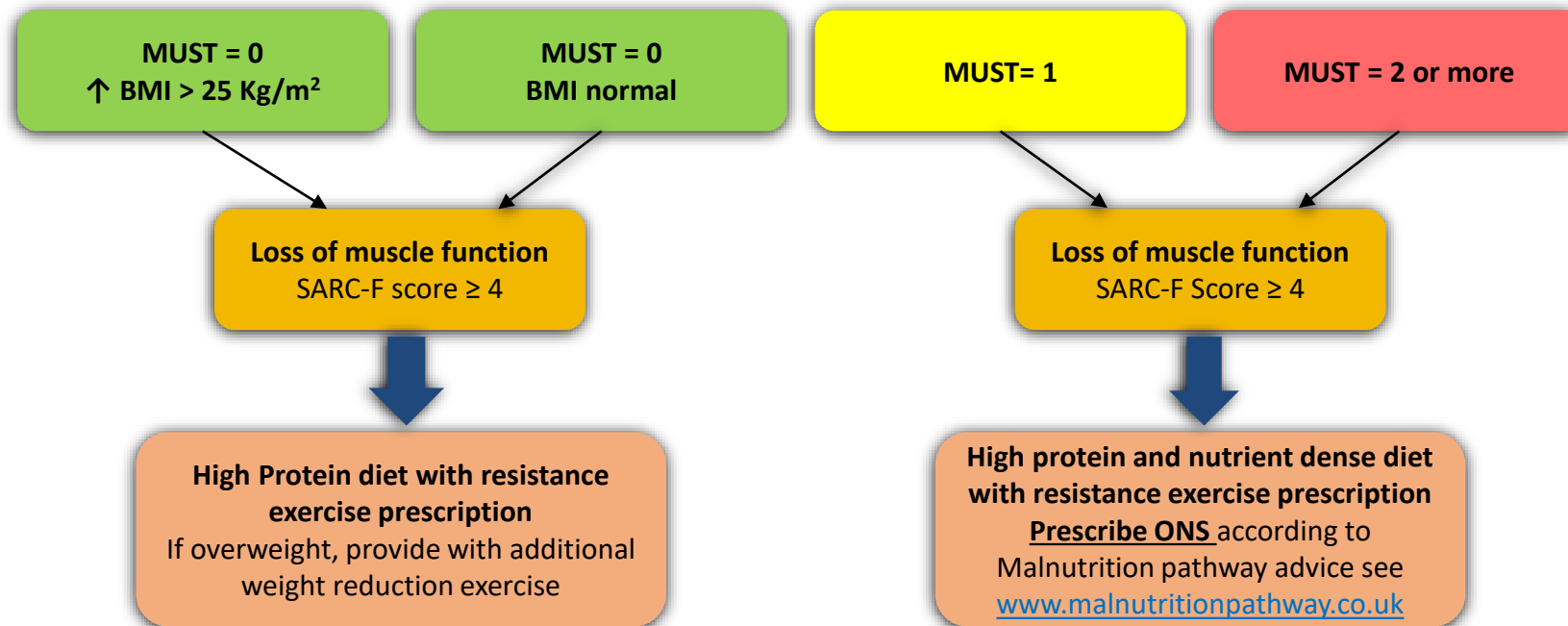
# Assessing for Malnutrition<sup>1</sup>

## 'MUST' screening tool (BAPEN)





# Operationalising Malnutrition and Sarcopenia: integrated assessment



**BMI** = Body Mass Index (Normal 20-25)

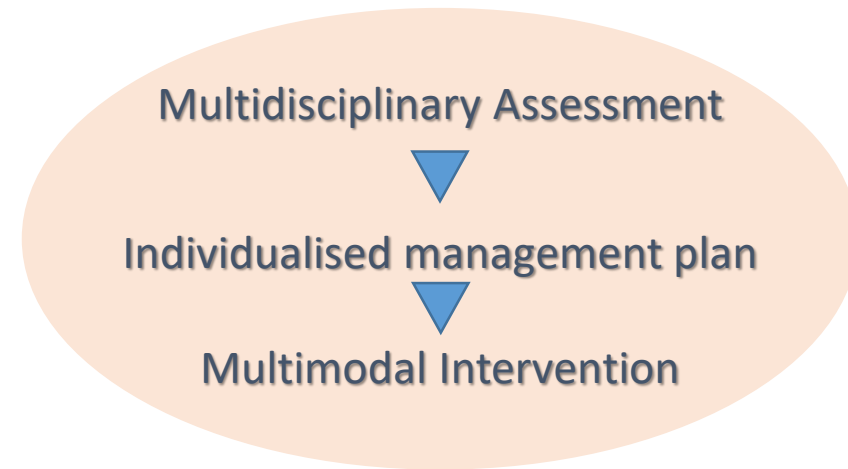
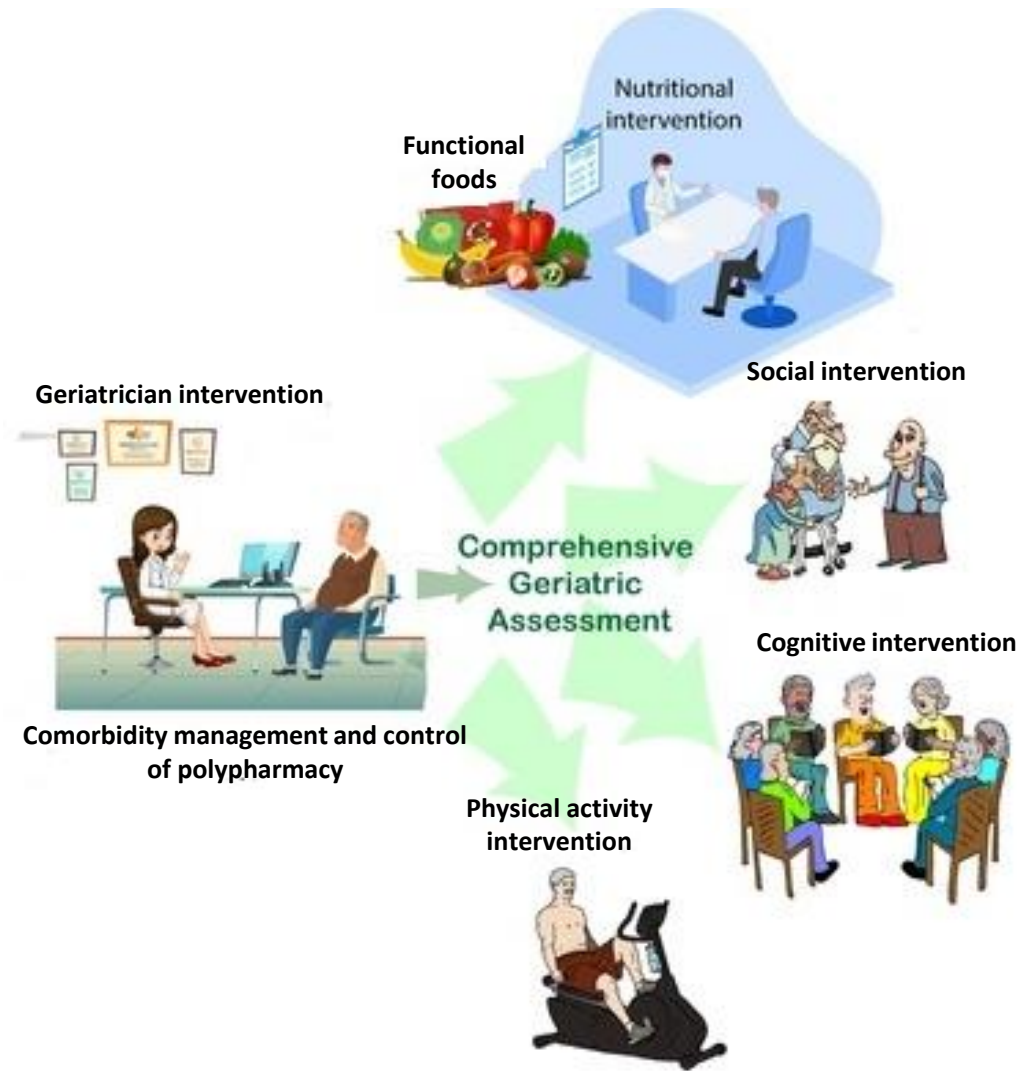
**MUST** = Malnutrition Universal Screening Tool

**SARC-F** = Strength, Assistance for Walking, Rising from a chair, Climbing Stairs and Falls

Managing Malnutrition and Sarcopenia in the Community (Holdoway and Ashworth, 2021)

[British Journal of Nursing - Sarcopenia and malnutrition: commonly occurring conditions in the older population](#)

# Frailty Management: Comprehensive Geriatric Assessment



## Effectiveness of CGA in managing Frailty<sup>1, 2</sup>

### Hospital Setting

- CGA is effective in reducing mortality and improving independence (still living at home)

### Community Setting

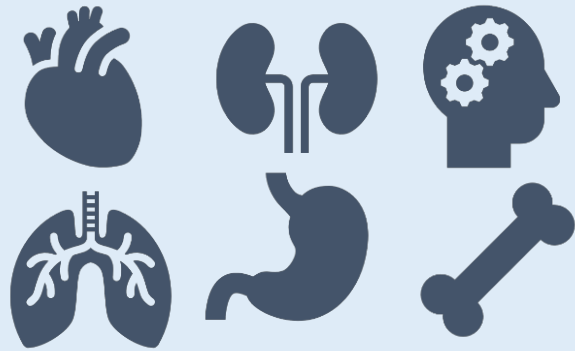
- CGA can reduce hospital admission and can reduce the risk of readmission in those recently discharged.

1. [https://www.bgs.org.uk/sites/default/files/content/resources/files/2019-03-12/CGA%20Toolkit%20for%20Primary%20Care%20Practitioners\\_0.pdf](https://www.bgs.org.uk/sites/default/files/content/resources/files/2019-03-12/CGA%20Toolkit%20for%20Primary%20Care%20Practitioners_0.pdf)

2. Cochrane Database of Systematic Reviews 2017(9):CD006211. doi: 10.1002/14651858.CD006211.pub3

# Frailty: Management

Medical Review focus in both primary and secondary care



**Optimise comorbidities**



## Look for and correct

- ✓ Anemia, especially iron deficiency
- ✓ Hypothyroidism
- ✓ Screen for Osteoporosis and manage appropriately
- ✓ Vitamin D deficiency



**Polypharmacy reduction**



Medications causing anorexia, nausea, vomiting and constipation can limit food intake



Drugs such as statins can have direct toxic effect on muscle

# Frailty: Management

Medical Review focus in both primary and secondary care

## *Prophylaxis*

**All adults + at increased risk of vitamin D deficiency**

- Daily supplement of 400 IU of vitamin D

## *Deficiency*

Oral vitamin D3

- loading dose of 300,000 IU, administered daily or weekly over 6-10 weeks
- followed by a daily maintenance dose of 800 IU



### Adult at risk group

People over 65 years of age	Thinning of the skin reduces the efficiency of vitamin D synthesis
People not exposed to a great deal of sunlight	Those who cover their skin Housebound or confined indoors for long periods
People with darker skin	People of African, African-Caribbean or South Asian origin (Darker skin pigments interfere with UV light getting to appropriate skin layer)

# Sarcopenia: Management approach

**No Specific pharmacological agent in routine clinical practice at present**

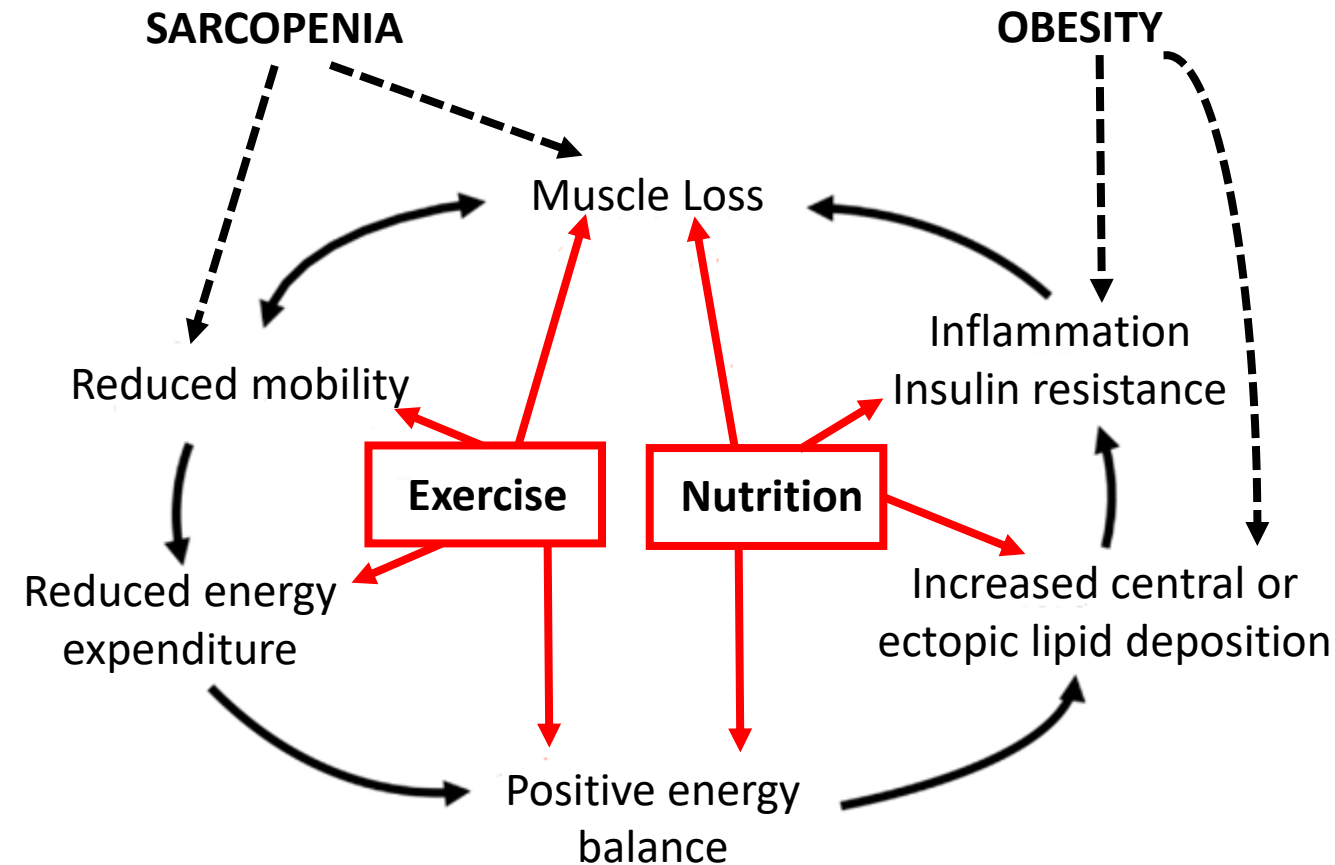
**Potential drugs being investigated may:**

- rebalance protein synthesis and degradation
- reshape the endocrine system
- reduce oxidative stress and promote mitochondrial function
- result in beneficial effects in muscle hypertrophy

**Targeting multiple pathways:**

- myostatin (MSTN)
- renin-angiotensin system (RAS)
- androgen receptor (AR)
- activated protein kinase (AMPK) signalling

1. <https://doi.org/10.1002/agm2.12168>



2. <https://doi.org/10.3390/nu10050605>

# ESPEN Expert Group endorsed recommendations<sup>1</sup>

ESPEN: The European Society for Clinical Nutrition and Metabolism  
BDA Parenteral & Enteral Nutrition Specialist Group (PENG)  
PROT-AGE

## Dietary protein intake

- Older adults have greater protein needs to compensate for anabolic resistance and hypermetabolic disease.
- Older adults may also have decreased intake due to age-related appetite loss, medical conditions, financial limits.
- Optimal intake of at least 1.0 to 1.5 g protein/kg BW/day is recommended; individual needs depend upon the severity of malnutrition risk.

- 2 g / kg / day in case of severe illness, injury or malnutrition
- Provide guidance to improve protein intake throughout the day
- Use visual aids to demonstrate good sources of protein  
+ guidance on portion sizes

## Exercise

- Regular exercise helps maintain skeletal muscle strength and function in older adults.
- Resistance training has limited but positive effects on recovery of muscle in older people.
- A combination of resistance training and adequate dietary protein/amino acid intake for healthy muscle aging is recommended.

- Strong evidence for preventing falls in older people with programmes aimed at improving balance & strength
- Exercise prescription tailored to the individual, Chair-based exercises for frail
- Provide patients with tools & information to allow them to continue to exercise independently and improve adherence

A synergistic effect is seen with protein intake & exercise

**Exercise makes muscle cells more receptive to amino acid-mediated anabolism**



# Optimising Nutritional Intake

Multiple studies have indicated that at least 25 - 30g of high-quality protein is necessary at each meal to optimally build or maintain muscle in older people and those who are unwell<sup>1</sup>

## Food Fortification

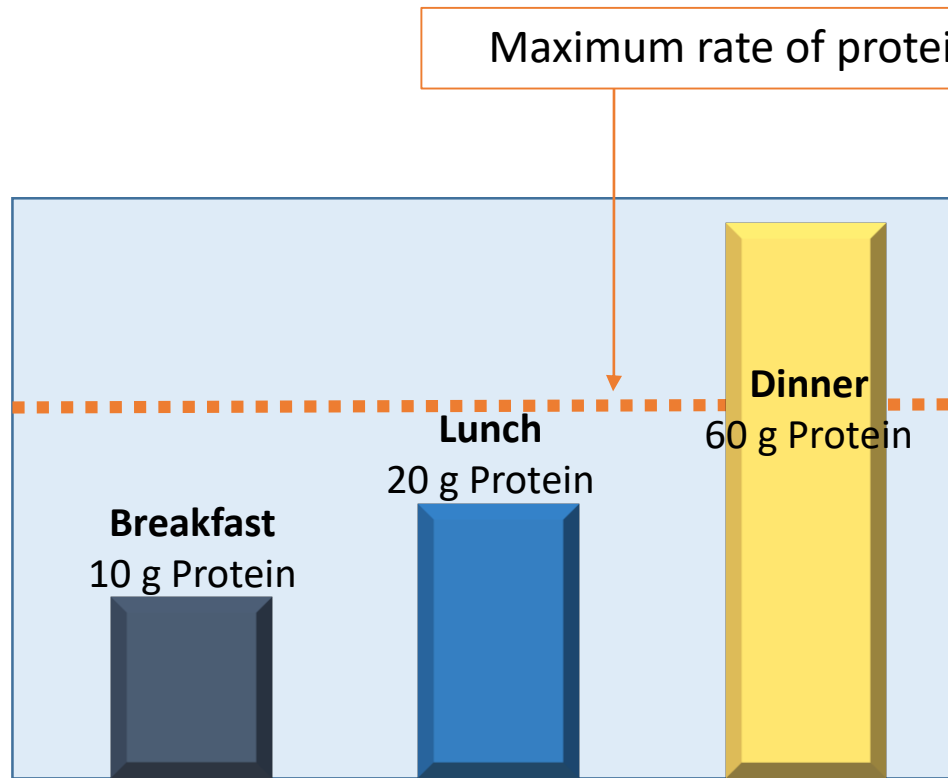
- Addition of vitamins and minerals to foods<sup>2</sup>
- Food fortification plays an important role in improving micronutrient intake<sup>2</sup>
- Based on the 'food first' approach<sup>3</sup>
- Energy- and protein-based fortification is viewed as an effective, well-tolerated, and cost-effective intervention to improve dietary intake of older people<sup>2</sup>

1. Malnutrition Pathway. 2021. Managing Adult Malnutrition in the Community. 3rd Edition. Accessed 2022.

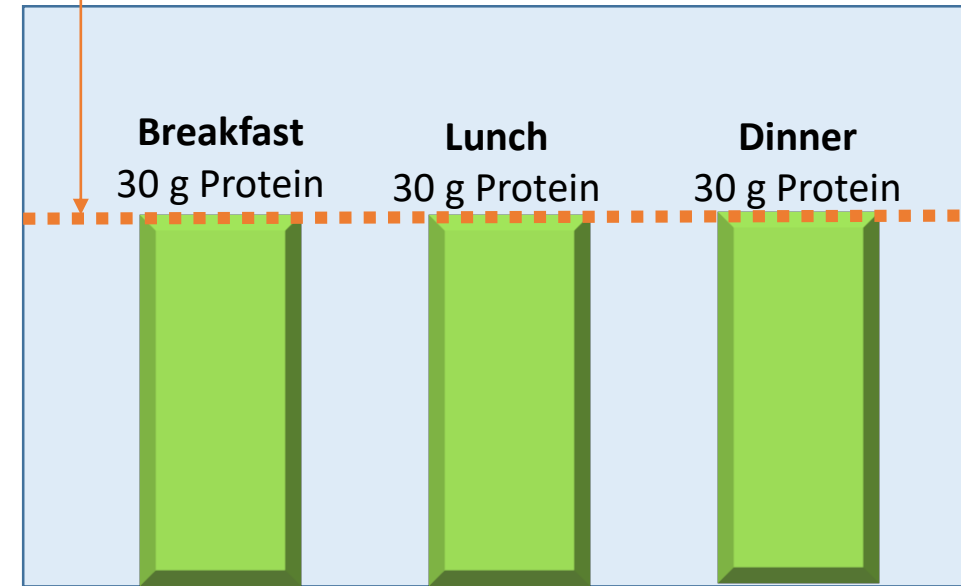
2 BDA. 2021. Food Fortification. Accessed 2022. 3. Roberts, H.C. The challenge of managing undernutrition in older people with frailty. *Nutrients*, 2019. 11(4), p.808.

# Optimising Nutritional Intake

Adequate protein intake distribution through the day



**Inadequate Protein Intake**



**Adequate Protein Intake**

Many frail older individuals are unable to meet this amount through diet alone



# What are oral nutritional supplements (ONS)

- ONS are sterile liquids, semi-solids or powders, which provide macro and micronutrients
- They can be prescribed in the short-term for acute illnesses or for individuals with chronic conditions
- ONS are used when diet alone is insufficient to meet daily nutritional requirements
- They are NOT intended as a food replacement

Many frail older individuals do better with High protein Low volume ONS that are better able to meet additional protein and calorie requirement

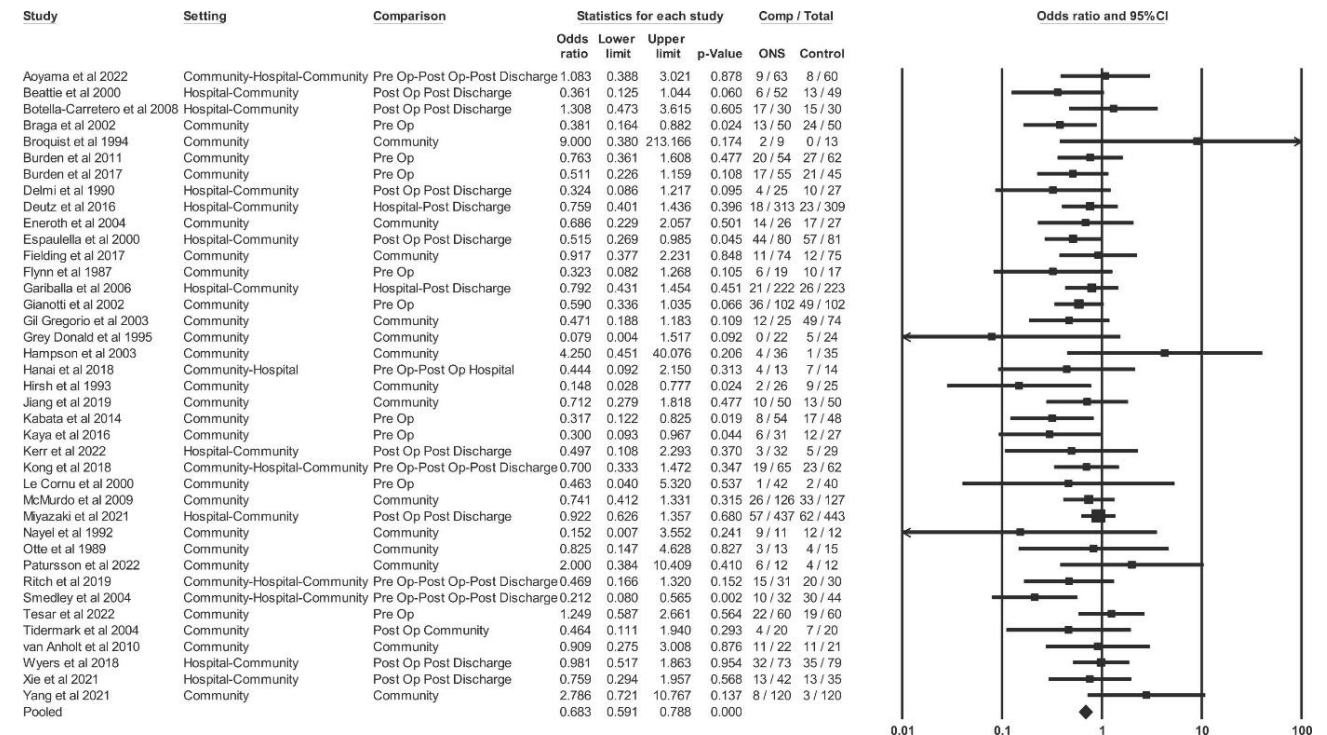
ONS - oral nutritional supplements

# A systematic review and meta-analysis of the effects of community use of oral nutritional supplements on clinical outcomes

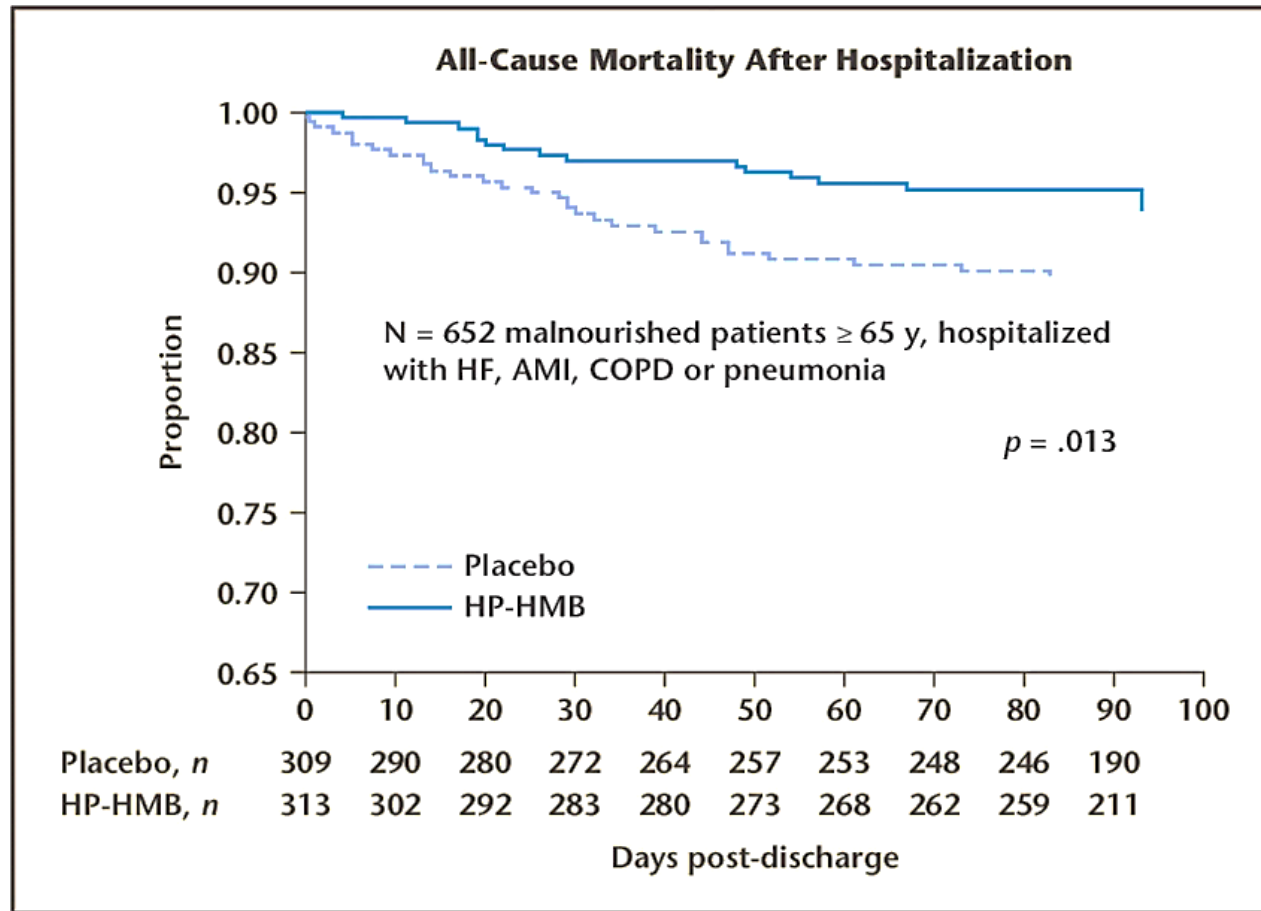
Included 44 randomised controlled trials (RCT) (29 RCT surgical, 15 RCT medical patients) examining the effect of ONS in community settings on the incidence of complications

## A 30% reduction in complications with ONS overall

- ONS consumption reduced complications including infections, pressure ulcers, wound and fracture healing
- Reductions when ONS were used in hospital and community settings
- Reductions in complications were only seen with high ONS adherence  $\geq 80\%$  and with ready to drink ONS



# Mortality benefits of treating malnutrition



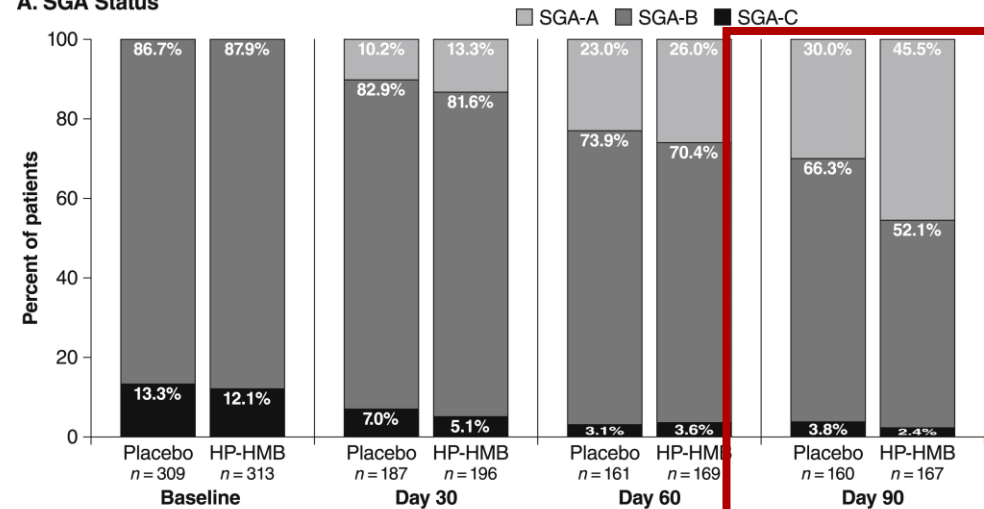
## Results from NOURISH Study

- **90-day mortality was significantly lower with HP-HMB** relative to placebo (4.8% vs. 9.7%; relative risk 0.49, 95% confidence interval [CI], 0.27 to 0.90;  $p = 0.018$ ).
- **The number-needed-to-treat to prevent 1 death was 20.3** (95% CI:10.9, 121.4).

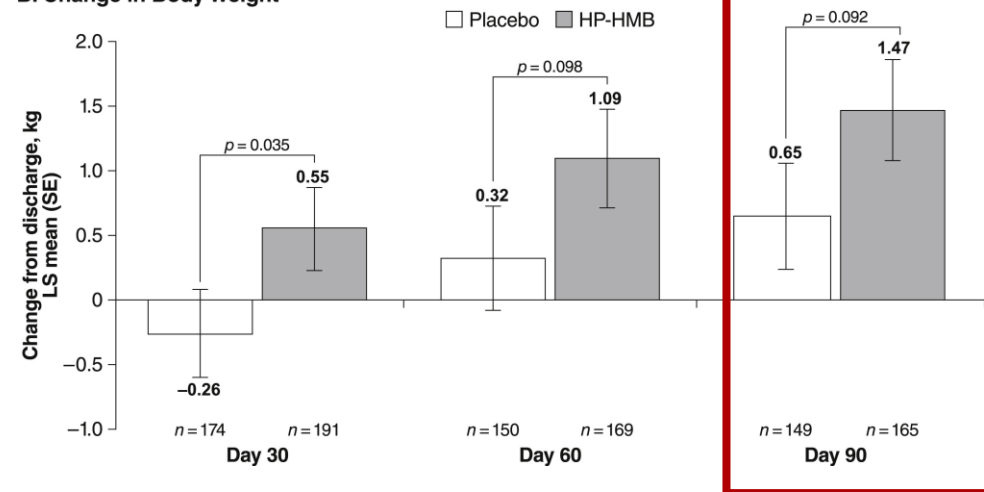
\*HP-ONS = High Protein Oral Nutrition Supplement  
\*HMB = beta hydroxybeta- methylbutyrate

# Improved nutritional status

A. SGA Status



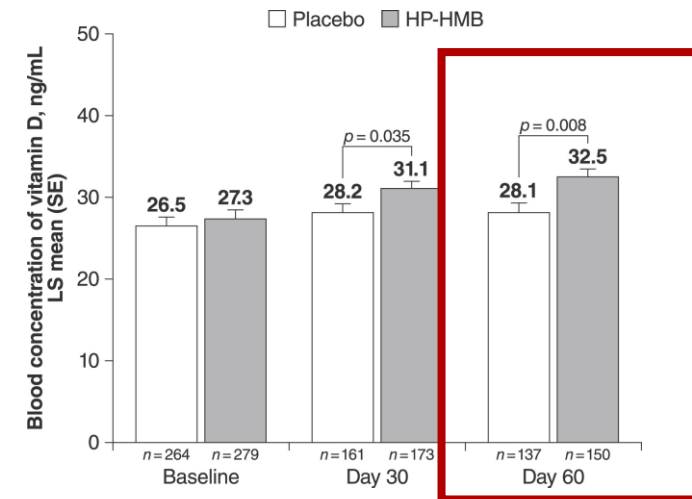
B. Change in Body Weight



## Results from NOURISH Study

- **HP-HMB ONS resulted in improved odds of better nutritional status** (SGA class, OR, 2.04, 95% CI: 1.28, 3.25,  $p = 0.009$ ) at day 90, and an increase in body weight at day 30 ( $p = 0.035$ ).
- **HP-HMB group had better Vitamin D status**

C. Vitamin D Status



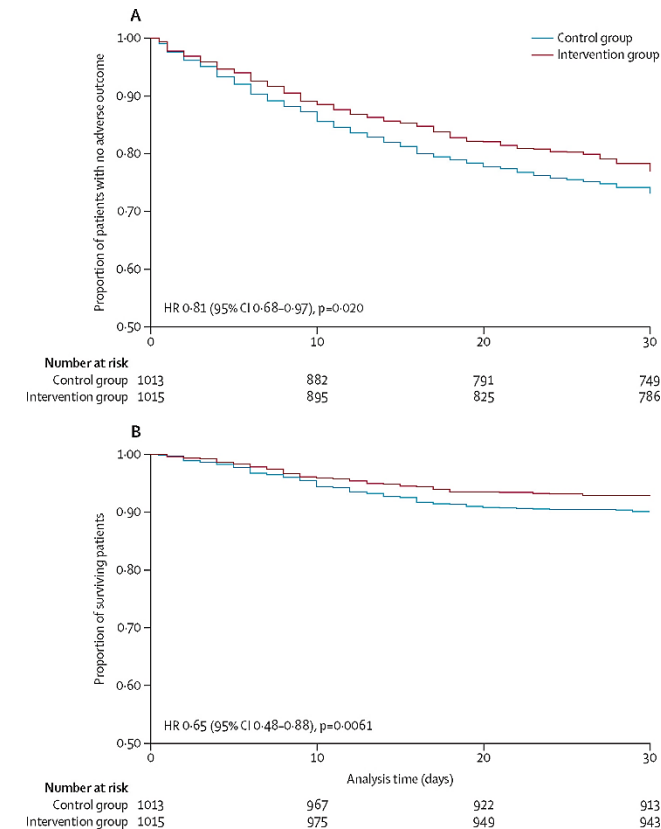
\*HP-ONS = High Protein Oral Nutrition Supplement  
\*HMB = beta hydroxybeta- methylbutyrate

# EFFORT

## Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial

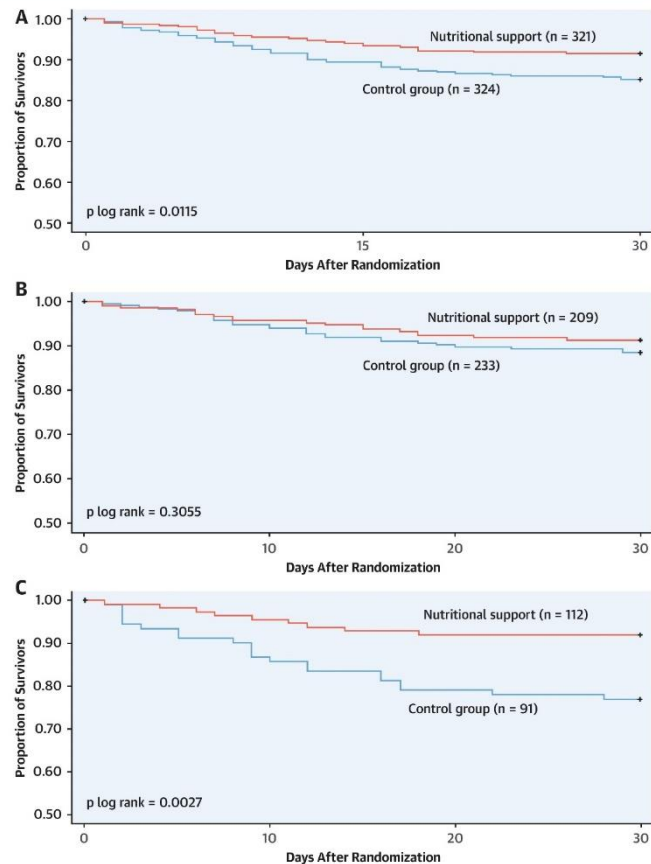
- By 30 days, 232 (23%) patients in the intervention group experienced an adverse clinical outcome, compared with 272 (27%) of 1013 patients in the control group (adjusted odds ratio [OR] 0.79 [95% CI 0.64–0.97],  $p=0.023$ ).
- Caloric goals were reached in 800 (79%) and protein goals in 770 (76%) of 1015 patients in the intervention group
- By day 30, 73 [7%] patients had died in the intervention group compared with 100 [10%] patients in the control group (adjusted OR 0.65 [0.47–0.91],  $p=0.011$ )

**Risk of dying reduced by 35%**



# Individualized Nutritional Support for Hospitalized Patients With Chronic Heart Failure

**CENTRAL ILLUSTRATION:** Kaplan-Meier Estimate of 30-Day Mortality for Patients With Moderate and High Nutritional Risk



Hersberger, L. et al. J Am Coll Cardiol. 2021;77(18):2307-19.

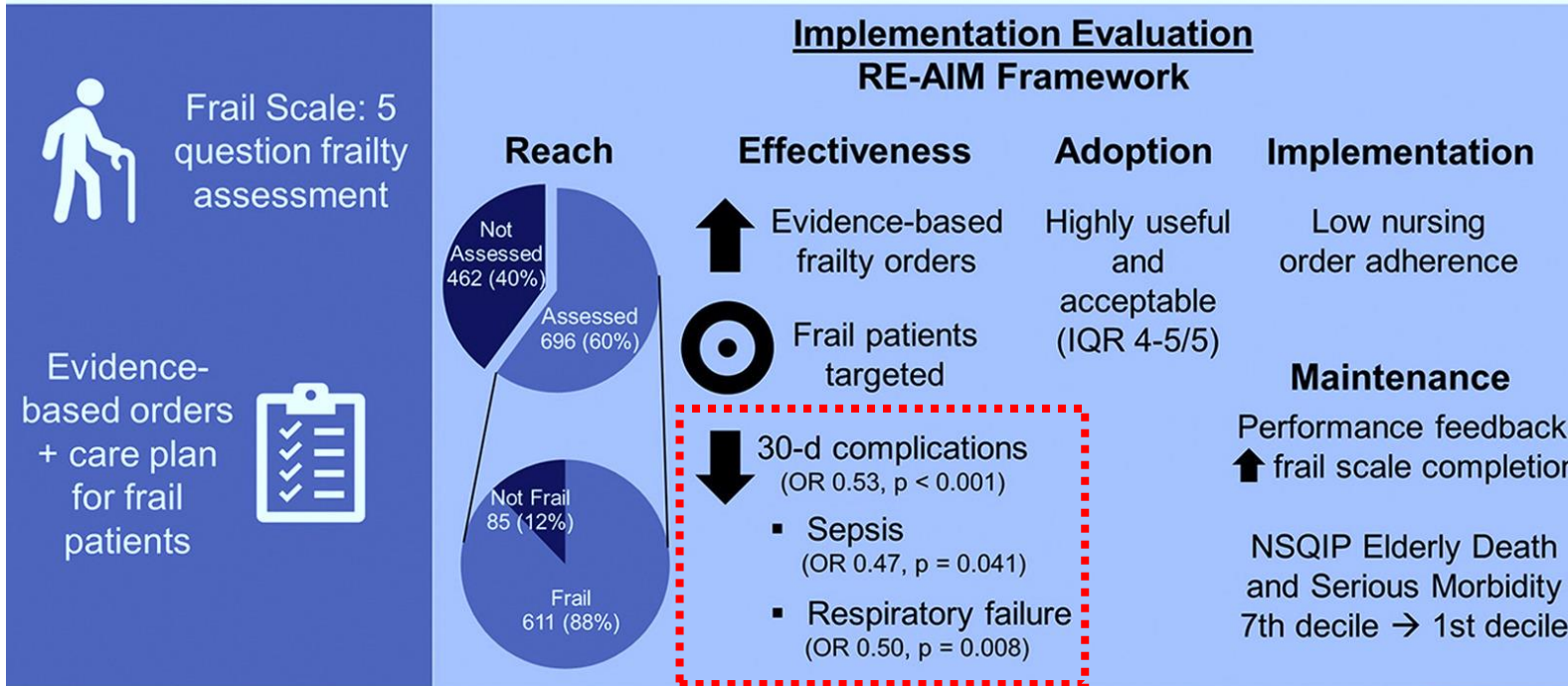
The principal findings of this secondary analysis of a large-scale, randomized controlled nutritional trial focusing on patients with chronic heart failure are 2-fold.

First, nutritional risk was strongly associated with both short- and long-term mortality, corroborating previous reports in this patient population.

Second, compared with a control group of patients receiving standard hospital food, the use of individualized nutritional support to reach nutritional goals resulted in a significant improvement in mortality at short- and long-term, and other clinical outcomes



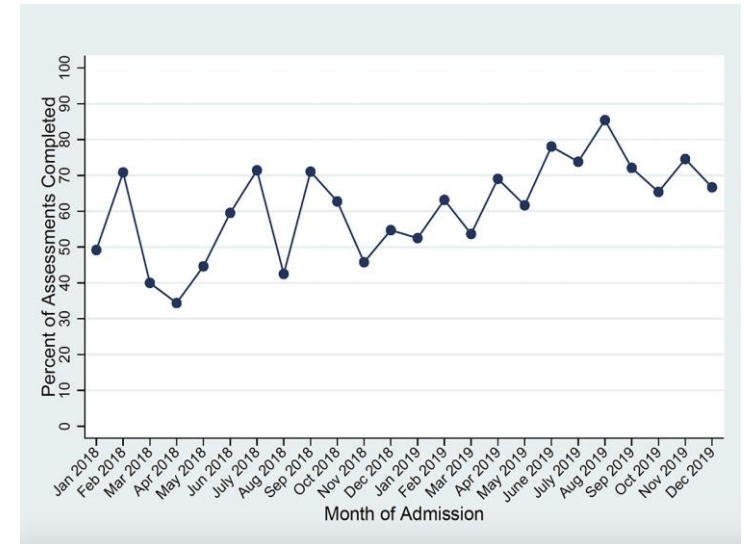
# Implementation of a Frailty Assessment and Targeted Care Interventions and Association with Reduced Postoperative Complications in Elderly Surgical Patients



Significant increases in the completion rates of frailty-specific care orders

- **Delirium precautions** (52.1% vs 30.7%;  $p < 0.001$ )
- **Aspiration precautions** (50.0% vs 26.9%;  $p < 0.001$ )
- **Avoidance of overnight vitals** (32.5% vs 0%;  $p < 0.001$ )
- **Nutrition consultation** (14.6% vs 53.5%;  $p < 0.001$ )

## Frailty Assessment improved



Frailty assessment completion rates increased from 52.7% in the first year of the intervention to 68.2% in the second year ( $p < 0.001$ ).

Rates of nursing care plan orders for frail patients increased from 20.7% to 77.1% ( $p < 0.001$ )

# Frailty and Sarcopenia: Slowing progression

Education and ↑ public health awareness – proactive assessment and management

- ✓ Provide **information** to patients/carers about loss of muscle mass
- ✓ Make patients/carers **aware** of why a high protein diet is important and dietary sources for the same
- ✓ Communicate the **synergistic role for** nutrition & exercise
- ✓ Flag & utilise existing local/national **resources**

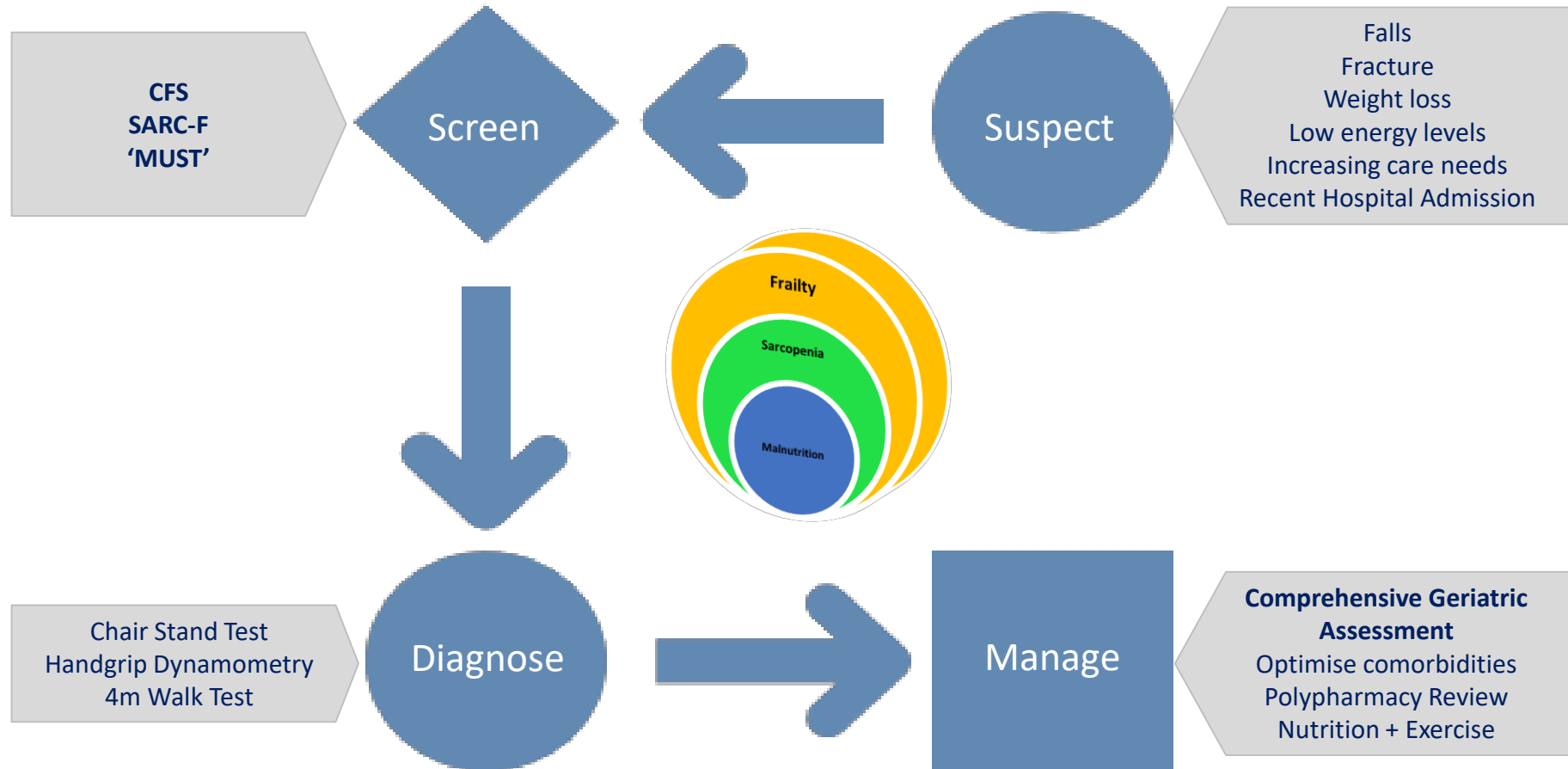


## Useful resources

- [https://www.ageing-better.org.uk/sites/default/files/2019-02/Raising-the-bar-on-strength-and-balance\\_0.pdf](https://www.ageing-better.org.uk/sites/default/files/2019-02/Raising-the-bar-on-strength-and-balance_0.pdf)
  - <https://www.iofbonehealth.org/living-sarcopenia>
- <https://www.rcplondon.ac.uk/projects/falls-and-fragility-fracture-audit-programme-fffap>



## Conclusion - 1



## Conclusion - 2

### Management of Frailty, Sarcopenia and Malnutrition

- Comprehensive Geriatric assessment – individualized management plan
- Older age is associated with a protein shortfall in diet contributing significantly to poor muscle health (Sarcopenia)
- ✓ Increase amount of protein in diet, prescribe HP-ONS where indicated
- ✓ Combine with individualized exercise program, especially resistance exercises, to improve muscle health

*Thank you*



Questions / Comments