



**Trinity College Dublin**

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin



# Nutritional assessment in oncology – What should we be measuring?

**Oonagh Griffin RD, MINDI**

Pancreatic Research Dietitian & HRB Research Fellow

Department of Surgery, Trinity College Dublin

National Surgical Centre for Pancreatic Cancer – St Vincent's University Hospital

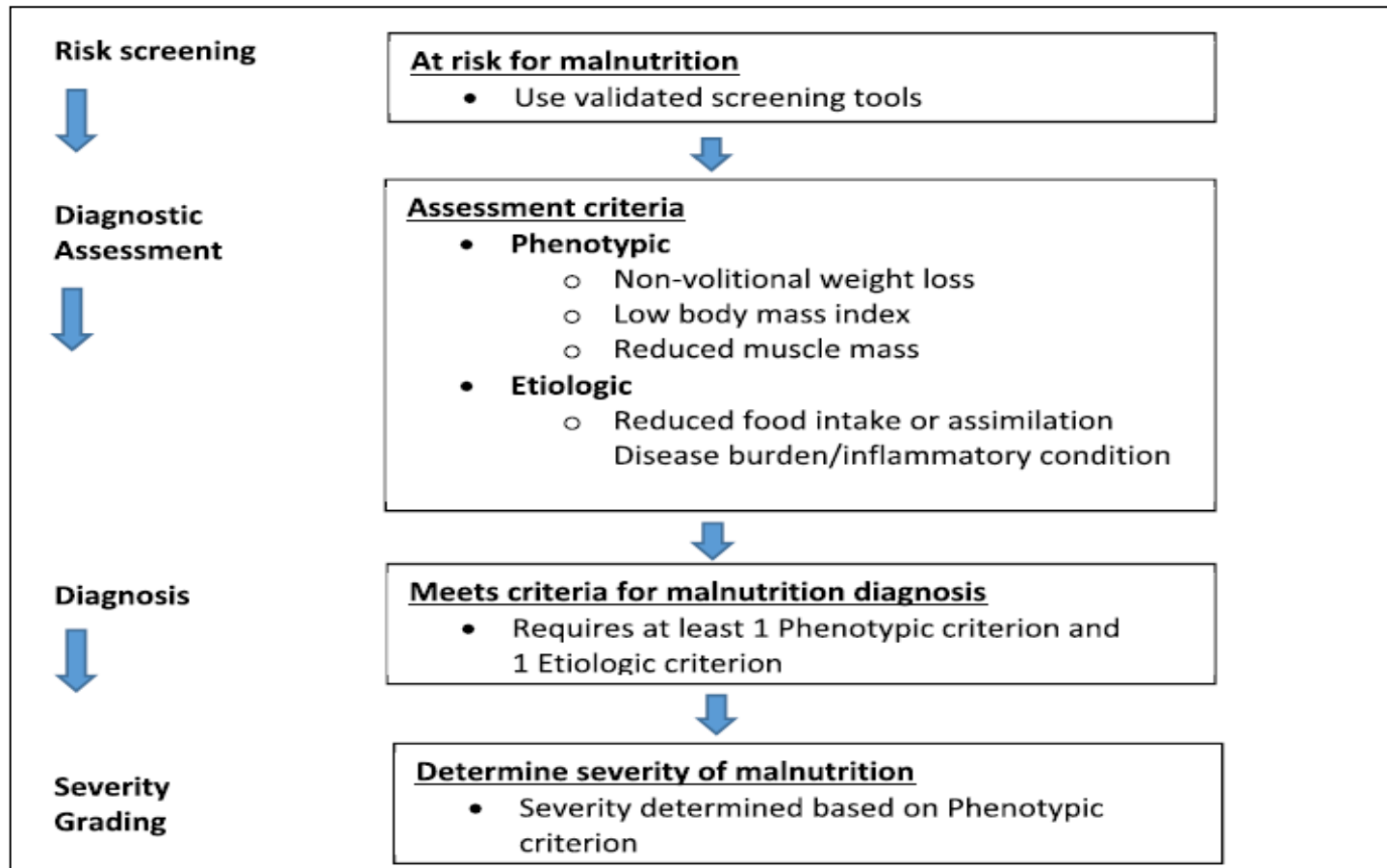
# Malnutrition

---

Broad term, with no universal definition

*‘Malnutrition is a state of nutrition in which a deficiency or excess (imbalance) of energy, protein and other nutrients causes measurable adverse effects on tissue/body form (body shape, size, composition) and function and clinical outcome’ (Elia 2000)*

## GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community<sup>☆</sup>



Cederholm T et al`2018, *in press*

# GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community<sup>☆</sup>

Phenotypic and etiologic criteria for the diagnosis of malnutrition.

| Phenotypic Criteria <sup>g</sup>                     |                                                                                                   |                                                                               | Etiologic Criteria <sup>g</sup>                                                                                                                                |                                                                                  |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Weight loss (%)                                      | Low body mass index (kg/m <sup>2</sup> )                                                          | Reduced muscle mass <sup>a</sup>                                              | Reduced food intake or assimilation <sup>b,c</sup>                                                                                                             | Inflammation <sup>d-f</sup>                                                      |
| >5% within past 6 months,<br>or >10% beyond 6 months | <20 if < 70 years, or<br><22 if >70 years<br>Asia:<br><18.5 if < 70 years, or<br><20 if >70 years | Reduced by validated body<br>composition measuring<br>techniques <sup>a</sup> | ≤50% of ER > 1 week, or any reduction<br>for >2 weeks, or any chronic GI condition<br>that adversely impacts food assimilation<br>or absorption <sup>b,c</sup> | Acute disease/injury <sup>d,f</sup><br>or chronic disease-related <sup>e,f</sup> |

Cederholm T et al`2018, *in press*

# Inadequate Nutrition

- Oral intake negatively affected by both disease burden and treatment-induced side effects
1. Cancer cachexia-induced anorexia and early satiety
  2. Disease/ Treatment specific nutrition impact symptoms & digestive limitations
  3. Fear of eating (pain/ aggravation of symptoms)
  4. Food aversion/restriction
  5. Anxiety and distress

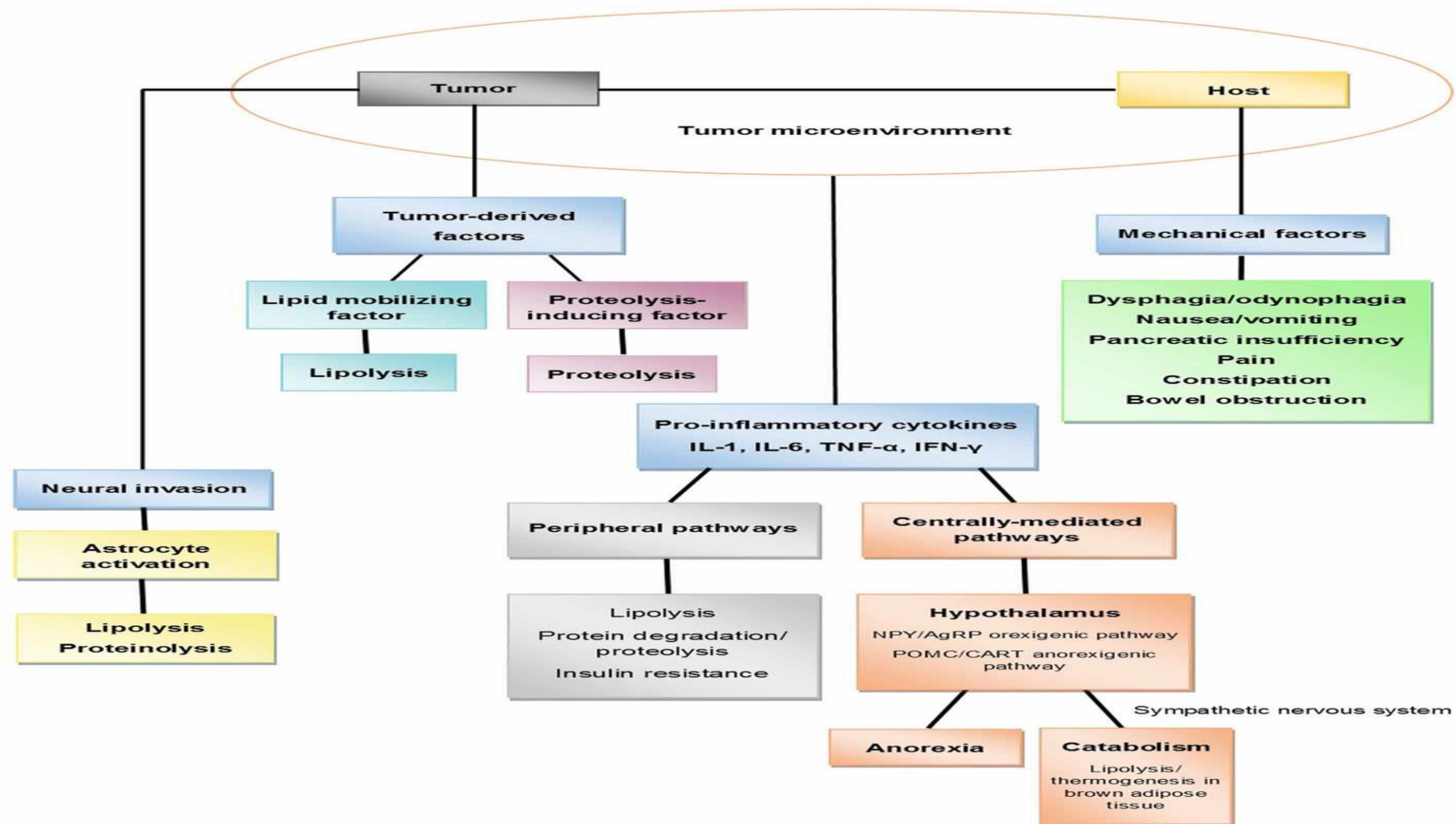


# Maldigestion and Malabsorption

---

- **Dysphagia**
- **Odynophagia**
- **Gastric Outlet Obstruction**
- **Radiation Enteropathy**
- **GI Resection**
- **Pancreatic Exocrine Insufficiency**
- **Obstructive Jaundice**
- **Diabetes**
  
- **Underlying pre-morbid conditions e.g IBD, previous surgery, PSC.**

# Cancer Cachexia and Inflammation



Tan CR et al. 2014



## ESPEN Guideline

### ESPEN guidelines on nutrition in cancer patients<sup>☆</sup>

Jann Arends <sup>a</sup>, Patrick Bachmann <sup>b</sup>, Vickie Baracos <sup>c</sup>, Nicole Barthelemy <sup>d</sup>, Hartmut Bertz <sup>a</sup>, Federico Bozzetti <sup>e</sup>, Ken Fearon <sup>f,†</sup>, Elisabeth Hütterer <sup>g</sup>, Elizabeth Isenring <sup>h</sup>, Stein Kaasa <sup>i</sup>, Zeljko Krznaric <sup>j</sup>, Barry Laird <sup>k</sup>, Maria Larsson <sup>l</sup>, Alessandro Laviano <sup>m</sup>, Stefan Mühlebach <sup>n</sup>, Maurizio Muscaritoli <sup>m</sup>, Line Oldervoll <sup>i,o</sup>, Paula Ravasco <sup>p</sup>, Tora Solheim <sup>q,r</sup>, Florian Strasser <sup>s</sup>, Marian de van der Schueren <sup>t,u</sup>, Jean-Charles Preiser <sup>v,\*</sup>

## **B -Nutritional screening and assessment**

**Regularly evaluate nutritional intake, weight change and BMI, beginning with cancer diagnosis and repeated depending on the stability of the clinical situation**

**Validated nutrition screening tools - NRS, MUST, MST, MNA**



## ESPEN Guideline

### ESPEN guidelines on nutrition in cancer patients<sup>☆</sup>

Jann Arends <sup>a</sup>, Patrick Bachmann <sup>b</sup>, Vickie Baracos <sup>c</sup>, Nicole Barthelemy <sup>d</sup>, Hartmut Bertz <sup>a</sup>, Federico Bozzetti <sup>e</sup>, Ken Fearon <sup>f,†</sup>, Elisabeth Hütterer <sup>g</sup>, Elizabeth Isenring <sup>h</sup>, Stein Kaasa <sup>i</sup>, Zeljko Krznaric <sup>j</sup>, Barry Laird <sup>k</sup>, Maria Larsson <sup>l</sup>, Alessandro Laviano <sup>m</sup>, Stefan Mühlebach <sup>n</sup>, Maurizio Muscaritoli <sup>m</sup>, Line Oldervoll <sup>i,o</sup>, Paula Ravasco <sup>p</sup>, Tora Solheim <sup>q,r</sup>, Florian Strasser <sup>s</sup>, Marian de van der Schueren <sup>t,u</sup>, Jean-Charles Preiser <sup>v,\*</sup>

## **B -Nutritional Screening and Assessment**

**In patients with abnormal screening, objective and quantitative assessment of nutritional intake, nutrition impact symptoms, muscle mass, physical performance and the degree of systemic inflammation**

No consensus on methods – SGA, PG-SGA and MNA

Muscle and fat mass e.g. DEXA, anthropometry, CT, BIA

Physical performance – ECOG, Karnofsky scale, walking tests, dynamometers

Systemic inflammation – CRP and albumin, modified Glasgow Prognostic Score

## Scored Patient-Generated Subjective Global Assessment (PG-SGA)

Patient ID Information

History (Boxes 1-4 are designed to be completed by the patient.)

### 1. Weight (See Worksheet 1)

In summary of my current and recent weight:

I currently weigh about \_\_\_\_\_ pounds

I am about \_\_\_\_\_ feet \_\_\_\_\_ tall

One month ago I weighed about \_\_\_\_\_ pounds

Six months ago I weighed about \_\_\_\_\_ pounds

During the past two weeks my weight has:

☐ decreased <sup>(1)</sup> ☐ not changed <sup>(0)</sup> ☐ increased <sup>(0)</sup>

Box 1

### 2. Food Intake: As compared to my normal intake, I would rate my food intake during the past month as:

☐ unchanged <sup>(0)</sup>

☐ more than usual <sup>(0)</sup>

☐ less than usual <sup>(1)</sup>

I am now taking:

☐ normal food but less than normal amount <sup>(1)</sup>

☐ little solid food <sup>(2)</sup>

☐ only liquids <sup>(3)</sup>

☐ only nutritional supplements <sup>(3)</sup>

☐ very little of anything <sup>(4)</sup>

☐ only tube feedings or only nutrition by vein <sup>(0)</sup>

Box 2

### 3. Symptoms: I have had the following problems that have kept me from eating enough during the past two weeks (check all that apply):

☐ no problems eating <sup>(0)</sup>

☐ no appetite, just did not feel like eating <sup>(3)</sup>

☐ nausea <sup>(1)</sup>

☐ vomiting <sup>(3)</sup>

☐ constipation <sup>(1)</sup>

☐ diarrhea <sup>(3)</sup>

☐ mouth sores <sup>(2)</sup>

☐ dry mouth <sup>(1)</sup>

☐ things taste funny or have no taste <sup>(1)</sup>

☐ smells bother me <sup>(1)</sup>

☐ problems swallowing <sup>(2)</sup>

☐ feel full quickly <sup>(1)</sup>

☐ pain, where? <sup>(3)</sup> \_\_\_\_\_

☐ fatigue <sup>(1)</sup>

☐ other\*\* <sup>(1)</sup> \_\_\_\_\_

\*\* Examples: depression, money, or dental problems

Box 3

### 4. Activities and Function: Over the past month, I would generally rate my activity as:

☐ normal with no limitations <sup>(0)</sup>

☐ not my normal self, but able to be up and about with fairly normal activities <sup>(1)</sup>

☐ not feeling up to most things, but in bed or chair less than half the day <sup>(2)</sup>

☐ able to do little activity and spend most of the day in bed or chair <sup>(3)</sup>

☐ pretty much bedridden, rarely out of bed <sup>(3)</sup>

Box 4

The remainder of this form will be completed by your doctor, nurse, dietitian, or therapist. Thank you.

## Scored Patient-Generated Subjective Global Assessment (PG-SGA)

### Worksheet 1 - Scoring Weight (Wt) Loss

To determine score, use 1 month weight data if available. Use 6 month data only if there is no 1 month weight data. Use points below to score weight change and add one extra point if patient has lost weight during the past 2

| Wt loss in 1 month | Points | Wt loss in 6 months |
|--------------------|--------|---------------------|
| 10% or greater     | 4      | 20% or greater      |
| 5-9.9%             | 3      | 10 - 19.9%          |
| 3-4.9%             | 2      | 6 - 9.9%            |
| 2-2.9%             | 1      | 2 - 5.9%            |
| 0-1.9%             | 0      | 0 - 1.9%            |

Numerical score from Worksheet 1

Additive Score of the Boxes 1-4 (See Side 1)  A

### 5. Worksheet 2 - Disease and its relation to nutritional requirements

All relevant diagnoses (specify) \_\_\_\_\_

One point each:

- ☐ Cancer ☐ AIDS ☐ Pulmonary or cardiac cachexia ☐ Presence of decubitus, open wound, or fistula  
☐ Presence of trauma ☐ Age greater than 65 years ☐ Chronic renal insufficiency

Numerical score from Worksheet 2  B

### 6. Work Sheet 3 - Metabolic Demand

Score for metabolic stress is determined by a number of variables known to increase protein & calorie needs. The score is additive so that a patient who has a fever of > 102 degrees (3 points) and is on 10 mg of prednisone chronically (2 points) would have an additive score for this section of 5 points.

| Stress          | none (0)           | low (1)                                        | moderate (2)                                                | high (3)                                                | Numerical score from Worksheet 3 <input type="text"/> C |
|-----------------|--------------------|------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
| Fever           | no fever           | >99 and <101                                   | ≥101 and <102                                               | ≥102                                                    |                                                         |
| Fever duration  | no fever           | <72 hrs                                        | 72 hrs                                                      | > 72 hrs                                                |                                                         |
| Corticosteroids | no corticosteroids | low dose<br>(<10mg prednisone equivalents/day) | moderate dose<br>(≥10 and <30mg prednisone equivalents/day) | high dose steroid<br>(≥30mg prednisone equivalents/day) |                                                         |

### 7. Worksheet 4 - Physical Exam

Physical exam includes a subjective evaluation of 3 aspects of body composition: fat, muscle, & fluid status. Since this is subjective, each aspect of the exam is rated for degree of deficit. Muscle deficit impacts point score more than fat deficit. Definition of categories: 0 = no deficit, 1+ = mild deficit, 2+ = moderate 3+ = severe

Muscle Status:

|                                                 |   |    |    |    |
|-------------------------------------------------|---|----|----|----|
| temples (temporalis muscle)                     | 0 | 1+ | 2+ | 3+ |
| clavicles (pectoralis & deltoids)               | 0 | 1+ | 2+ | 3+ |
| shoulders (deltoids)                            | 0 | 1+ | 2+ | 3+ |
| interosseous muscles                            | 0 | 1+ | 2+ | 3+ |
| Scapula (latissimus dorsi, trapezius, deltoids) | 0 | 1+ | 2+ | 3+ |
| thigh (quadriceps)                              | 0 | 1+ | 2+ | 3+ |
| calf (gastrocnemius)                            | 0 | 1+ | 2+ | 3+ |
| Global muscle status rating                     | 0 | 1+ | 2+ | 3+ |

Fluid Status:

|                            |   |    |    |    |
|----------------------------|---|----|----|----|
| ankle edema                | 0 | 1+ | 2+ | 3+ |
| sacral edema               | 0 | 1+ | 2+ | 3+ |
| ascites                    | 0 | 1+ | 2+ | 3+ |
| Global fluid status rating | 0 | 1+ | 2+ | 3+ |

Numerical score from Worksheet 4  D

Total PG-SGA score

(Total numerical score of A+B+C+D above)

(See triage recommendations below)

Global PG-SGA rating (A, B, or C) =

Clinician Signature \_\_\_\_\_ RD RN PA MD DO Other \_\_\_\_\_ Date \_\_\_\_\_

### Worksheet 5 - PG-SGA Global Assessment Categories

| Category                  | Stage A                                                            | Stage B                                                                                           | Stage C                                                                                          |
|---------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Weight                    | Well nourished<br>No wt loss<br>OR Recent wt gain                  | Moderately malnourished<br>≥ 5% wt loss in 1 month<br>(or 10% in 6 mos)<br>OR Progressive wt loss | Severely malnourished<br>≥ 5% wt loss in 1 month<br>(or ≥10% in 6 mos)<br>OR Progressive wt loss |
| Nutrient intake           | No deficit<br>OR Significant recent improvement                    | Definite decrease in intake                                                                       | Severe deficit in intake                                                                         |
| Nutrition Impact Symptoms | None<br>OR Significant recent improvement allowing adequate intake | Present of nutrition impact symptoms (PG-SGA Box 3)                                               | Present of nutrition impact symptoms (PG-SGA Box 3)                                              |
| Functioning               | No deficit OR Recent improvement                                   | Moderate functional deficit<br>OR Recent deterioration                                            | Severe functional deficit<br>OR recent significant deterioration                                 |
| Physical Exam             | No deficit OR Chronic deficit but recent improvement               | Evidence of mild to moderate loss of muscle mass / SQ fat / muscle tone on palpation              | Obvious signs of malnutrition<br>(eg. severe loss muscle, SQ tissue, possible edema)             |

**Nutritional Triage Recommendations:** Additive score is used to define specific nutritional interventions including patient & family education, symptom management including pharmacologic intervention, and appropriate nutrient intervention (food, nutritional supplements, enteral, or parenteral triage).  
*First line nutrition intervention includes optimal symptom management.*

**Triage based on PG-SGA point score**

- 0-1 No intervention required at this time. Re-assessment on routine and regular basis during treatment.  
 2-3 Patient & family education by dietitian, nurse, or other clinician with pharmacologic intervention as indicated by symptom survey (Box 3) and lab values as appropriate.  
 4-8 Requires intervention by dietitian, in conjunction with nurse or physician as indicated by symptoms (Box 3).  
 ≥ 9 Indicates a critical need for improved symptom management and/or nutrient intervention options.

# Diagnostic Criteria for the Classification of Cancer-Associated Weight Loss

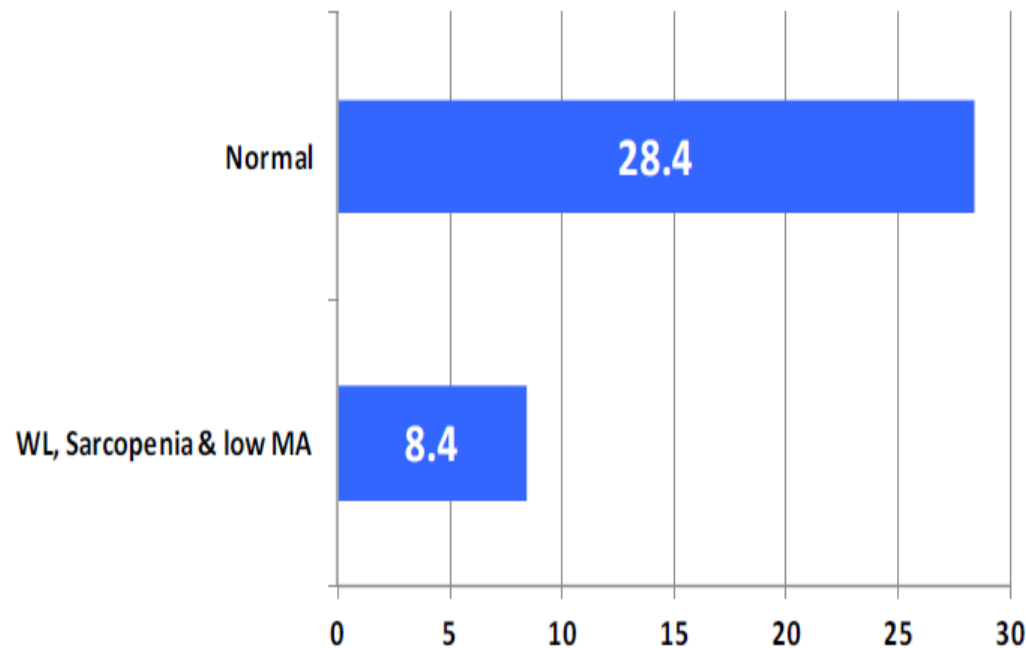
*Lisa Martin, Pierre Senesse, Ioannis Gioulbasanis, Sami Antoun, Federico Bozzetti, Chris Deans, Florian Strasser, Lene Thoresen, R. Thomas Jagoe, Martin Chasen, Kent Lundholm, Ingvar Bosaeus, Kenneth H. Fearon, and Vickie E. Baracos*

- **n=8160 cancer patients**
- **Weight loss and BMI independently predicted survival**
- **Inability to maintain weight, even subtle losses 2.4%, significantly related to decreased survival**

|                 |     | BMI (kg/m <sup>2</sup> ) |    |    |    |   |
|-----------------|-----|--------------------------|----|----|----|---|
|                 |     | 28                       | 25 | 22 | 20 |   |
| Weight Loss (%) | 2.5 | 0                        | 0  | 1  | 1  | 3 |
|                 | 6   | 1                        | 2  | 2  | 2  | 3 |
|                 | 11  | 2                        | 3  | 3  | 3  | 4 |
|                 | 15  | 3                        | 3  | 3  | 4  | 4 |
|                 |     | 3                        | 4  | 4  | 4  | 4 |

# Regardless of BMI at presentation:

Patients with weight loss, sarcopenia and low muscle density survived **8.4 months**  
Vs **28.4 months** for those with normal muscle mass



Message: cancer pts with weight loss and muscle wasting have a poor prognosis regardless of overall body weight

Martin L et al, 2015



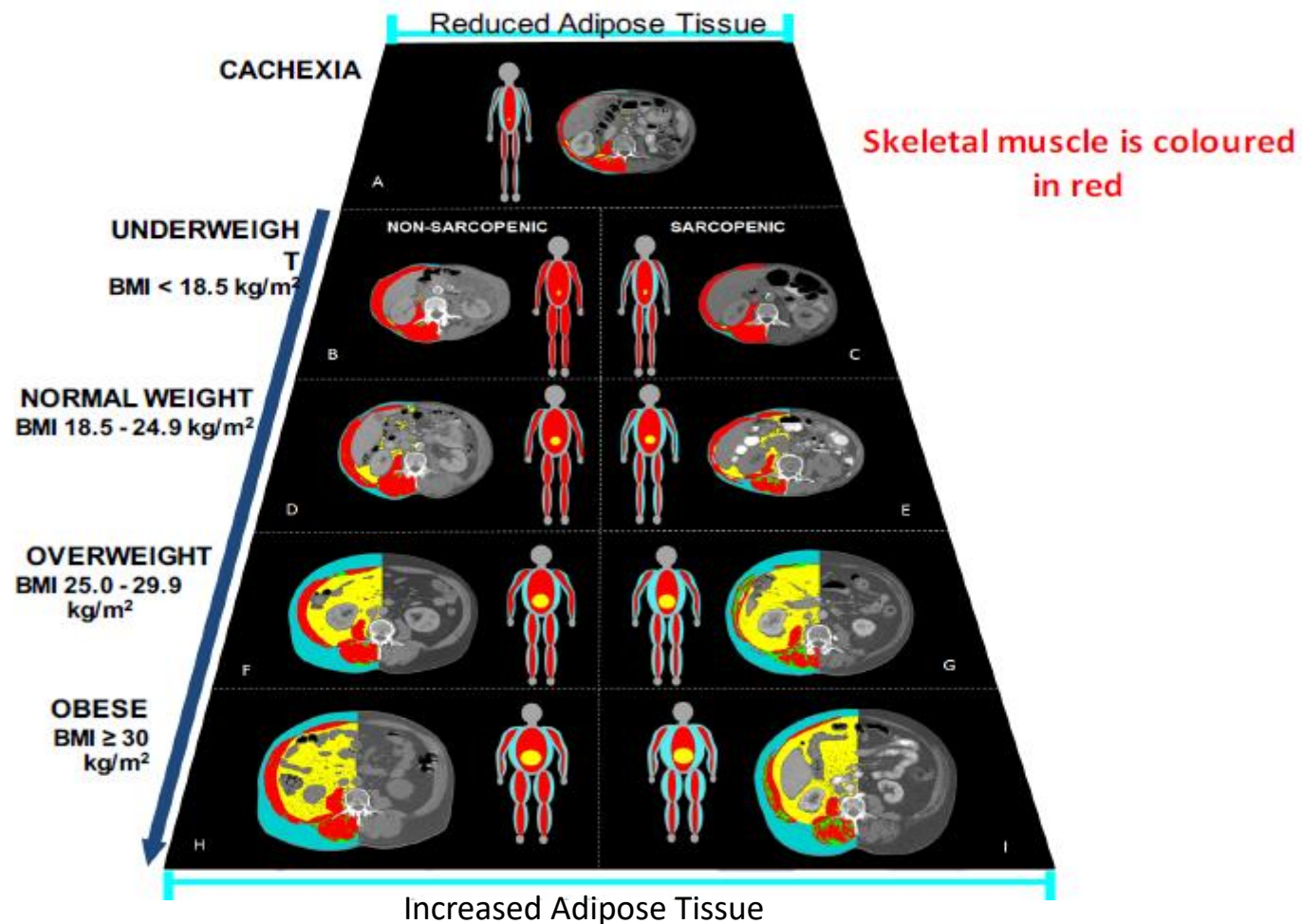
- Nutrition Day Oncology 2012-2016
- n=9100 adults with cancer, inpatient setting, with 30 day outcome data available
- Median age 65 years (IQR: 55-74), 54.6% male, mean BMI 24.3 (5.3) kg/m<sup>2</sup>
- 30 – day mortality 7% (95% CI 6.5-7.5), 14.9% for patients with systemic infection (95%CI 12-17.7)

**Do Weight loss (>5%) and/ or BMI influence the rate of systemic infections?**

- No difference seen across WHO BMI Categories
- Higher incidence of systemic infections observed in patients with weight loss (OR 1.6, P<0.0001)

# Body Composition Variability in Cancer

Prado C et al 2016

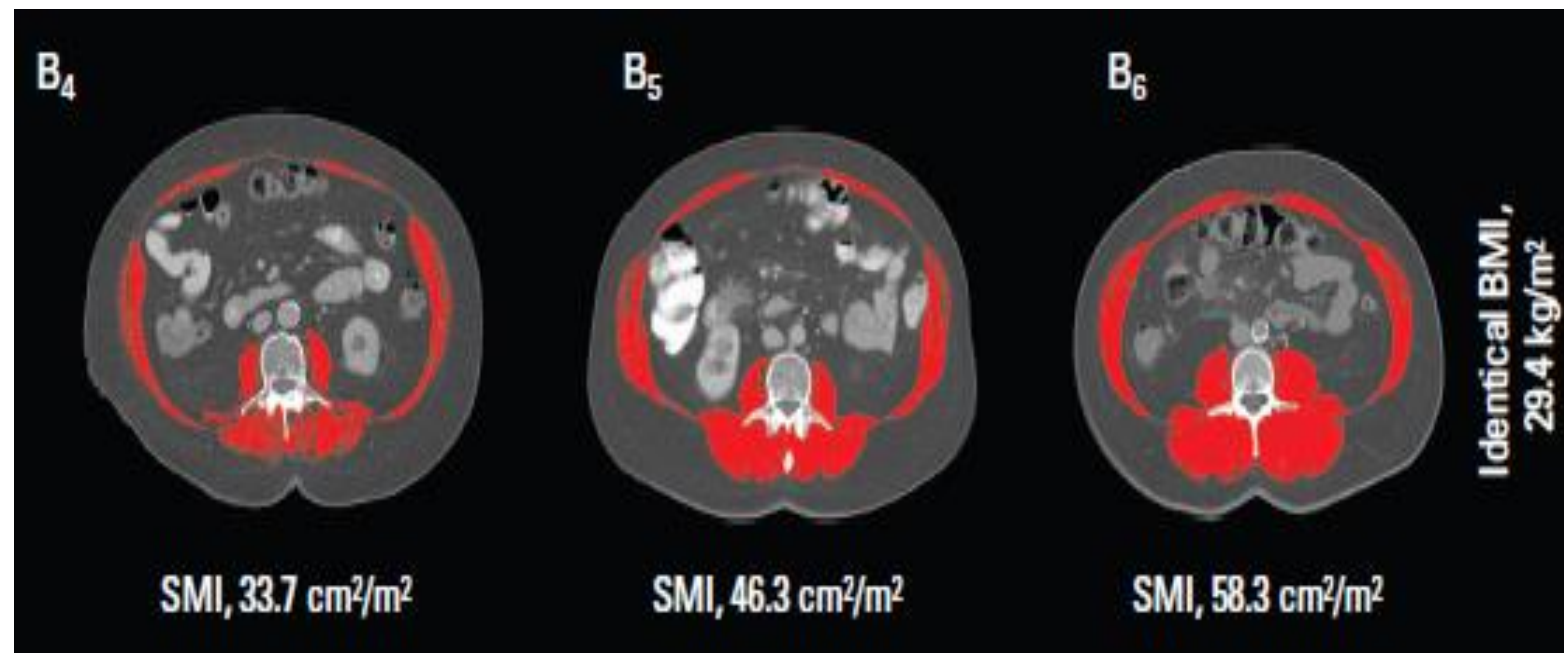


# Cancer Cachexia in the Age of Obesity: Skeletal Muscle Depletion Is a Powerful Prognostic Factor, Independent of Body Mass Index

JOURNAL OF CLINICAL ONCOLOGY

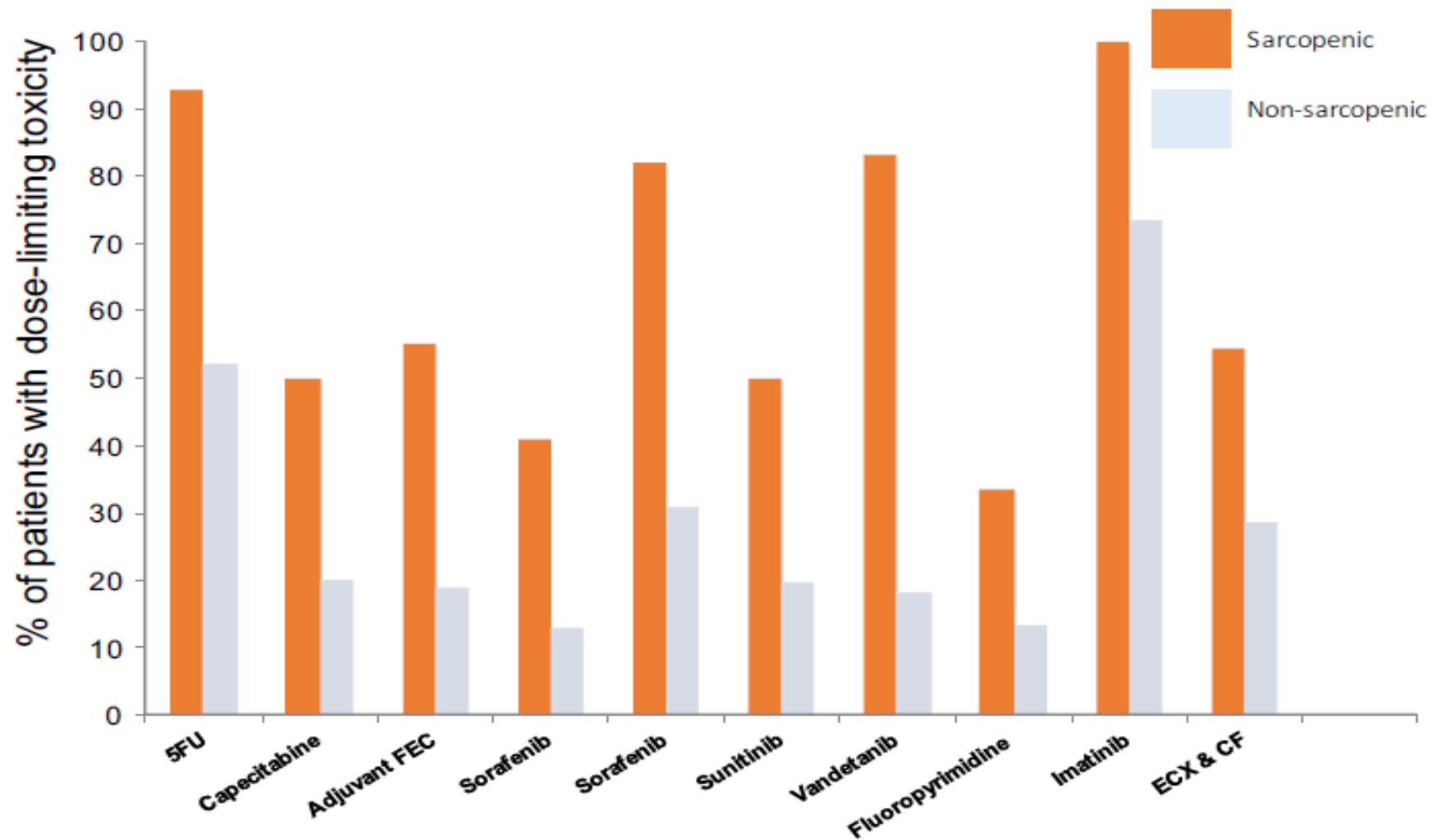
Lisa Martin, Laura Birdsell, Neil MacDonald, Tony Reiman, M. Thomas Clandinin, Linda J. McCargar, Rachel Murphy, Sunita Ghosh, Michael B. Sawyer, and Vickie E. Baracos

VOLUME 31 · NUMBER 12 · APRIL 20 2013



**BMI 29.4kg/m<sup>2</sup>**  
**Body Surface Area 1.78m<sup>2</sup> - identical**  
**chemotherapy dose**

# Chemotherapy toxicity and Sarcopenia



Prado C et al 2016

SCIENTIFIC REVIEW

## **Radiologically Determined Sarcopenia Predicts Morbidity and Mortality Following Abdominal Surgery: A Systematic Review and Meta-Analysis**

Keaton Jones<sup>1,4</sup> · Alex Gordon-Weeks<sup>1</sup> · Claire Coleman<sup>2</sup> · Michael Silva<sup>3</sup>

- 24 studies, n=5267
- Sarcopenia predicted

Major post-operative complications (*RR 1.61, 95% CI 1.24-4.15.*)

1, 3 and 5 year overall survival

*1 year RR 1.61, 95%CI 1.36-1.91, p<0.0001*

*3 year RR 1.45, 95% CI 1.33-1.58, p<0.0001*

*5 year RR 1.25, 95% CI 1.11-1.42, p =0.0003*

# Sarcopenia is Associated with Increased Hospital Costs

- n=452 patients undergoing GI cancer surgery (Erasmus MC, Rotterdam)
- 46% sarcopenic pre-op
- Low skeletal muscle mass independently associated with increased cost of €4000 per patient

|                                               | B (Euros) | Standard Error (Euros) | P-value |
|-----------------------------------------------|-----------|------------------------|---------|
| Low skeletal muscle mass                      | 4,061     | 1,654                  | 0.015   |
| Age ( $\geq 65$ years)                        | 484       | 1,648                  | 0.769   |
| Sex (male)                                    | 2,126     | 1,693                  | 0.210   |
| Overweight (BMI $\geq 25$ kg/m <sup>2</sup> ) | -587      | 1,650                  | 0.722   |
| ASA classification (3 or 4)                   | 7,205     | 2,044                  | <0.001  |
| Extent of surgery (major surgery)             | 11,127    | 1,650                  | <0.001  |

Abbreviations: BMI, Body Mass Index; ASA, American Society of Anesthesiologists

Van Vugt JLA et al, PLOS ONE 31<sup>st</sup> October, 2017

# Sarcopenia in an Overweight or Obese Patient Is an Adverse Prognostic Factor in Pancreatic Cancer

Benjamin H.L. Tan,<sup>1</sup> Laura A. Birdsell,<sup>2</sup> Lisa Martin,<sup>2</sup> Vickie E. Baracos,<sup>2</sup> and Kenneth C.H. Fearon<sup>1</sup>

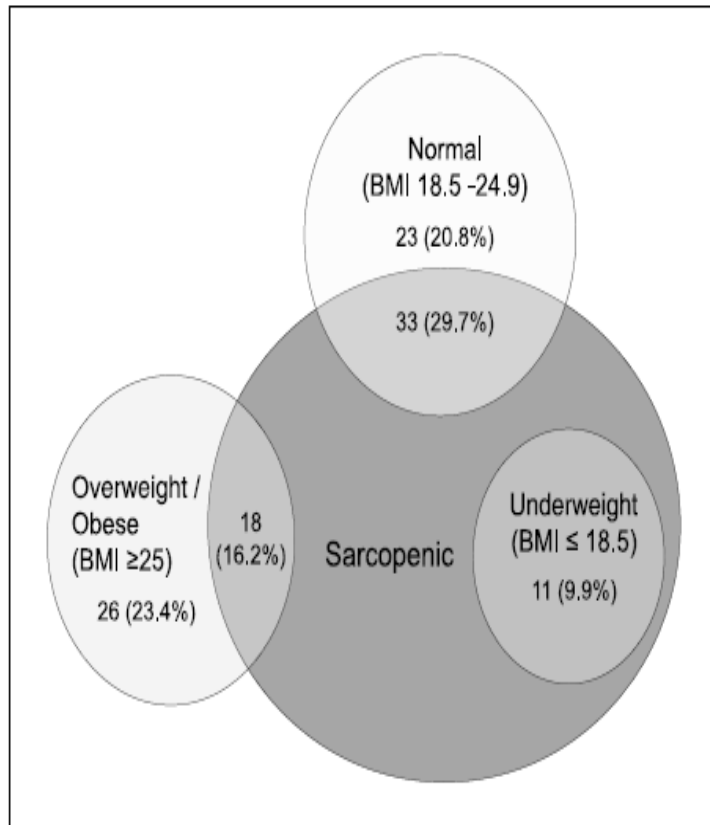


Fig. 1. Venn diagram of BMI classes and sarcopenic patients.

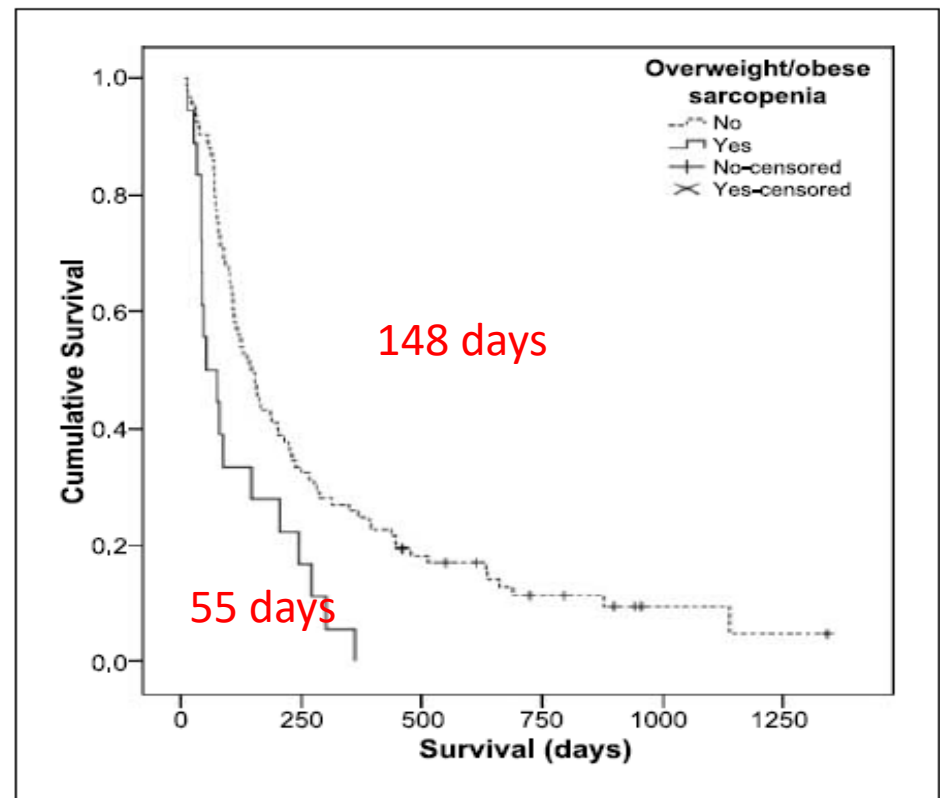
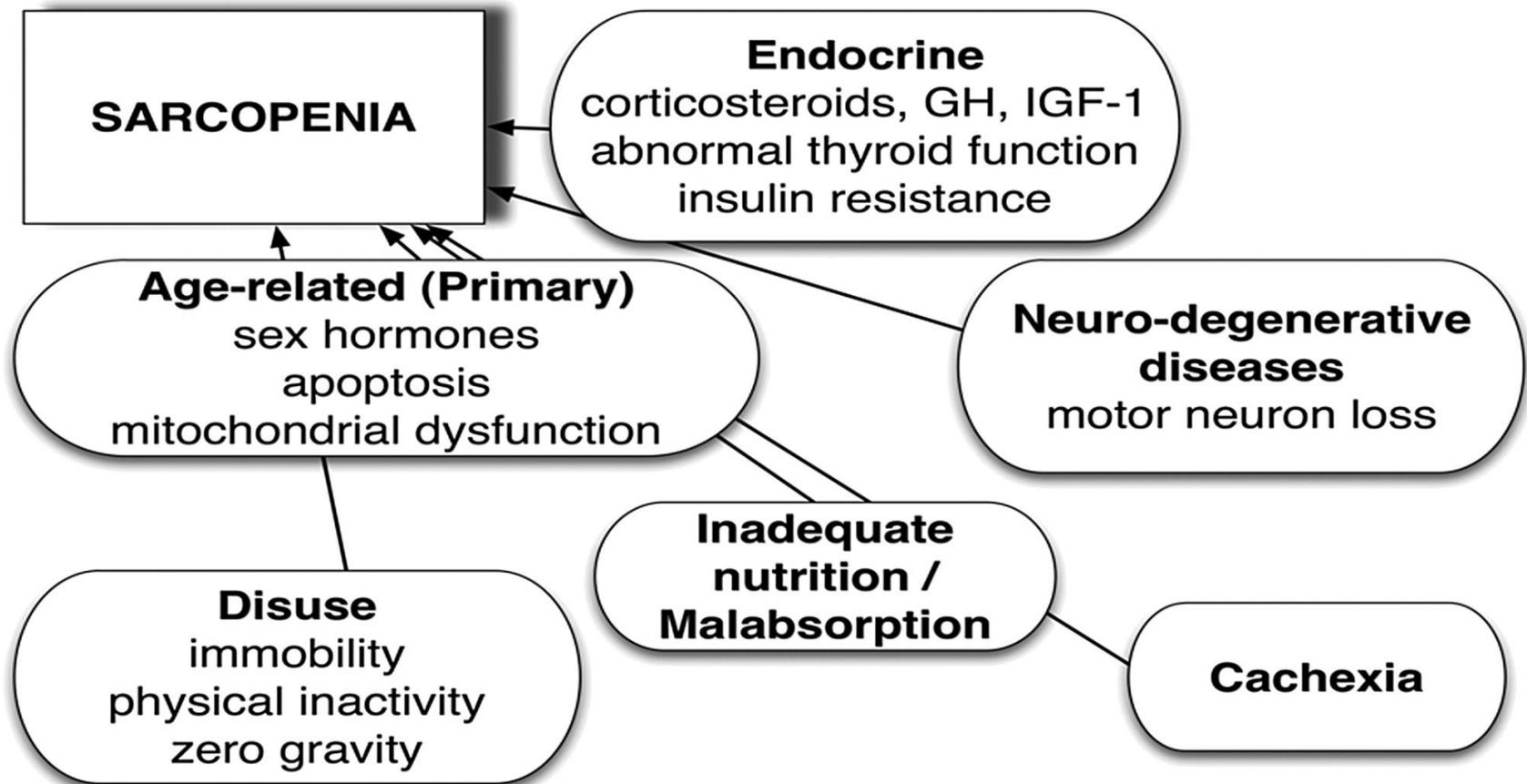


Fig. 2. Survival curves of patients with overweight/obese sarcopenia and patients without overweight/obese sarcopenia.

# Mechanisms of Sarcopenia

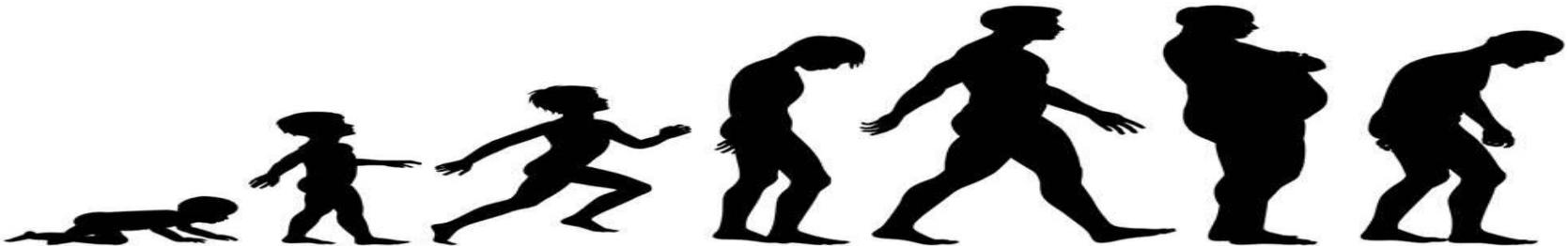


Cruz-Jentoft AJ et al, Age and Aging  
2010;39:412- 423

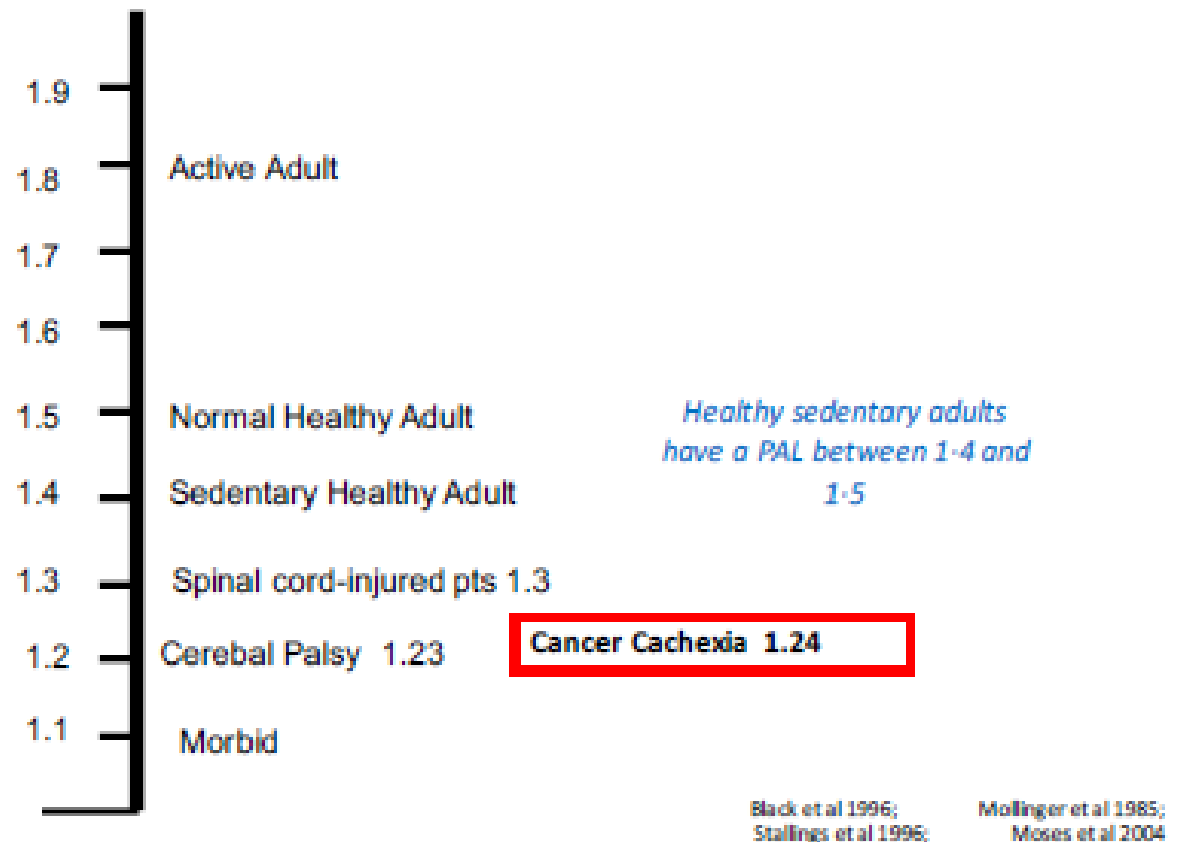
# Primary Sarcopenia

- Aging population, with increasing numbers developing cancer at a later age
- Loss of lean tissue is normal physiological response to ageing
- Anabolic resistance: blunted protein synthetic response to protein intake
- Aggravated by obesity (↑insulin resistance, myosteatorosis, ↑ pro-inflammatory cytokines → “inflammaging”)
- Higher protein intake required, with even protein distribution (min 20g/meal)
- Exercise: Resistance training vs Endurance Exercise

Haran PH et al, JCSM, 2012



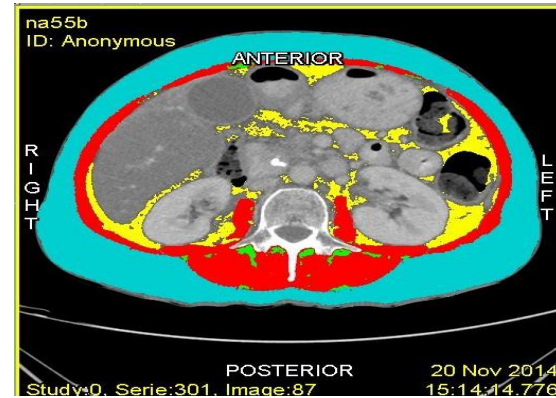
# Physical Activity Levels in Health & Disease



# Body Composition Assessment Methods



**DXA**



**CT/MRI**



**Ultrasound**

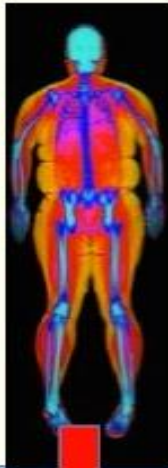


**Bio-Impedance Analysis**

| Technique | Advantages                                                                                    | Disadvantages                                                                                  |
|-----------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| DXA       | Quick<br>3 Compartments<br>Appendicular Muscle<br>Small radiation                             | Access<br>Weight limitations<br>Extreme hydration changes                                      |
| BIA       | Accessible<br>Portable, low cost, no burden<br>Phase angle<br>Useful for longitudinal changes | Assumes constant hydration factor<br>Not accurate in extremes of BMI                           |
| CT/MRI    | Precise<br>Tissue analysis<br>Cancer, COPD, HIV, CVD, Kidney disease, Cirrhosis               | Radiation<br>Opportunistic only                                                                |
| US        | Portable<br>Less costly<br>Quick<br>No radiation<br>Separate SAT and VAT                      | 9 anatomical points needed for analysis<br>Sensitive to hydration changes<br>Protocol required |

Prado C, personal communication 2017

# DEXA



**FAT MASS**

**BONE  
TISSUE**

**SOFT  
LEAN  
TISSUE**

**FAT  
TISSUE**

**FAT  
FREE  
TISSUE**

# CT/MRI



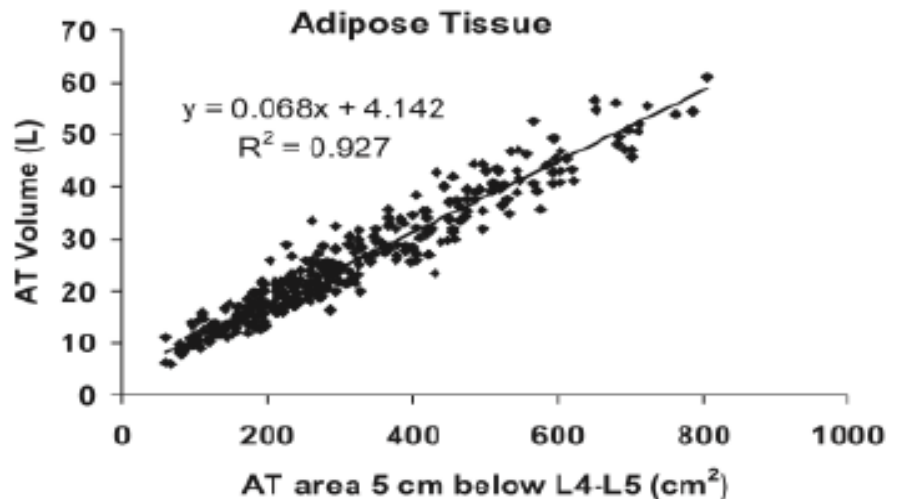
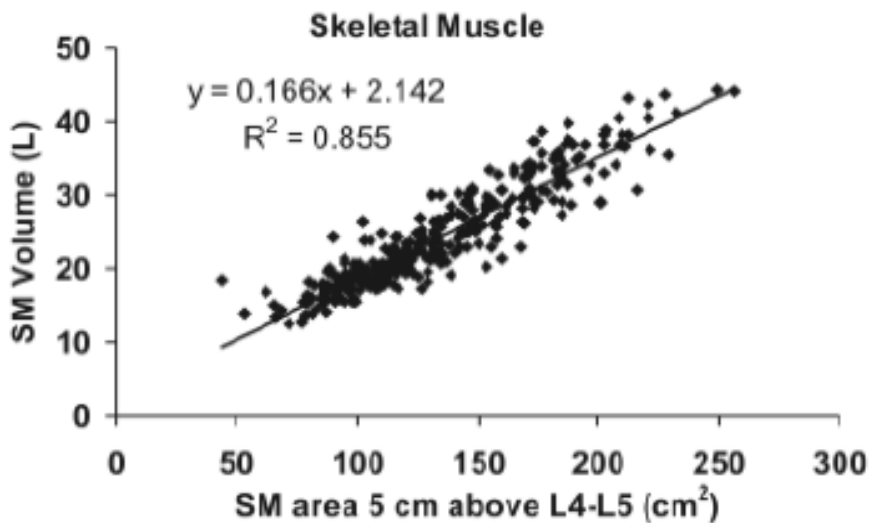
**FAT MASS**

**BONE  
TISSUE**

**LIVER  
KIDNEY  
SPLEEN  
TUMOUR  
INTESTINES  
SKELETAL  
MUSCLE**

# Total Body Skeletal Muscle and Adipose Tissue

Estimation from a single abdominal cross-sectional image

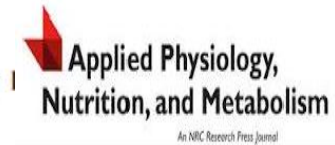


**Best correlate for skeletal muscle seen at L3 (TAMA)**

Shen W., et al. J. Appl. Physiol. 2004; 97: 2333

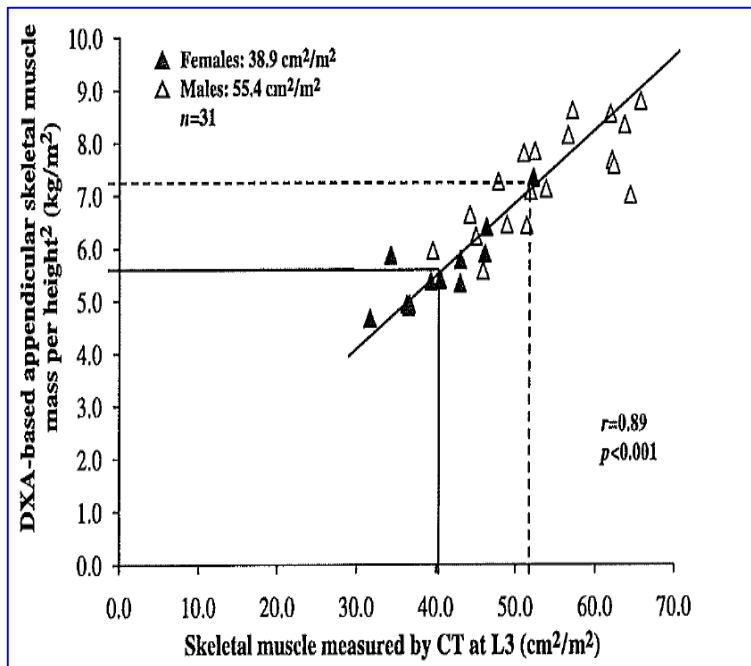
# A practical and precise approach to quantification of body composition in cancer patients using computed tomography images acquired during routine care

Marina Mourtzakis, Carla M.M. Prado, Jessica R. Lieffers, Tony I. Linda J. McCargar, and Vickie E. Baracos



## Cut-off points for sarcopenia

- DXA analysis: males < 7.25 kg/m<sup>2</sup>, females < 5.45 kg/m<sup>2</sup>
- CT analysis: males < 55.4 cm<sup>2</sup>/m<sup>2</sup>, females < 38.9 cm<sup>2</sup>/m<sup>2</sup>



Whole body FFM(kg):

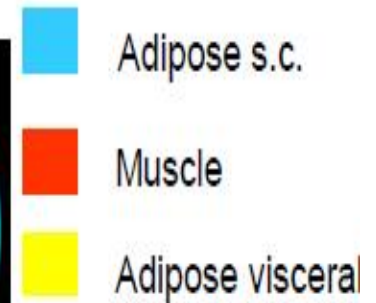
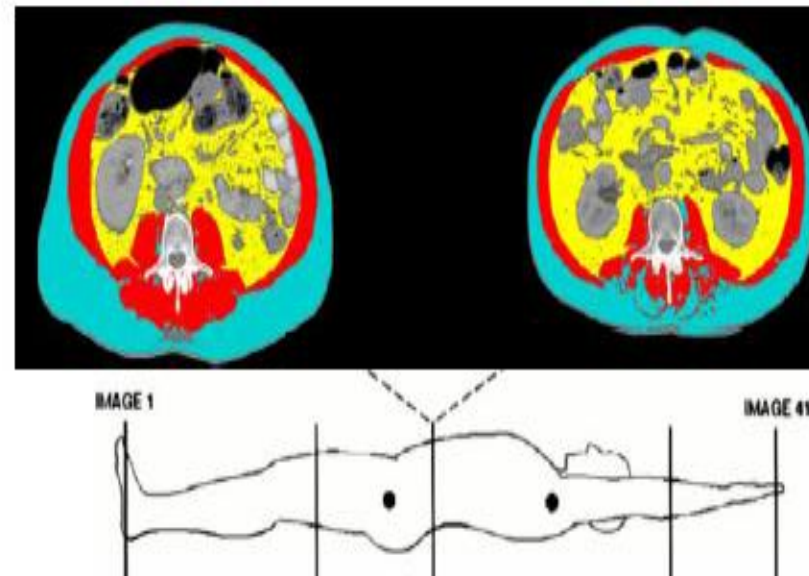
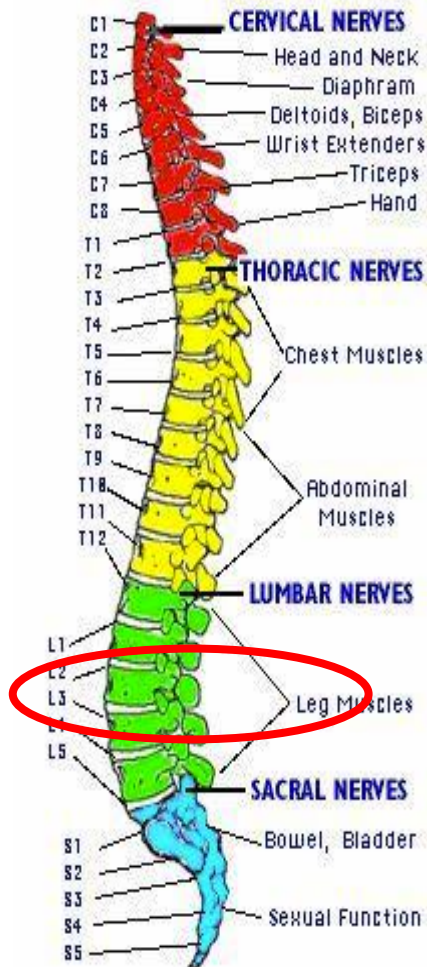
$$0.3 * [\text{skeletal muscle at L3 using CT (cm}^2\text{)}] + 6.06$$

Whole body FM(kg):

$$0.042 * [\text{fat issue at L3 using CT (cm}^2\text{)}] + 11.2$$

Appl. Physiol. Nutr. Metab. 33: 997-1006 (2008)

# Landmarking for CT analysis

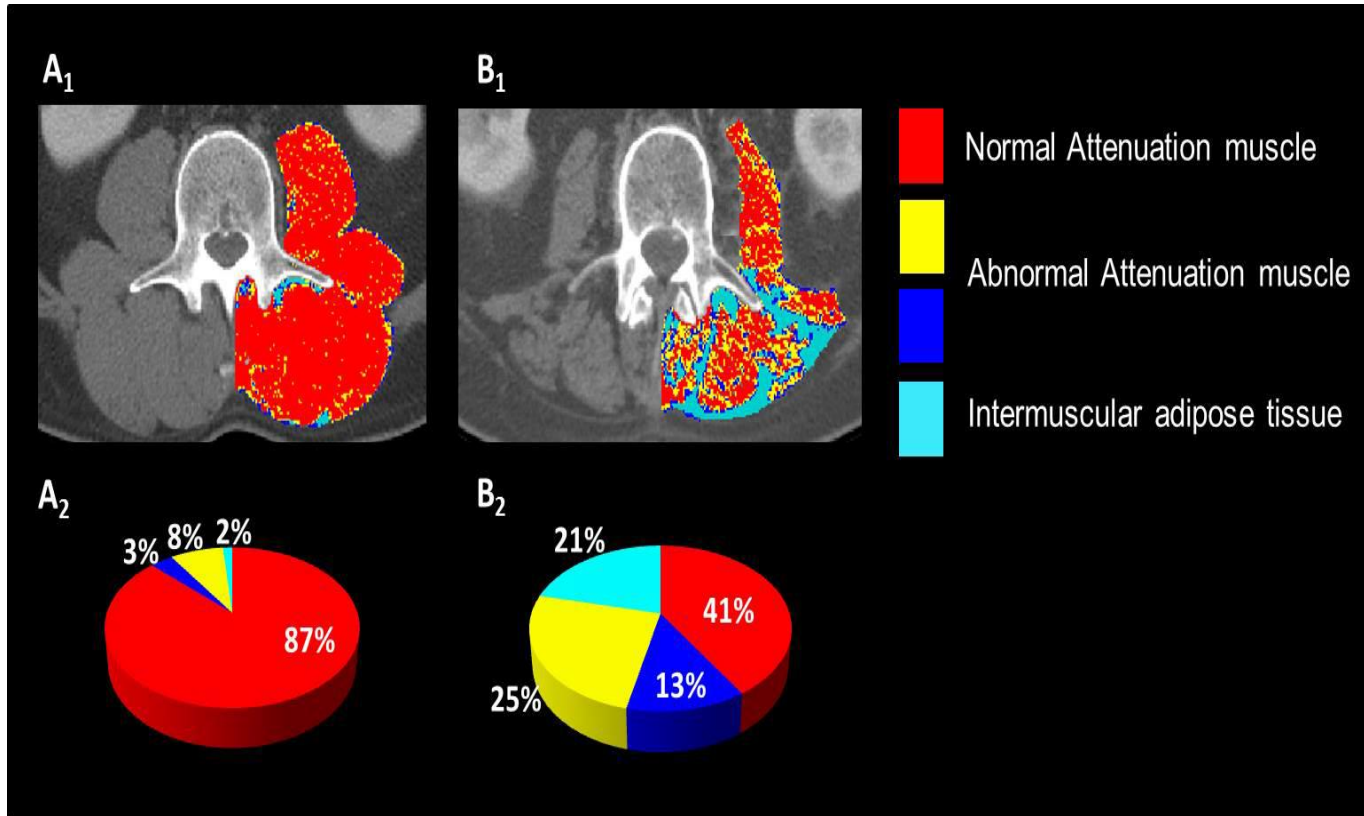


# CT – Based Body Composition

---

- **Multiple software packages – Osirix, Slice-O-matic, Image- J**
- **Hounsfield unit thresholds to discriminate between structures/tissues.**
- **Opportunistic use typically – which may limit timing, controlling for use of contrast enhancement**
- **Requires some anatomical knowledge and training**
- **Automated software in development (latter stages)**
- **Trials in development/ progress to look at alternative chemotherapy dosing strategies**

# Muscle attenuation and/or radio-density



‘Aubrey J et al 2014

## **Sarcopenia: revised European consensus on definition and diagnosis**

**Table 1. 2018 operational definition of sarcopenia**

---

Probable sarcopenia is identified by Criterion 1.

Diagnosis is confirmed by additional documentation of Criterion 2.

If Criteria 1, 2 and 3 are all met, sarcopenia is considered severe.

---

- (1) Low muscle strength
  - (2) Low muscle quantity or quality
  - (3) Low physical performance
-

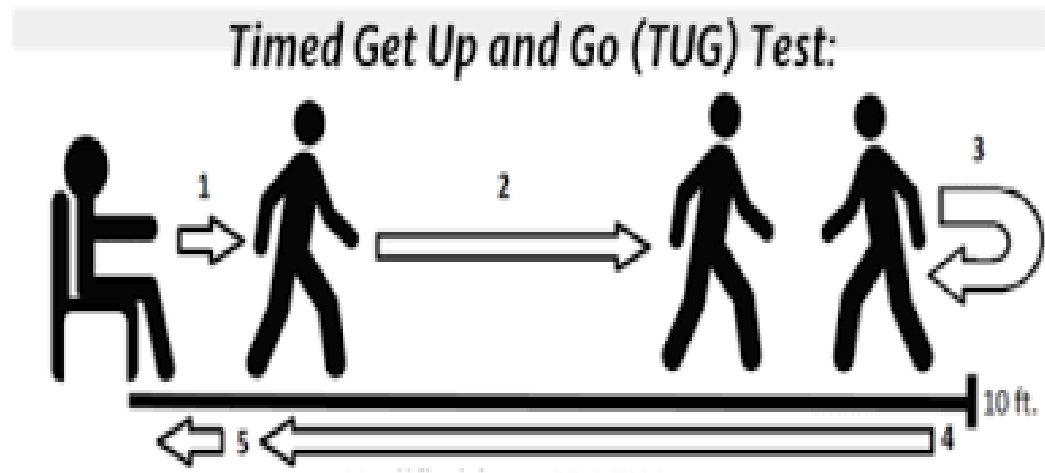
# Body Composition Assessment

Measuring Muscle Mass, strength and function

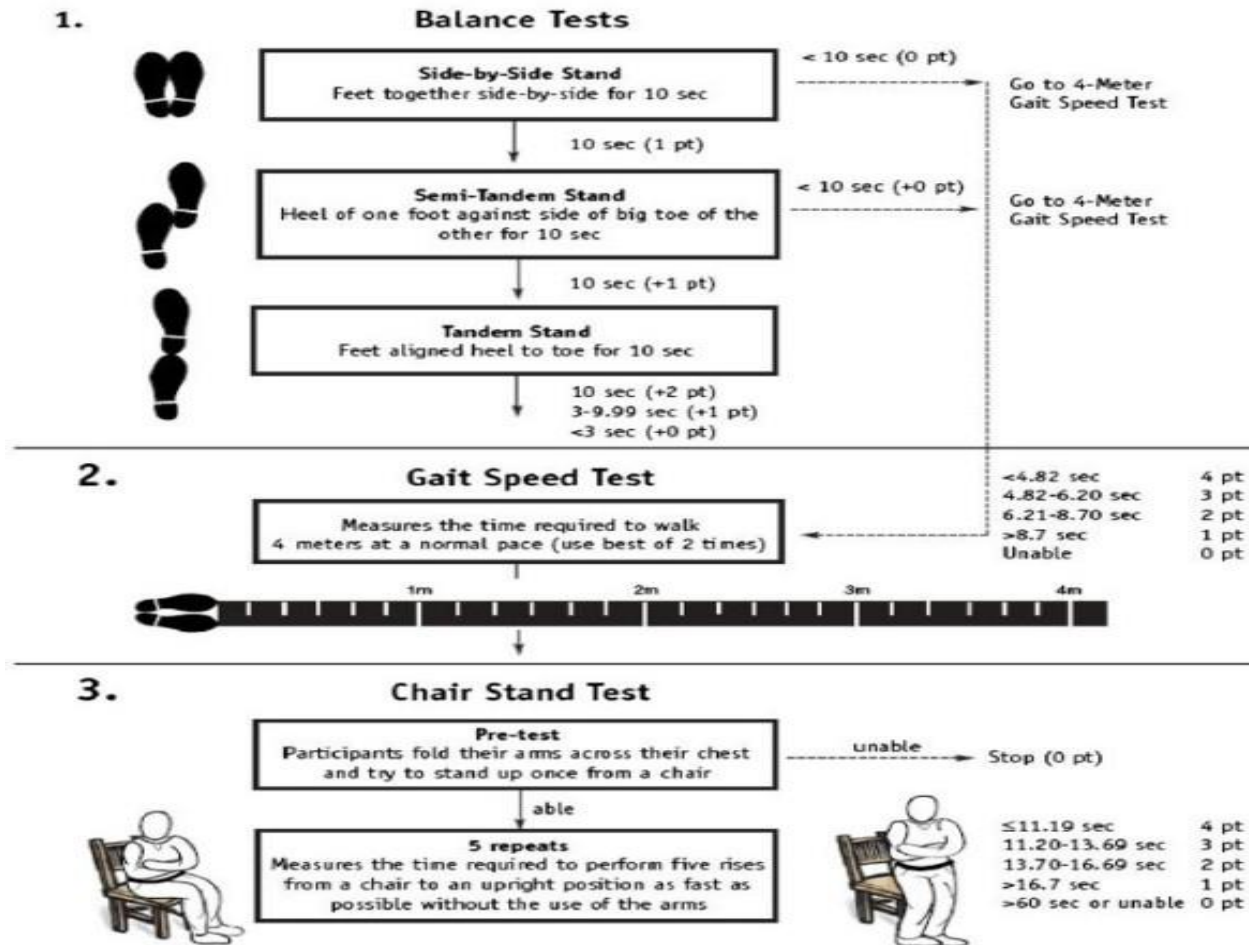
| Variable             | Clinical                                                                            | Research                                                                  |
|----------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Muscle mass          | BIA<br>DXA<br>Anthropometry                                                         | CT<br>MRI<br>DXA<br>BIA                                                   |
| Muscle strength      | Handgrip strength                                                                   | Handgrip strength<br>Knee flexion/extension<br>Peak expiratory flow       |
| Physical performance | Short Physical Performance Battery (SPPB)<br>Usual gait speed<br>Get-up-and-go test | SPPB<br>Usual gait speed<br>Timed get-up-and-go<br>Stair climb power test |

Cruz-Jentoft AJ et al, Age and Aging 2010;39:412- 423

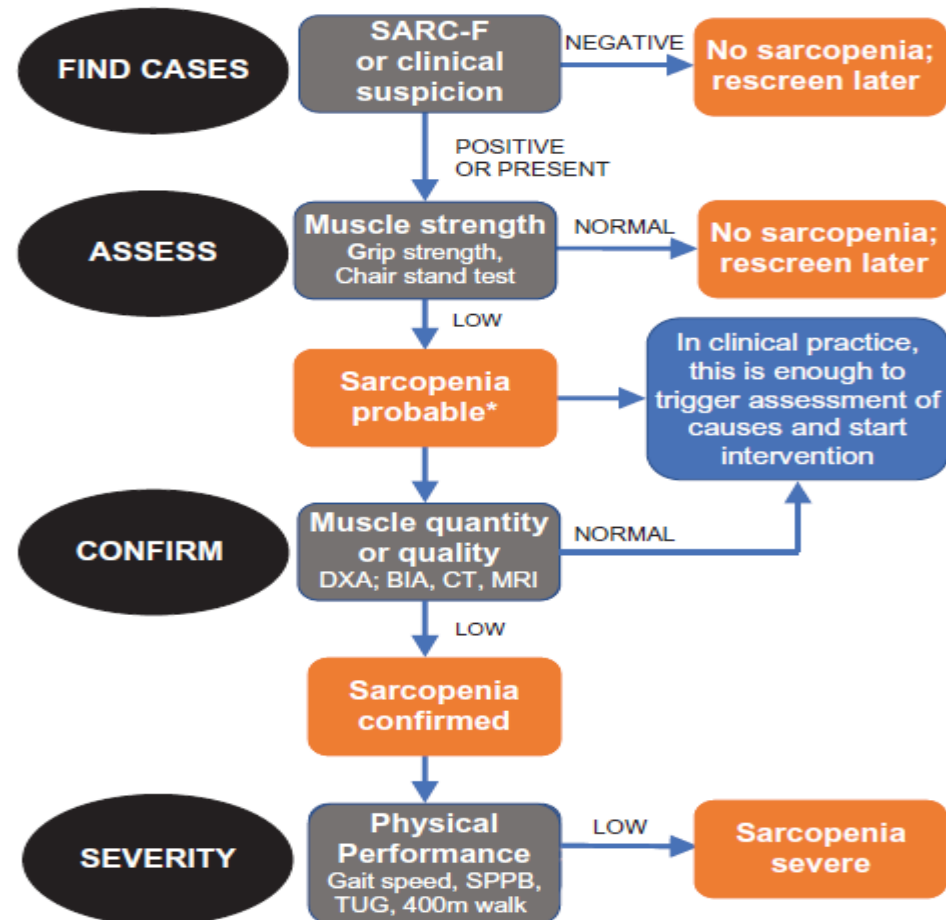
# Timed Up and Go



# Short Physical Performance Battery Test



# EWGSOP2 Suggested Algorithm for Sarcopenia



Cruz-Jentoft AJ et al, Age and Aging 2018

# SARC- F Questionnaire

TABLE. The Simple “SARC-F” Sarcopenia Questionnaire (0-10 points)<sup>3</sup>

| Component             | Question                                                           | Scoring                                                  |
|-----------------------|--------------------------------------------------------------------|----------------------------------------------------------|
| Strength              | How much difficulty do you have in lifting and carrying 10 pounds? | None = 0<br>Some = 1<br>A lot or unable = 2              |
| Assistance in walking | How much difficulty do you have walking across a room?             | None = 0<br>Some = 1<br>A lot, use aids, or unable = 2   |
| Rise from a chair     | How much difficulty do you have transferring from a chair or bed?  | None = 0<br>Some = 1<br>A lot or unable without help = 2 |
| Climb stairs          | How much difficulty do you have climbing a flight of 10 stairs?    | None = 0<br>Some = 1<br>A lot or unable = 2              |
| Falls                 | How many times have you fallen in the last year?                   | None = 0<br>1-3 falls = 1<br>4 or more falls = 2         |

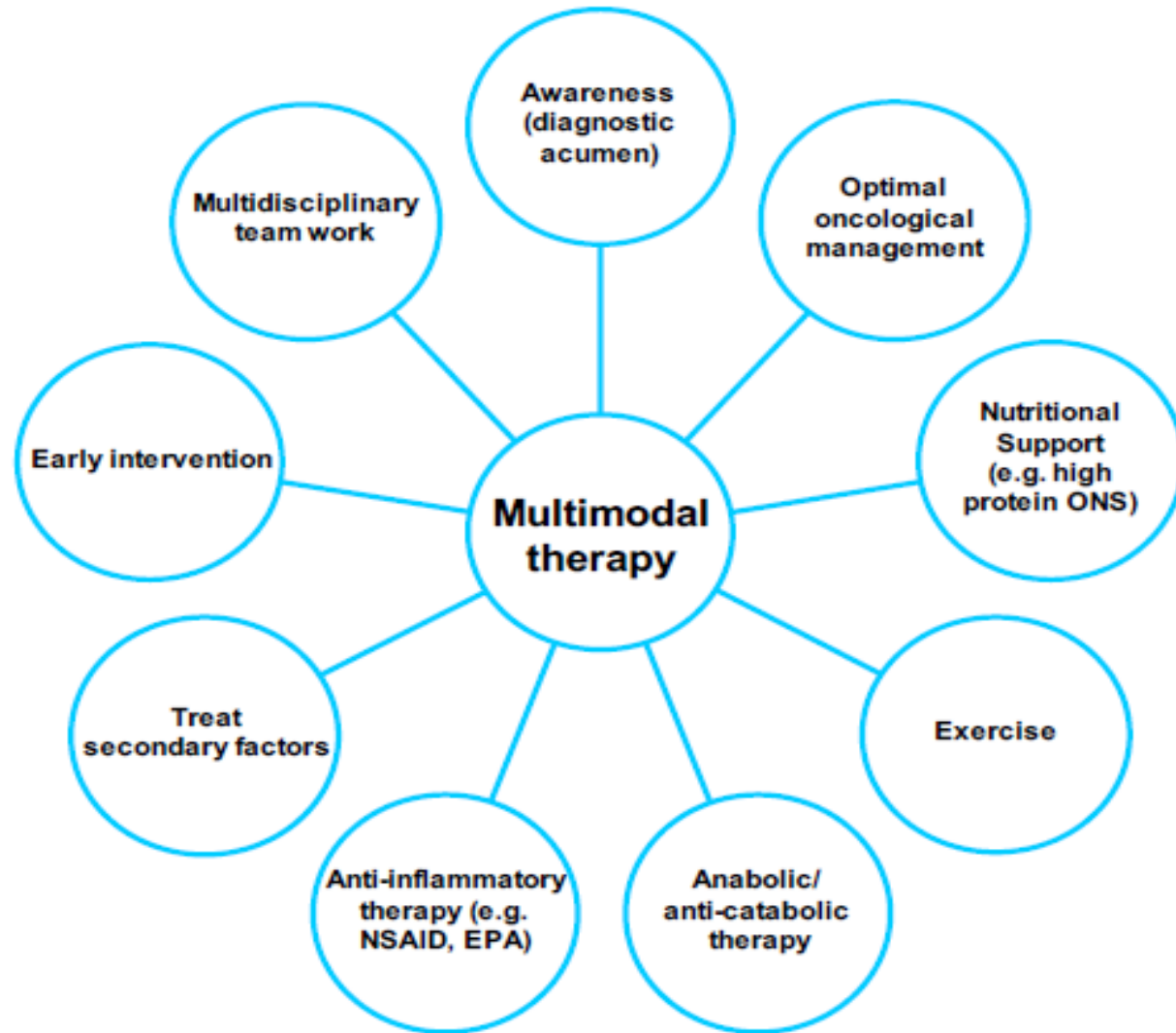
Malmstrom et al, 2015

# EWSOP2 sarcopenia cut-offs

**Table 3.** EWGSOP2 sarcopenia cut-off points

| Test                                                                                | Cut-off points for men                  | Cut-off points for women |
|-------------------------------------------------------------------------------------|-----------------------------------------|--------------------------|
| EWGSOP2 sarcopenia cut-off points for low strength by chair stand and grip strength |                                         |                          |
| Grip strength                                                                       | <27 kg                                  | <16 kg                   |
| Chair stand                                                                         | >15 s for five rises                    |                          |
| EWGSOP2 sarcopenia cut-off points for low muscle quantity                           |                                         |                          |
| ASM                                                                                 | <20 kg                                  | <15 kg                   |
| ASM/height <sup>2</sup>                                                             | <7.0 kg/m <sup>2</sup>                  | <6.0 kg/m <sup>2</sup>   |
| EWGSOP2 sarcopenia cut-off points for low performance                               |                                         |                          |
| Gait speed                                                                          | ≤0.8 m/s                                |                          |
| SPPB                                                                                |                                         | ≤8 point score           |
| TUG                                                                                 |                                         | ≥20 s                    |
| 400 m walk test                                                                     | Non-completion or ≥6 min for completion |                          |

# Multimodal best supportive care



Fearon KC 2012

# MENAC Study

## Phase II results

---

Incurable lung and pancreatic cancer

- Phase II, n= 46
- Multi-modal intervention (Celecoxib 300mg od, Prosure bd, energy and protein targets, home based exercise programme)
- Compliance: 76% Celecoxib, 60% exercise, 48% nutritional supplements

Phase III now underway

- NSAID switched to Ibuprofen

Solheim T et al, JCSM 2017 Oct;8(5) 778-788

# Nutritional assessment in oncology – what should we be measuring? And monitoring?

- Weight loss – severity and duration
- Functional status and muscle strength
- Adequacy of dietary intake
- Absorptive capacity
- Ability to assimilate nutrients (systemic inflammation)

Phenotypic Criteria

Aetiologic  
Criteria

- Nutrition impact symptoms (Disease/treatment)
- Treatment tolerance and QOL.

And ideally (and increasingly necessary)

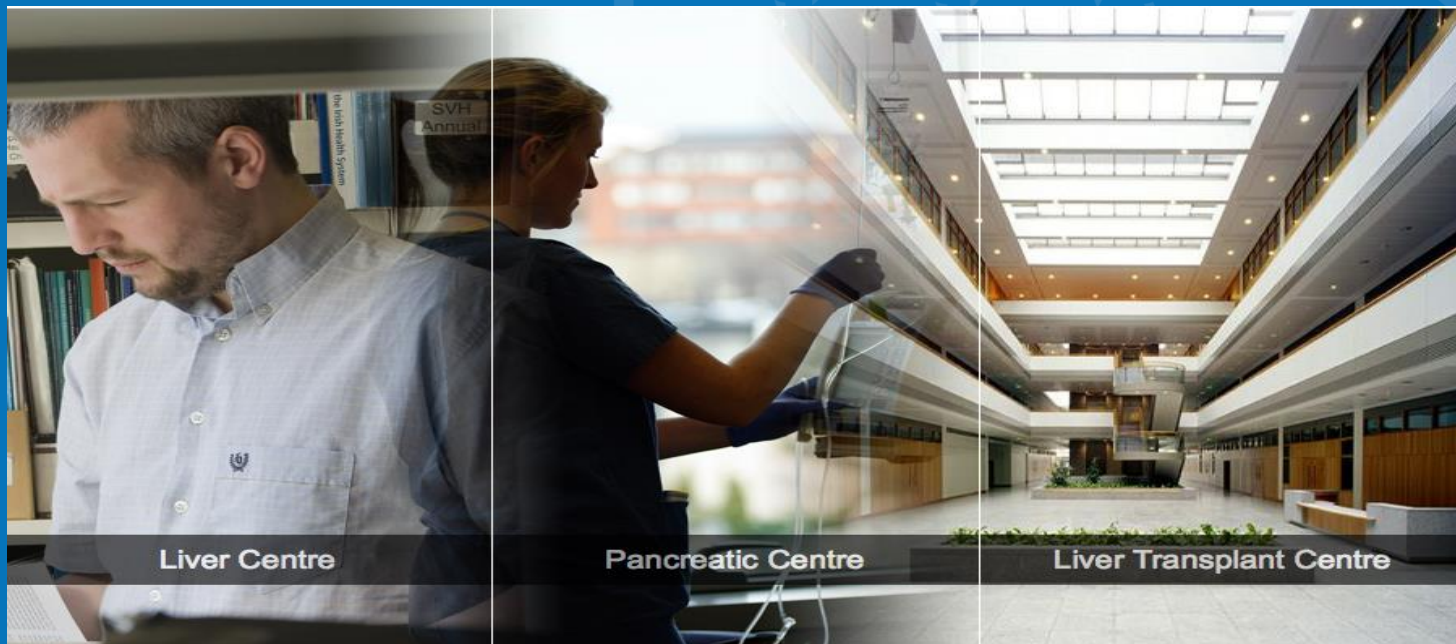
- Formal body composition assessment



**Trinity College Dublin**

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin



**Thank You**

