

The Global leadership initiative on malnutrition (GLIM)

A new diagnostic tool for malnutrition in clinical practice





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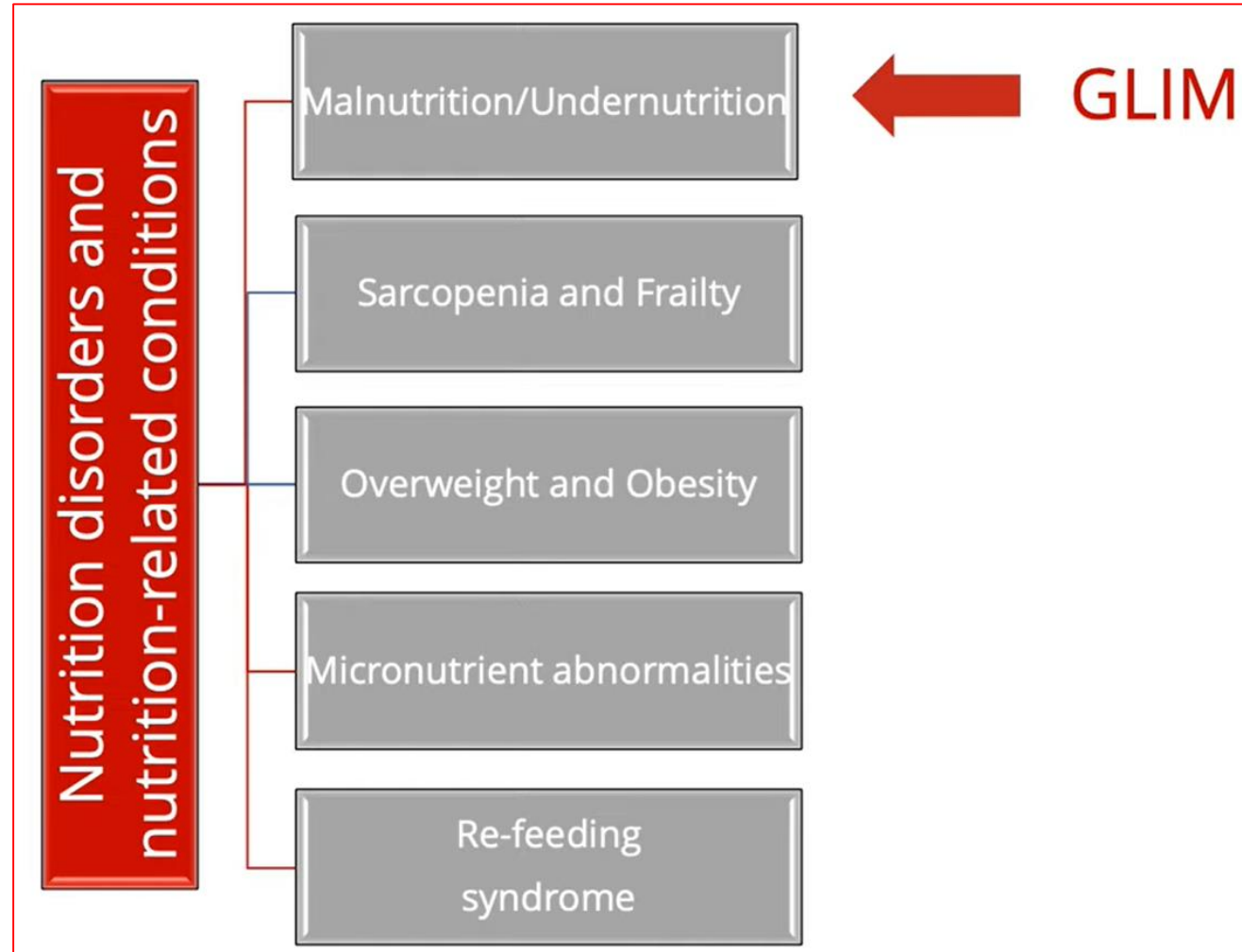
Why the GLIM?

- A core leadership committee with representatives of several of the global clinical nutrition societies was created in January 19th 2016:
- ASPEN (www.nutritioncare.org), 
- ESPEN (www.espen.org), 
- FELANPE (www.felanpeweb.org) 
- PENSA (www.pensa-online.org) 
- The core GLIM leadership committee then created a larger supporting working group comprised of invited members that brought additional global diversity and expertise to the consensus effort.

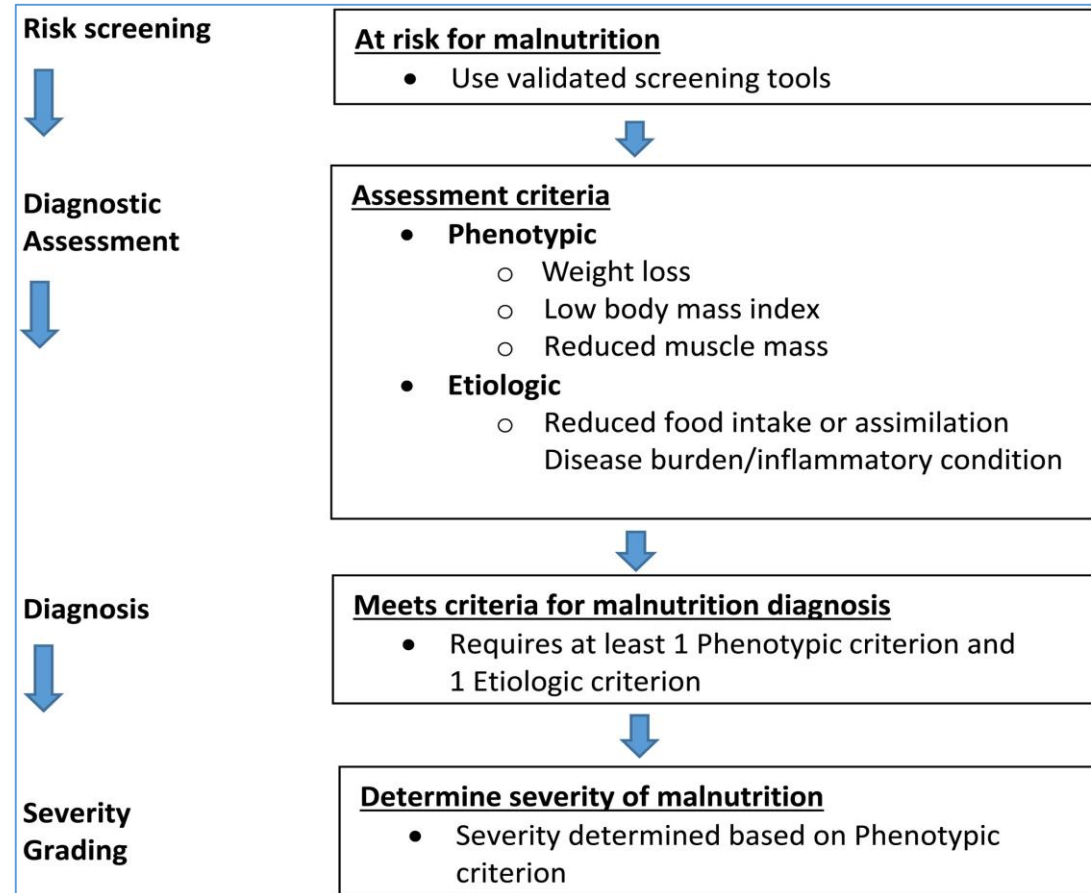
Why the GLIM?

- In order to respond to the needs of the clinical nutrition and medical communities
- Focus on standardizing the clinical practice of malnutrition diagnosis.
- Clarify overlaps with related disease classifications including cachexia.
- **The purpose of this specific initiative is to reach global consensus on the identification and endorsement of criteria for the diagnosis of malnutrition in clinical settings.**

Spectrum of the GLIM



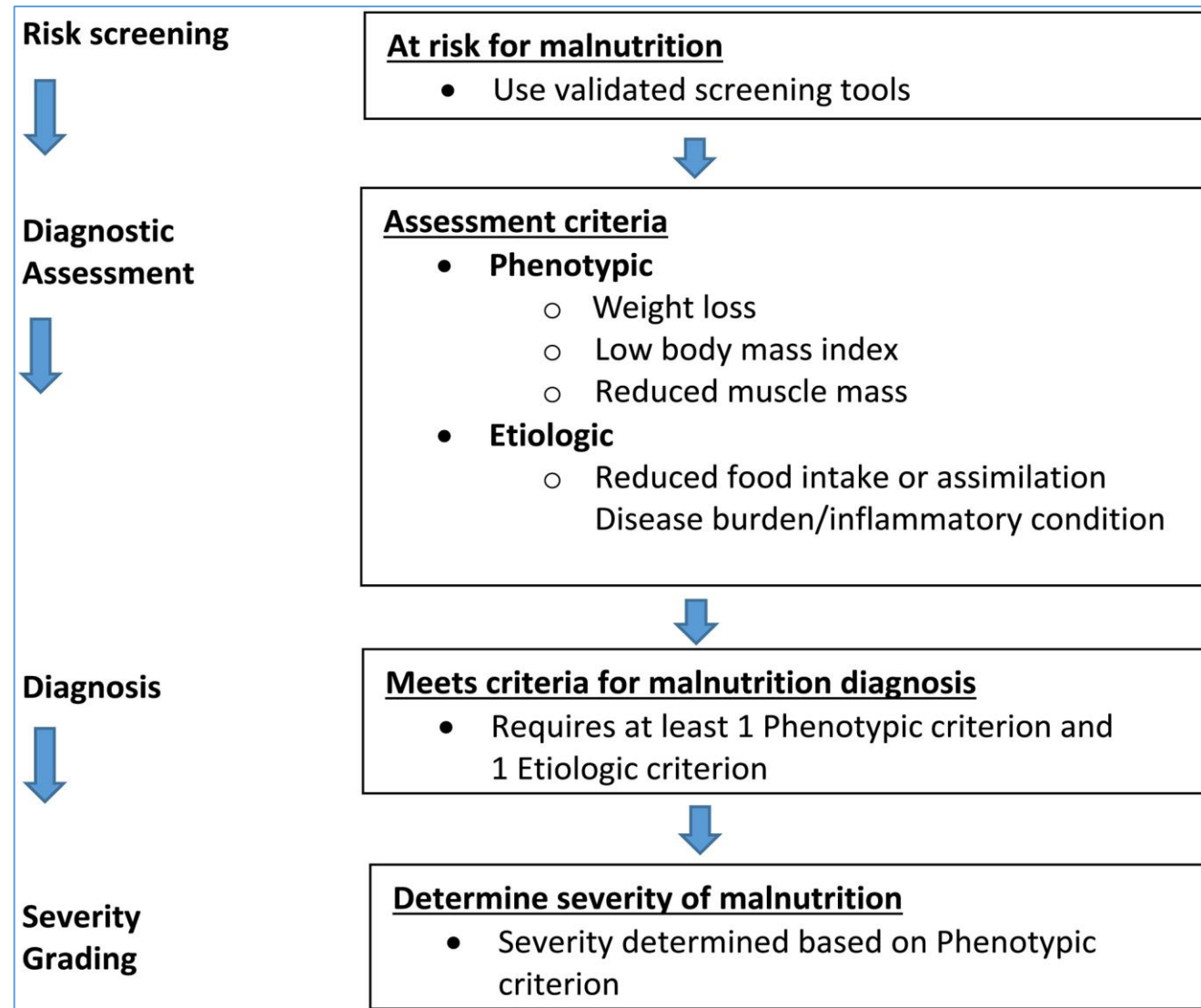
The logic behind the GLIM



Step 1: screening for nutritional risk

Phenotypic Criteria			Etiologic Criteria		
	Weight loss	Low body mass index (kg/m ²)	Reduced muscle mass/muscle function	Reduced food intake	Severe disease/inflammation
NRS-2002 ¹²					
Mild	>5% in 3 mo	NS	NA	50–75% of required preceding week	E.g. hip fracture, chronic disease
Moderate	>5% in 2 mo	18.5–20.5	NA	25–60% of required preceding week	E.g. major abdominal surgery, stroke
Severe	>5% in 1 mo	<18.5	NA	0–25% of required preceding week	E.g. head injury, bone marrow transplantation, intensive care
MNA-SF_a ²¹					
Mild	1–3 kg in last months	21–23	NS	NS	NS
Moderate	“Does not know”	19–21	“Does not go out”	Moderate loss of appetite past 3 mo	Mild dementia
Severe	>3 kg last months	<19	Bed or chair bound	Severe loss of appetite past 3 mo	Acute disease past 3 mo, or severe dementia/depression
MUST ²²					
Medium risk	5–10% in 3–6 mo	18.5–20	NA	NS	NA
High risk	>10% in 3–6 mo	<18.5	NA	Acute illness AND no food intake for >5 d	NA

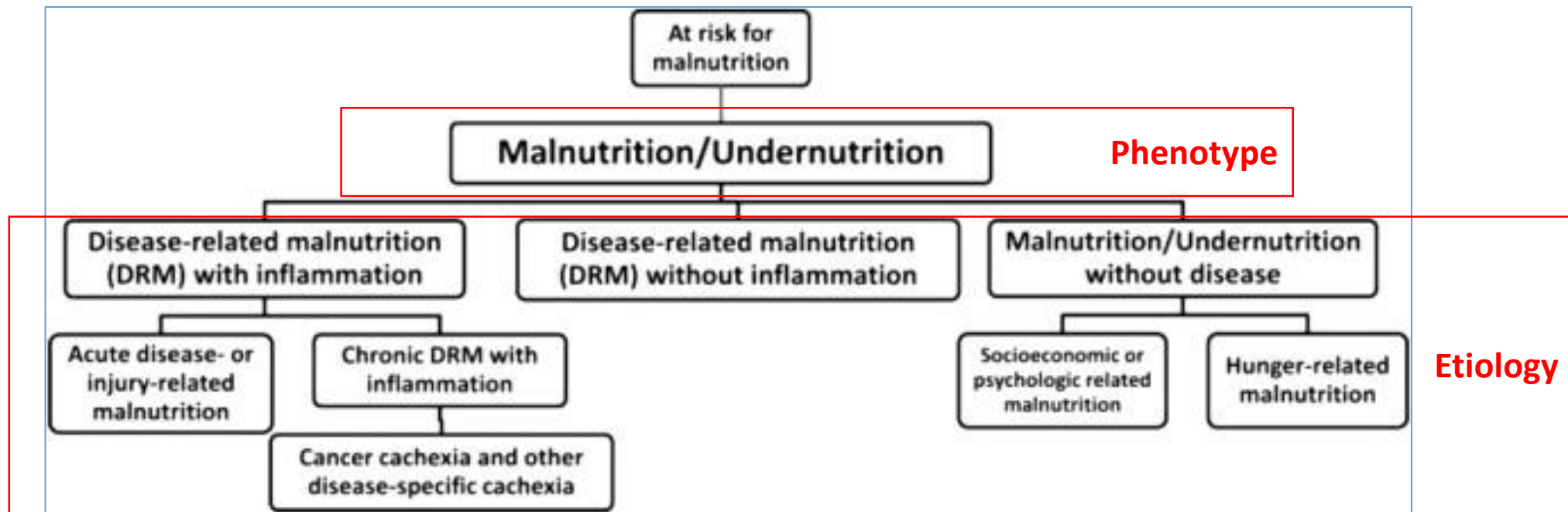
GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community



Step 2: Diagnosis criteria for malnutrition: GLIM

	NRS-2002 ^{12a}	MNA-SF ^{21a'b}	MUST ^{22a}	ESPEN 2015 ^{8a}	ASPEN/AND ^{7a}	SGA ^{4a}	Evans 2008 ^{5c}	PEW 2008 ^{23d}	Fearon 2011 ^{6c}
Etiologies									
Reduced food intake	X	X	X	X	X	X		X	X
Disease burden/inflammation	X	X	X	X	X	X	X	X	X
Symptoms									
Anorexia		X				X	X		X
Weakness		X				X	X		
Signs/Phenotype									
Weight loss	X	X	X	X	X	X	X	X	X
Body mass index	X	X	X	X			X	X	X
Lean/fat free/muscle mass		X		X	X	X	X	X	X
Fat mass					X	X		X	
Fluid retention/ascites					X	X			
Muscle function; e.g. grip strength					X	X	X		
Biochemistry							X	X	

Step 2: Diagnosis criteria for malnutrition: GLIM



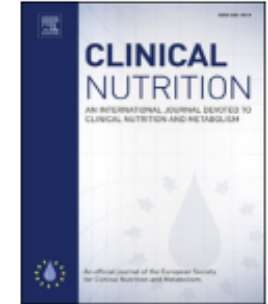


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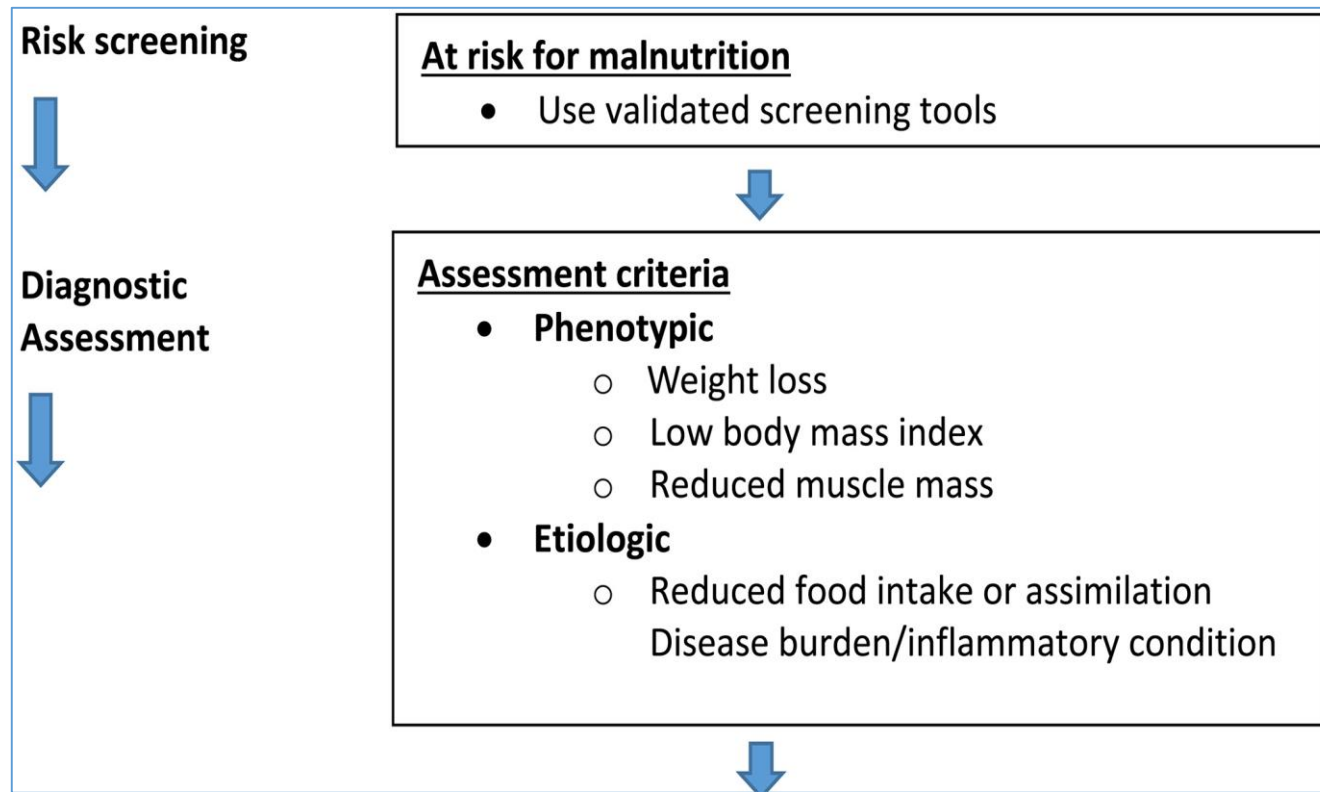
journal homepage: <http://www.elsevier.com/locate/clnu>



ESPEN Endorsed Recommendation

GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community[☆]

T. Cederholm^{a, b, *, 1}, G.L. Jensen^{c, 1}, M.I.T.D. Correia^d, M.C. Gonzalez^e, R. Fukushima^f, T. Higashiguchi^g, G. Baptista^h, R. Barazzoniⁱ, R. Blaauw^j, A. Coats^{k, l}, A. Crivelli^m, D.C. Evansⁿ, L. Gramlich^o, V. Fuchs-Tarlovsky^p, H. Keller^q, L. Llido^r, A. Malone^{s, t}, K.M. Mogensen^u, J.E. Morley^v, M. Muscaritoli^w, I. Nyulasi^x, M. Pirlich^y, V. Pisprasert^z, M.A.E. de van der Schueren^{aa, ab}, S. Siltharm^{ac}, P. Singer^{ad, ae}, K. Tappenden^{af}, N. Velasco^{ag}, D. Waitzberg^{ah}, P. Yamwong^{ai}, J. Yu^{aj}, A. Van Gossum^{ak, 2}, C. Compher^{al, 2}, GLIM Core Leadership Committee, GLIM Working Group³



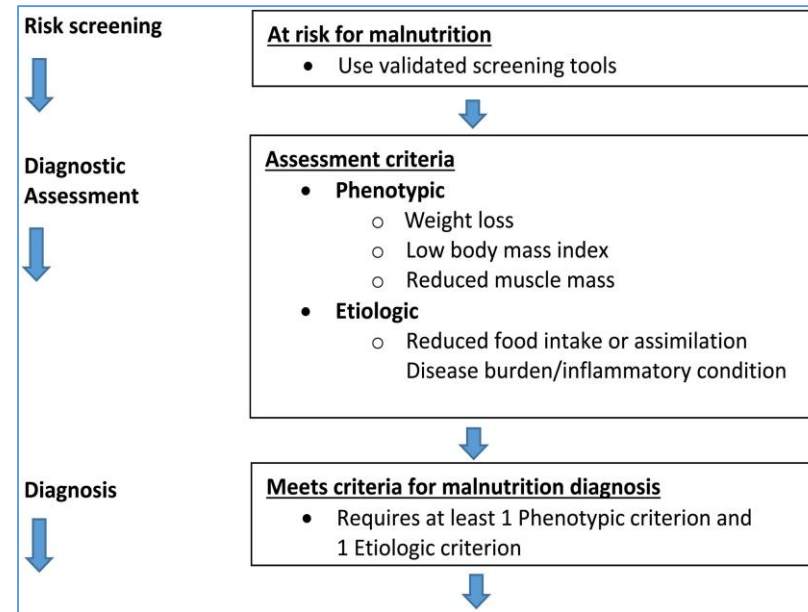
Phenotypic Criteria			Etiologic Criteria	
Weight loss (%)	Low body mass index (kg/m ²)	Reduced muscle mass	Reduced food intake or assimilation	Inflammation
>5% within past 6 months, or >10% beyond 6 months	<20 if <70 years, or <22 if >70 years	Reduced by validated body composition measuring techniques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

Step 2: Diagnosis criteria for malnutrition: GLIM

Body composition cut-offs

	Males	Females
Appendicular Skeletal Muscle Index (ASMI, kg/m ²)	<7.26	<5.25
ASMI, kg/m ²	<7	<6
ASMI, kg/m ²		
- DXA	<7	<5.4
- BIA	<7	<5.7
Fat free mass index (FFMI, kg/m ²)	<17	<15
Appendicular lean mass (ALM, kg)	<21.4	<14.1
Appendicular lean mass adjusted for BMI = ALM/BMI	<0.725	<0.591

Step 3: Grading the severity



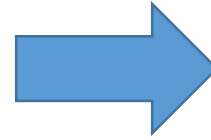
	Phenotypic Criteria ^a		
	Weight loss (%)	Low body mass index (kg/m ²) ^b	Reduced muscle mass ^c
Stage 1/Moderate Malnutrition (Requires 1 phenotypic criterion that meets this grade)	5–10% within the past 6 mo, or 10–20% beyond 6 mo	<20 if <70 yr, <22 if ≥70 yr	Mild to moderate deficit (per validated assessment methods – see below)
Stage 2/Severe Malnutrition (Requires 1 phenotypic criterion that meets this grade)	>10% within the past 6 mo, or >20% beyond 6 mo	<18.5 if <70 yr, <20 if ≥70 yr	Severe deficit (per validated assessment methods – see below)

Glim checklist

	Phenotypic criteria	Check if present
Unintentional Weight loss (%)	> 5% within past 6 months	
	> 10% beyond 6 months	
BMI (kg/m²)	< 20 if < 70 years (Asia: < 18.5)	
	< 22 if ≥ 70 years (Asia: < 20)	
Muscle mass	Reduced	

	Etiologic criteria	Check if present
Reduced food intake	Ingestion ≤ 50% of needs from 1 to 2 weeks	
	Any reduction for > 2 weeks	
or	Any chronic GI condition that adversely impacts food assimilation or absorption	
Assimilation		
Disease burden/ Inflammation	Presence of acute disease/injury or chronic disease related	

Malnutrition: if at least one criterion was checked in each section



Determine Malnutrition Severity			
Severity Grade	Phenotypic Criteria		
	Unintentional Weight Loss (%)	Low BMI (kg/m ²) ^a	Reduced Muscle Mass
Stage 1: Moderate Malnutrition Patient requires 1 phenotypic criterion that meets this grade.	<ul style="list-style-type: none"> • 5-10% in 6 months; or • 10-20% in more than 6 months 	<ul style="list-style-type: none"> • <20 if <70 years; or • <22 if ≥70 years 	<ul style="list-style-type: none"> • Mild-to-moderate deficit (per validated assessment methods on previous page)
Stage 2: Severe Malnutrition Patient requires 1 phenotypic criterion that meets this grade.	<ul style="list-style-type: none"> • >10% in 6 months; or • >20% in more than 6 months 	<ul style="list-style-type: none"> • 18.5 if <70 years; or • <20 if ≥70 years 	<ul style="list-style-type: none"> • Severe deficit (per validated assessment methods on previous page)

What are the advantages of GLIM over other diagnostic criteria?

Combination of criteria to diagnose malnutrition

M.A.E. de van der Schueren et al. / Clinical Nutrition xxx (xxxx) xxx

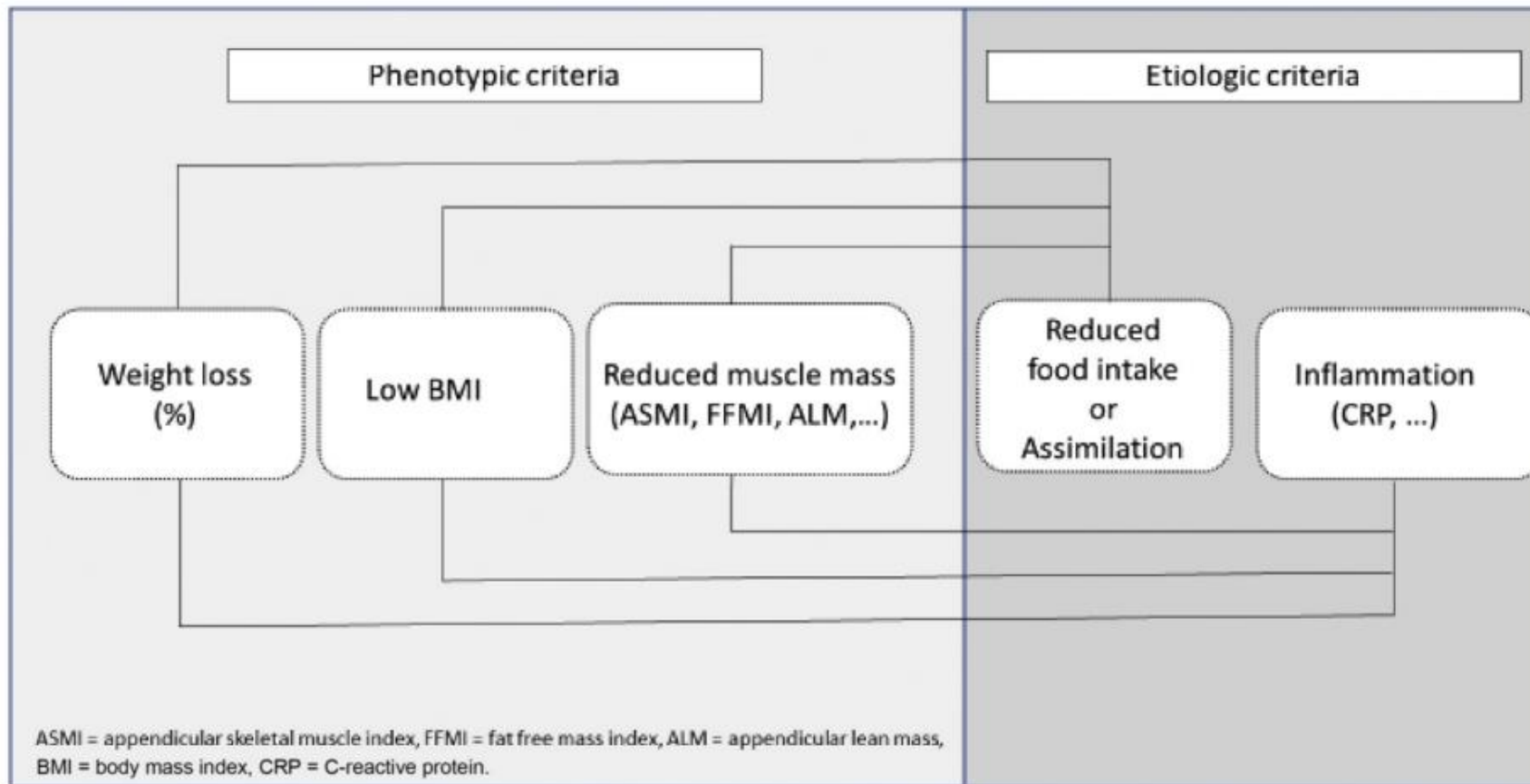
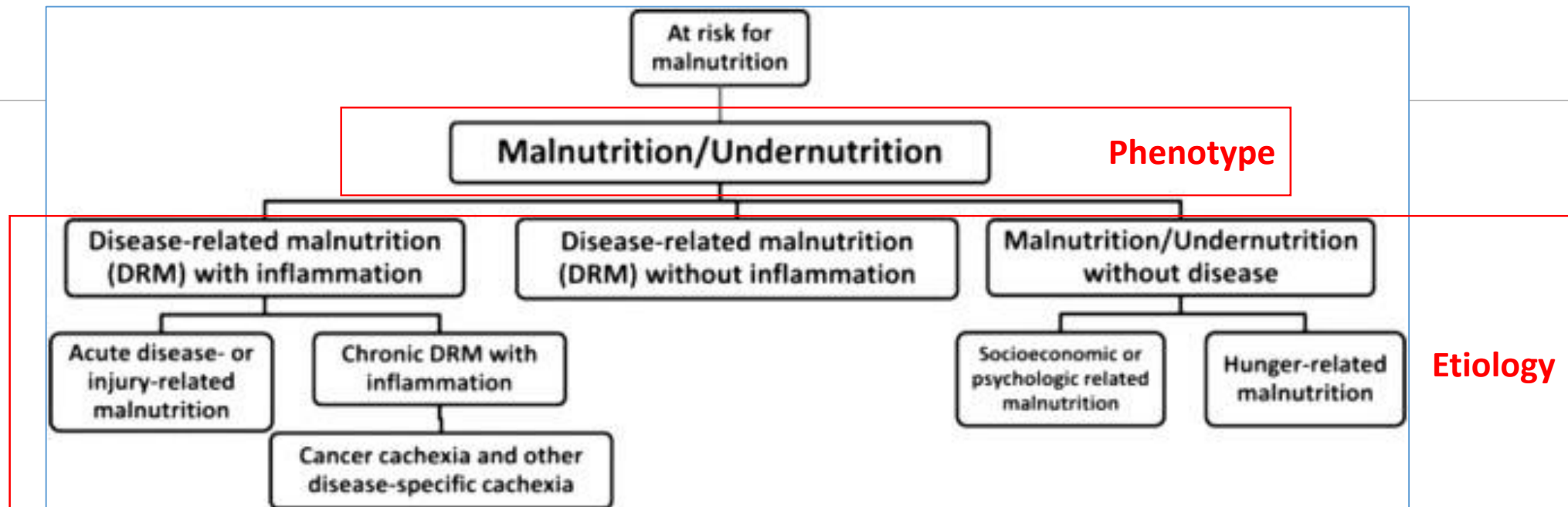


Fig. 1. Potential combinations of GLIM criteria for validation. ALM, appendicular lean mass; ASMI, appendicular skeletal muscle index; BMI, body mass index; CRP, C-reactive protein; FFMI, fat-free mass index; GLIM, Global Leadership Initiative on Malnutrition. Figure adapted with permission from Reference [32].

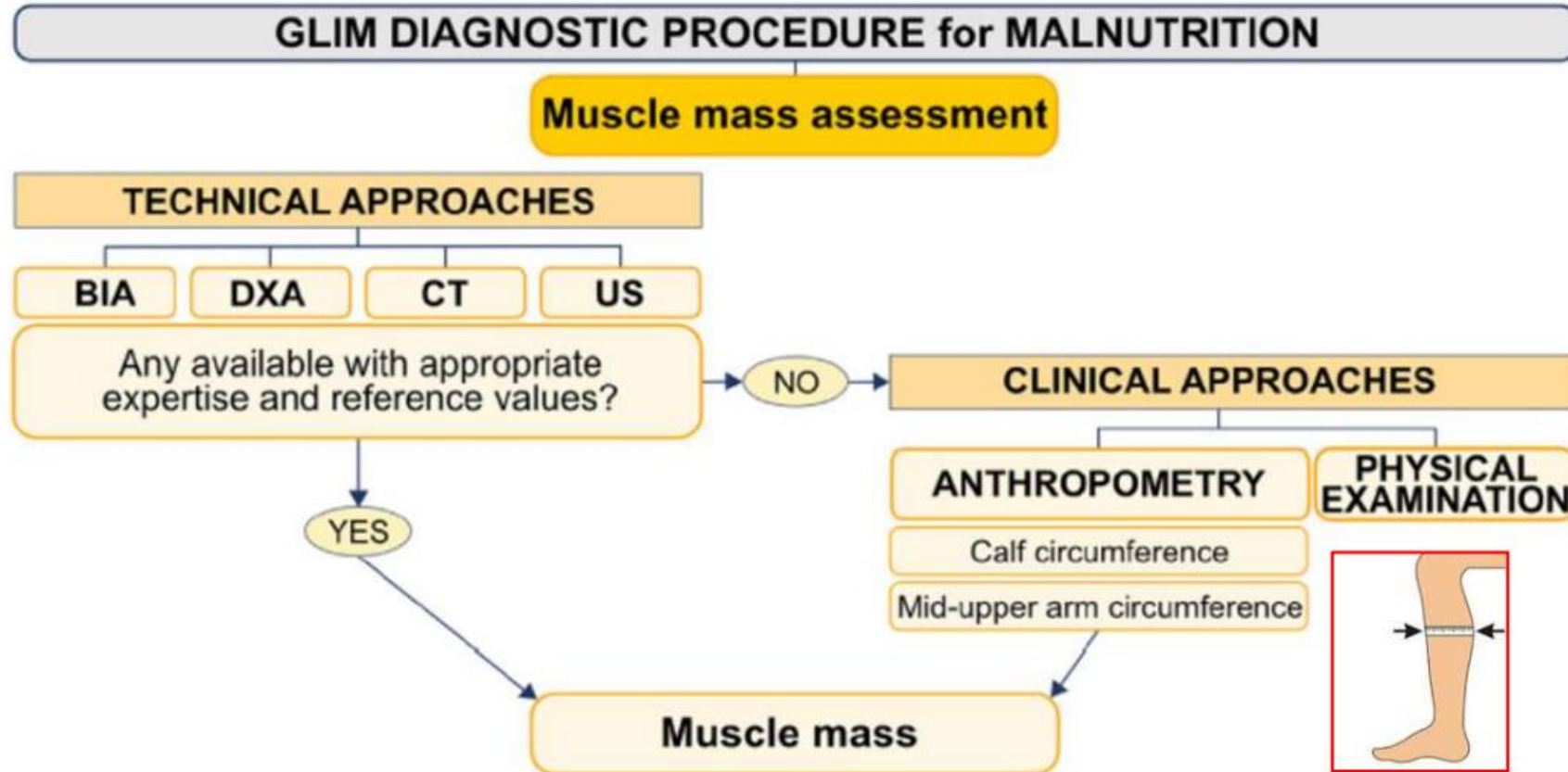
Takes into account the concept of disease related malnutrition

Malnutrition related to

- Chronic disease with inflammation
- Chronic disease with minimal or no perceived inflammation
- Acute disease or injury with severe inflammation
- Starvation including hunger/food shortage associated with socio-economic or environmental factors

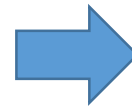
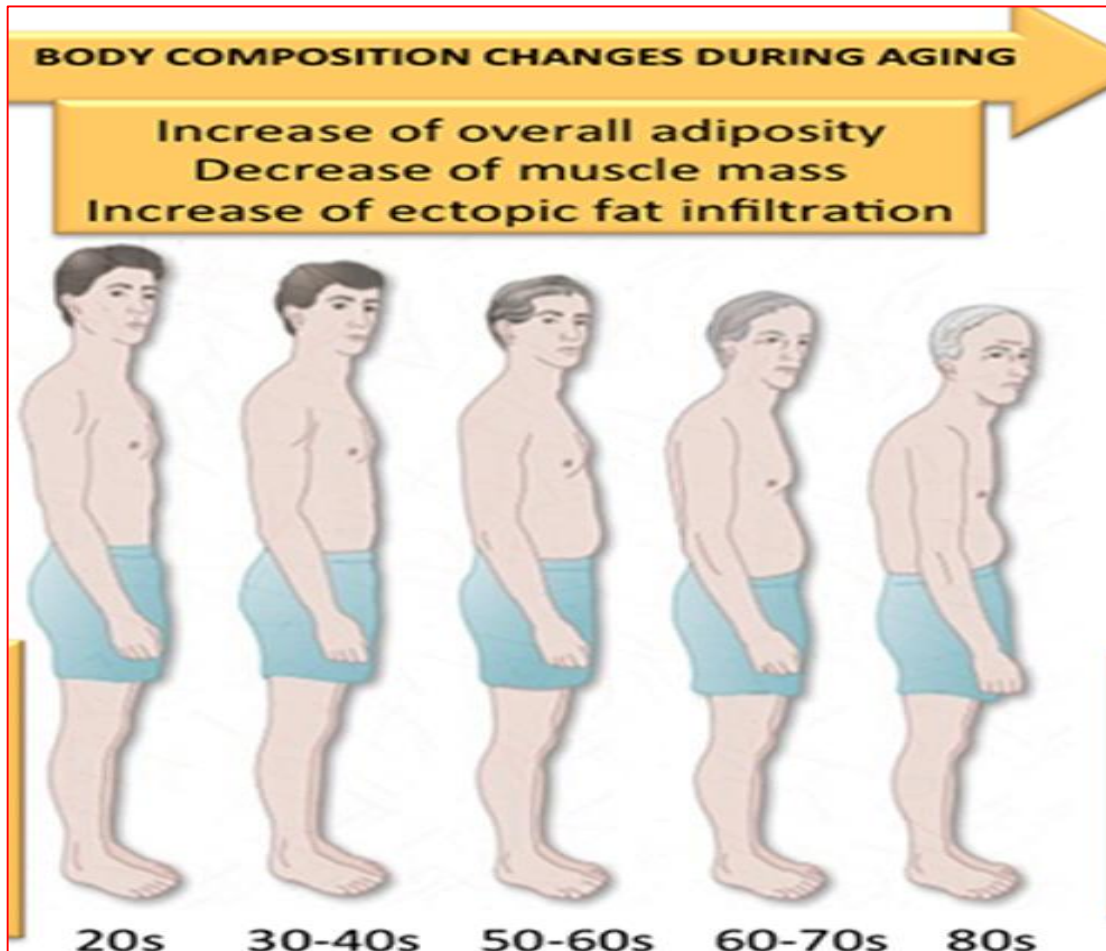


Takes into account the modifications of body composition

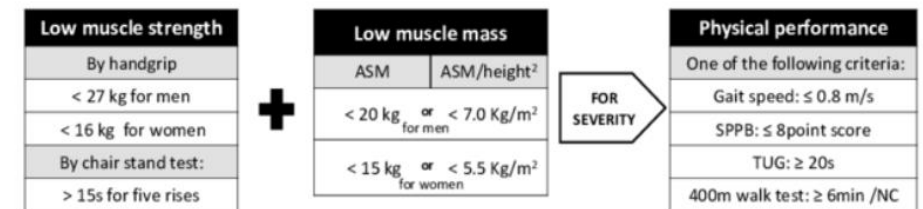
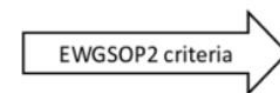


Barazzoni R et al. Clin Nutr 2022

Body composition matters



	Males	Females
Appendicular Skeletal Muscle Index (ASMI, kg/m ²)	<7.26	<5.25
ASMI, kg/m ²	<7	<6
ASMI, kg/m ²		
- DXA	<7	<5.4
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Appendicular lean mass (ALM, kg)	<21.4	<14.1
Appendicular lean mass adjusted for BMI = ALM/BMI	<0.725	<0.591



Where we are?

JPEN

Journal of Parenteral and
Enteral Nutrition

aspen
LEADING THE SCIENCE AND
PRACTICE OF CLINICAL NUTRITION
American Society for Parenteral and Enteral Nutrition

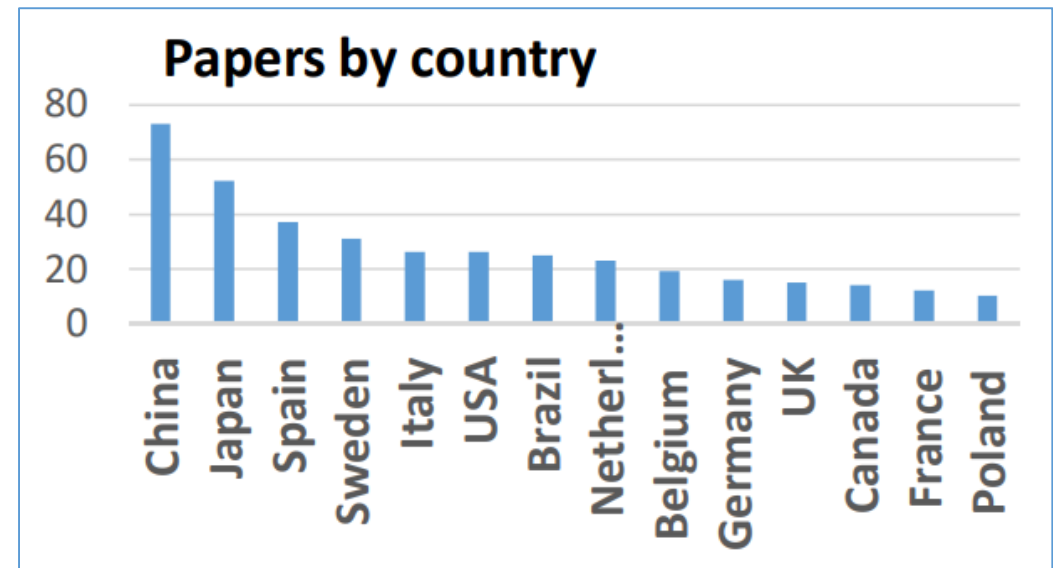
Review |  Full Access

Global Leadership Initiative on Malnutrition (GLIM): Guidance on Validation of the Operational Criteria for the Diagnosis of Protein-Energy Malnutrition in Adults

Heather Keller RD, PhD , Marian A. E. de van der Schueren RD, PhD, for the GLIM Consortium, Gordon L. Jensen MD, PhD, Rocco Barazzoni MD, PhD, Charlene Compher PhD, RD, M. Isabel T. D. Correia MD, PhD, M. Cristina Gonzalez MD, PhD, Harriët Jager-Wittenaar PhD, RD, Matthias Pirlich MD, PhD, Alison Steiber PhD, RDN, Dan Waitzberg MD, PhD, Tommy Cederholm MD, PhD

Where we are?

- Glim bibliometry Jan 2019-2023
- 327 papers in pubmed
- 220 validation studies
- Validation studies:
 - How to define disease: Criterion validity: compared to standard
 - Predictive validity: ability to predict negative outcomes
 - Implementation/ Criterion specification:
 - Muscle mass methodology and cut-off
- burden/inflammation?
- ICD coding for ICD-11 (WHO)

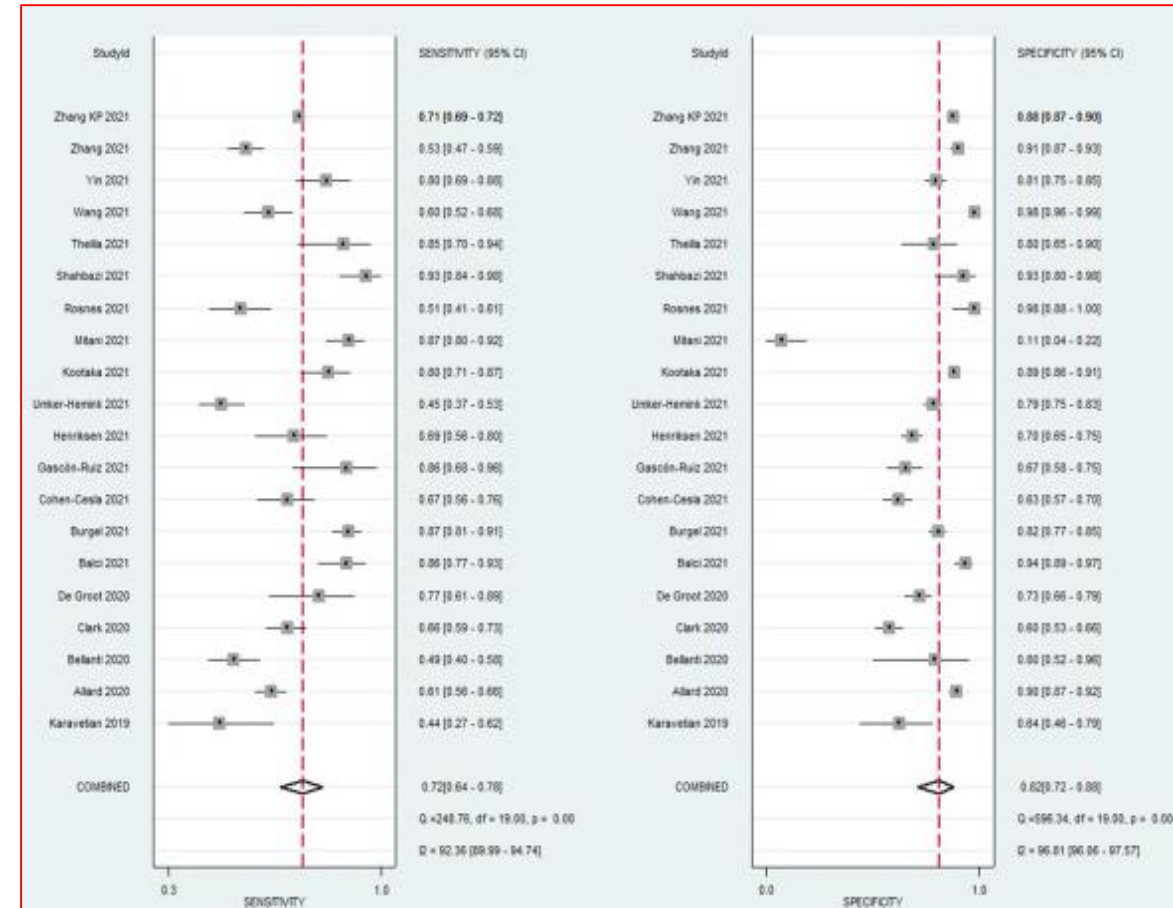
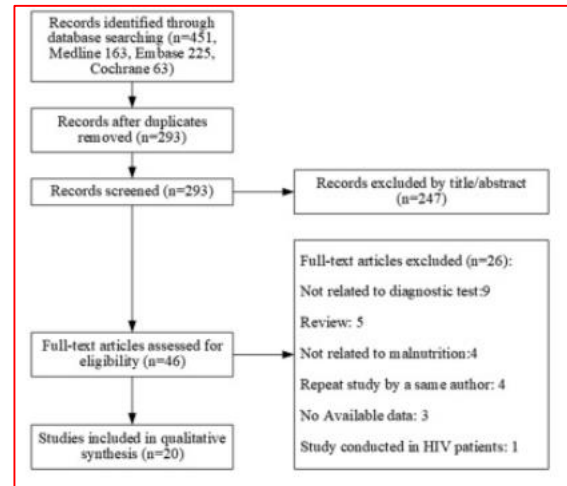


GLIM validation studies

GLIM Criterion validity

GLIM criterion validity:

- 20 studies
 - 13 countries
 - >10.000 patients
 - 7 Cancer
 - 8 Inhospital
 - 2 CKD
 - 2 ICU
 - 1 CVD
-
- 15 studies: SGA or PG-SGA as semi-gold comparator
 - Results:
 - Amalgamated **sensitivity 0.72 (true positives)**
 - Amalgamated specificity 0.82 (true negatives)



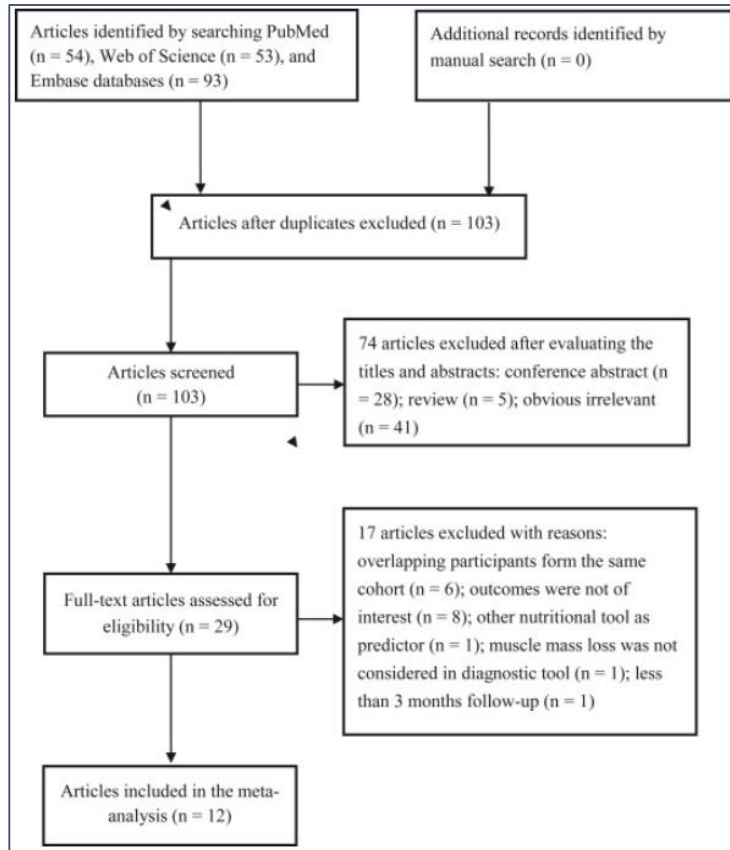
Conclusion: The GLIM criteria “have the potential to be used as the gold standard for diagnosing malnutrition”

GLIM Vs PG-SGA predicitive validity

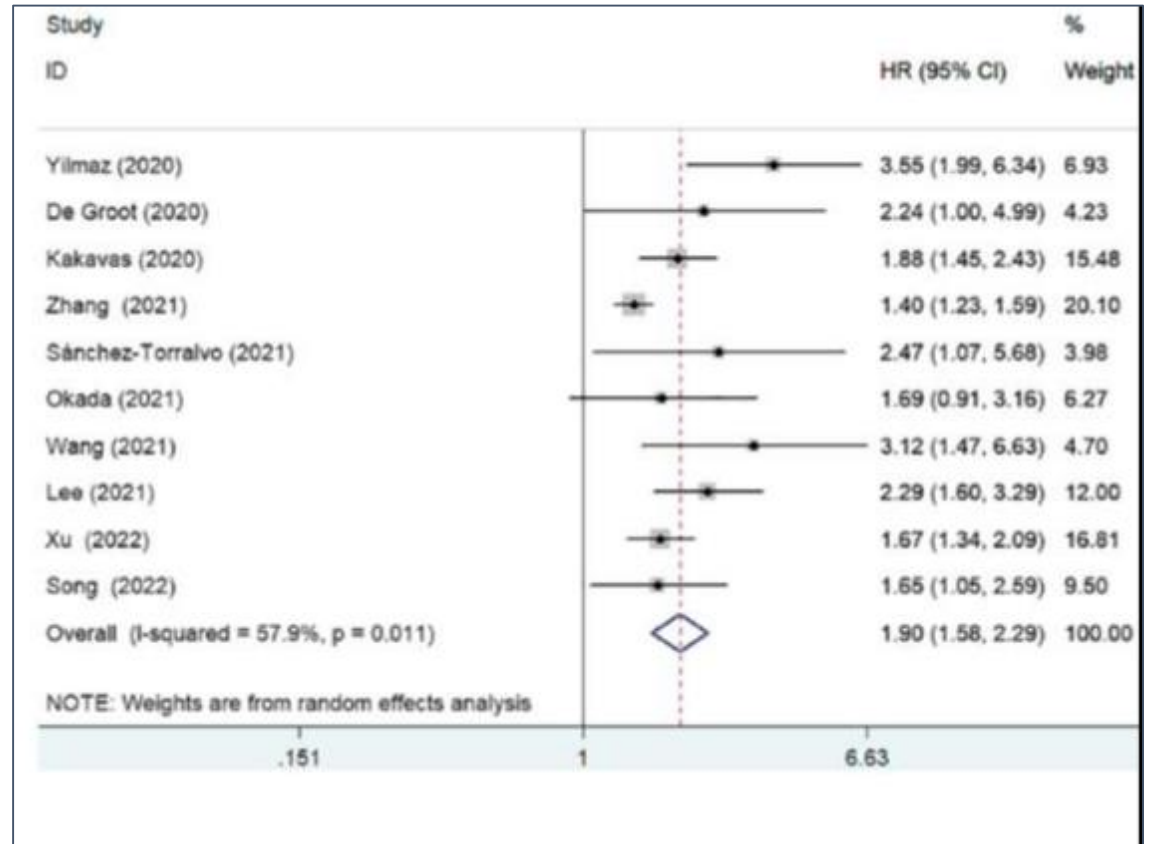
- Exemple of cancer patients
- 468 patients
- 33,7% Vs 39,7% for GLIM
- Results:
 - **GLIM was superior to PG-SGA to predict outcomes in cancer patients**

	Moderate malnutrition		Severe malnutrition		GLIM vs PG-SGA			
	OR (95%CI)	p	OR (95%CI)	p	Changed Log-likelihood	p	AIC	BIC
Severe toxicity								
GLIM criteria	2.0(1.1-3.5)	0.023	3.7(1.4-9.5)	0.008	0.034	0.008	395.653	452.382
PG-SGA	1.5(0.8-2.7)	0.217	2.9(1.3-6.3)	0.007	0.026	0.026	397.905	454.634
Discontinuity of treatment								
GLIM criteria	2.3(0.8-6.5)	0.121	6.6(1.9-23.3)	0.003	0.057	0.015	178.821	235.55
PG-SGA	1.7(0.6-4.9)	0.319	4.7(1.5-15.4)	0.010	0.042	0.046	181.017	237.746
Artificial nutrition support								
GLIM criteria	1.7(0.8-3.4)	0.163	5.9(2.2-15.4)	0.000	0.051	0.002	287.403	344.1322
PG-SGA	1.4(0.7-3.2)	0.365	6.8(2.9-16.1)	0.000	0.078	<0.001	280.7383	337.4675

GLIM predictive validity (cancer patients)



Twelve article reporting on 11 studies including 6799 cancer patients were identified.



Meta-analysis indicated that malnutrition defined by the GLIM was associated with poor overall survival (HR 1.90; 95% CI 1.58-2.29) and disease-free survival (HR 1.51; 95% CI 1.27-1.79), respectively.

From NRS to GLIM?

Score	BMI	Age	3 months weight loss	6 months weight loss	Weight loss beyond 6 months	Body composition	Decrease in food intake	Disease severity
NRS-2002	✓	✓	✓	-	-	-	✓	✓
Glim	✓	✓	✓ (included in the 6 months)	✓	✓	-	✓	✓

GLIM and malnutrition codification

Toward a better codification of malnutrition

The screenshot shows the ICD-11 for Mortality and Morbidity Statistics website. The search bar contains the word "malnutrition". The left sidebar shows a tree view of categories, with "5B54 Underweight in adults" selected. The main content area displays the details for this code, including its parent category "Undernutrition", a description "Body mass index (BMI) <math>< 18.5 \text{ kg/m}^2</math>", and a table of severity levels.

ICD-11 for Mortality and Morbidity Statistics (Version : 02/2022) EN

Search [Advanced Search] Browse Coding Tool Special Views Info

03 Diseases of the blood or blood-forming organs
04 Diseases of the immune system
05 Endocrine, nutritional or metabolic diseases
 Endocrine diseases
 Nutritional disorders
 Undernutrition
 5B50 Underweight in infants, children or adolescents
 5B51 Wasting in infants, children or adolescents

 5B52 Acute malnutrition in infants, children or adolescents
 5B53 Stunting in infants, children or adolescents

 5B54 Underweight in adults
 5B55 Vitamin A deficiency
 5B56 Vitamin C deficiency
 5B57 Vitamin D deficiency
 5B58 Vitamin E deficiency
 5B59 Vitamin K deficiency
 5B5A Vitamin B1 deficiency
 5B5B Vitamin B2 deficiency
 5B5C Vitamin B3 deficiency

Foundation URI : <http://id.who.int/icd/entity/1153296343>

5B54 Underweight in adults

Parent
Undernutrition [Show all ancestors](#)

Description
Body mass index (BMI) <math>< 18.5 \text{ kg/m}^2</math>

Postcoordination

Add detail to **Underweight in adults**

Associated with (use additional code, if desired .)

Search

Has severity (use additional code, if desired .)

XS5W	Mild
XS0T	Moderate
XS25	Severe

In switzerland

	Minimal (E44.1)	Moderate (E44.0)	Severe (E43)
NRS (mandatory)	3	4	≥5
BMI	-	18.5-20.5	<18.5kg
Weight loss	> 5% in 3 months	>5% in 2 months	>5% in 1 month
Food intake	50-75%	25-50%	0-25%

Toward a better codification of malnutrition

The screenshot shows the ICD-11 for Mortality and Morbidity Statistics website. The search bar contains the word "malnutrition". The left sidebar shows a tree view of categories, with "5B54 Underweight in adults" selected. The main content area displays the details for this code, including its parent category "Undernutrition", a description "Body mass index (BMI) <math>< 18.5 \text{ kg/m}^2</math>", and a table of severity levels.

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 5B53 Stunting in infants, children or adolescents

 5B54 Underweight in adults
 5B55 Vitamin A deficiency
 5B56 Vitamin C deficiency
 5B57 Vitamin D deficiency
 5B58 Vitamin E deficiency
 5B59 Vitamin K deficiency
 5B5A Vitamin B1 deficiency
 5B5B Vitamin B2 deficiency
 5B5C Vitamin B3 deficiency

Foundation URI : <http://id.who.int/icd/entity/1153296343>

5B54 Underweight in adults

Parent
Undernutrition [Show all ancestors](#)

Description
Body mass index (BMI) $< 18.5 \text{ kg/m}^2$

Postcoordination

Add detail to **Underweight in adults**

Associated with (use additional code, if desired.)
Search

Has severity (use additional code, if desired.)

XS5W	Mild
XS0T	Moderate
XS25	Severe

A Clinically Relevant Diagnosis Code for “Malnutrition in Adults” Is Needed in ICD-11

T. Cederholm¹, E. Rothenberg², R. Barazzoni³

1. Clinical Nutrition and Metabolism, Department of Public Health and Caring Sciences, Uppsala University, Uppsala, Theme Inflammation & Aging, Karolinska University Hospital, Stockholm, Sweden; 2. Faculty of Health Sciences, Kristianstad University, Kristianstad, Sweden; 3. Department of Medical, Surgical and Health Sciences, University of Trieste, Trieste, Italy

Corresponding Author: Tommy Cederholm, Clinical Nutrition and Metabolism, Department of Public Health and Caring Sciences, Uppsala University, Uppsala, Sweden, tommy.cederholm@pubcare.uu.se

Introduction

Malnutrition is a devastating condition with adverse outcomes in terms of complications, prognosis and quality of life (1-5). It is a complex condition with many aetiologies, that evolves separately or from the interaction between food deprivation and catabolic processes linked to disease-related inflammation.

Textbooks define malnutrition in adults as “a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease”. Caring for malnutrition in clinical settings requires attention to prevention, diagnosis and management of nutritional and metabolic alterations.

International Classifications of Diseases

Urgent need of a clinically relevant ICD-11 diagnosis code for malnutrition in adults

Thus, the clinical picture of malnutrition is characterized by a complex combination of various etiologic factors, like food deprivation and inflammatory conditions, and phenotypic expressions like weight loss and muscle wasting. For this reason, the clinical nutrition community needs an ICD coding of “Malnutrition in adults” that reflects the current malnutrition perception, and that may support clinical decision-making in every day practice.

The pending ICD-11 in its present edition does not meet this requirement. Currently, there are two ICD-11 codes relating to malnutrition in adults. “Underweight in adults” (5B54) appears to be the major malnutrition concept for adults, that is described by BMI<18.5 kg/m². Malnourished adults in healthcare in most regions of the world now rarely fulfil this criterion, at least not until late disease stages. On the contrary, many malnourished

ICD-11 new nomenclature proposal (Cederholm et al)

- Proposal of 4 codes that reflect disease related malnutrition:
 - **5B72 Malnutrition in adults:** When malnutrition is confirmed by the presence of a combination of phenotypic criteria; e.g. weight loss, low body mass index or reduced muscle mass, and etiologic criteria; e.g. reduced food assimilation (intake/digestion/absorption) or disease burden/inflammation.
 - **5B72.0** Malnutrition in adults related to acute or chronic disease, injury or infection **with moderate to severe inflammation**
 - **5B72.1** Malnutrition in adults related to disease with **non-discernible or low level of inflammation**
 - **5B72.2** Malnutrition in adults **related to pure starvation**

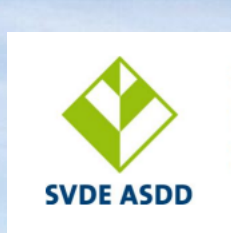
In conclusion

- GLIM criteria are intended to improve screening , diagnosis and grading of malnutrition.
- By composing with phenotypic and etiologic criteria they allow a large possibilities for the diagnosis of malnutrition
- They translate well the concept of disease related malnutrition to clinical practice
- Body composition parameters may allow to diagnose malnutrition in certain circumstances
- Validation studies prove that GLIM is compatible with clinical practice with interesting accuracy
- GLIM should support a better codification of malnutrition compatible with the concept of disease related malnutrition.



Thank you for your attention

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Phenotypic Criteria			Etiologic Criteria		
	Weight loss (%)	Low body Mass Index (kg/m ²)	Reduced muscle mass/muscle function	Reduced food intake	Severe disease/inflammation
SGA ⁴					
Moderate/Stage B	5–10% past 6 mo	NA	Mild to moderate deficits in function or muscle mass	“Definite decrease”	Yes
Severe/Stage C	>10% past 6 mo	NA	Severe deficit in function and muscle mass	“Severe deficit”	Yes
Evans 2008 ⁵					
Cachexia	>5% in <12 mo	<20	Low FFMI, decreased muscle strength	“Anorexia”	Increased CRP/IL6, low serum albumin (<3.2 g/l)
PEW 2008 ²³					
Protein-energy wasting	>5% in 3 mo, or > 10% in >6 mo	<23	Muscle mass down by 5% last 3 mo, or > 10% in >6 mo. Reduced MAC	Energy intake <25 kcal/kg BW/d for >2 mo	Chronic kidney disease, Serum albumin <3.8 g/dl
Fearon 2011 ⁶					
Precachexia	<5%	NA	NA	“Anorexia”	Metabolic change
Cachexia	>5% in 6 mo (>2%)	<20 (when WL > 2%)	Sarcopenia - ASMI 7.26/5.45 kg/m ² (m/w) when WL >2%	“Often reduced food intake”	Cancer with catabolic drive (systemic inflammation)
ASPEN/AND 2012 ⁷					
Moderate	1–2% in 1 w to 20% in 1 y	NA	Mild muscle loss	<75% of ER for 7 d-3 mo	Yes
Severe	>2% in 1 week to >20% in 1 year	NA	Moderate to severe muscle loss, or reduced grip strength	<50% of ER for >5 d- < 1 mo	Yes
ESPEN 2015 ⁸					
Malnutrition	>5% past 3 mo, or > 10%	<18.5, or <20 (<70y)/ <22(>70y)	FFMI <15 kg/m ² (f), <17 kg/m ² (m)	According to any validated tool	NA