ACADEMIA LATINOAMERICANA
DE MEDICINA DEL ADULTO MAYOR

ALMA

De la sarcopenia al deterioro funcional

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Instituto de Geriatría

Institutos Nacionales de Salud de México

red envejecimiento y fragilidad

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

Instituto de Geriatría
Por un envejecimiento sano y activo

Red Temática
ESDS
Envejecimiento, Salud y Desarrollo Social

PLAN DE LA PRESENTACION

- La masa, la función muscular y el envejecimiento
- El proceso de discapacidad
- La pérdida de potencia muscular como determinante de la discapacidad
- Mecanismos posibles
- Una aproximación epidemiológica que desemboca en la clínica

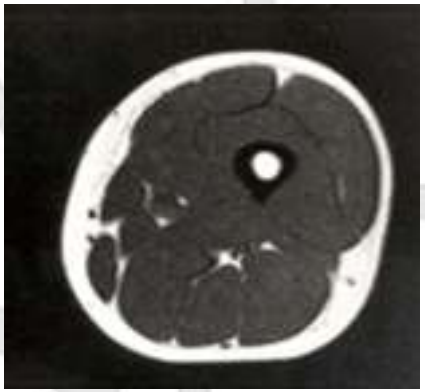
Sarcopenia y deterioro funcional: las grandes preguntas.

- Creencias actuales: la merma de la movilidad con la edad se debe a disminución de la masa muscular.
- Sin embargo, estudios como el Health ABC han mostrado que:
  - La fuerza declina 3 veces más rápido que la masa
  - La debilidad y la infiltración grasa correlacionan con la discapacidad
  - Luego de ajustar por fuerza y grasa muscular, la asociación con masa muscular y riesgo de discapacidad pierde significancia
- El decremento en la calidad del músculo es más importante que la masa
- ¿Que cualidad del músculo determina la movilidad?
- ¿Cuáles son los mecanismos que vinculan la calidad del músculo y la infiltración adiposa con la función muscular?

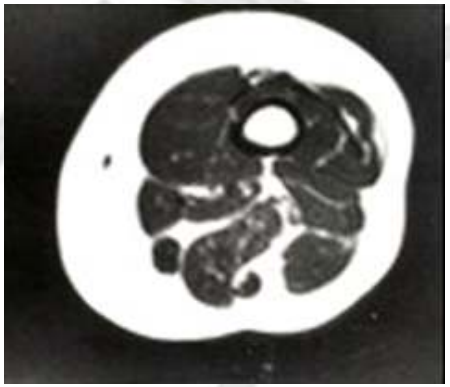
La masa muscular y el envejecimiento



Años

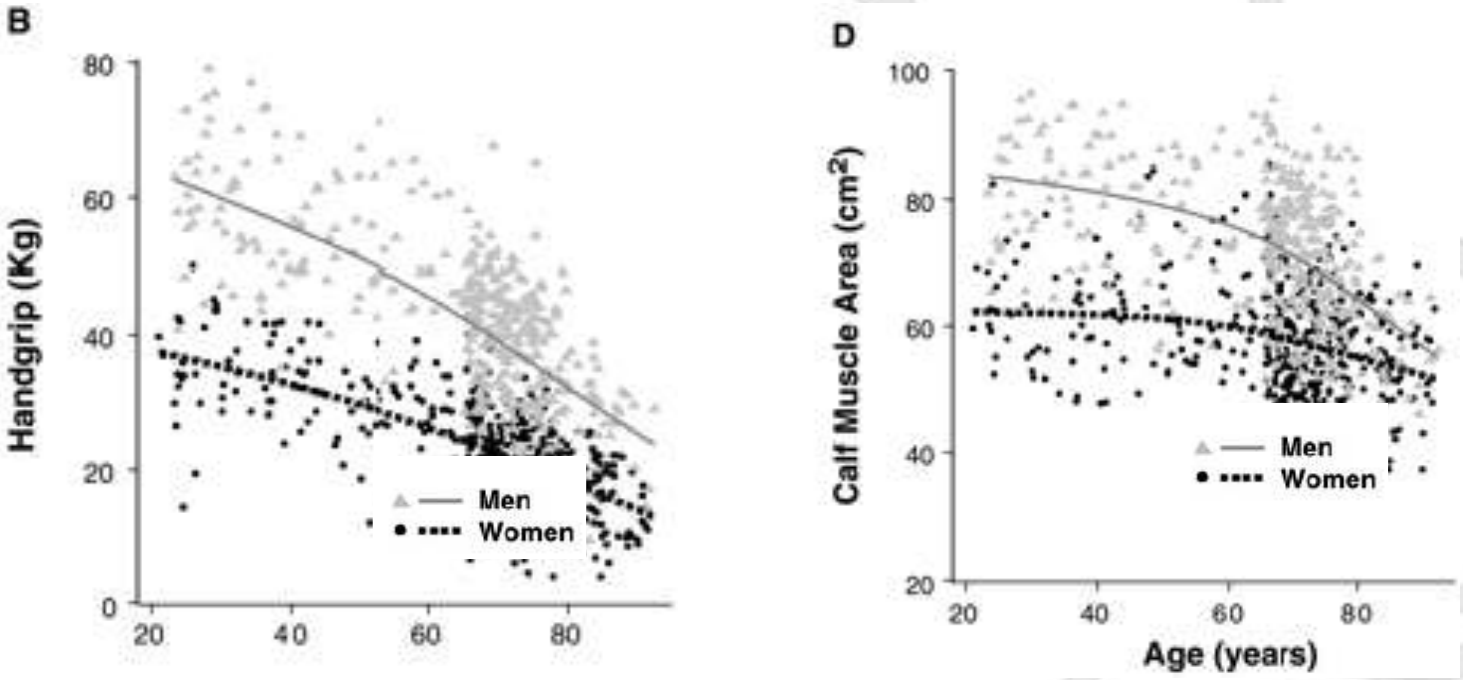


Adulto joven



Adulto mayor

MASA Y FUERZA MUSCULAR

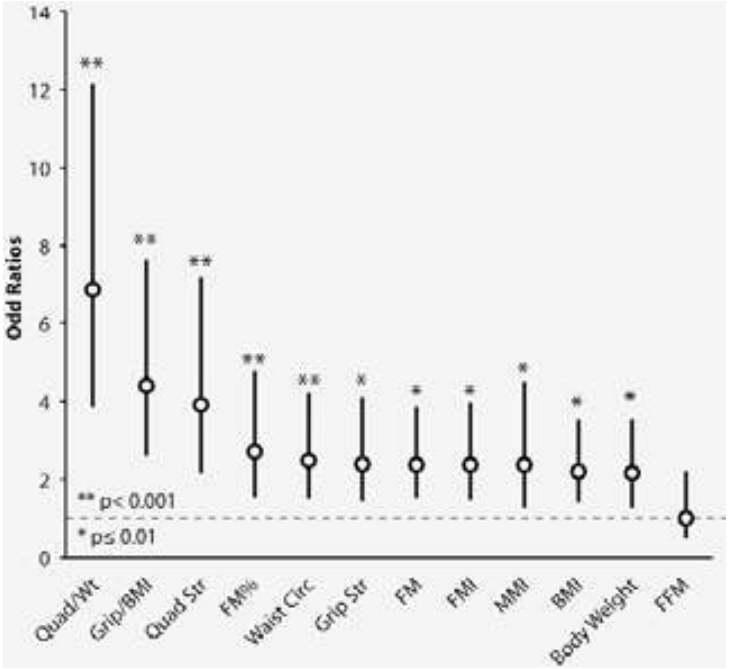


La Sarcopenia se define como la pérdida de función muscular relacionada a la edad (tanto de masa muscular como de fuerza; Roubenoff et al., 2000)

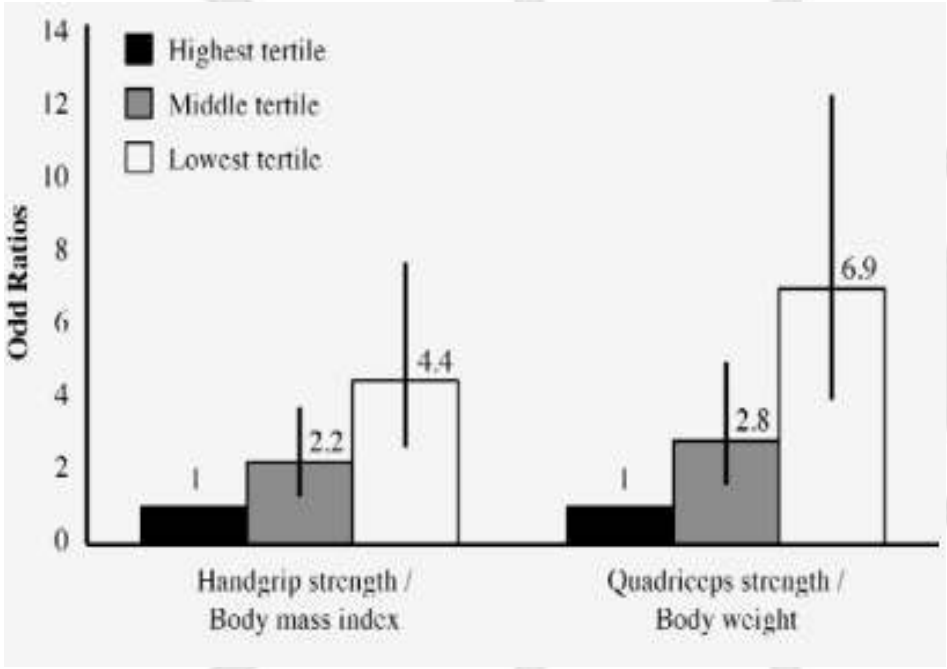
Lauretani F et al. J Appl Physiol 2003

FUERZA MUSCULAR Y CAPACIDAD FUNCIONAL

DISABILITIES

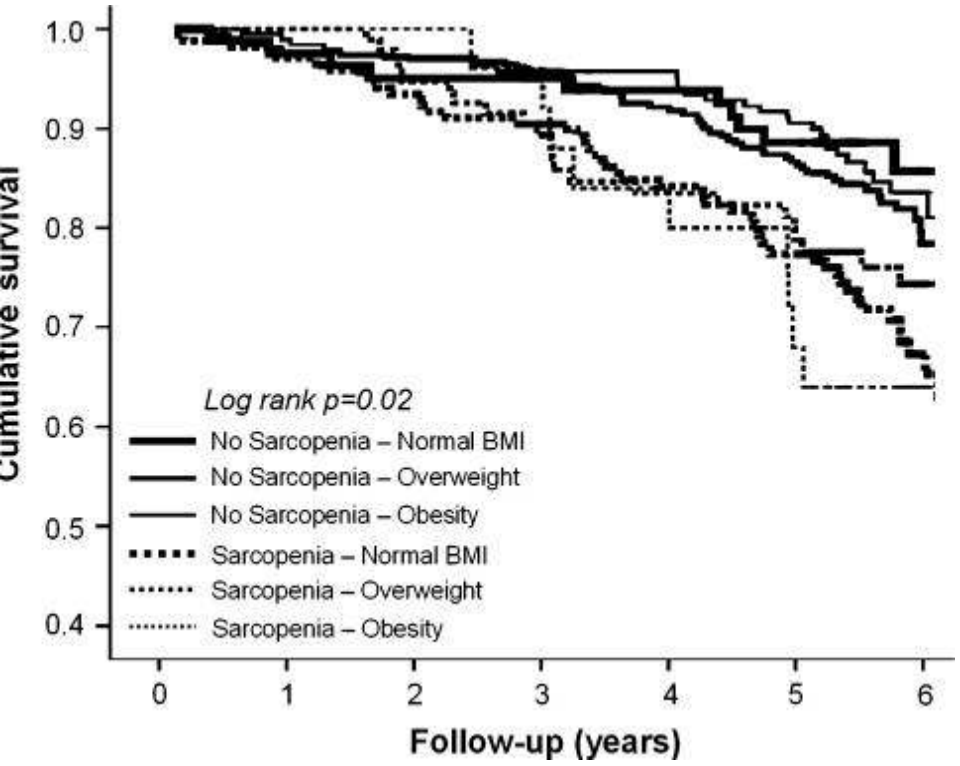


DISABILITIES

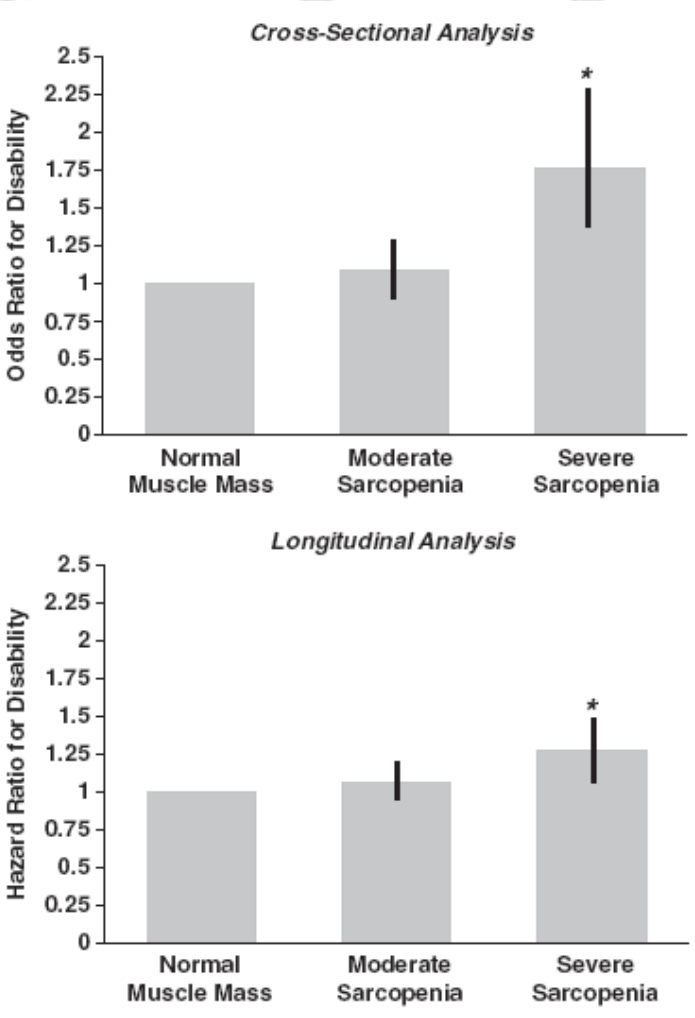


Choquette S et al.,NUAGE survey JNHA, 2010

SARCOPENIA, DISCAPACIDAD FÍSICA Y MORTALIDAD

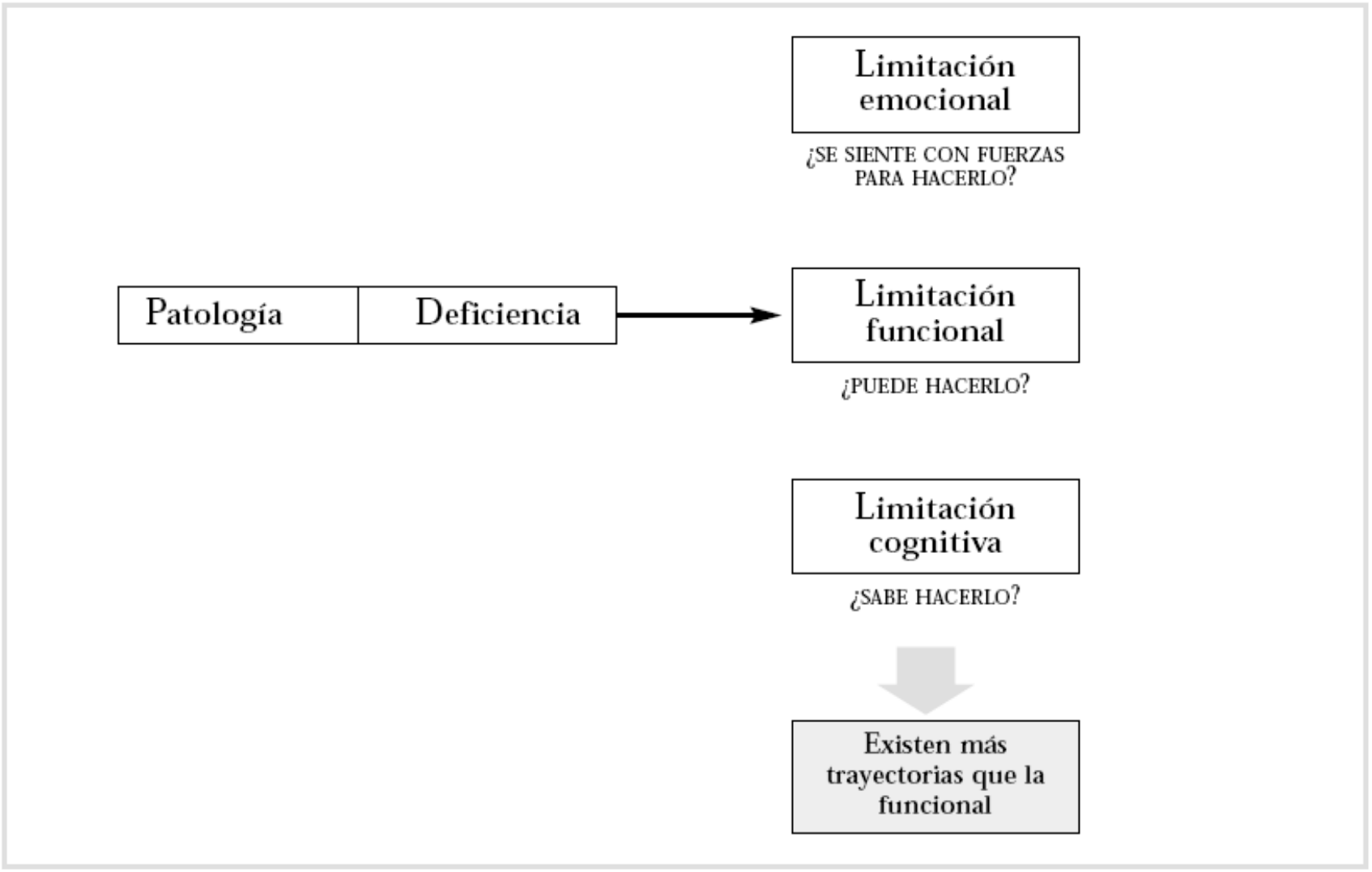


Cesari M et al., 2009 J Gerontol

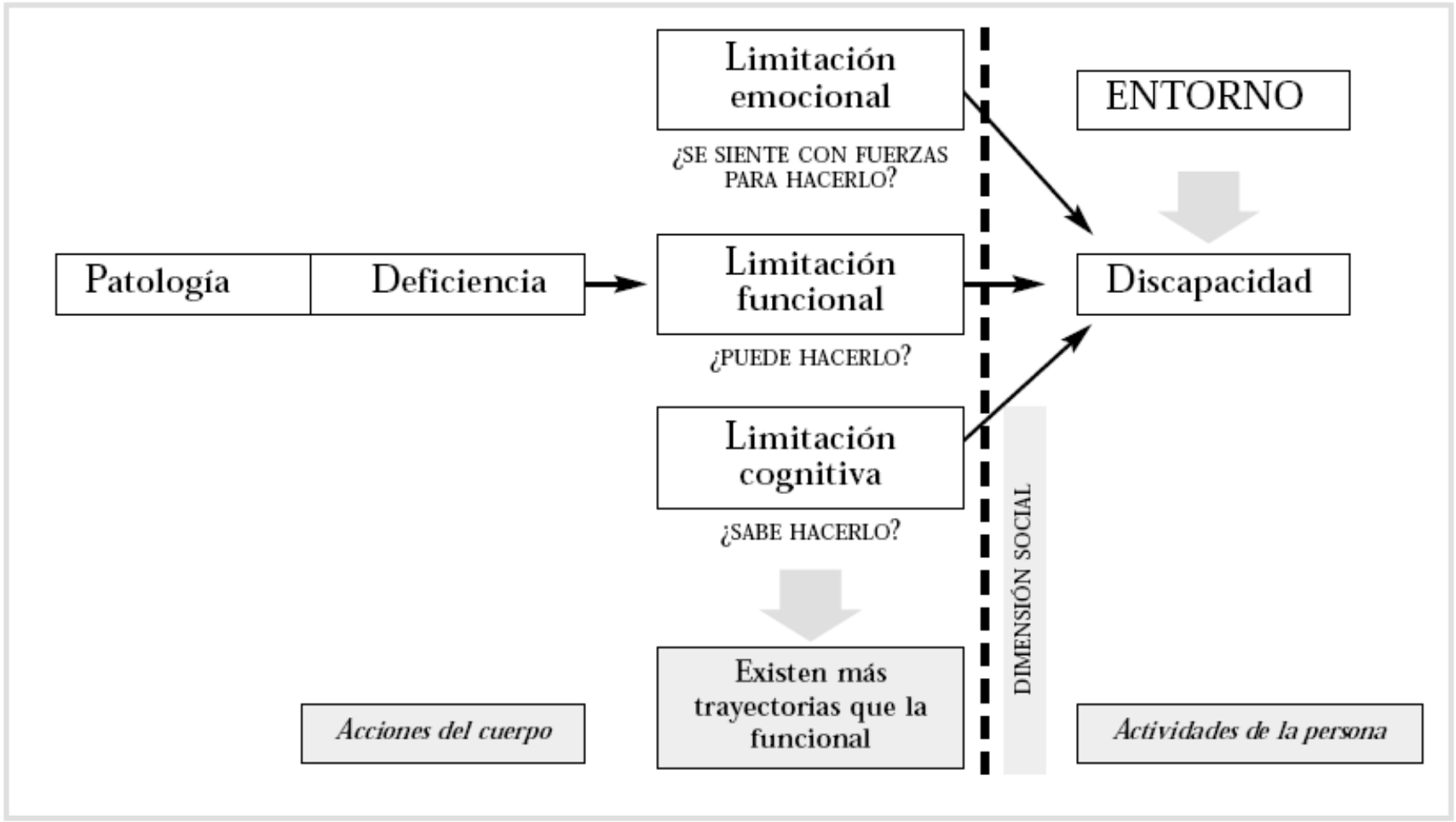


Janssen I et al., 2006 JAGS

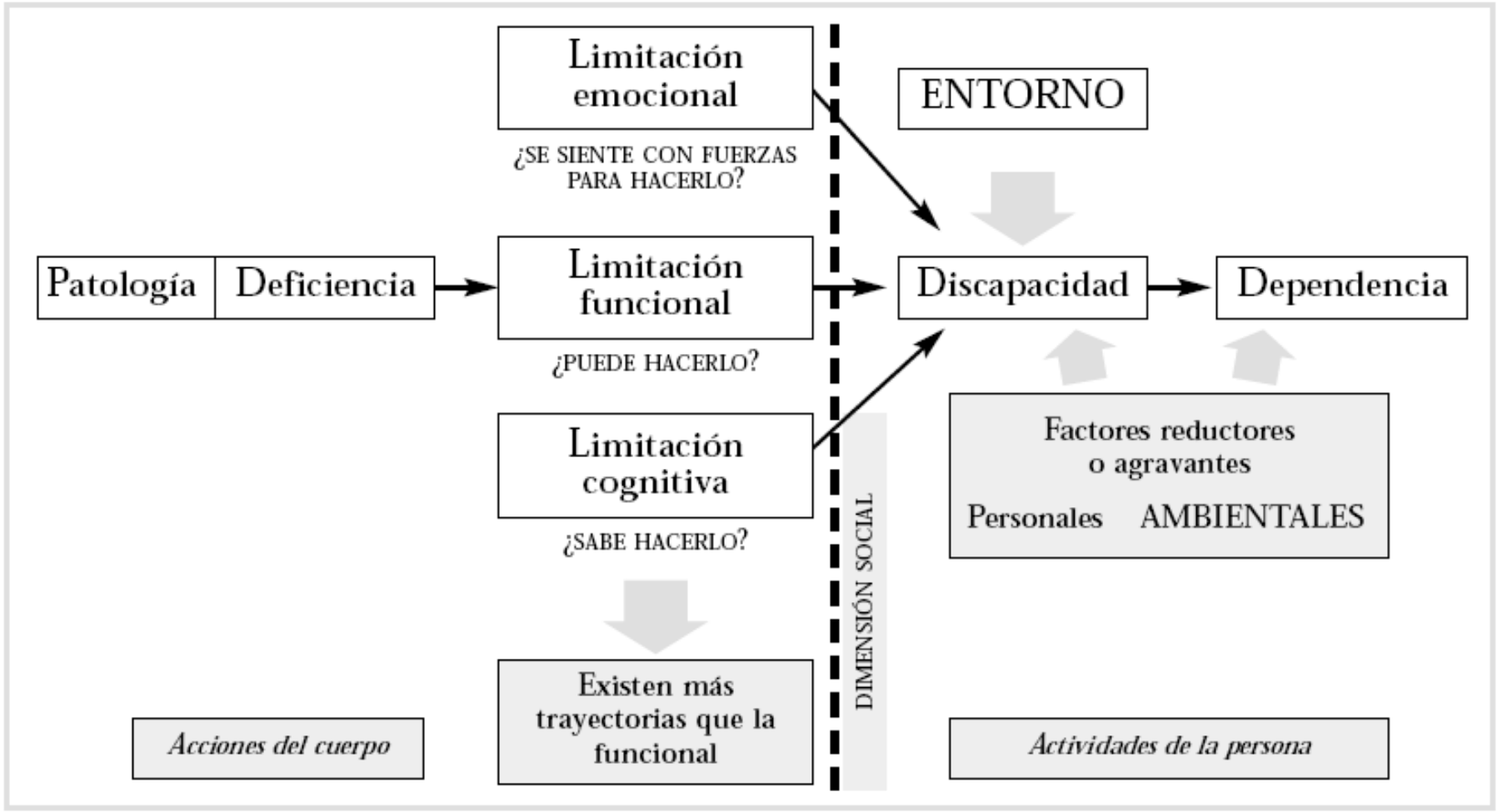
El proceso de discapacidad de la patología a la limitación



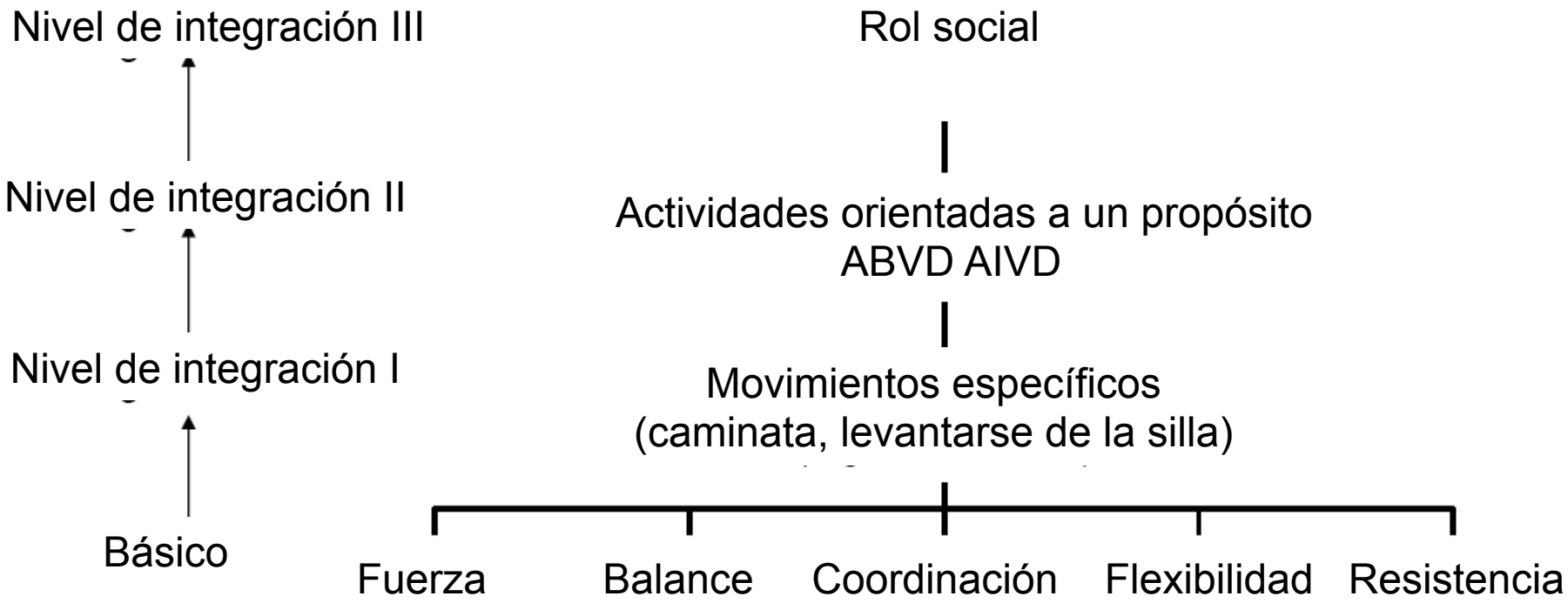
El proceso de discapacidad de la patología a la discapacidad



El proceso de discapacidad de la patología a la dependencia:

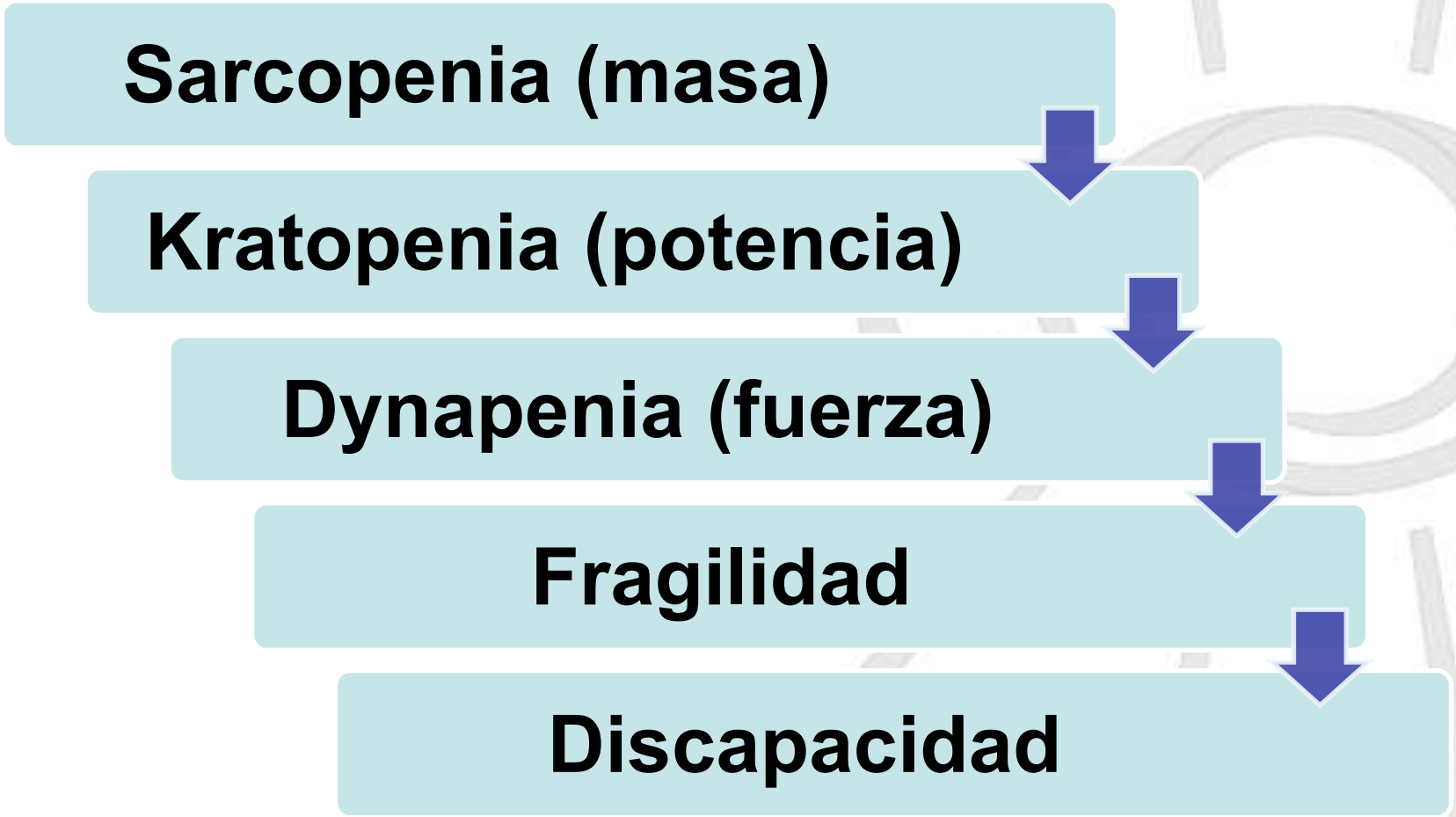


Marco de referencia de la jerarquía de las actividades funcionales



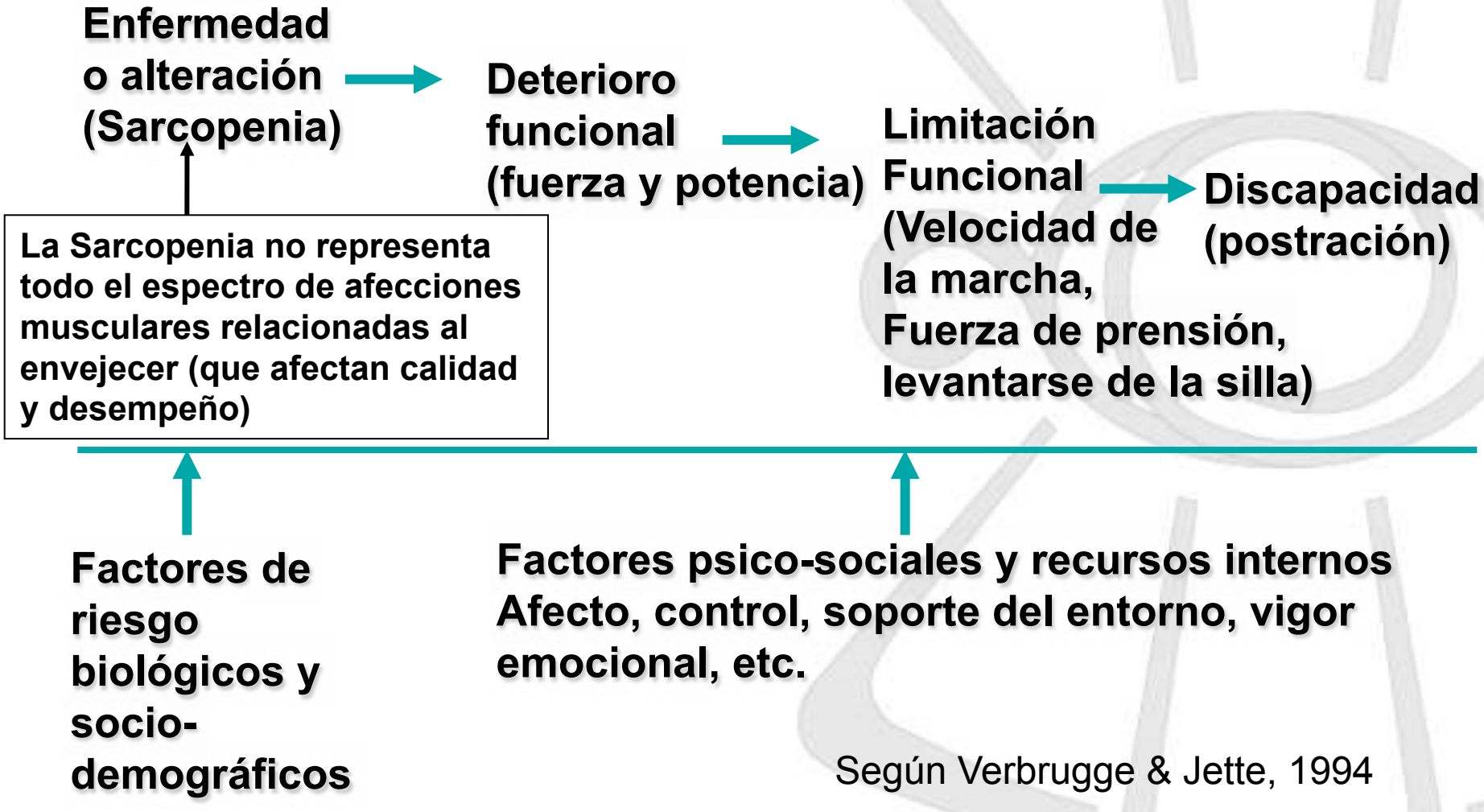
Reuben, D. (2003). Performance-based measures of physical function: Concepts and roles. *Presented at the National Institute on Aging Behavioral and Social Research Physical Performance Protocols Meeting*, December 12, 2003, in Bethesda, MD.

La cascada de la pérdida de masa muscular a la discapacidad

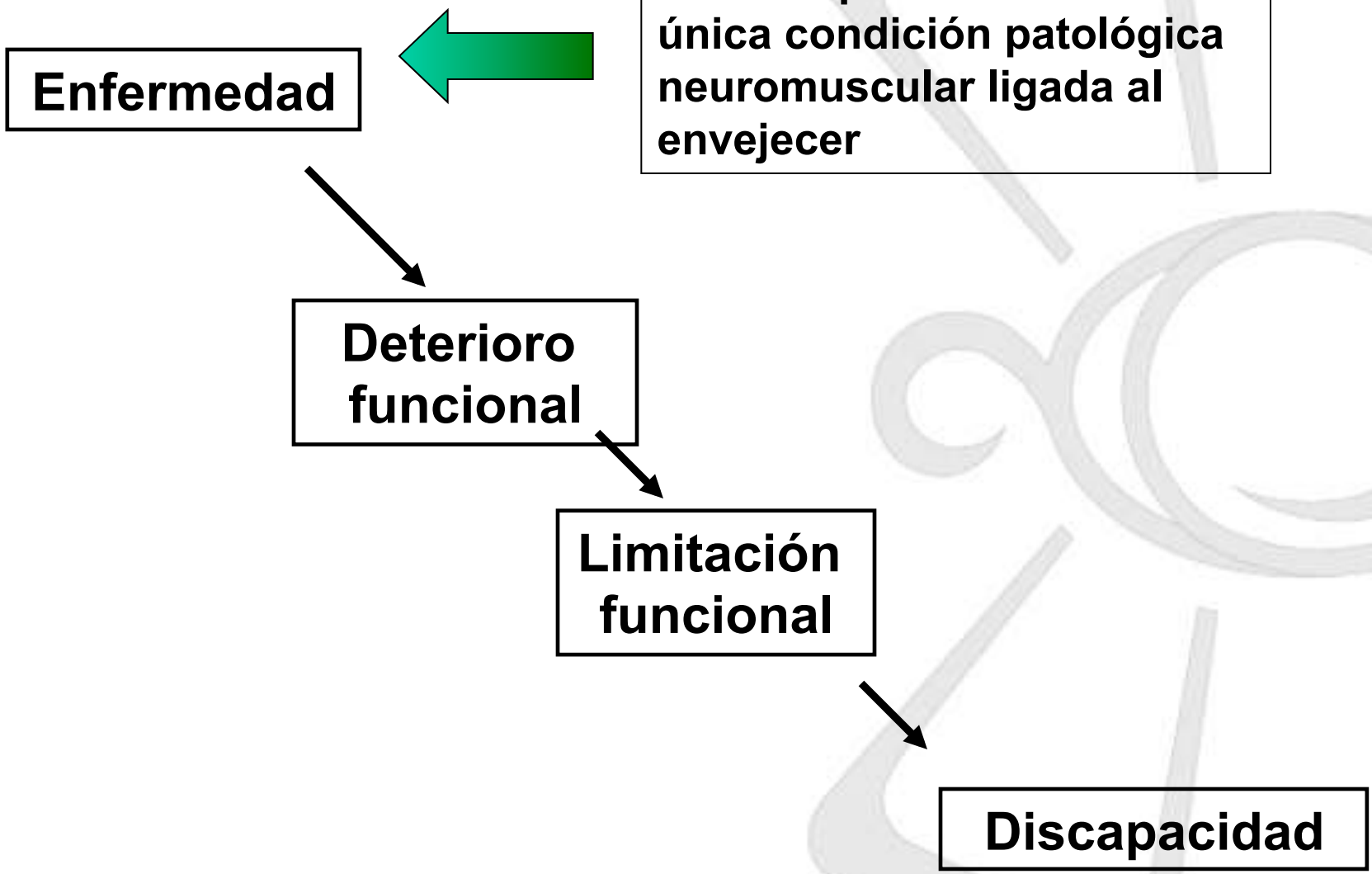


Según Morley J, JNHA, mayo 2011

Modelo conceptual del proceso de discapacidad



Según Verbrugge & Jette, 1994


La sarcopenia no es la única condición patológica neuromuscular ligada al envejecer
Enfermedad
Deterioro funcional
Limitación funcional
Discapacidad

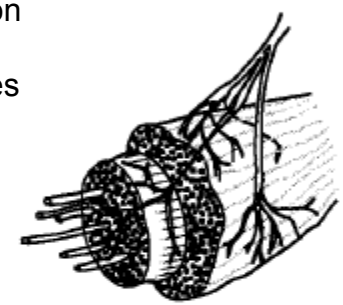
Niveles de afección neuromuscular

La disminución de la fuerza y poder pueden resultar de:

Cambios musculares en su capacidad para producir fuerza

Baja tensión en fibras Individuales

Mayor expresión de Fibras lentas



Atrofia muscular

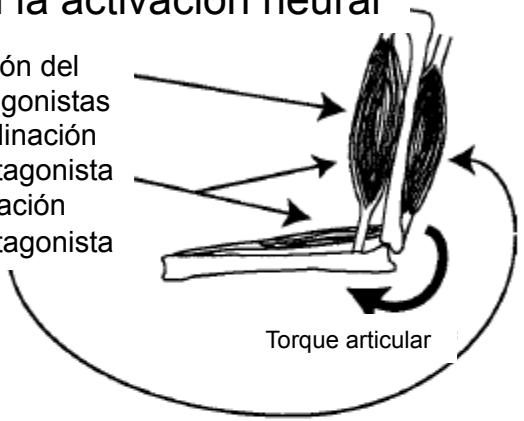
Muerte de Fibras musculares

Re-inervación

Remodelación de Unidades motoras

Cambios en la activación neural

Disminución del impulso a agonistas
Mala coordinación agonista/antagonista
Co-activación agonista/antagonista





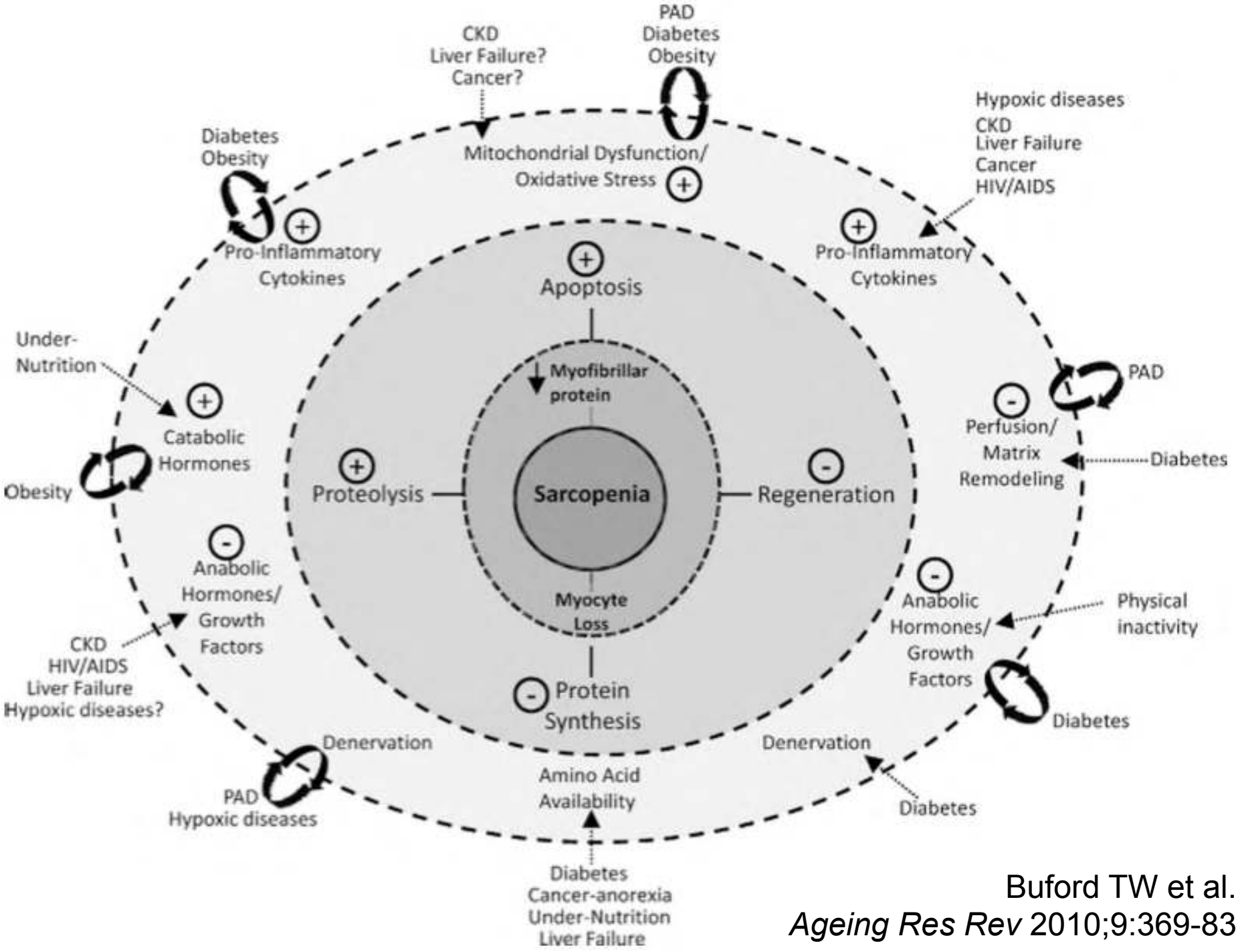
EVC o cambios degenerativos

Muerte de Moto-neuronas

Afección medular

Neuropatía periférica

Según Barry B J Gerontol 59(4):730, 2004



Buford TW et al.
Ageing Res Rev 2010;9:369-83

Journal of Gerontology: MEDICAL SCIENCES
2008, Vol. 63A, No. 8, 829–834

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Special Article "Green Banana"*

Sarcopenia ≠ Dynapenia

Brian C. Clark[1] and Todd M. Manini[2]

[1]Interdisciplinary Institute for Neuromusculoskeletal Research, Department of Biomedical Sciences, Ohio University College of Osteopathic Medicine, Athens.
[2]Department of Aging and Geriatric Research, Institute on Aging, University of Florida College of Medicine, Gainesville.

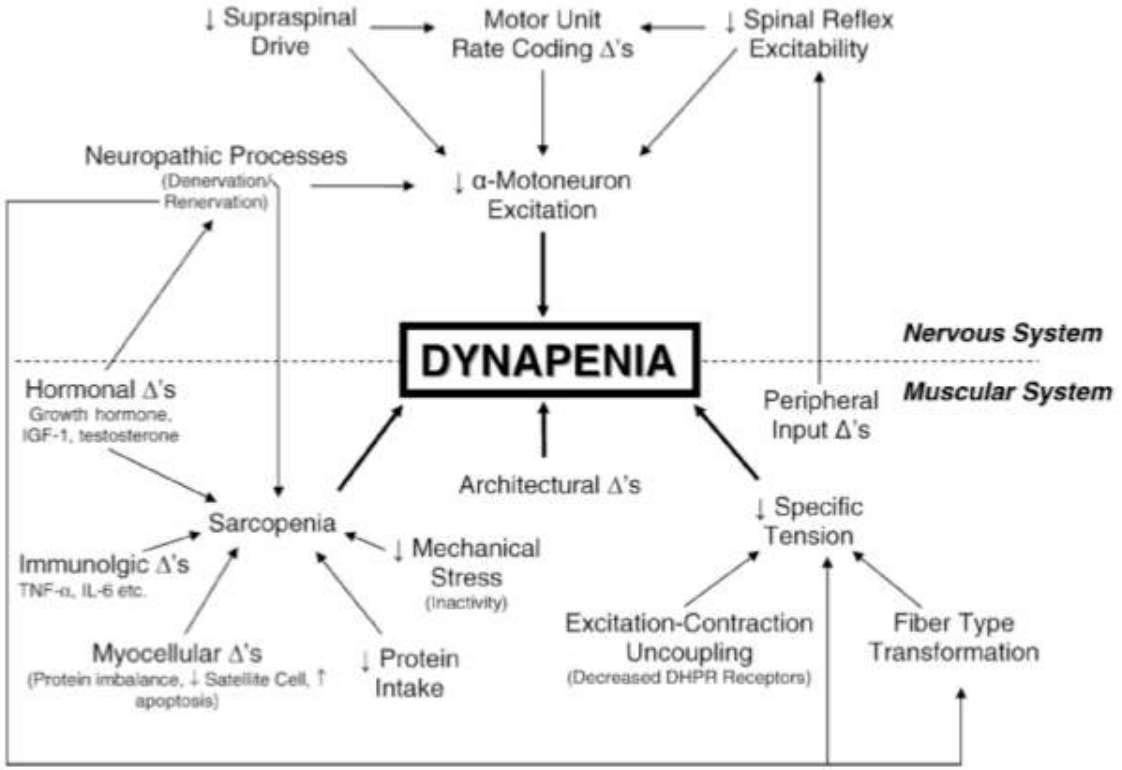
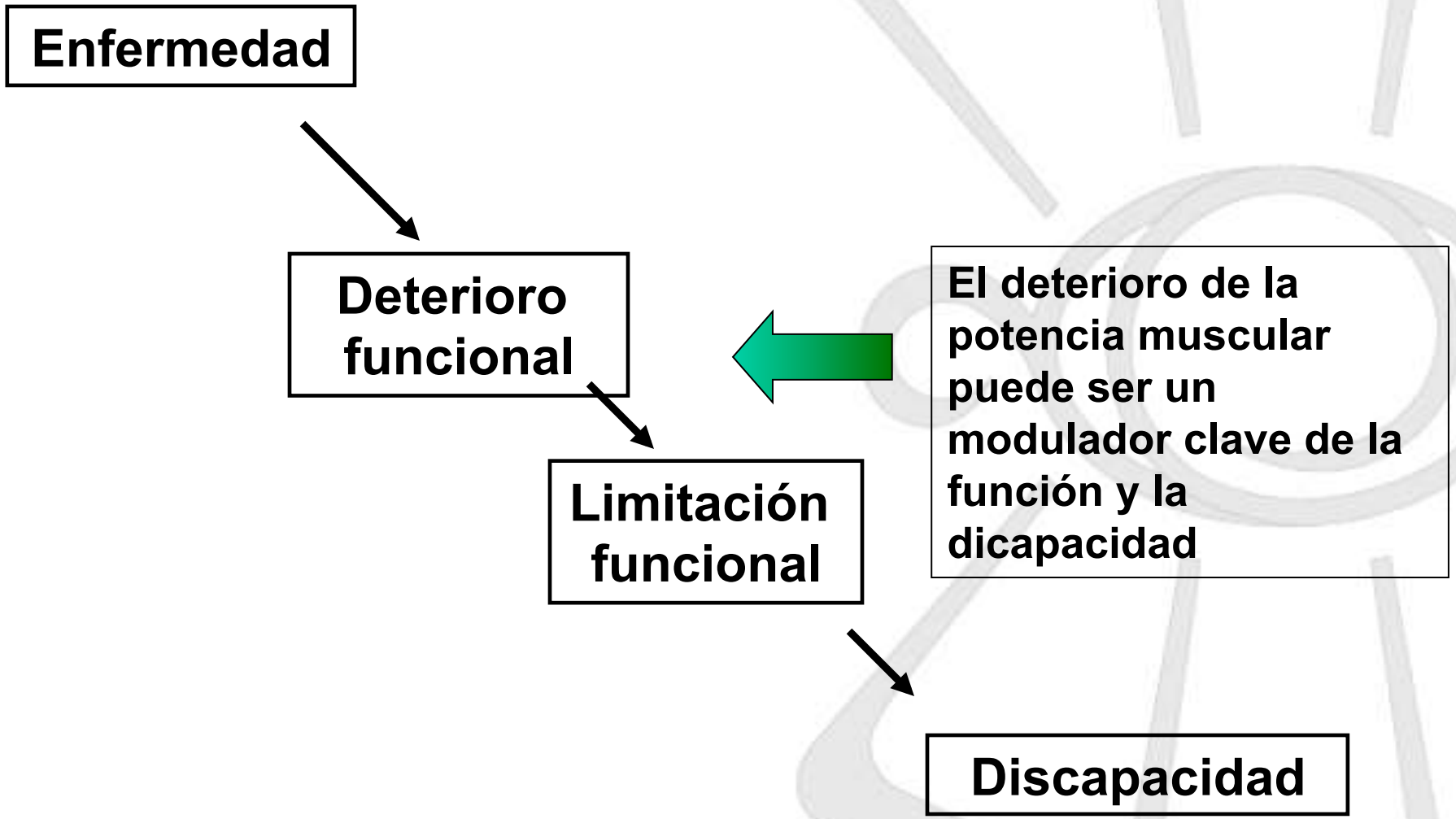
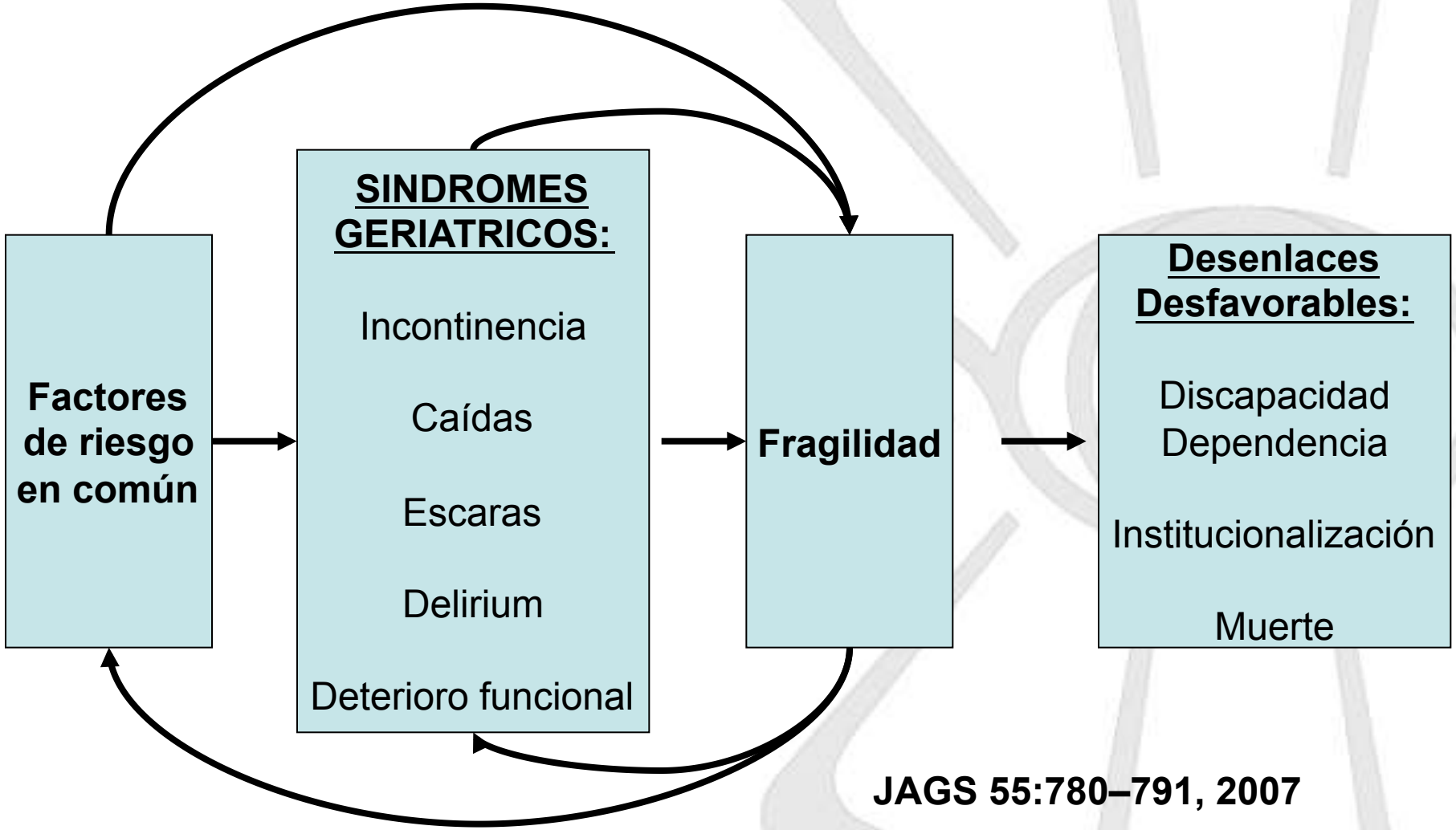


Figure 3. Etiology of the age-associated loss of strength (dynapenia). Figure summarizes the influence of multiple factors that may lead to dynapenia. IGF-1 = insulin-like growth factor 1; DHPR = dihydropyridine receptors; TNF-α = tumor necrosis factor-α; IL-6 = interleukin 6.

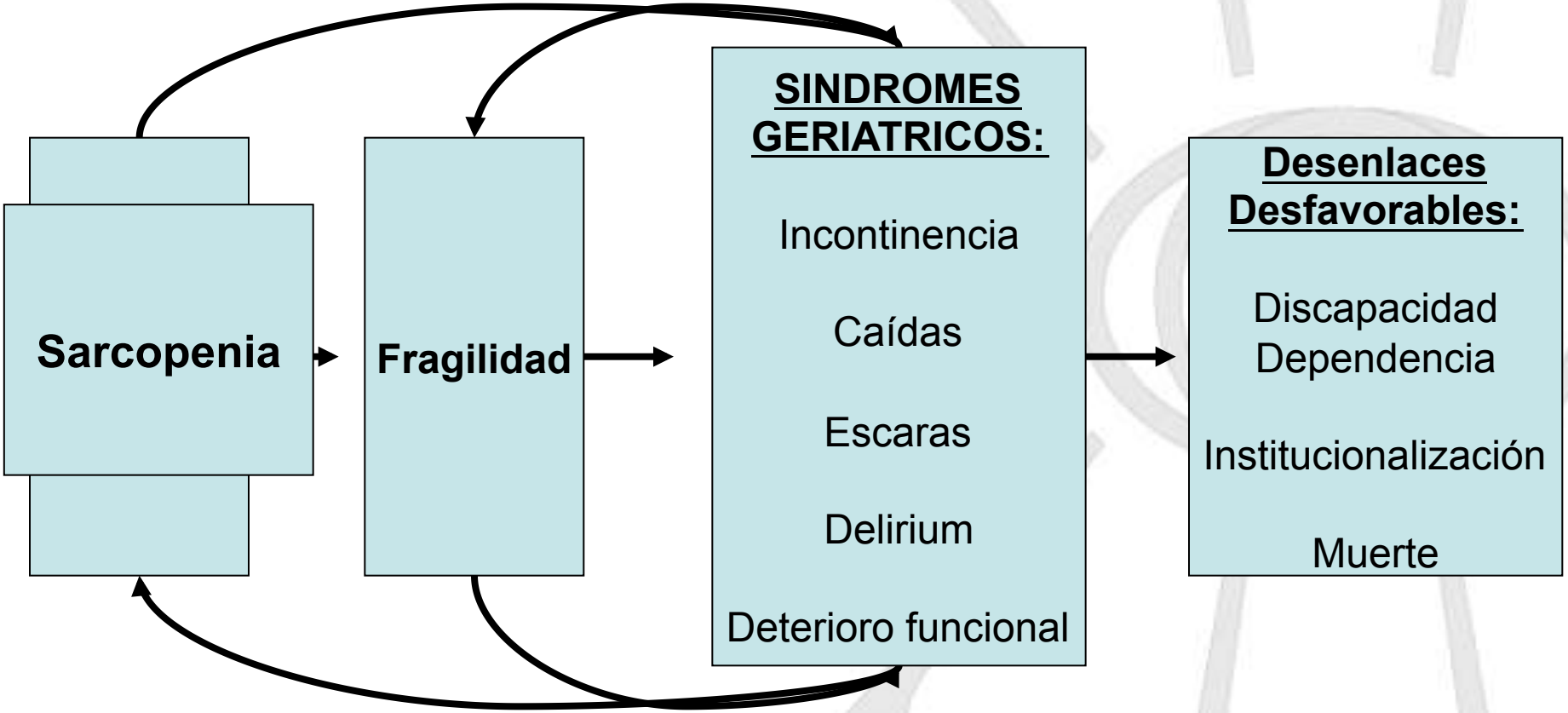

Enfermedad
Deterioro funcional
Limitación funcional
Discapacidad
El deterioro de la potencia muscular puede ser un modulador clave de la función y la dicapacidad

Modelo conceptual



JAGS 55:780–791, 2007

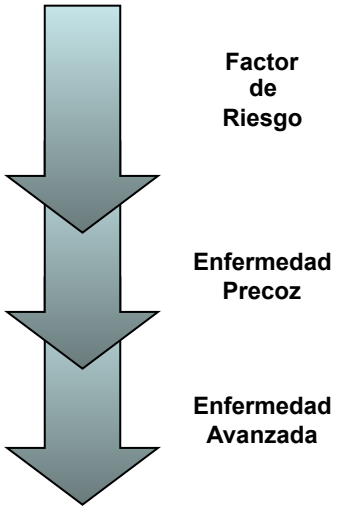
Modelo conceptual



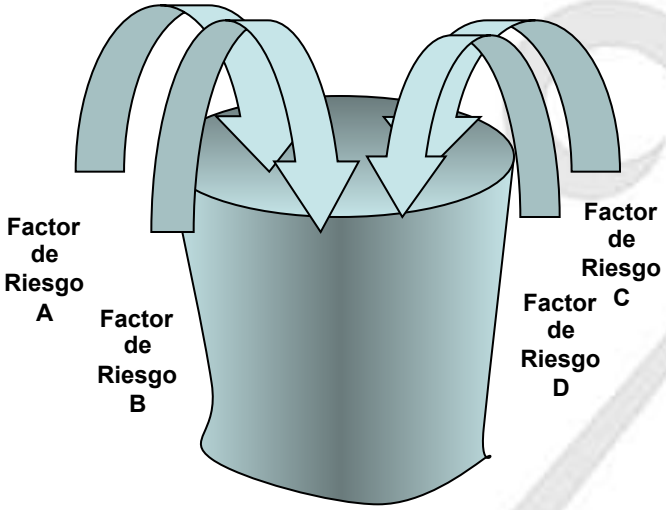
Modificado de:
JAGS 55:780–791, 2007

Modelo conceptual

A. Lineal

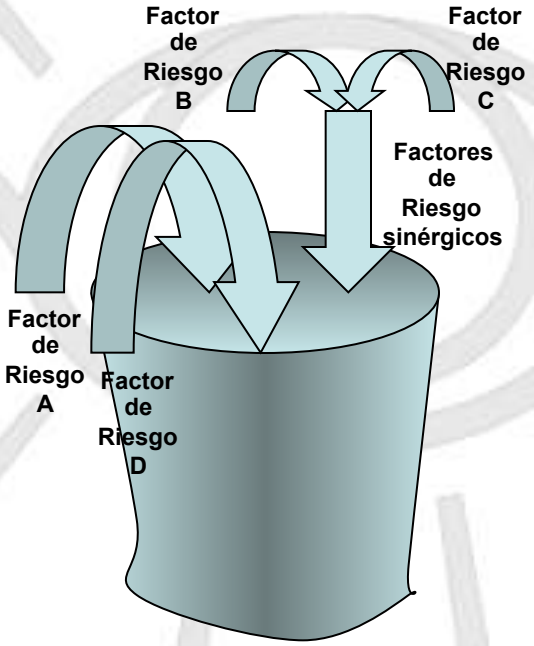


B Concéntrico

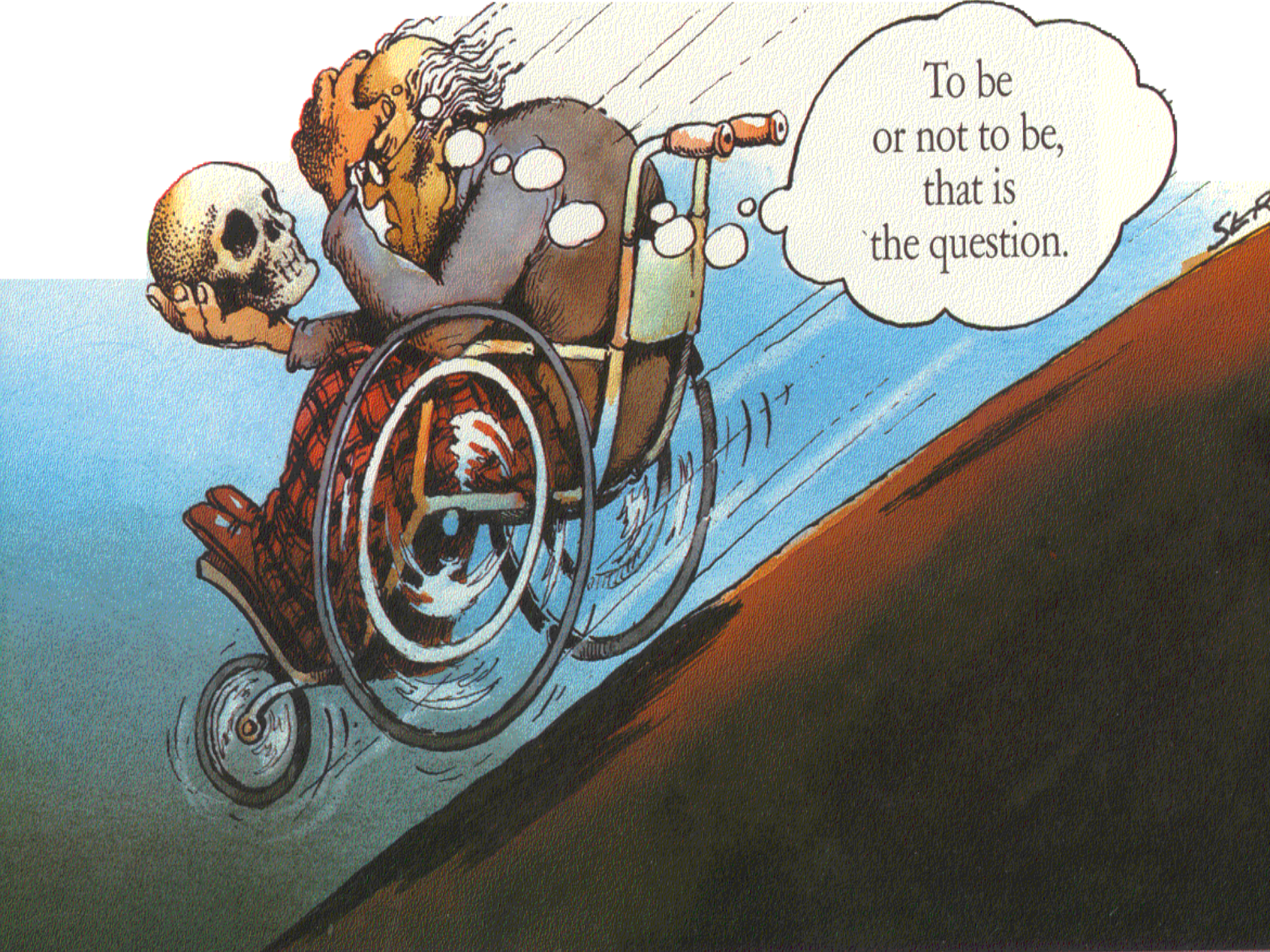


Fenotipo clínico

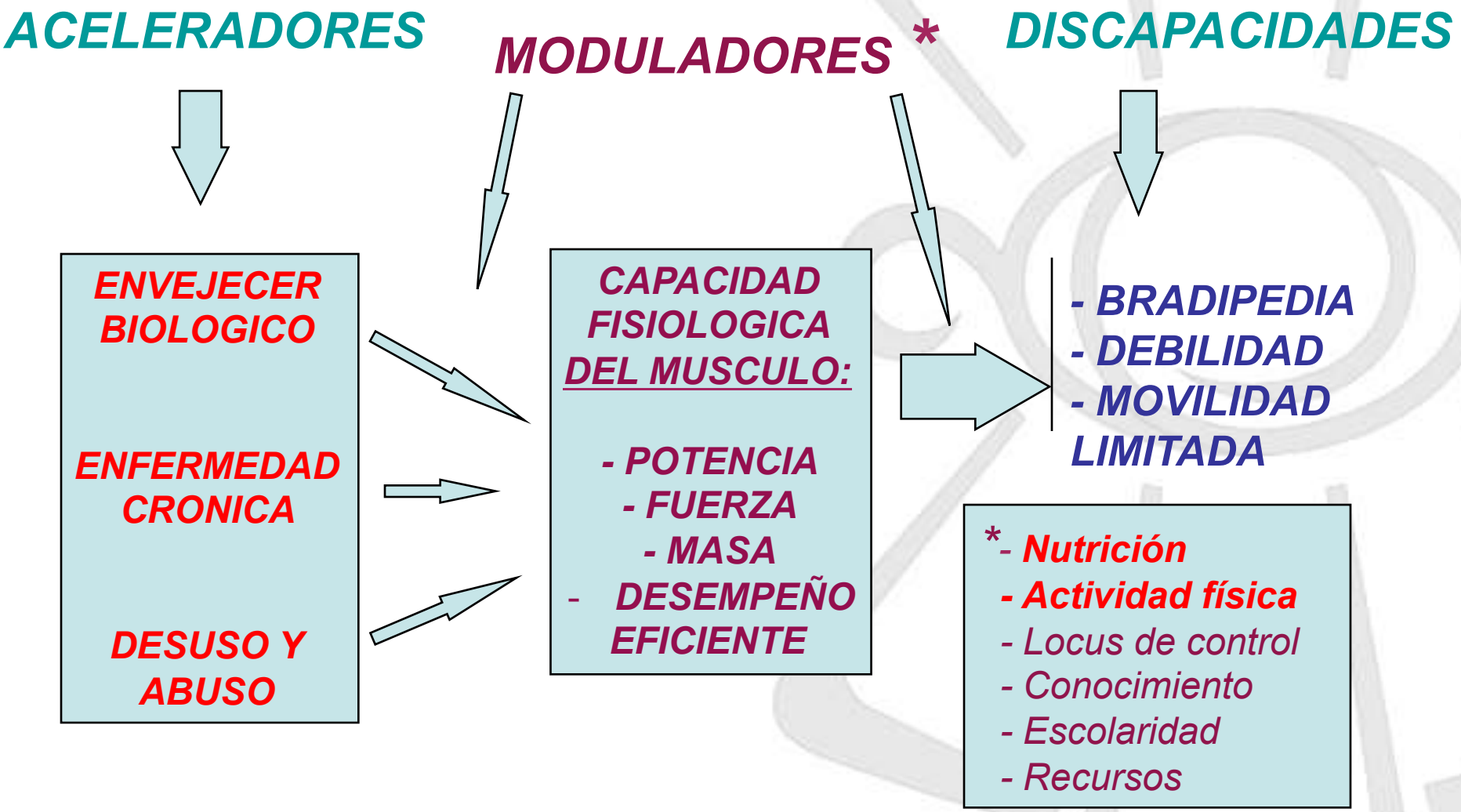
C. Interactivo concéntrico

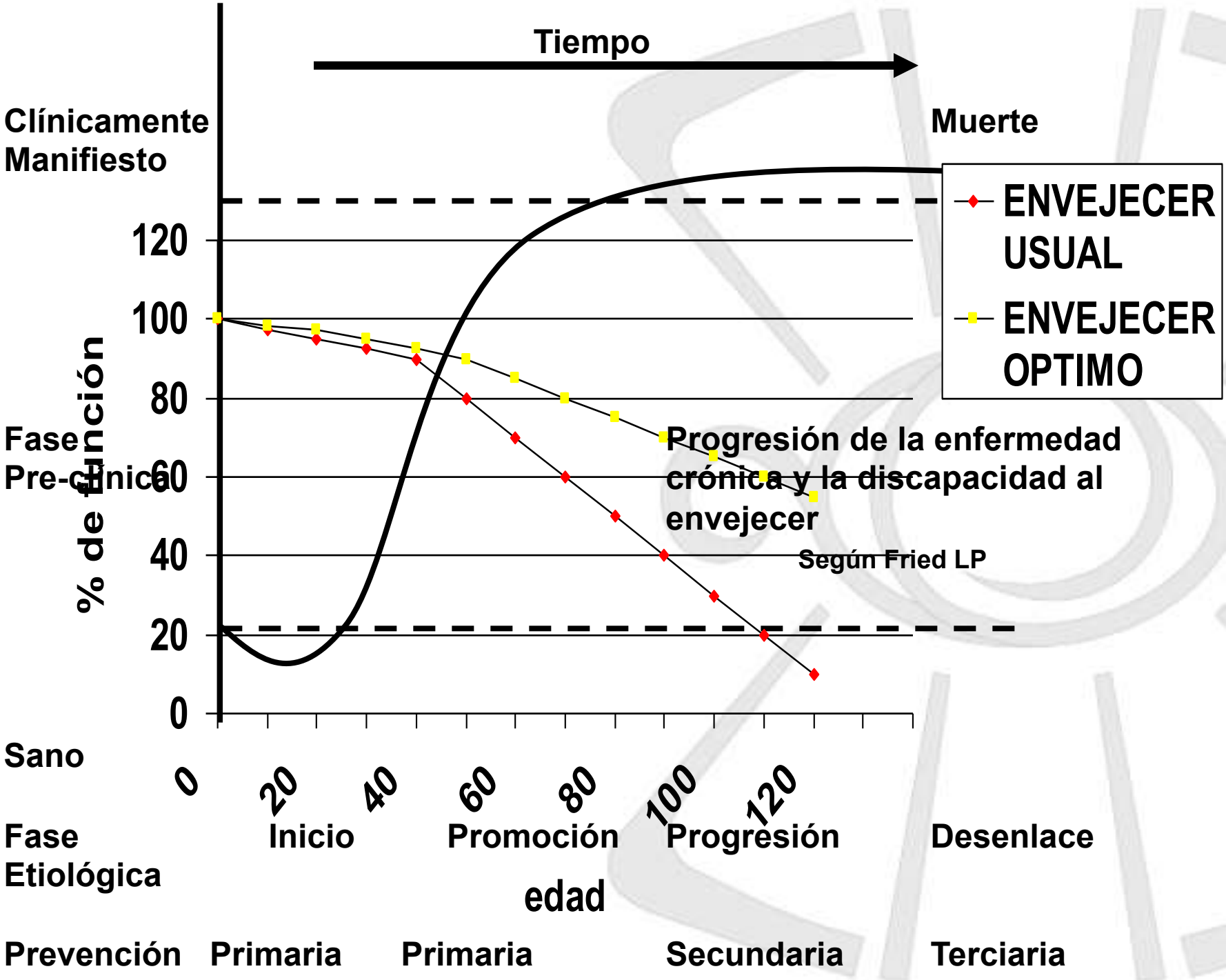


Fenotipo clínico

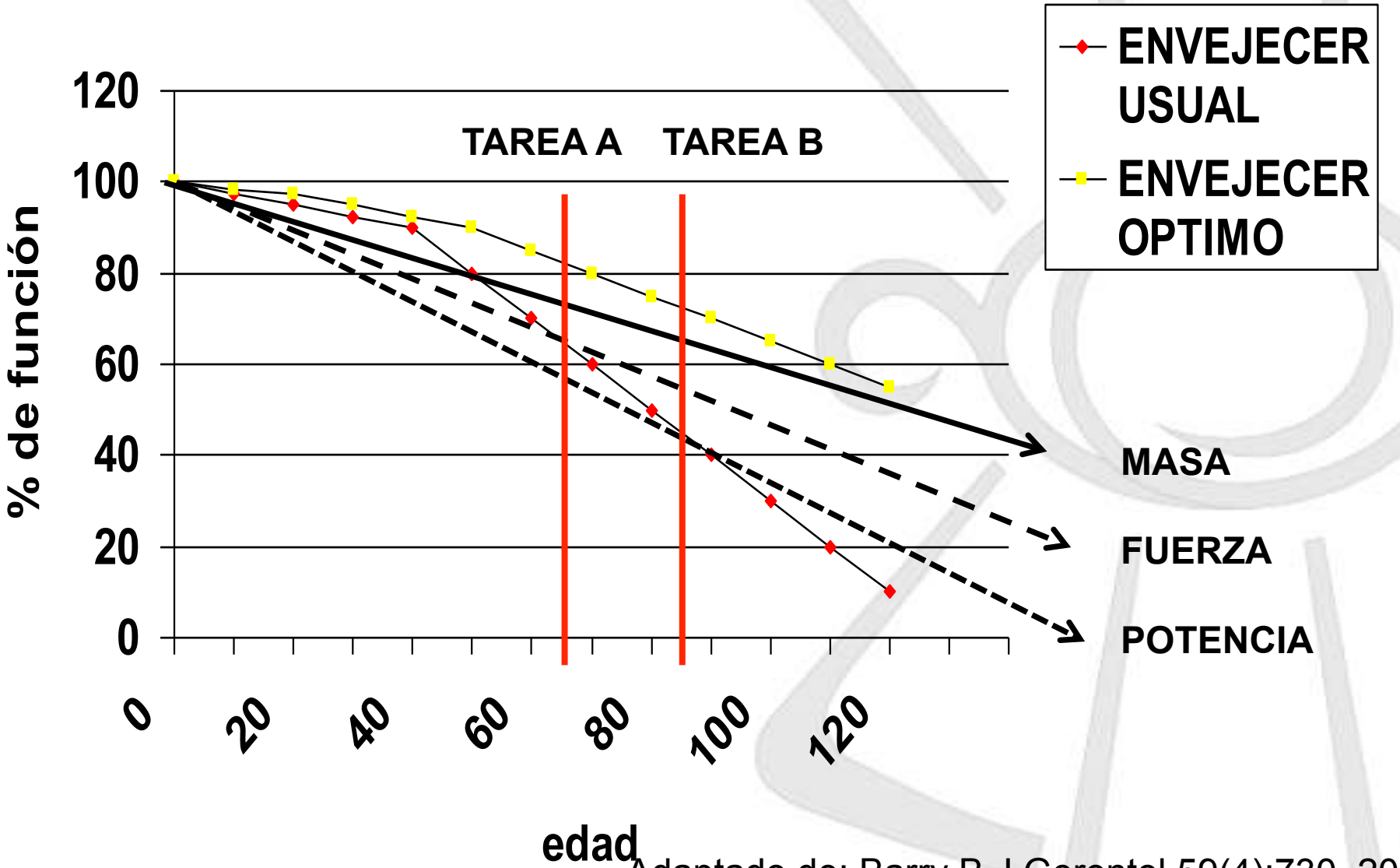

To be
or not to be,
that is
the question.

De la sarcopenia a la discapacidad




Tiempo
Clínicamente Manifiesto
Muerte
ENVEJECER USUAL
ENVEJECER OPTIMO
Progresión de la enfermedad crónica y la discapacidad al envejecer
Según Fried LP
% de función
120
100
80
60
40
20
0
Fase Pre-Clínica
Sano
0
20
40
60
80
100
120
edad
Fase Etiológica
Inicio
Promoción
Progresión
Desenlace
Prevención Primaria
Primaria
Secundaria
Terciaria

DETERIORO DE LA RESERVA FUNCIONAL MUSCULAR



Adaptado de: Barry B J Gerontol 59(4):730, 2004

Relación entre la declinación de la potencia muscular y la capacidad funcional

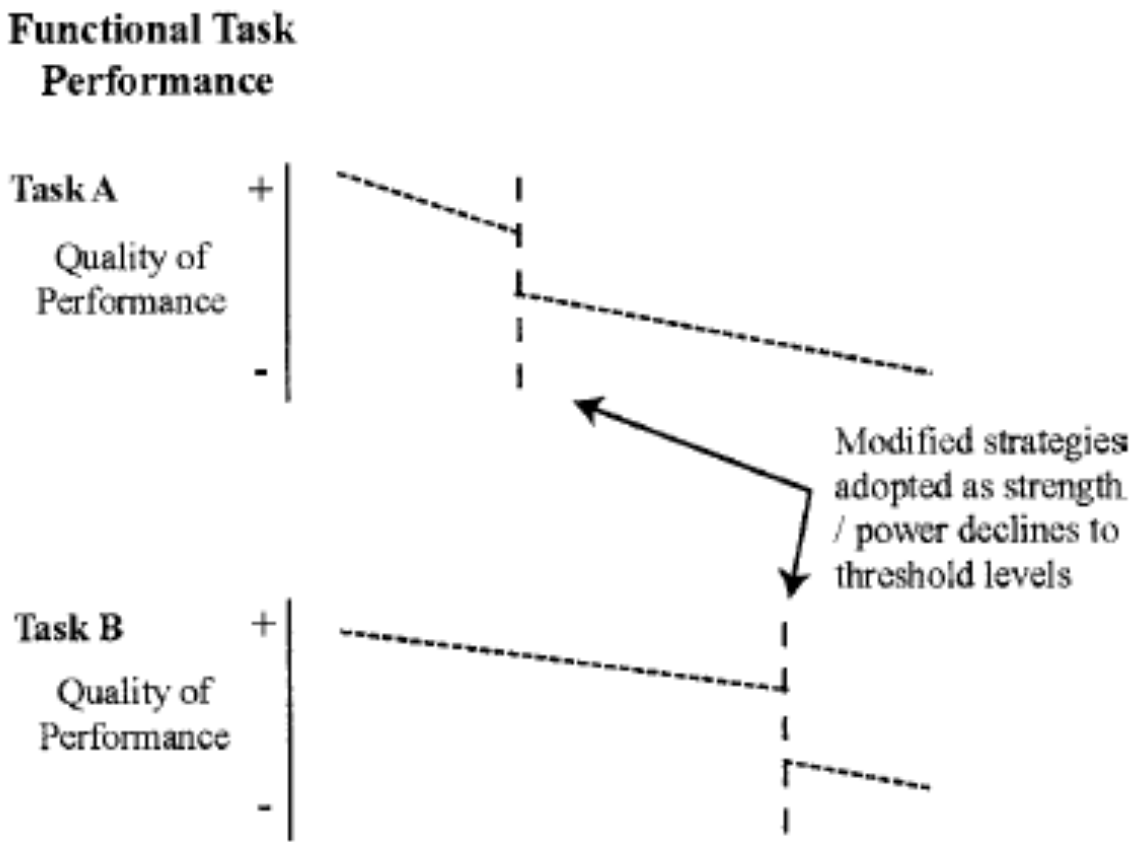


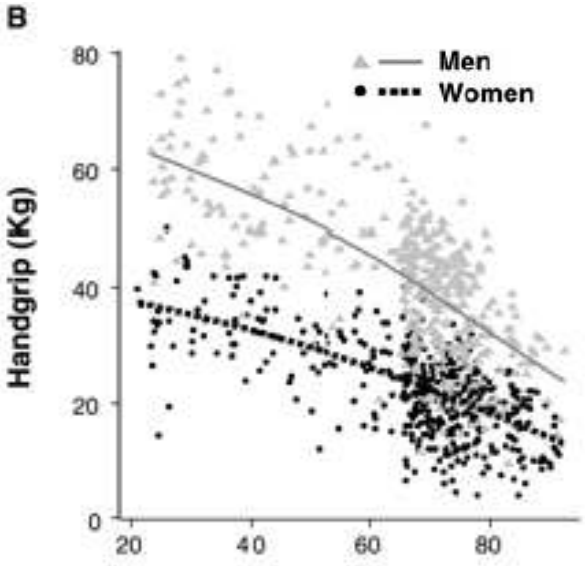
Figure 2. Schematic outline of the relationship between the reduced strength and power of older adults to the deterioration of functional task performance.

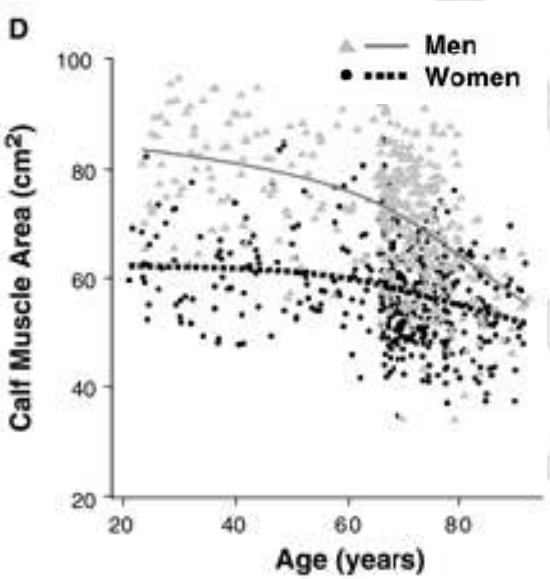
DEFINICION DE POTENCIA MUSCULAR

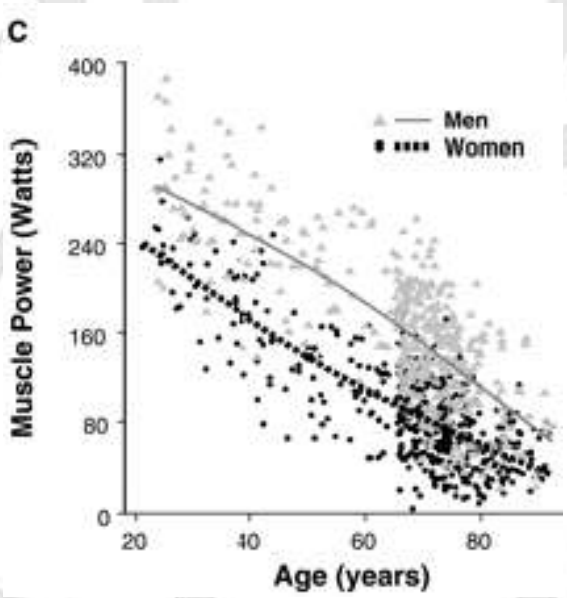
- **Definición:** La capacidad para desempeñar un trabajo por unidad de tiempo.

- **PODER =** TRABAJO / TIEMPO = FUERZA * DISTANCIA / TIEMPO = **FUERZA * VELOCIDAD**

MASA MUSCULAR, FUERZA Y POTENCIA

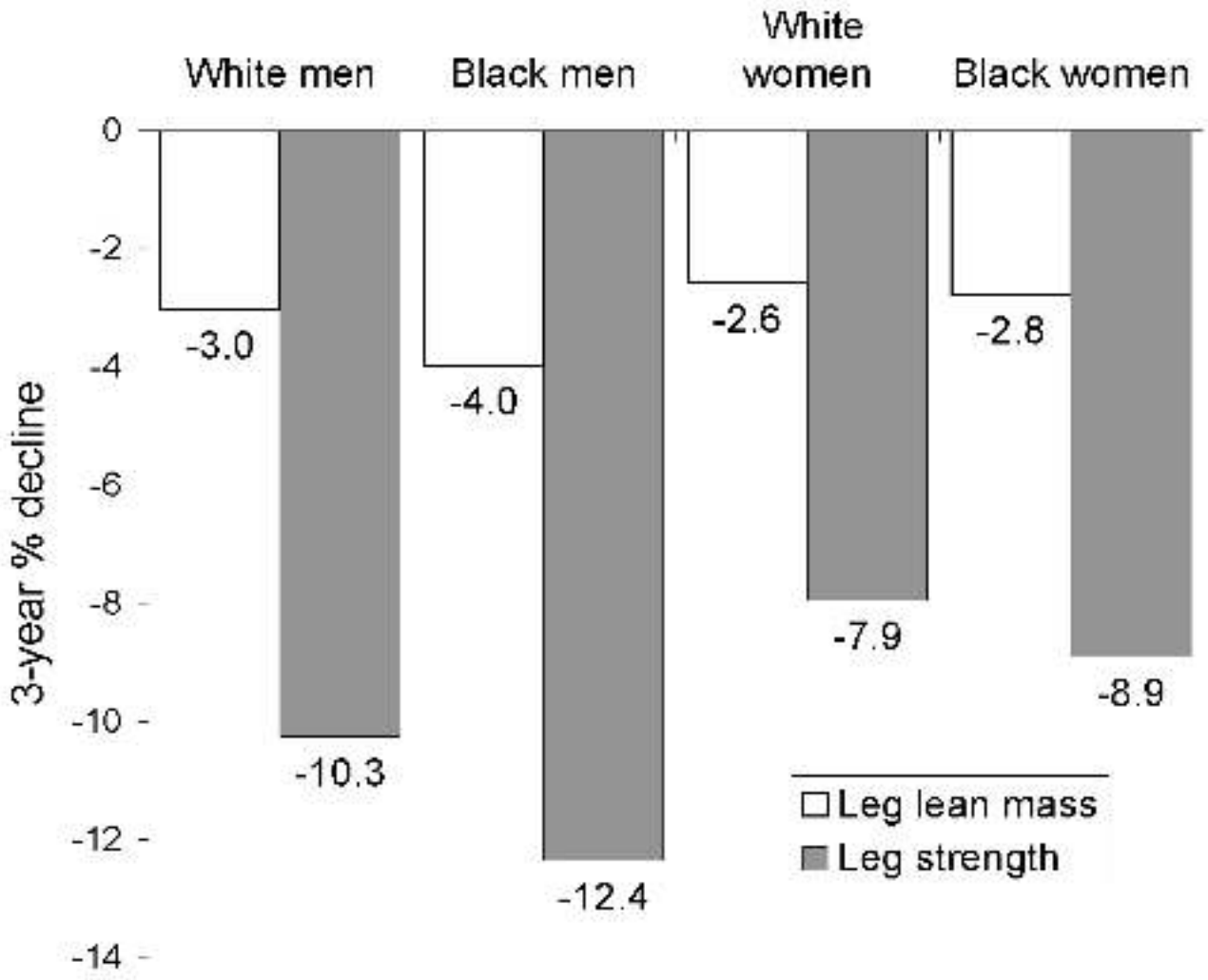






Lauretani F et al. J Appl Physiol 2003

La fuerza se pierde más de prisa que la masa muscular

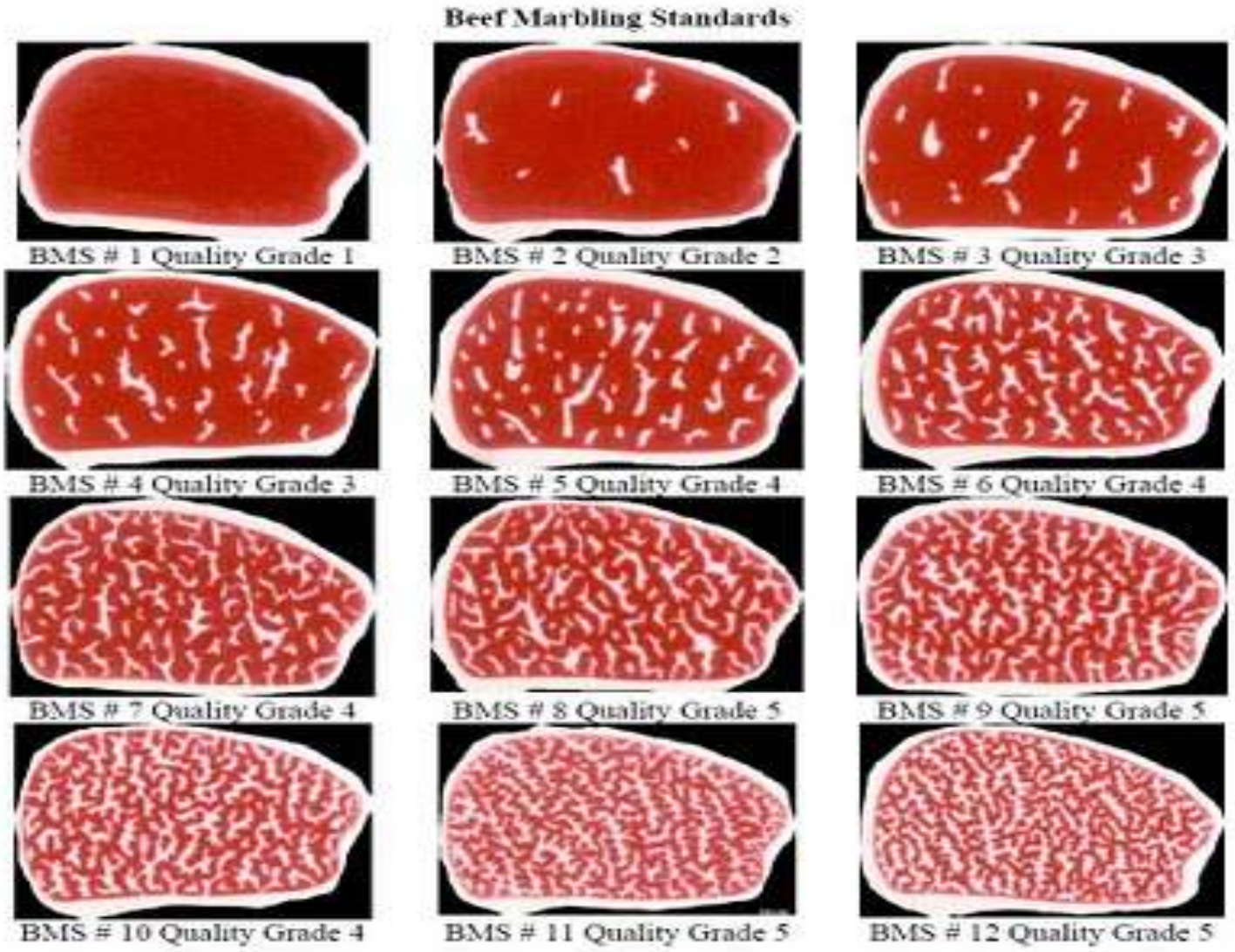


From Health ABC
Goodpaster et al.. Journal of Gerontology. 2006





Carta de “marmoleo” de la res



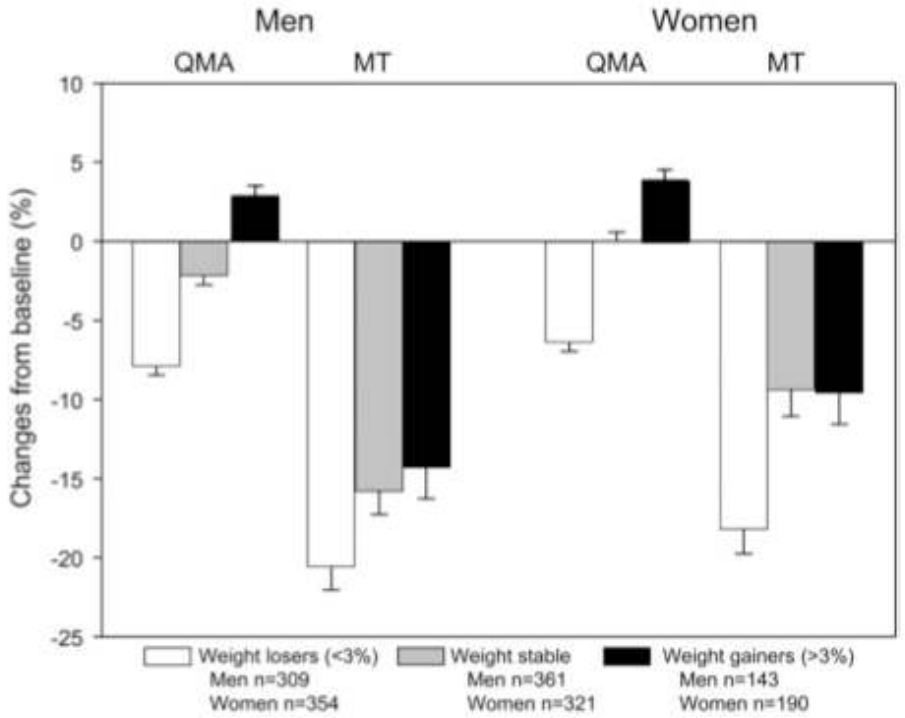


FIGURE 1. Adjusted least-squares mean (±SEM) 5-y percentage changes in quadriceps muscle area (QMA) and average muscle torque (MT) by weight change group and sex. There were significant within-group declines in MT in men and women in all weight groups (all $P < 0.001$) and changes in QMA (all $P < 0.001$), except for QMA changes in weight-stable women. There were significant differences between weight-change groups for QMA and MT changes (all $P < 0.001$). However, there was a greater percentage decline in MT in each weight-loss group than in changes in muscle area. Data were analyzed by using ANCOVA, with adjustment for baseline values, age, baseline drinking, smoking, baseline BMI, interim hospitalization, and baseline and change in physical activity level, baseline comorbidity, and diabetes.

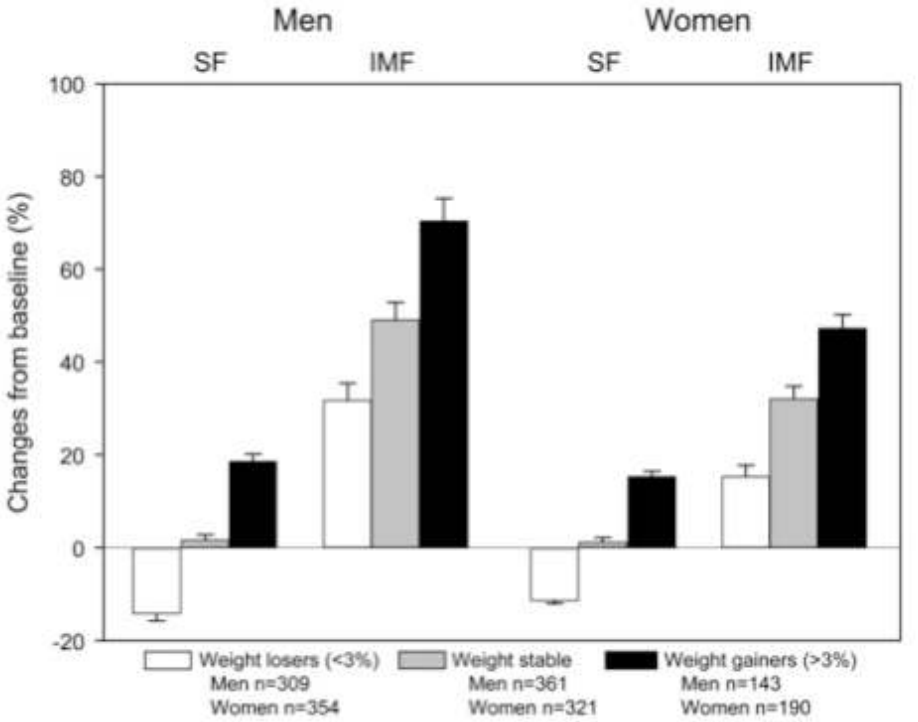


FIGURE 2. Adjusted least-squares mean (±SEM) 5-y percentage changes in midthigh subcutaneous fat (SF) and intermuscular fat (IMF) areas by weight-change group and sex. There were significant within-group changes in men and women for SF in the weight-loss and weight-gain groups (all $P < 0.001$). There were also significant within-group changes in men and women in all weight groups for IMF (all $P < 0.001$). There were significant differences between weight-change groups for SF and IMF changes (all $P < 0.001$). Data were analyzed by using ANCOVA, with adjustment for baseline values, age, baseline drinking, smoking, baseline BMI, interim hospitalization, and baseline and change in physical activity level, baseline comorbidity, and diabetes.

QMA: Quadriceps muscle area
MT: Muscle torque
SF: Subcutaneous fat
IMF: Intermuscular fat

Delmonico MJ et al. *Am J Clin Nutr* 2009;90:1579-85
Clark B, Manini TM. *J Gerontol Med Sci* 2008;63A: 829-34

US National Institute on Aging and Clinical Translational Science Awards task force Multi-modality Intervention Trial for a Complex Geriatric Condition, such as Mobility Limitation

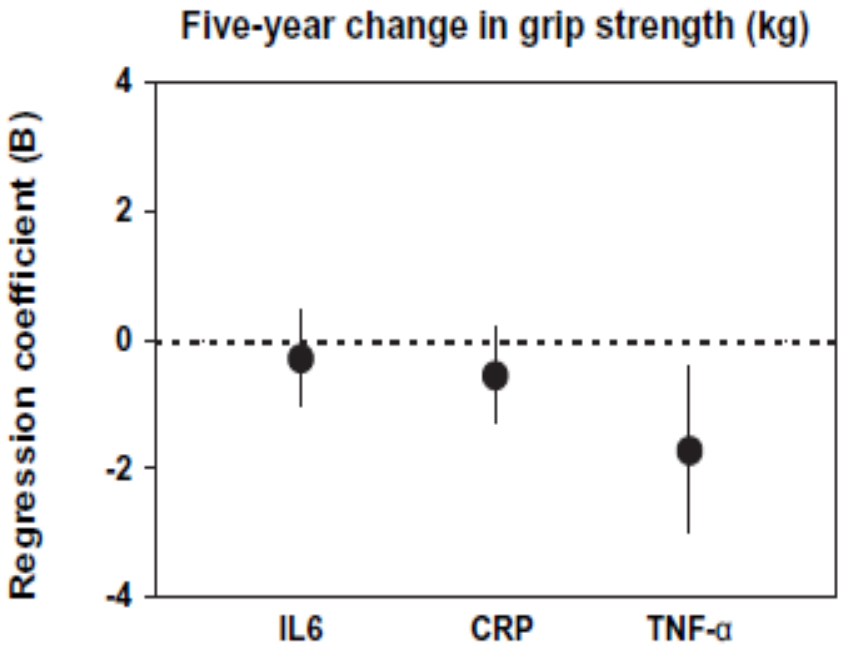
The Interventions Panel

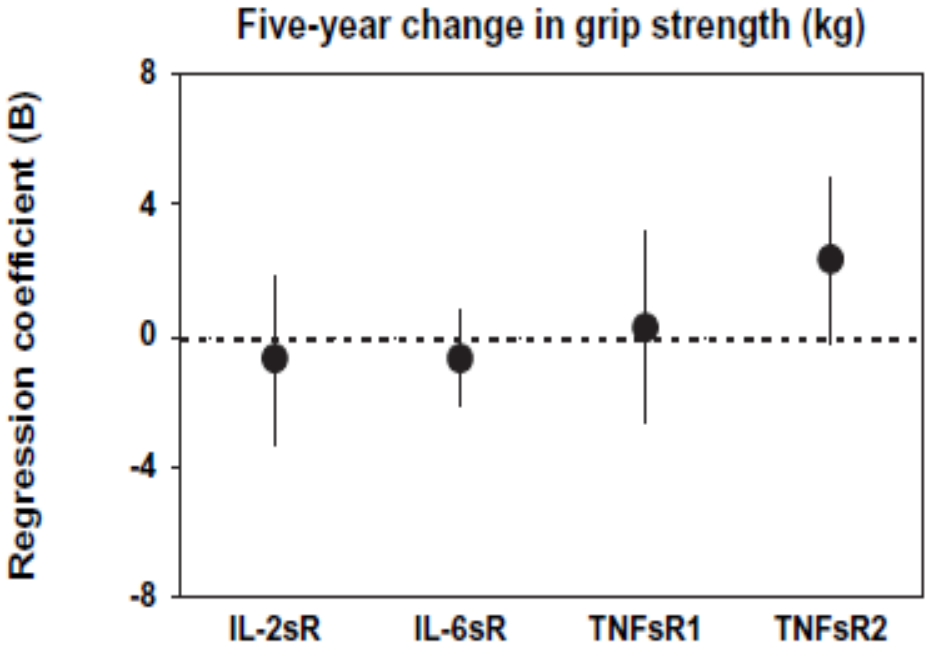
Marco Pahor
Shally Bhasin
Steve Cummings
Rebecca Jackson
Bob Schwartz
Elena Volpi

Factores de riesgo biológicos de sarcopenia modificables
•Anemia
•Inflamación (elev. IL-6, CRP, TNF-alpha)
•Elevación de AGEs
•Baja albumina sérica
•Baja DHEA-S
•Baja testosterona en hombres
•Baja vitamina D
•Bajo IGF-1
•Carbonilación de proteinas (estrés oxidativo)

Higher Inflammatory Marker Levels in Older Persons: Associations With 5-Year Change in Muscle Mass and Muscle Strength

Laura A. Schaap,[1] Saskia M. F. Pluijm,[2] Dorly J. H. Deeg,[1] Tamara B. Harris,[3] Stephen B. Kritchevsky,[4] Anne B. Newman,[5] Lisa H. Colbert,[6] Marco Pahor,[7] Susan M. Rubin,[8] Frances A. Tylavsky,[9] Marjolein Visser,[1,10] for the Health ABC Study

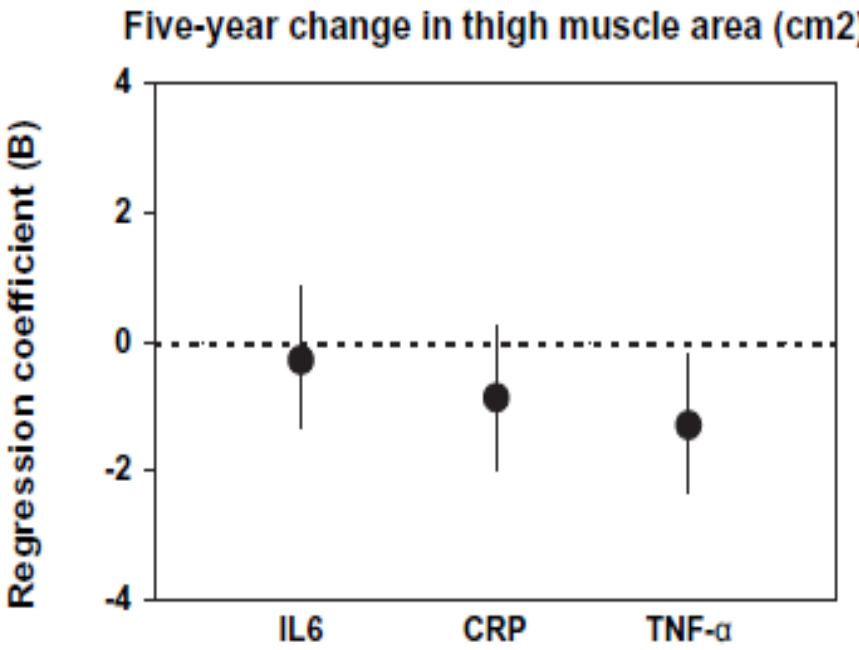


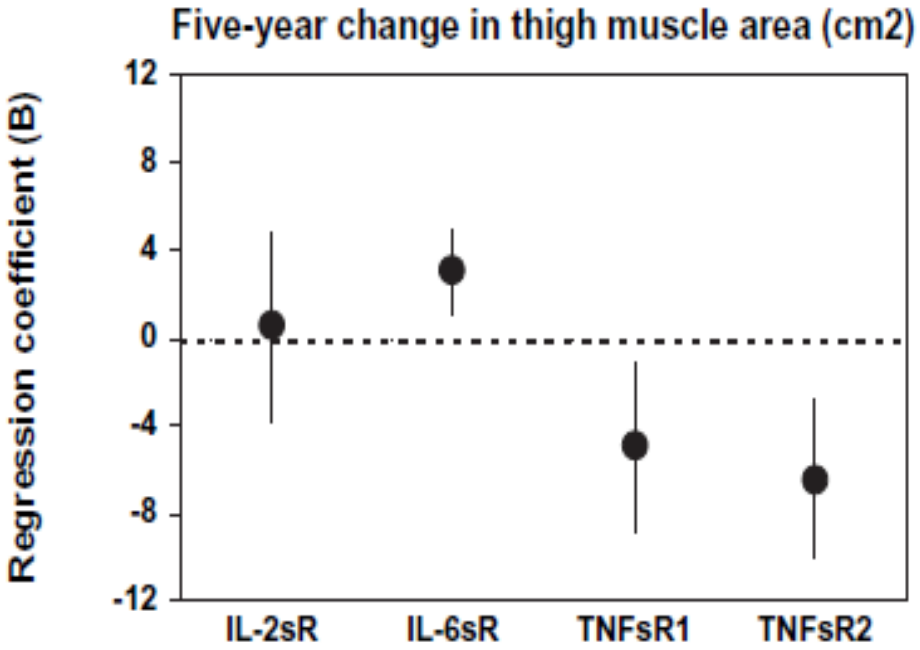


Journal of Gerontology: MEDICAL SCIENCES
Cite journal as: J Gerontol A Biol Sci Med Sci
2009 Vol. 64A, No. 11, 1183–1189

Higher Inflammatory Marker Levels in Older Persons: Associations With 5-Year Change in Muscle Mass and Muscle Strength

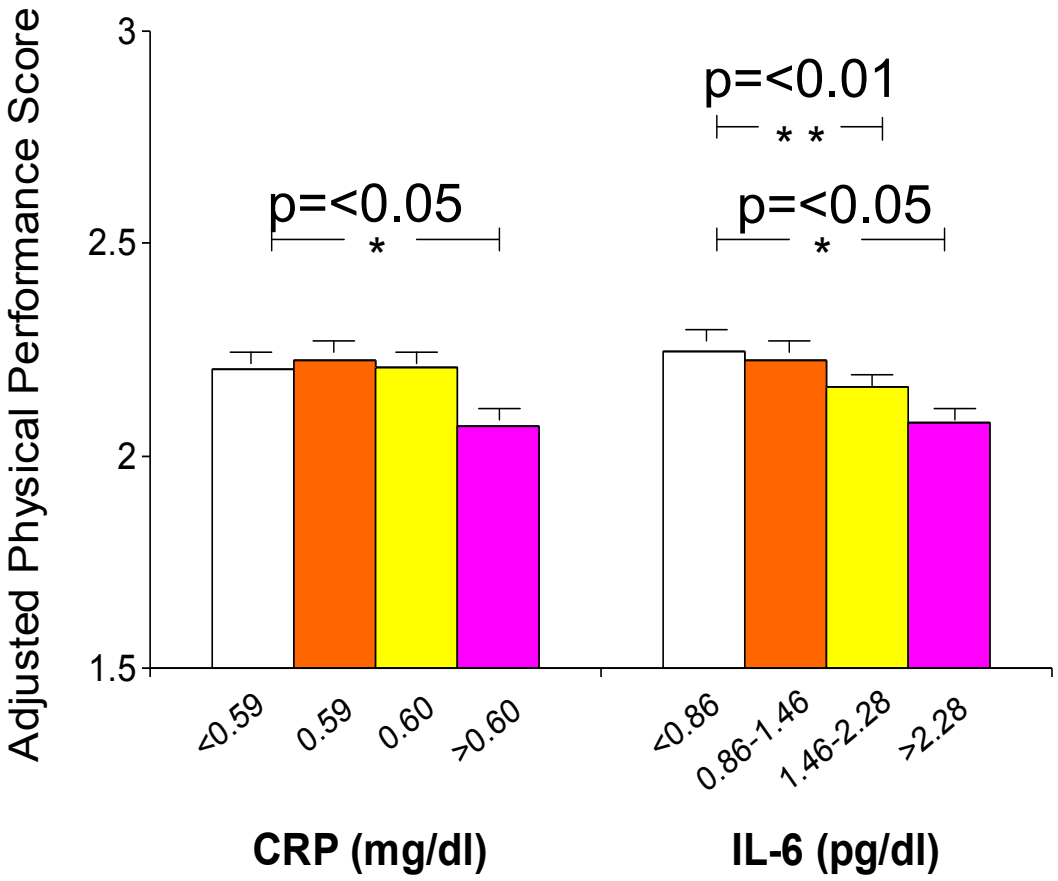
Laura A. Schaap,[1] Saskia M. F. Pluijm,[2] Dorly J. H. Deeg,[1] Tamara B. Harris,[3] Stephen B. Kritchevsky,[4] Anne B. Newman,[5] Lisa H. Colbert,[6] Marco Pahor,[7] Susan M. Rubin,[8] Frances A. Tylavsky,[9] Marjolein Visser,[1,10] for the Health ABC Study





Journal of Gerontology: MEDICAL SCIENCES
Cite journal as: J Gerontol A Biol Sci Med Sci
2009 Vol. 64A, No. 11, 1183–1189

InChianti – Inflammation and physical performance in older persons



Cesari et al. *J.Gerontol. 2004; 59A:242*

Elevated Serum Advanced Glycation End Products and Poor Grip Strength in Older Community-Dwelling Women

Mansi Dalal,[1] Luigi Ferrucci,[2] Kai Sun,[1] Justine Beck,[1] Linda P. Fried,[1] and Richard D. Semba[1]

Table 3. Multivariate Linear Regression Models of Serum Carboxymethyl-Lysine, sRAGE, and esRAGE With Grip Strength

Characteristic*	Beta	*SE*	*p*
Serum CML, highest quartile versus lower three quartiles	−1.31	0.61	.03
Serum sRAGE (ng/mL)	0.44	0.27	.10
Serum esRAGE (ng/mL)	1.16	1.30	.38

Notes: CML = carboxymethyl-lysine; esRAGE = endogenous secretory receptor for advanced glycation end product; SE = standard error.

* Separate models were fit for serum CML, sRAGE, and esRAGE, and each model was adjusted for age, race, BMI, Mini-Mental State Examination score <24, depression, and diabetes.

Journal of Gerontology: MEDICAL SCIENCES
cite journal as: J Gerontol A Biol Sci Med Sci
2009. Vol. 64A, No. 1, 132–137

Lower serum albumin concentration and change in muscle mass: the Health, Aging and Body Composition Study[1–3]

Marjolein Visser, Stephen B Kritchevsky, Anne B Newman, Bret H Goodpaster, Frances A Tylavsky, Michael C Nevitt, and Tamara B Harris, for the Health, Aging and Body Composition Study

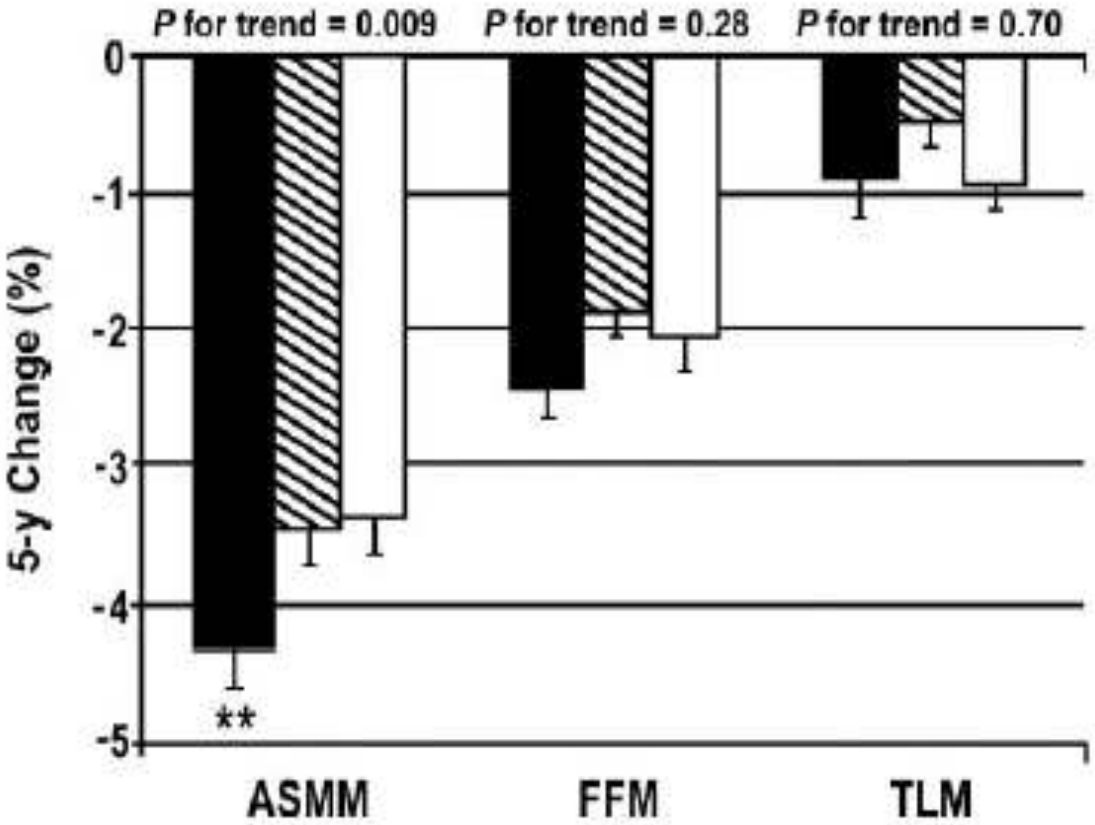


FIGURE 1. Adjusted mean (±SE) relative 5-y change in appendicular skeletal muscle mass (ASMM; $n = 1866$), total-body fat-free mass (FFM; $n = 1784$), and trunk lean mass (TLM; $n = 1849$) according to categories of baseline serum albumin concentration: ■, low (<38 g/L); ▨, intermediate (38-41.9 g/L); and □, high (≥42 g/L). Multiple linear regression analysis was

Am J Clin Nutr 2005;82:531–7.

Effect of DHEAS on Skeletal Muscle Over the Life Span: The InCHIANTI Study

Giorgio Valenti,[1] Licia Denti,[1] Marcello Maggio,[1] GianPaolo Ceda,[1] Stefano Volpato,[2] Stefania Bandinelli,[3] Graziano Ceresini,[1] Anne Cappola,[4] Jack M. Guralnik,[5] and Luigi Ferrucci[6]

Table 4. Factors Independently Associated With Calf Muscle Area in Different Age Groups

	Age 20–39 Years ($N = 56$)		Age 40–59 Years ($N = 51$)		Age 60–79 Years ($N = 342$)		Age 80+ Years ($N = 62$)	
	b (*SE*)	*p*	b (*SE*)	*p*	b (*SE*)	*p*	b (*SE*)	*p*
Age (y)	–0.15 (0.59)	.79	–0.18 (0.52)	.72	–0.76 (0.22)	<.001	–0.50 (0.52)	.35
log(DHEA) (mg/dL)	–2.15 (7.10)	.76	1.41 (4.89)	.77	2.40 (0.94)	<.01	–1.66 (1.57)	.30
log(IL-6) (mcg/mL)					–2.82 (1.12)	<.02		
Height (cm)			0.93 (0.39)	<.03	0.31 (0.13)	<.02	0.64 (0.25)	<.02
BMI	1.83 (0.87)	<.05	2.56 (0.77)	<.002	2.12 (0.29)	<.0001		
Total caloric intake (Kcal/day)*100					–0.49 (0.17)	<.0005		
Albumin (g/dL, mean + *SE*)							14.48 (4.48)	<.005
Triglycerides (mg/dL)*10							0.54 (0.22)	<.02

Notes: In all four age-stratified models, past and present physical activity, smoking alcohol intake, total and HDL cholesterol, number of diseases, number of depressive symptoms, and ADL disability were not independently associated with calf muscle area.

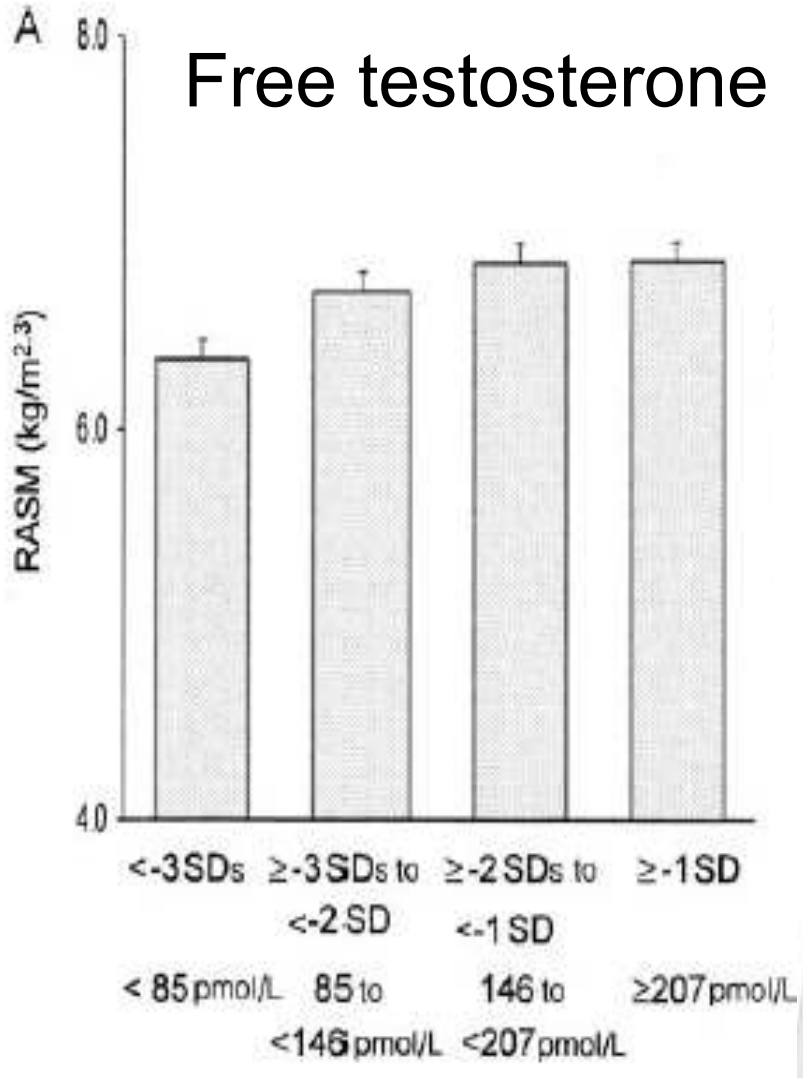
SE = standard error; DHEA = dehydroepiandrosterone; IL-6 = interleukin-6; BMI = body mass index; HDL = high-density lipoprotein; ADL = activities of daily living.

Journal of Gerontology: MEDICAL SCIENCES
2004, Vol. 59A, No. 5, 466–472

Hormonal and lifestyle determinants of appendicular skeletal muscle mass in men: the MINOS study[1–3]

Pawel Szulc, François Duboeuf, François Marchand, and Pierre D Delmas

Relative Appendicular Skeletal Mass Index



Am J Clin Nutr 2004;80:496–503.

Low Vitamin D and High Parathyroid Hormone Levels as Determinants of Loss of Muscle Strength and Muscle Mass (Sarcopenia): The Longitudinal Aging Study Amsterdam

MARJOLEIN VISSER, DORLY J. H. DEEG, AND PAUL LIPS

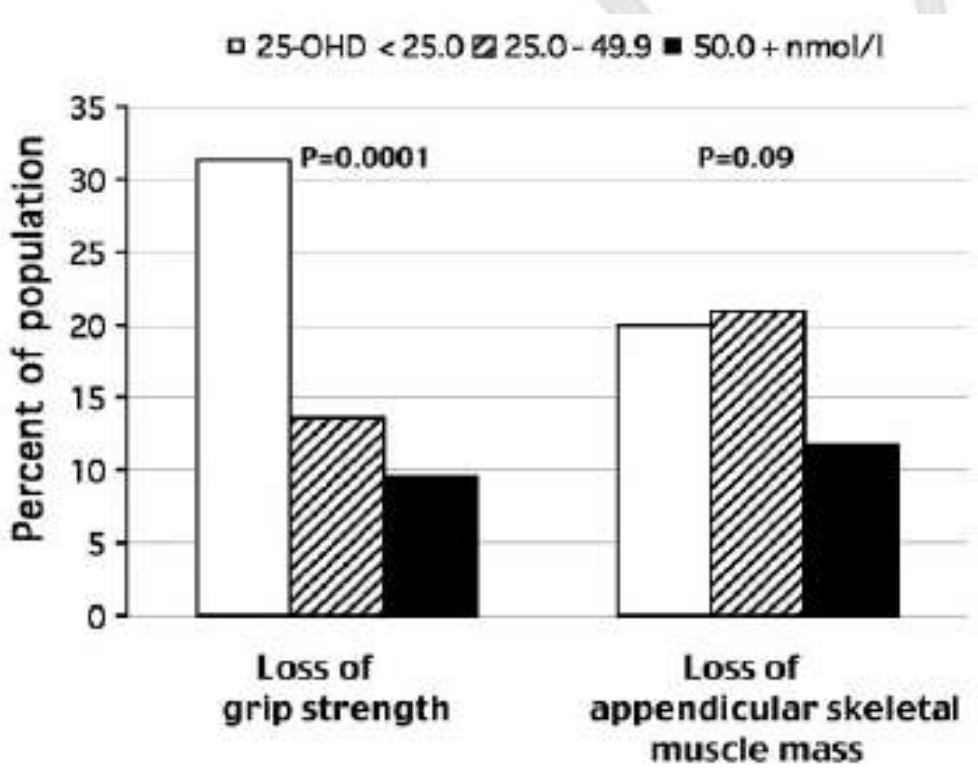


FIG. 1. Prevalence of grip strength loss (defined as loss >40%, study sample n = 1,008) and appendicular muscle mass loss (defined as loss >3%, study sample n = 331) during 3-yr follow-up according to categories of baseline serum 25-OHD concentration. *P* value of χ^2 test.

J Clin Endocrinol Metab, December 2003, 88(12):5766–5772

Low Vitamin D and High Parathyroid Hormone Levels as Determinants of Loss of Muscle Strength and Muscle Mass (Sarcopenia): The Longitudinal Aging Study Amsterdam

MARJOLEIN VISSER, DORLY J. H. DEEG, AND PAUL LIPS

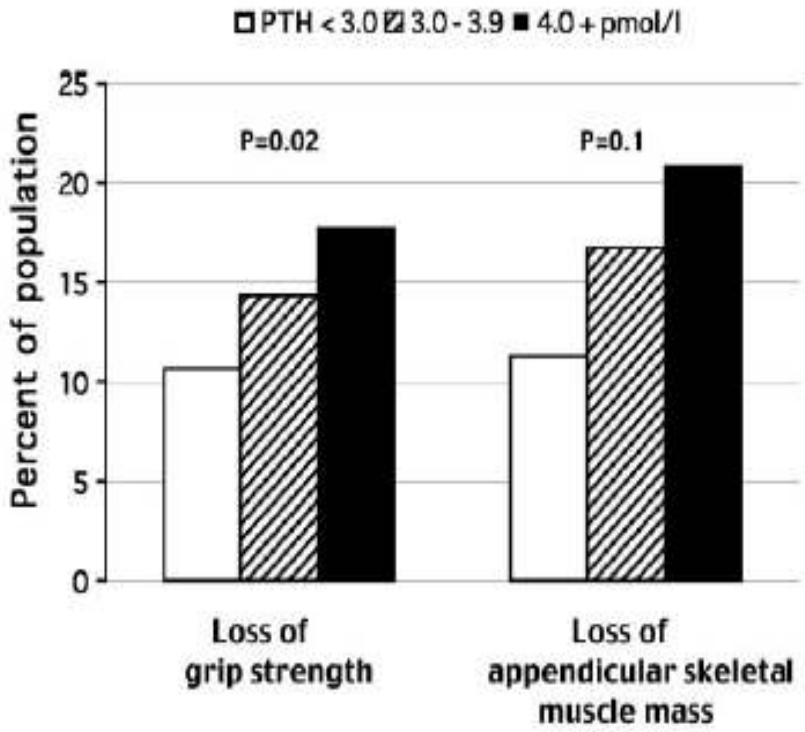


FIG. 2. Prevalence of grip strength loss (defined as loss >40%, study sample n = 1,008) and appendicular muscle mass loss (defined as loss >3%, study sample n = 331) during 3-yr follow-up according to tertiles of baseline serum PTH concentration. *P* value of χ^2 test.

J Clin Endocrinol Metab, December 2003, 88(12):5766–5772

Insulin-Like Growth Factor-1 and Interleukin 6 Predict Sarcopenia in Very Old Community-Living Men and Women: The Framingham Heart Study

Hélène Payette, PhD,† Ronenn Roubenoff, MD, MHS, FACP,*† Paul F. Jacques, DSc,† Charles A. Dinarello, MD,‡ Peter W. F. Wilson, MD,§ Leslie W. Abad, MS,*† and Tamara Harris, MD, MSc‖*

JAGS 51:1237–1243, 2003

Table 3. Multivariate Linear Regression Model to Predict Changes in Fat-Free Mass in Very Old Participants of Framingham Heart Study

	Men*		Women†	
Predictor	$\hat{\beta} \pm$ SE	*P*-value	$\hat{\beta} \pm$ SE	*P*-value
Intercept	−1.11 ± 2.66	.676	2.61 ± 1.47	.076
Age	−0.02 ± 0.03	.535	−0.01 ± 0.02	.621
FFM index, kg/m^2	−0.27 ± 0.07‡	<.001	−0.35 ± 0.05‡	<.001
Body fat, %	0.13 ± 0.02§	<.001	0.09 ± 0.01§	<.001
Weight change, kg	0.29 ± 0.03‖	<.001	0.22 ± 0.02‖	<.001
Serum IGF-1, mg/dL	0.005 ± 0.002§	.002	—	—
Cellular IL-6, quartiles¶	—	—	−0.14 ± 0.06‡	.024

*F = 29.12; R^2 adj. = 0.38; P < .001.

†F = 37.92; R^2 adj. = 0.36; P < .001.

‡A negative coefficient indicates that greater baseline fat-free mass (FFM) index and interleukin 6 (IL-6) levels are predictive of greater losses in FFM.

§A positive coefficient indicates that greater baseline body fat percentage and serum insulin-like growth factor 1 (IGF-1) are predictive of smaller losses in FFM.

‖Total body weight changes in the same direction as FFM.

¶IL-6 quartiles: ≤25%: ≤1.96 ng/mL; 25–50% : >1.96 and ≤3.20 ng/mL; 50–75%: >3.20 and ≤5.00 ng/mL; >75%: >5.00 ng/mL.

^β = estimated regression coefficient (β); SE = standard error.

Oxidative protein damage is associated with poor grip strength among older women living in the community

Caitlin Howard[1], Luigi Ferrucci[2], Kai Sun[1], Linda P. Fried[1], Jeremy Walston[1], Ravi Varadhan[1], Jack M. Guralnik[3], and Richard D. Semba[1]

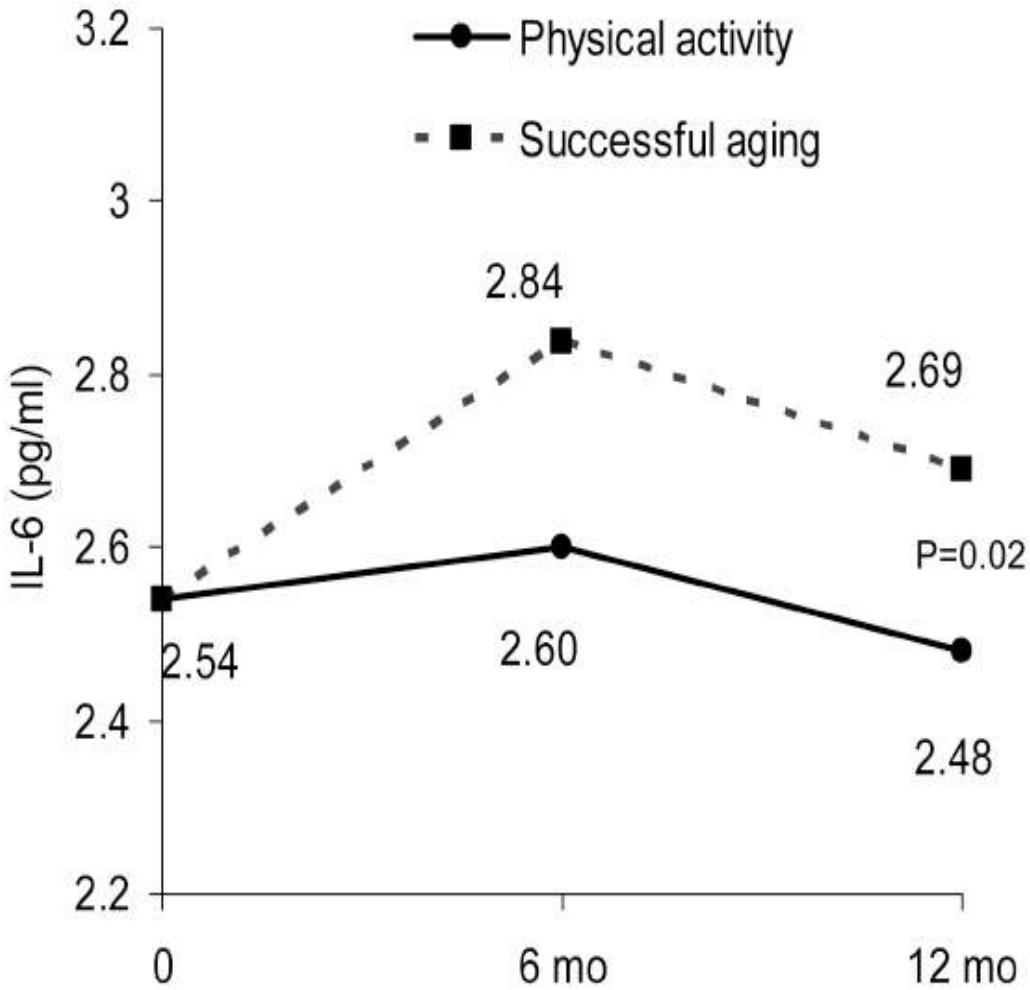
Multivariate ordered logistic regression models of serum protein carbonyls and other risk factors with grip strength

Variable	OR	95% CI	*P*
Protein carbonyls (nmol/mg)	8.74	1.06–71.89	0.043
IL-6 (pg/ml)	1.06	1.00–1.13	0.052
Age (yr)	1.09	1.06–1.11	<0.0001
Race (white)	1.72	1.24–2.39	0.001
Current smoking	0.74	0.46–1.19	0.22
Body mass index *			
<18.5 kg/m^2	1.63	0.69–3.88	0.27
25.0–29.9 kg/m^2	0.63	0.44–0.90	0.01
≥30 kg/m^2	0.53	0.37–0.76	0.001
MMSE	1.14	0.76–1.69	0.53
Hypertension	1.01	0.75–1.35	0.95
Congestive heart failure	1.46	0.92–2.34	0.11
Depression	1.79	1.22–2.63	0.003

J Appl Physiol. 2007 July ; 103(1): 17–20.

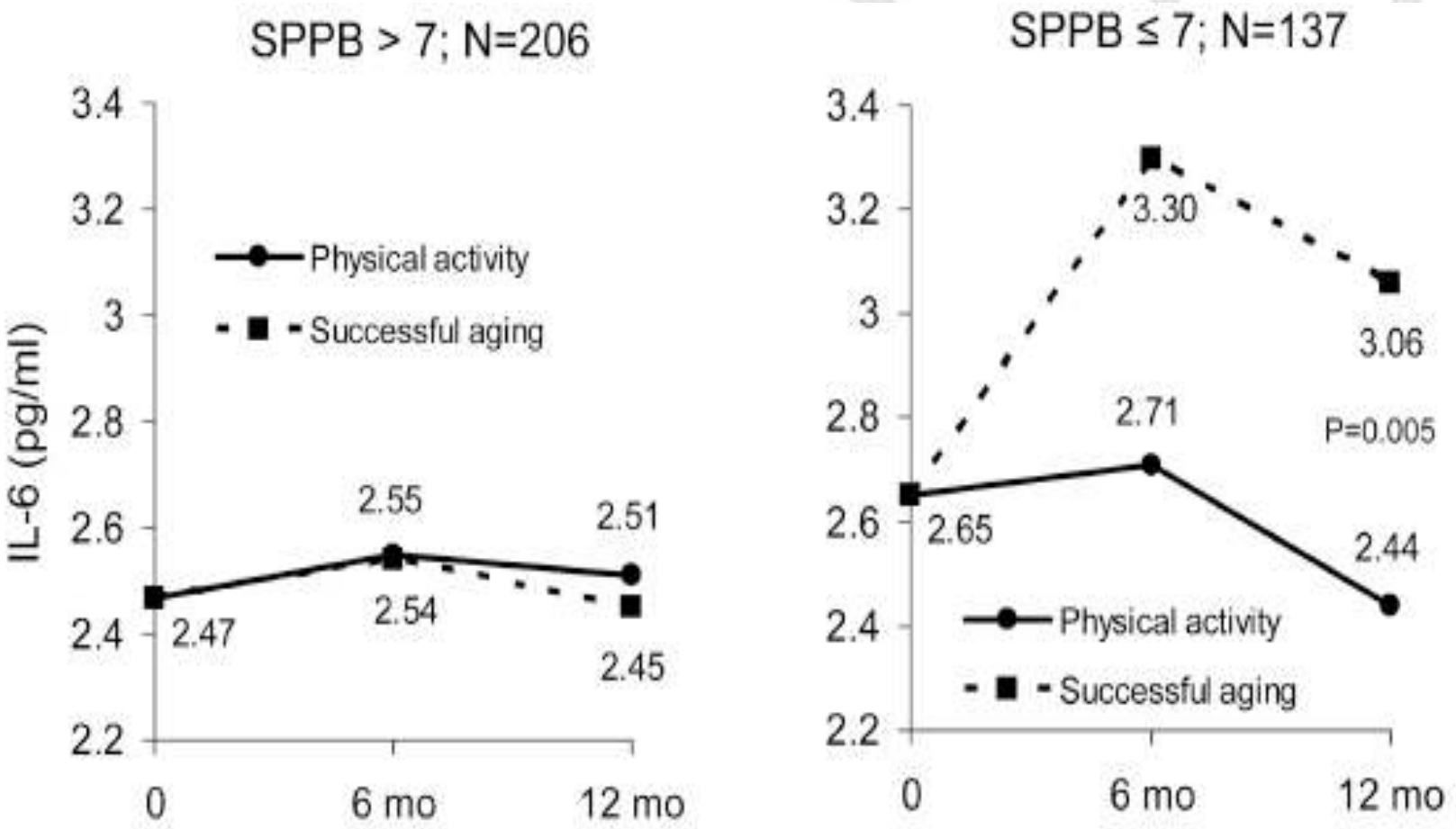
Factores de riesgo biológicos de sarcopenia modificables
•Anemia
•Inflamación (elev. IL-6, CRP, TNF-alpha)
•Elevación de AGEs
•Baja albumina sérica
•Baja DHEA-S
•Baja testosterona en hombres
•Baja vitamina D
•Bajo IGF-1
•Carbonilación de proteinas (estrés oxidativo)

LIFE-Pilot – Actividad Física e IL-6



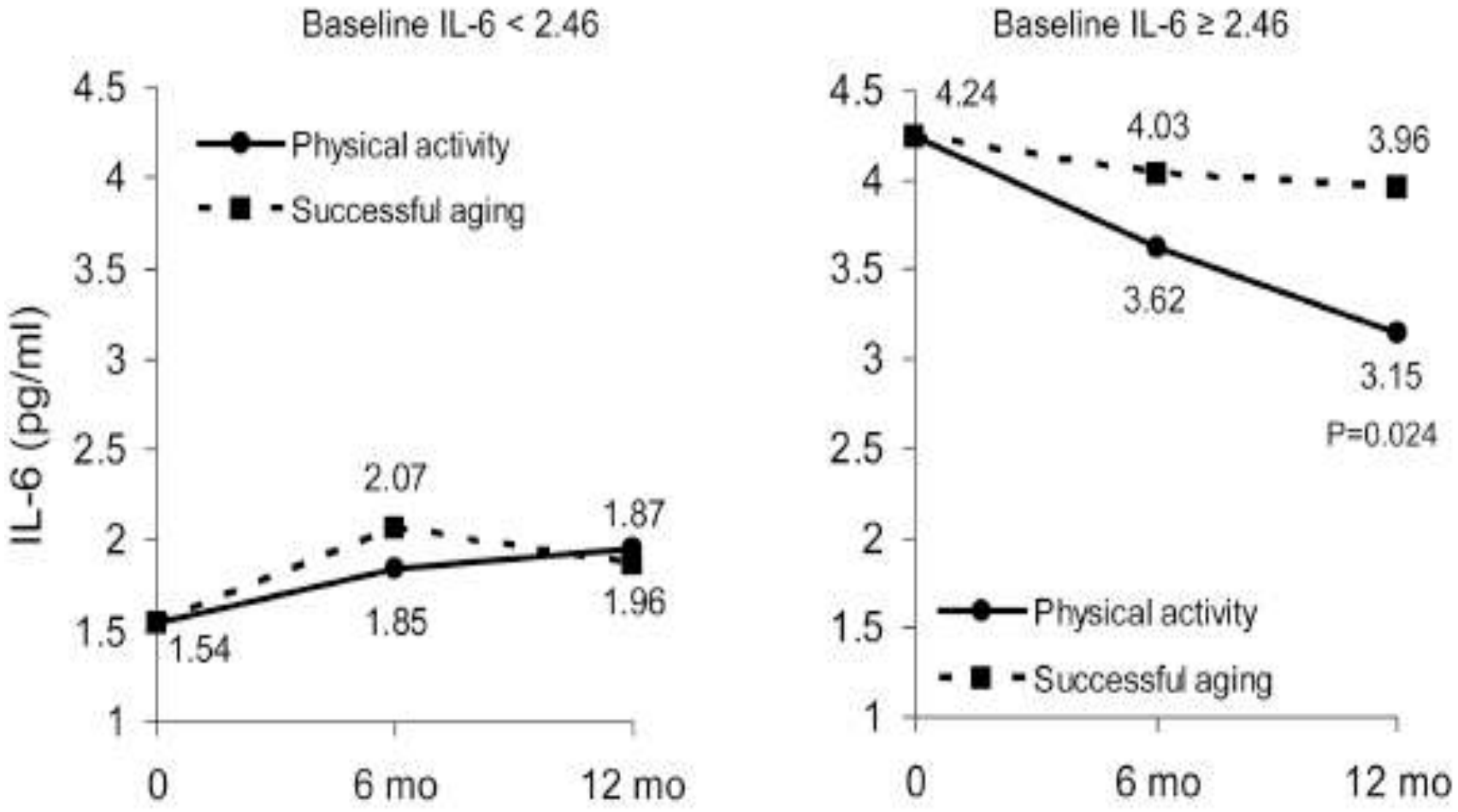
Nicklas et al. *JAGS; 2008;56:2045*

LIFE-P – actividad física e IL-6 según SPPB basal

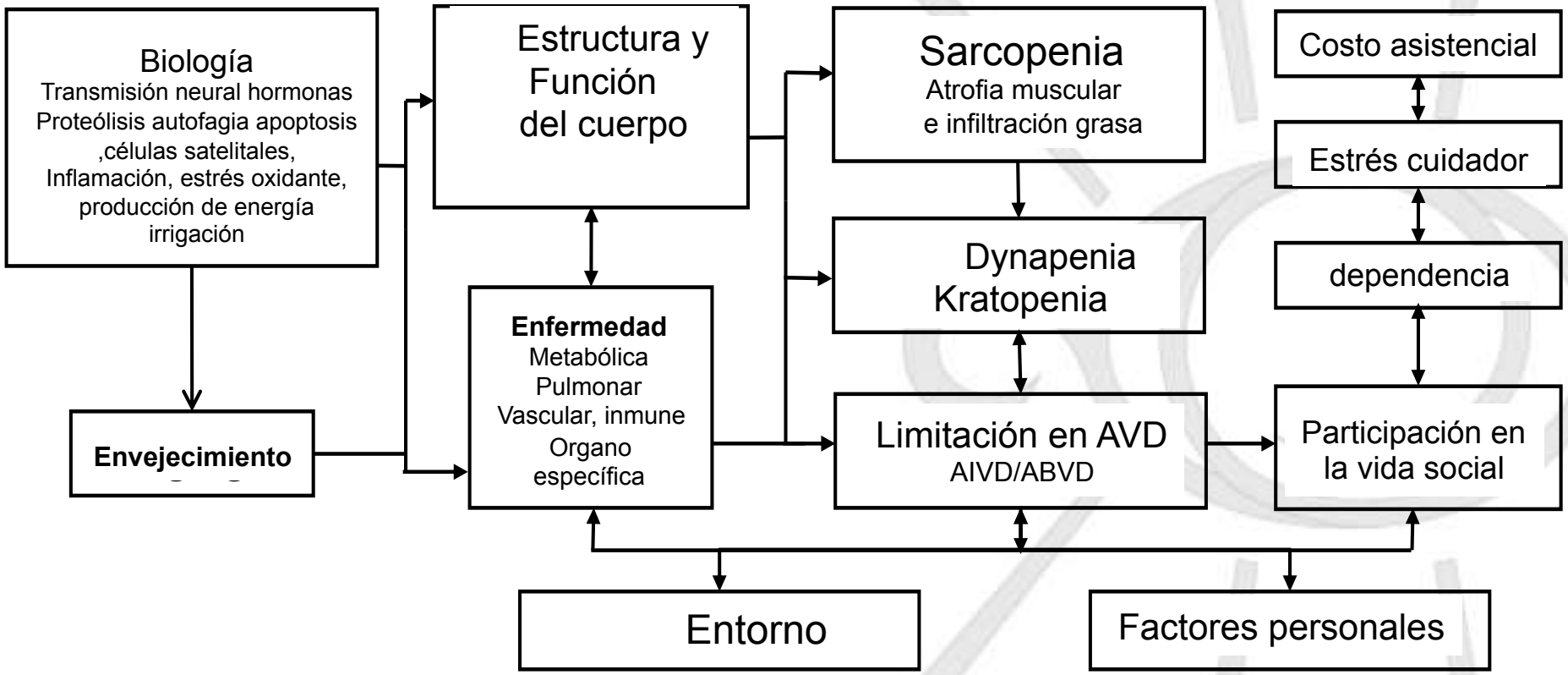


Nicklas et al. *JAGS; 2008;56:2045*

LIFE-P – actividad física e IL-6 según IL-6 basal



Nicklas et al. *JAGS; 2008;56:2045*



Buford TW et al.
Ageing Res Rev 2010;9:369-83

Evaluación de la sarcopenia *puntos clave no resueltos*

- Decremento por edad o por enfermedad?
- Naturaleza bidimensional de la sarcopenia
- Diferentes ritmos de declinación en diferentes segmentos corporales?
- Hasta ahora enfocada a músculo estriado
- Identificación necesaria de una metodología que sirva como “estandar de oro”
- Definición necesaria de puntos de corte clínicamente relevantes
- Técnicas de imagen apropiadas para personas mayores

Sarcopenia: An Undiagnosed Condition in Older Adults.

Current Consensus Definition:
Prevalence, Etiology, and Consequences

International Working Group on Sarcopenia

From the International Sarcopenia Consensus Conference Working Group Meeting
Rome, Italy

November 18, 2009

J Am Med Dir Assoc 2011; 12: 249–256

Sarcopenia: Consenso vigente

"Sarcopenia es la pérdida de masa y función musculo-esquelética asociada a la edad. Es un síndrome complejo que se asocia con la sola pérdida de músculo o en conjunción con aumento en la masa grasa. Las causas de la sarcopenia son multifactoriales e incluyen desuso, cambios en la función endócrina, enfermedades crónicas, inflamación resistencia a la insulina y deficiencias nutricionales. Mientras que la caquexia puede ser un componente de la sarcopenia, ambas condiciones difieren en su naturaleza."

Velocidad de la marcha < 1.0 $m \cdot s^{-1}$; hombres = $aLM/Ht^2 \leq 7.23\ kg/\ m^2$
Mujeres = $aLM/Ht^2 \leq 5.67\ kg/\ m^2$

Detección oportuna de la Sarcopenia

- Evalúe al paciente buscando evidencia de deterioro de la funcionalidad física o debilidad muscular.
- Considere Sarcopenico al paciente incapaz de deambular o de levantarse de una silla sin ayuda.
- Mida la velocidad de la marcha en 4 mts.
- Pacientes con una velocidad de la marcha habitual de < 1.0 m/seg. Deben ser sometidos a medición de masa muscular por DXA.

Sarcopenia with limited Mobility

A position paper from the Society on Sarcopenia, Cachexia and Wasting Disorders Trialist Workshop,

Washigton DC, December, 2010

published in JAMDA , June 2011

Sarcopenia con movilidad limitada

- Es una condición específica con clara pérdida de masa muscular y un desenlace claro para la intervención.
- Es un síndrome no una enfermedad
- Definición basada en consenso
- Difiere de un concepto más general de fragilidad.

Sarcopenia con movilidad limitada: Definición

Una persona con pérdida muscular cuya velocidad de marcha es igual o menor a 1m/s o que camina menos de 400 m en una caminata de 6 min. La persona debe tener también una merma en la masa muscular corregida por la talla al cuadrado de más de dos desviaciones estándar por debajo de las personas sanas de entre 20 y 30 años del mismo grupo étnico. La Sarcopenia se cree es relacionada a la edad y su prevalencia crece al envejecer.

Sarcopenia con movilidad limitada: Exclusiones

- Enfermedad vascular periférica con claudicación intermitente
- Defectos musculares congénitos o adquiridos
- Desórdenes del SNC como EVC, parkinson o esclerosis múltiple
- Desórdenes del sistema nervisoso periférico como enfermedad de motoneuronas, enfermedad medular o neuropatía periférica
- Demencia
- Caquexia

Sarcopenia con movilidad limitada: Intervenciones clínicamente significativas.

- Incremento de 50 metros en la caminata de 6 minutos
- Incremento en la velocidad de la marcha de 0.1 m/seg

- NOTA: el incremento de 50 metros ha sido empleado por la FDA para aprobar fármacos relacionados con enfermedad vascular periférica y EPOC

Algunas precisiones:

- Existe cierta sobreposición entre la definición de Roma de "**Sarcopenia**" y la definición de la Society on Sarcopenia, Cachexia and Wasting Disorders Trialist Workshop de **"Sarcopenia con movilidad limitada"**.
- La definición de **"Sarcopenia con movilidad limitada"** captura de una mejor manera el impacto funcional y potenciales desenlaces terapéuticos

Como evaluar la sarcopenia (masa muscular)



BIA

vs.



vs.



- BIA (UQAM; Ω: ohm)
  - Masa muscular esqueletica (MM; Janssen et al., 2004): [talla (m)²/*R (Ω)* x 0.401] + [edad (años) x -0.071] + 5.102

Cómo evaluar la sarcopenia (fuerza muscular)



VS.



Isometrica;
Concentrica;
Excentrica

VS.







1 repetición maxima

Cómo evaluar la sarcopenia (potencia muscular)

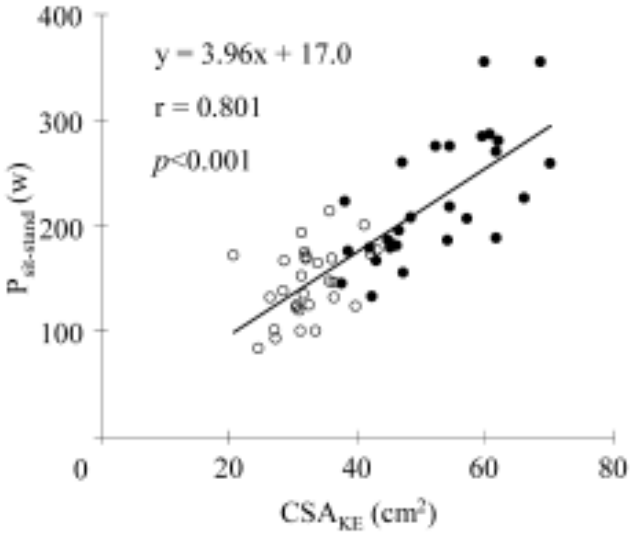
- **Protocolo de Takai:**
- **Levantarse 10 veces a la máxima velocidad**

$$P_{\text{sit-stand}} = \frac{(L - 0.4) \times \text{body mass} \times g \times 10}{T_{\text{sit-stand}}}$$



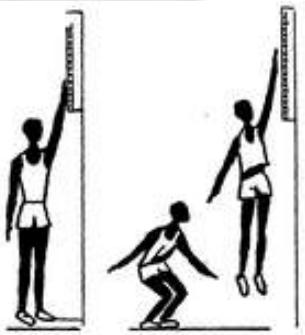


vs.









Takai Y et al., J Physiol Anthrop 28:123, 2009

IAGG Global Research Network on Aging

SARCOPENIA PREVALENCE AND MORTALITY RISK IN MEXICO CITY

Victoria Arango MSc [1], Ulises Perez MSc [1], Jose Alberto Avila Funes MSc [2], Liliana Ruiz MSc [2], Roberto Castrejón MSc [1], Pedro Arroyo MD [1] and Luis Miguel Gutiérrez-Robledo MD PhD

[1] Institute of Geriatrics

[2] National Institute of Medical Sciences

Introduction

- There is no consensus about how to estimate sarcopenia prevalence in the field in large epidemiological studies.
- Several studies show a prevalence that varies between 8 and 50% in persons over 50 years,
- The wide range of variation in prevalence may be due to:
  - Gender, ethnicity, location and, mainly diagnostic criteria for case definition

The context

- We are about to carry on the third wave of the Mexican Health and Aging Survey (ENASEM) in 2012; a large (12,000 individuals 50 years and older) panel survey that began in 2001.
- We are in the process of selecting the variables and biomarkers to be measured
- We decided to explore the variables available in a small cohort study, in order to advance towards the development of an algorithm that would allow us to identify sarcopenia at the community level with simple measurements.

Population and methods

- A cohort of 1124 community-dwelling Mexicans 70 years' and older at baseline (2008) was used to test an algorithm for sarcopenia detection (ASD) and its predictive validity for mortality.
- The cohort has completed 120 weeks of follow up.
- ASD was conceptualized as a measure of sarcopenia derived form the EUGMS consensus, that combines estimates of muscle quantity and function. It is based on component items that can be easily obtained in the field

Aim

To explore the predictive validity for adverse outcomes of an algorithm developed to identify sarcopenia

prevalence in Mexican seniors, living in Coyoacán



«Coyote´s place»

Population at Delegación Coyoacán

Coyoacán	Total		Men		Women	
	No.	%	No.	%	No.	%
70 - 79	22,748	3.6	9,327	3.2	13,421	4.0
80 - 89	9,290	1.5	3,386	1.1	5,904	1.8
90 +	1,735	0.3	538	0.2	1,197	0.4
Total 70 +	33,773	5.4	13,251	4.5	20,522	6.2
Total Coyoacán	628,063	100	295,802	100	332,261	100

POPULATION AND METHODS

- The sample of this study consisted of 345 subjects older than 70 out of 1124 randomly selected individuals from the universal pension system list
- The subsample was selected based on the availability of the complete SPPB, anthropometric and grip strength data
- There was no statistical difference between this subsample and the entire cohort in the main variables
- We reviewed the mortality data after 120 weeks.

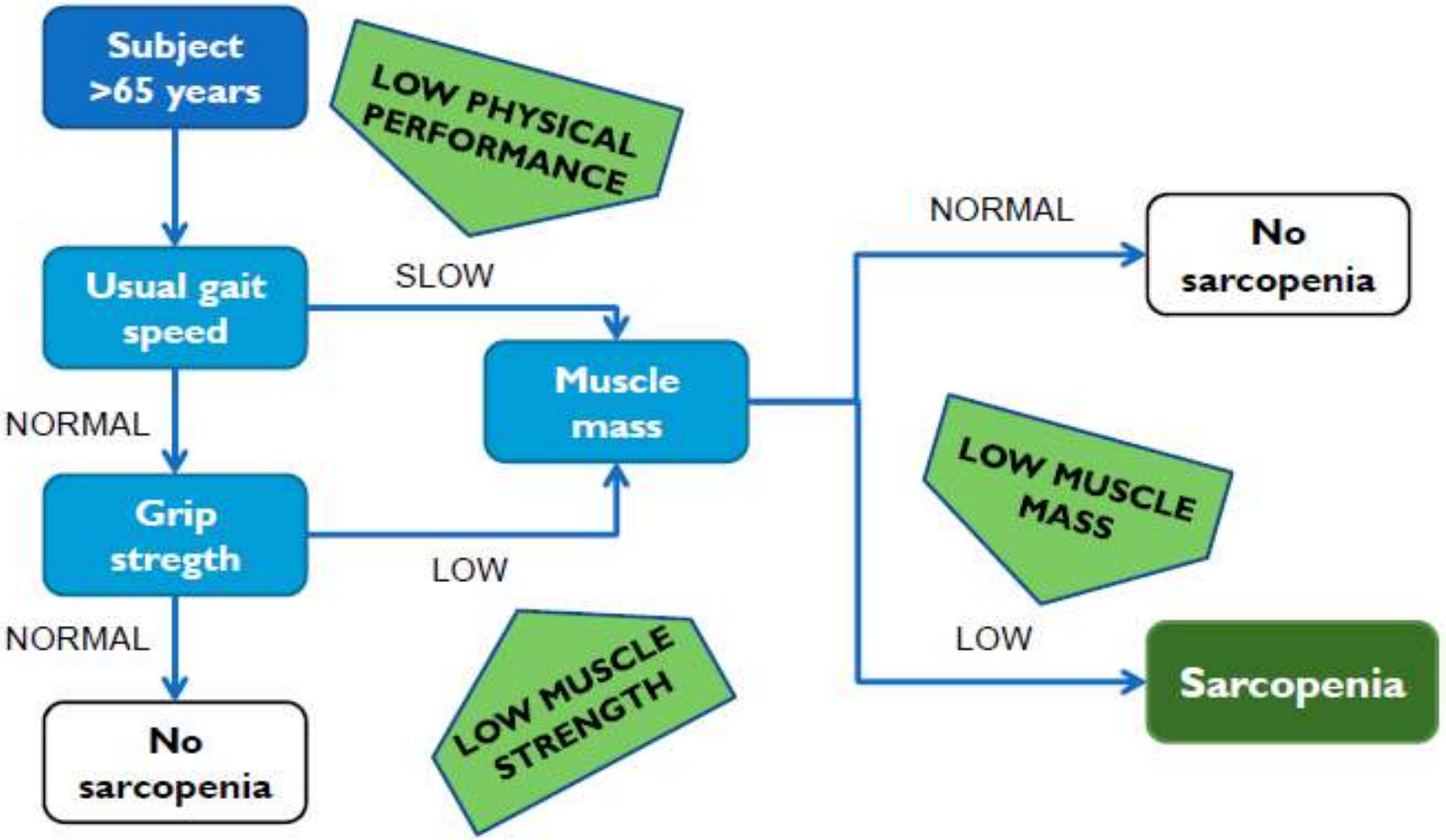
General description

Variable	Male	Female	Total
Mean Age	78.4 (±7)	78.5 (±6.8)	78.5 (±6.9)
Years of education	6 (±5)	5 (±5)	5.5 (±5.2)
Iliterate	1.9% (n=3)	2.7% (n=5)	2.4% (n=8)
% Married	64% (n=87)	33.1% (n=52)	47.4% (n=139)

Anthropometry

Variable	male(±DE)	female(±DE)	Total (±DE)
Weight	69.25 (±12.96)	60.64 (±11.04)	64.66 (±12.7)
Height	160.87 (±7.24)	147.91 (±4.31)	153.96 (±9.37)
BMI, kg/m^2	26.53 (±3.69)	27.85 (±4.31)	27.23 (±4.08)
Abdominal Circ. cms.	96.81 (±10.89)	95.09 (±11.16)	95.89 (±11.05)
Hip circ. cms	97.9 (±8.71)	101.13 (±9.91)	99.62 (±9.49)
Calf circ, cms.	34.28 (±3.57)	33.02 (±3.98)	33.61 (±3.84)
Arm circ, cms	28.32 (±3.36)	28.87 (±3.74)	28.61 (±3.57)
Knee heigth cms	50.34 (±2.63)	46.09 (±2.93)	48.08 (±3.51)
Grip strength, kPa	25.2 (±7.76)	15.42 (±4.59)	19.98 (±7.94)

EWSOP Case Finding



Cruz-Jentoft AJ et al. Sarcopenia: European consensus on definition and diagnosis. Report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010

Sarcopenia definition was based in European criteria (EWSOP):



Muscle mass



Muscle force



Physical performance

Cruz Jentoft A, Baeyen JP, Bauer J et al. Sarcopenia: European consensus on definition and diagnosis Report of the European Working Group on Sarcopenia in Older People Age and Ageing 2010; 1–12

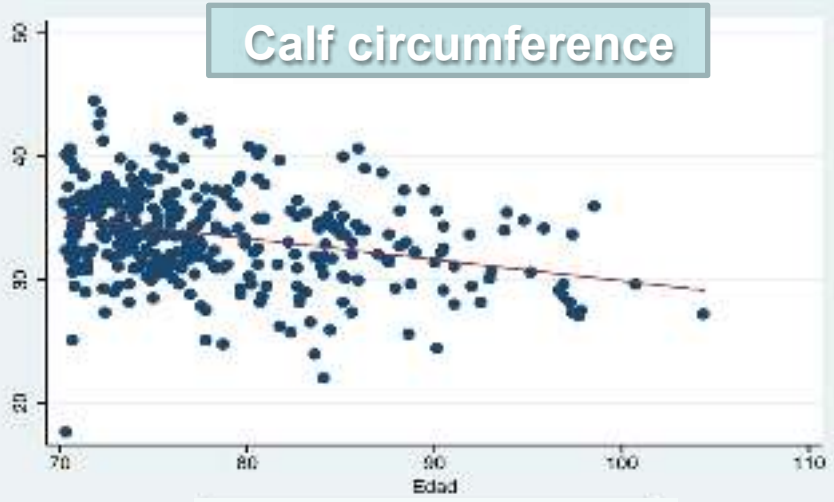
Calf circumference and sarcopenia diagnosis

	Low muscular mass	Normal muscular mass
<31cm	44.3%/Sensibility	
>31cm		91.4%/ Specificity

Rolland Y. Lauwers-Cances V, JAGS 51:1120–1124, 2003

Correlations

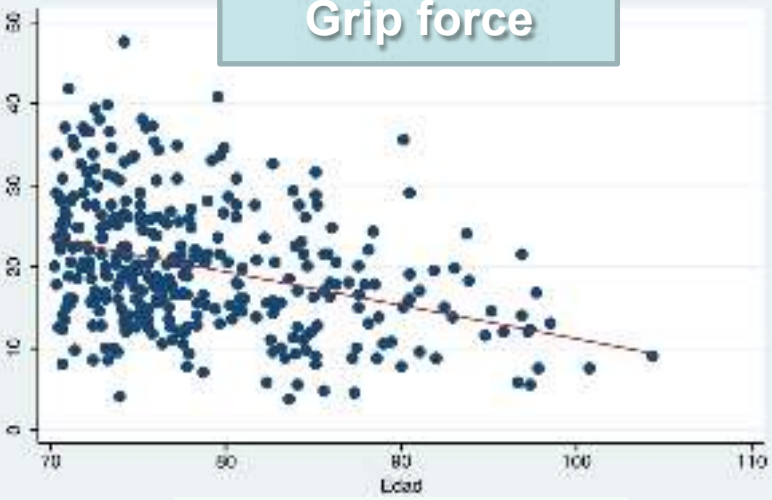
Calf circumference



Walking speed



Grip force



Co-relations with advancing age and co-relations index

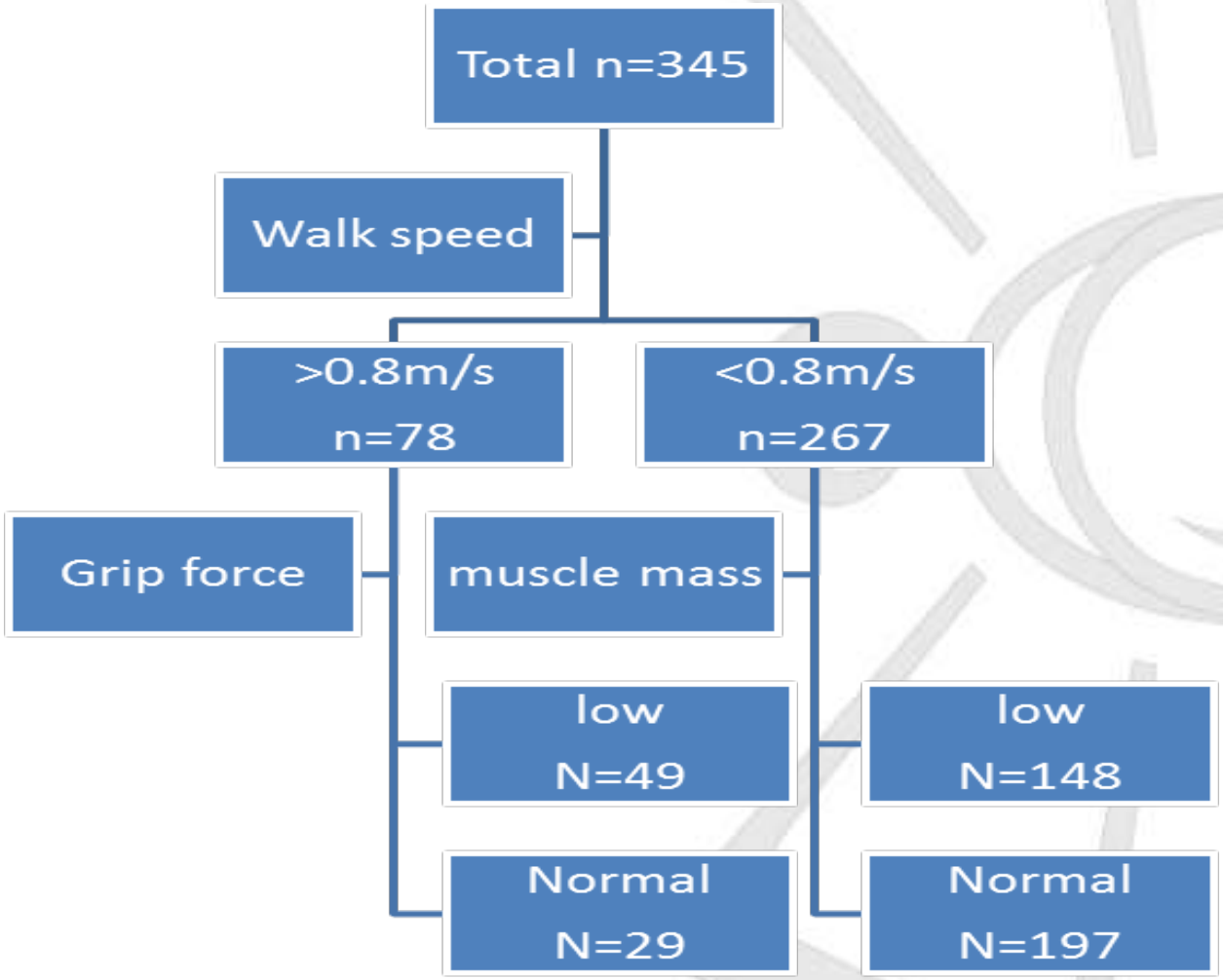
Variables	Age
Grip force	r=-0.373 R^2=0.139 p=<0.01
Gait speed	r=-0.308 R^2=0.094 p=<0.01
Calf circumference	r=-0.312 R^2=0.097 p=<0.01

Finally, trough the algorithm we got the case definition

- **Gait speed**
  - > 0.8 m/s
  - < 0.8 m/s
- **Grip strength**
  - Men: < 30 kg
    Women: < 20 kg
- **Calf circumference**
  - ≥ 31 cms
  - < 31 cms

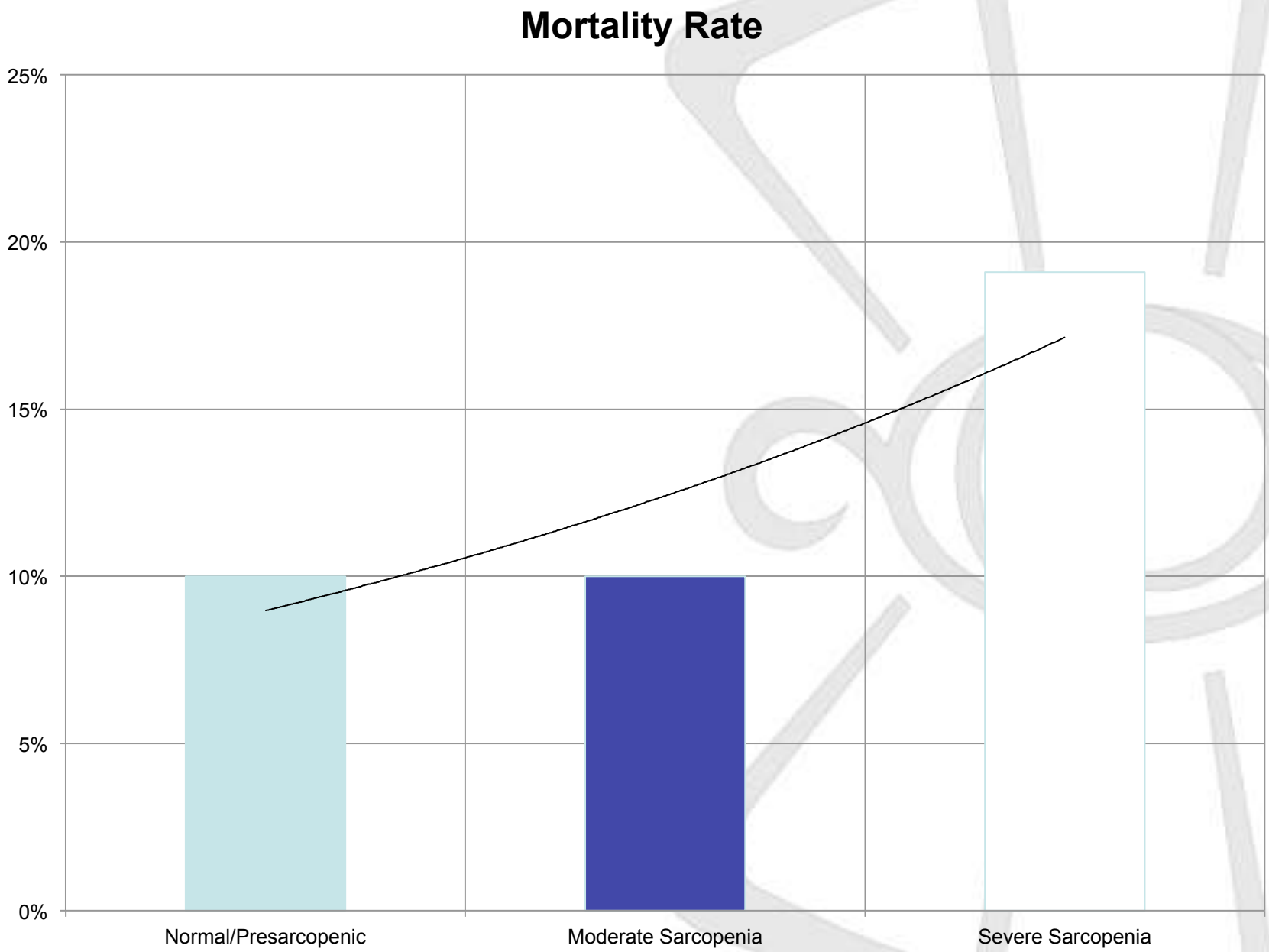
RESULTS

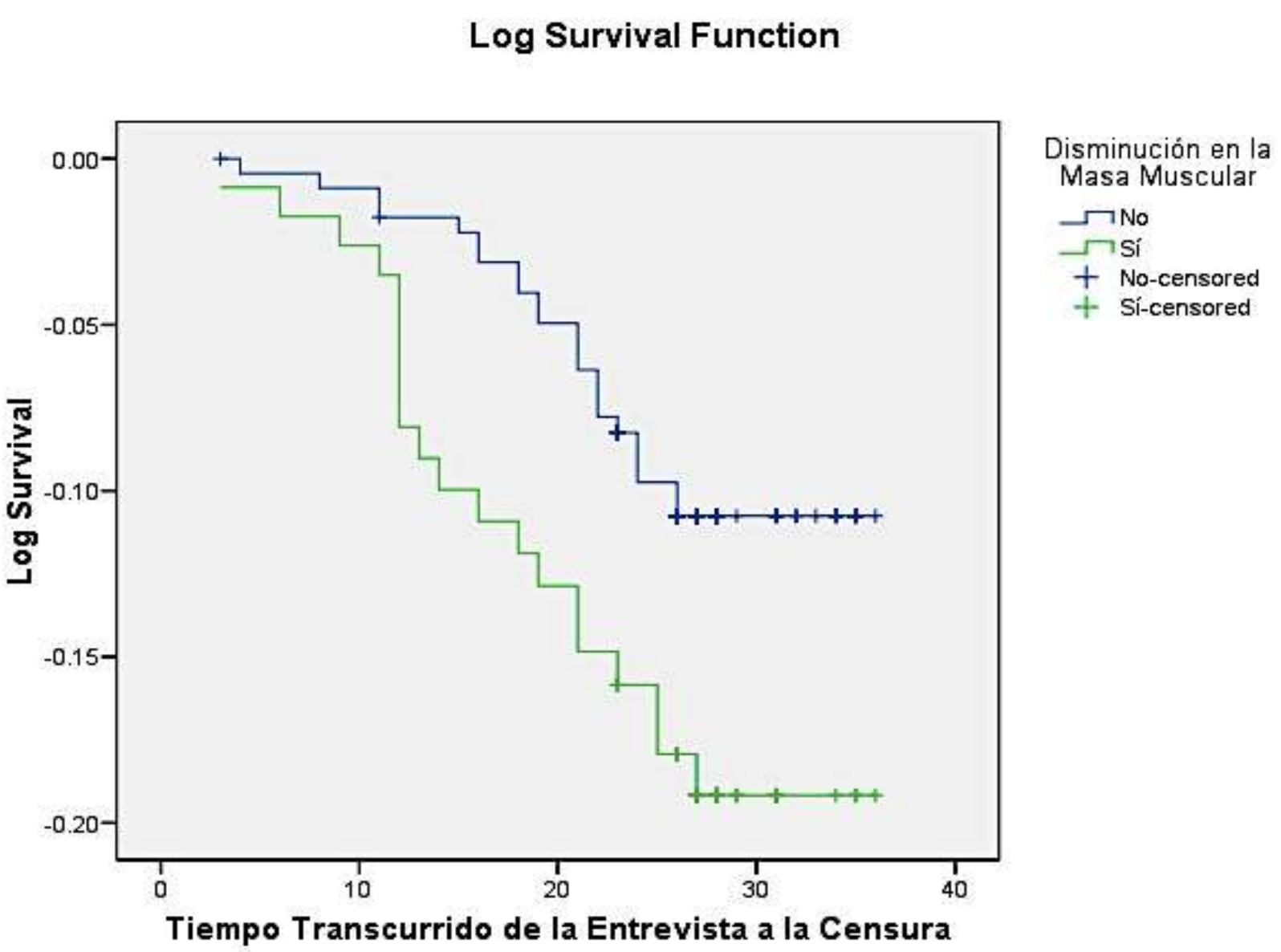
Absolute numbers

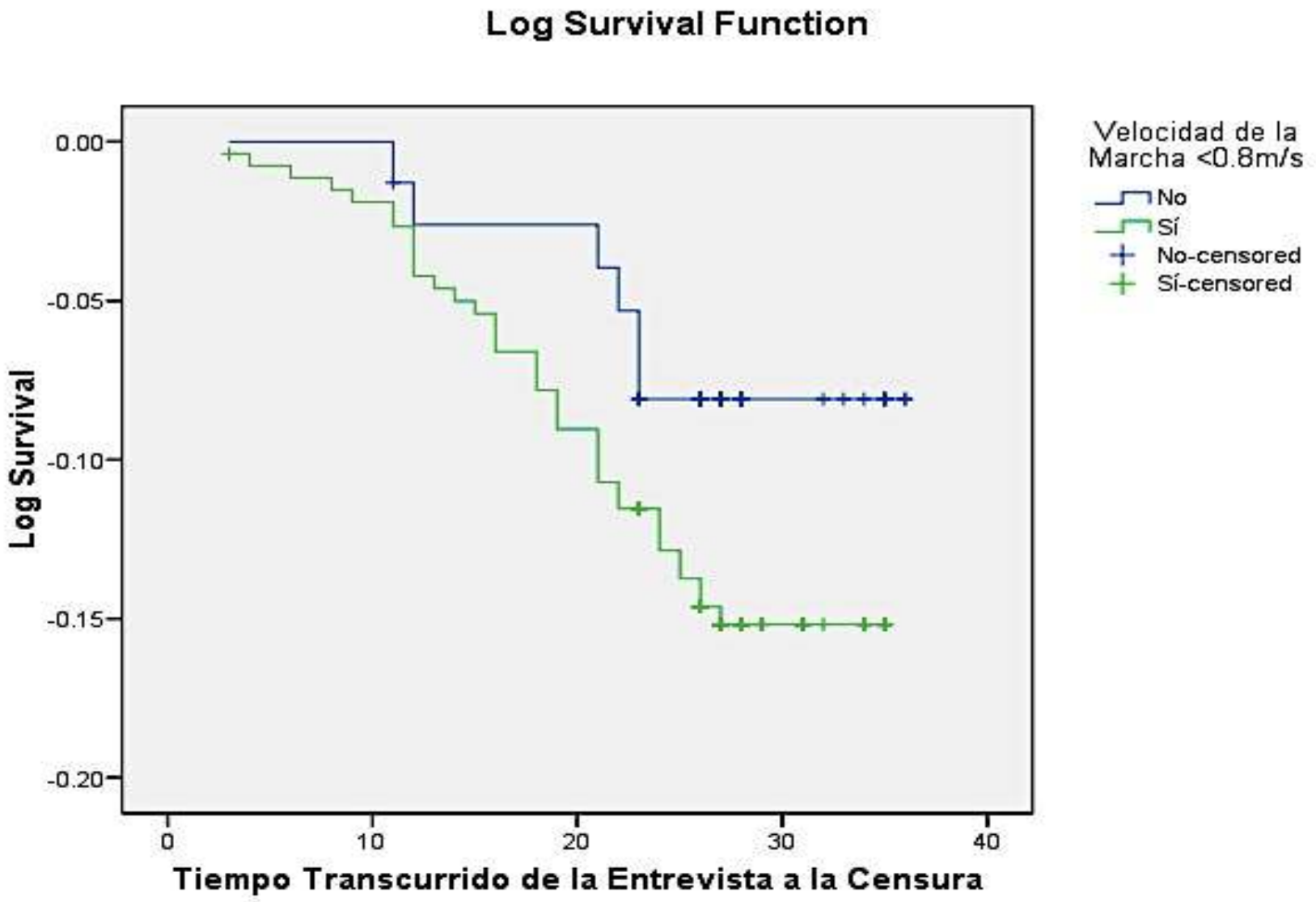


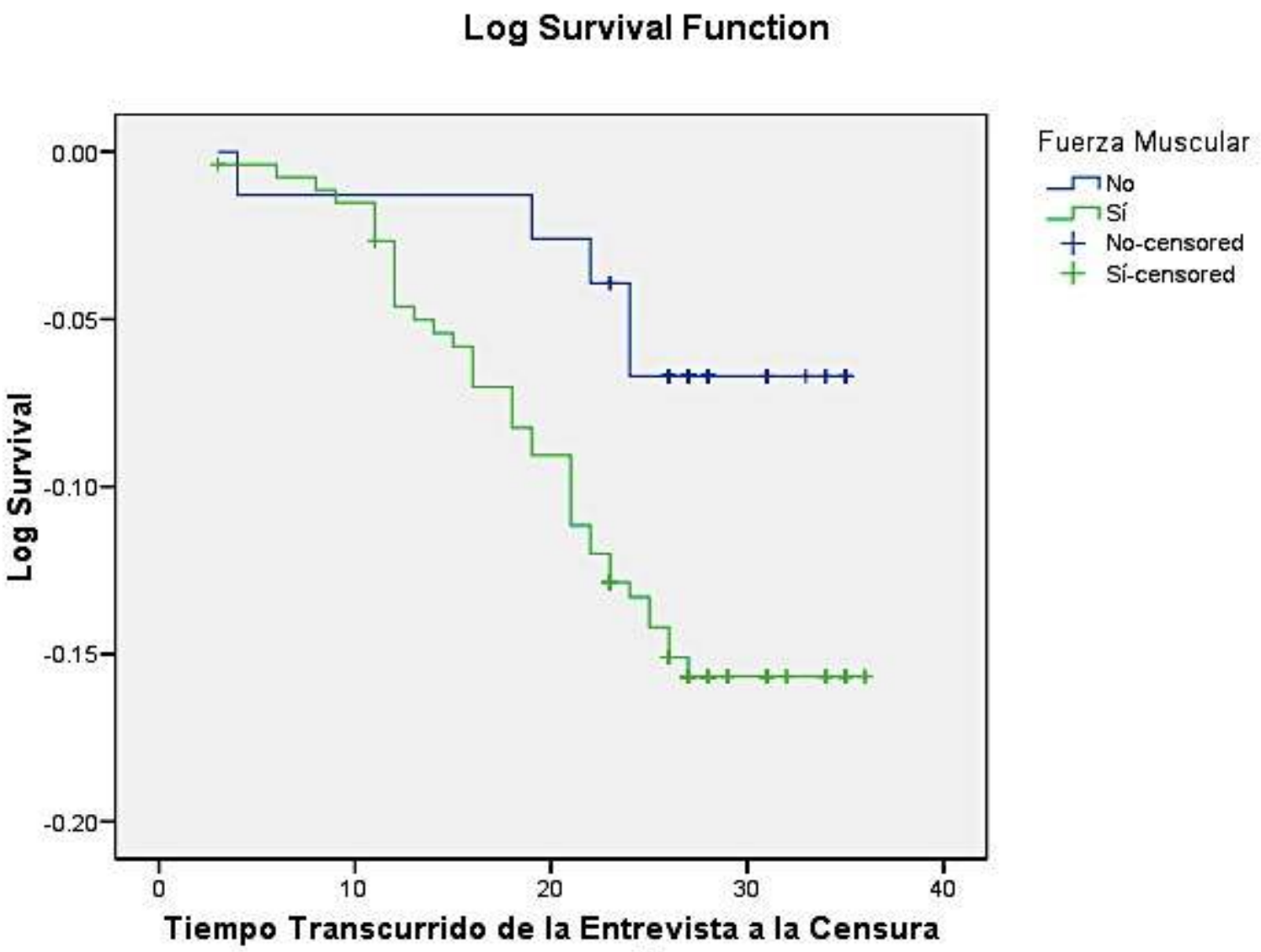
Sarcopenia Prevalence

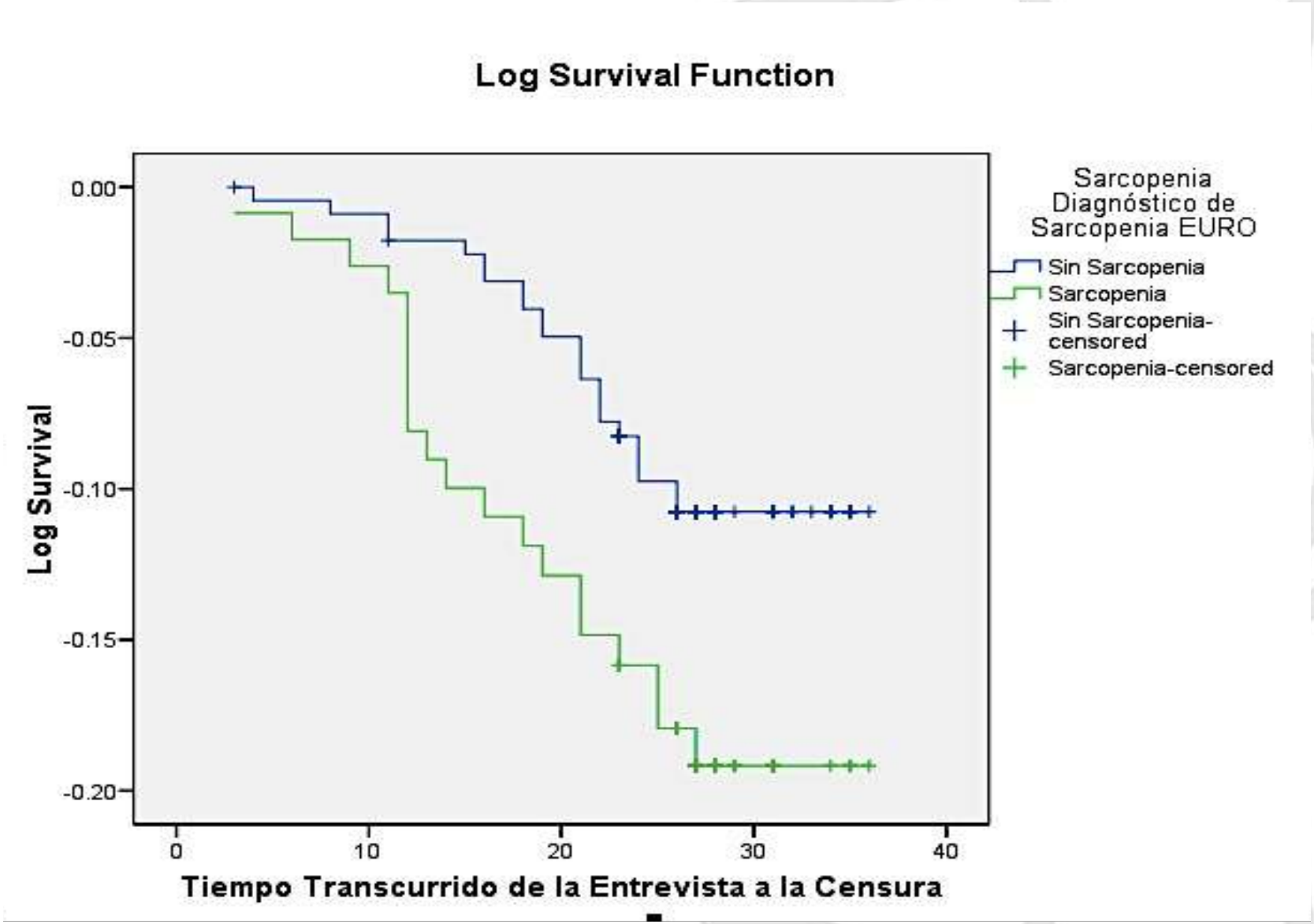
Age	EWSOP %(n)		
	Men	Women	Total
70-80	5.5 (6)	20.8 (26)	13.15 (32)
81-90	27.8 (10)	33.3 (15)	30.55 (25)
>90	43.8 (7)	71.4 (10)	57.6 (17)
Total	25.7 (23)	41.83 (51)	33.76 (74)


Mortality Rate
25%
20%
15%
10%
5%
0%
Normal/Presarcopenic
Moderate Sarcopenia
Severe Sarcopenia


Log Survival Function
Log Survival
0.00
-0.05
-0.10
-0.15
-0.20
0
10
20
30
40
Tiempo Transcurrido de la Entrevista a la Censura
Disminución en la Masa Muscular
No
Sí
No-censored
Sí-censored


Log Survival Function
Log Survival
0.00
-0.05
-0.10
-0.15
-0.20
0
10
20
30
40
Tiempo Transcurrido de la Entrevista a la Censura
Velocidad de la Marcha <0.8m/s
No
Sí
No-censored
Sí-censored


Log Survival Function
Log Survival
0.00
-0.05
-0.10
-0.15
-0.20
0
10
20
30
40
Tiempo Transcurrido de la Entrevista a la Censura
Fuerza Muscular
No
Sí
No-censored
Sí-censored


Log Survival Function
0.00
-0.05
-0.10
-0.15
-0.20
Log Survival
0
10
20
30
40
Tiempo Transcurrido de la Entrevista a la Censura
Sarcopenia
Diagnóstico de
Sarcopenia EURO
Sin Sarcopenia
Sarcopenia
Sin Sarcopenia-
censored
Sarcopenia-censored

Discussion

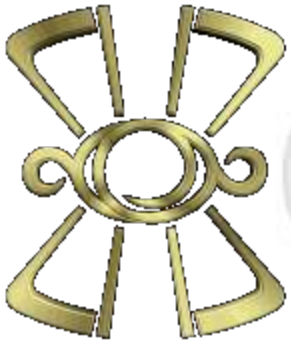
- Fat mass and calf circunference are not usefull to predict mortality
  - Cesari M, Pahor M, Lauretani F, Zamboni V, Bandinelli S, Bernabei R, Guralnik JM, Ferrucci L. Skeletal muscle and mortality results from the InCHIANTI Study. Gerontol A Biol Sci Med Sci. 2009 Mar;64(3):377-84. Epub 2009 Jan 30.
- Seemingly calf circunference becomes useful when combined with strength and physycal performance measurement
- Estimates of prevalence resemble those observed in institutionalized elders in Italy with the same algorithm, prevalence of institutionalization in Mexico is very low (<1%)
  - Landi F et al. Prevalence and Risk Factors of Sarcopenia Among Nursing Home Older Residents. J Gerontol A Biol Sci Med Sci 2011

Conclusion

- The EWSOP algorithm applied to the Mexican population gave a global estimate of sarcopenia prevalence of 33.8% in community dwelling individuals older than 70 years.
- More frequent in women it grows with advancing age
- Mortality risk increases significantly in those identified as sarcopenic

Mensajes finales

- Comprendemos la participación de la sarcopenia en el proceso de discapacidad lo suficiente para comenzar a intervenir.
- La potencia muscular es probablemente la medida clave como predictor del declive funcional y probablemente refleja la calidad del músculo.
- Estamos en el umbral de la traducción de estos conceptos a la clínica.



Gracias por su atención