

COMPARISON OF THE PERFORMANCE OF SCREENING METHODS FOR SARCOPENIA

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CONFLICT OF INTEREST DISCLOSURE

My collaborators and I have **no** potential
conflict of interest to report.



INTRODUCTION & OBJECTIVES

Sarcopenia, a real public health burden:

- Adverse health consequences
- Health care expenditure
- Growing prevalence



Need early identification of older adults with sarcopenia, but diagnostic devices are resource-consuming (*cost, time, availability, radiation...*): development of screening methods.

Based on data from the SarcoPhAge (Sarcopenia and Physical impairment with advancing Age) **cohort, our aim was to perform a comparison of the performance of the screening tools in predicting elders at risk of sarcopenia.**

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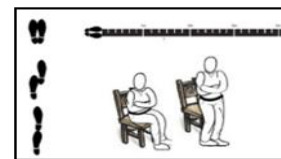
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MATERIAL & METHODS

The SarcoPhAge study, an ongoing prospective study whose main goal is to evaluate the long-term health outcomes of sarcopenia (534 individuals aged 65 years or older).

Diagnosis of sarcopenia, 3 main assessments:

- Muscle mass - *Dual-Energy X-Ray absorptiometry (DEXA)*
- Muscle strength - *hand-dynamometer*
- Physical performance – *Short Physical Performance Battery (SPPB)*



Clinical relevance: perform analysis across 5 diagnostic

definitions: Cruz-Jentoft *et al.* (EWGSOP), Fielding *et al.* (IWGS), Morley *et al.* (Society of Sarcopenia, Cachexia and Wasting Disorders), Chen *et al.* (AWGS), Studenski *et al.* (FNIH).

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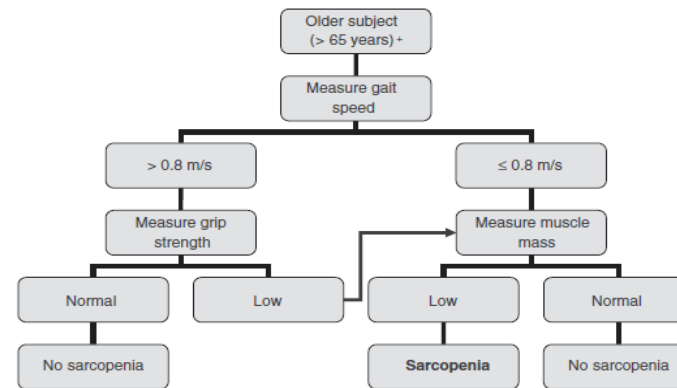
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Five screening methods:

- 2-step algorithm of the EWGSOP



- SARC-F questionnaire of Malmstrom & Morley

SARC-F Screen for Sarcopenia

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 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 Some = 1 A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1-3 falls = 1 4 or more falls = 2

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- Screening grid from Goodman *et al.*

Table 4 Predicted probabilities of low muscle mass by age and BMI: female complex model

	BMI													
	<18	18	19	20	21	22	23	24	25	26	27	28	29	30+
65	99.0%		93.9%	77.4%	81.4%	62.3%	41.4%	32.4%	31.4%	28.9%	21.7%	12.5%	8.5%	2.0%
66	98.0%			88.9%	72.1%	64.7%	39.8%	36.9%	32.1%	41.1%	9.6%	13.1%	6.1%	1.3%
67				87.5%	77.8%	57.5%	61.3%	45.3%	32.4%	33.0%	23.2%	4.8%	3.8%	1.5%
68		97.4%	91.1%		93.9%	58.2%	45.2%	53.8%	30.2%	22.4%	20.6%	10.4%	4.2%	2.0%
69			93.5%	82.1%		52.2%	55.8%	54.1%	23.8%	25.1%	13.0%	9.9%	6.8%	1.8%
70			98.2%	92.3%	80.3%	56.6%	62.4%	45.7%	25.7%	34.3%	10.6%	13.5%	5.1%	1.6%
71	92.5%		96.1%	78.5%	74.2%	71.9%	71.1%	42.4%	32.3%	10.7%	13.8%	10.8%	19.1%	2.1%
72	94.6%	96.8%	84.4%		93.7%	76.7%	70.5%	38.0%	36.9%	21.6%	19.0%	14.2%	14.6%	1.2%
73	98.3%		81.1%	86.1%	78.4%	55.8%	63.0%	44.8%	26.9%	19.6%	18.0%	14.8%	5.7%	2.5%
74	98.6%	94.2%	72.5%		74.7%	71.3%	25.2%	35.5%	42.0%	25.9%	17.2%	9.8%	7.4%	2.3%
75		93.7%		45.5%	62.6%	77.9%	49.8%	63.6%	32.7%	17.9%	19.1%	16.0%	3.3%	1.1%
76			94.7%		89.4%	75.4%	51.5%	52.7%	37.3%	21.1%	14.6%	2.3%	3.0%	4.7%
77			84.7%	84.8%	70.1%	47.9%	80.8%	76.8%	47.6%	27.3%	22.4%	10.6%	13.2%	2.0%
78	89.6%		92.4%	73.7%	63.4%	71.0%	80.0%		32.6%	47.1%	10.9%		3.2%	3.4%
79	93.5%	97.4%			88.6%		36.0%	53.7%	29.3%	18.6%	18.8%	10.8%		5.2%
80	91.6%	95.6%	84.8%	89.4%	82.0%	74.2%	75.2%	34.4%	45.4%	19.7%	12.0%	9.8%		2.6%
81	96.9%		92.2%	79.9%	73.5%	68.2%	65.4%	42.8%	28.4%	23.3%	29.1%	13.1%	17.8%	3.8%
82		94.1%	90.6%	83.8%		77.7%	58.3%	53.8%	26.8%	36.4%	21.5%	3.3%		2.5%
83		91.2%	89.3%	74.9%	78.7%		74.8%	33.1%	40.4%	46.5%	31.8%	5.6%		0.7%
84		98.0%	93.6%	72.9%	82.9%	65.9%	77.2%	65.7%	39.4%	21.8%	22.4%	14.1%		2.8%
85	96.9%		92.5%	85.5%	78.2%	69.7%	62.1%	45.8%	43.7%	22.3%	18.0%	11.3%	10.5%	2.6%

■	Probability ≥0.50
■	Probability 0.20-0.49
□	Probability <0.20

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- Score chart of Ishii *et al.*

Score in men: $0.62x(\text{age}-64)-3.09x(\text{grip strength}-50)-4.64x(\text{calf circumference}-42)$.

Probability in men: $1/1[1+e^{-(\text{sum score}/10-11.9)}]$.

Score in women: $0.80x(\text{age}-64)-5.09x(\text{grip strength}-34)-3.28x(\text{calf circumference}-42)$.

Probability in women: $1/1[1+e^{-(\text{sum score}/10-12.5)}]$.

- Prediction equation of Yu *et al.*

Appendicular skeletal muscle mass prediction equation: $10.05+0.35(\text{weight})-0.62(\text{BMI})-0.02(\text{age})+5.10(\text{if male})$.

➔ Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), area under the curve (AUC)

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Capacity to identify older adults without sarcopenia

Probability of suffering from sarcopenia in case of positive test

Probability of not suffering from sarcopenia in case of negative test

Indicators of performance of 5 screening methods across 5 definitions of sarcopenia (n=306)

	Sensitivity	Specificity	PPV	NPV
	Proportion in % (95% CI)	Proportion in % (95% CI)	Probability in % (95% CI)	Probability in % (95% CI)
<i>Definition of Cruz-Jentoft et al</i>				
2-stage algorithm of the EWGSOP	33.3 (28.0-38.6)	91.0 (87.8-94.2)	42.5 (37.0-48.0)	87.2 (83.5-90.9)
SARC-F of Malmstrom et al	36.0 (30.6-41.4)	87.1 (83.3-90.9)	35.3 (29.9-40.7)	87.4 (83.7-91.1)
Screening grid of Goodman et al	47.5 (41.9-53.1)	89.4 (86.0-92.8)	50.9 (45.3-56.5)	88.0 (84.4-91.6)
Score chart of Ishii et al	84.3 (80.2-88.4)	80.9 (76.5-85.3)	46.7 (41.1-52.3)	96.3 (94.2-98.4)
Equation of Yu et al	51.0 (45.4-56.6)	86.7 (82.9-90.5)	43.3 (37.7-48.9)	89.8 (86.4-93.2)
<i>Definition of Fielding et al</i>				
2-stage algorithm of the EWGSOP	43.2 (37.6-48.8)	91.1 (87.9-94.3)	40.0 (34.5-45.5)	92.1 (89.1-95.1)
SARC-F of Malmstrom et al	43.2 (37.6-48.8)	86.6 (82.8-90.4)	30.8 (25.6-36.0)	91.7 (88.6-94.8)
Screening grid of Goodman et al	45.9 (40.3-51.5)	88.8 (85.3-92.3)	36.2 (30.8-41.6)	92.3 (89.3-95.3)
Score chart of Ishii et al	86.8 (83.0-90.6)	77.7 (73.0-82.4)	34.8 (29.5-40.1)	97.7 (96.0-99.4)
Equation of Yu et al	64.9 (59.6-70.2)	86.6 (82.8-90.4)	40.0 (34.5-45.5)	94.7 (92.2-97.2)
<i>Definition of Morley et al</i>				
2-stage algorithm of the EWGSOP	38.9 (33.4-44.4)	88.5 (84.9-92.1)	17.5 (13.2-21.8)	95.9 (93.7-98.1)
SARC-F of Malmstrom et al	55.6 (50.0-61.2)	85.4 (81.4-91.4)	19.2 (14.8-23.6)	96.8 (94.8-98.8)
Screening grid of Goodman et al	66.7 (61.4-72.0)	87.8 (84.1-91.5)	25.5 (20.6-30.4)	97.7 (96.0-99.4)
Score chart of Ishii et al	100.0 (100-100)	74.3 (69.4-79.2)	34.8 (29.5-40.1)	97.7 (96.0-99.4)
Equation of Yu et al	83.3 (79.1-87.5)	84.4 (80.3-88.5)	25.0 (20.1-29.9)	98.8 (97.6-100)
<i>Definition of Chen et al</i>				
2-stage algorithm of the EWGSOP	70.6 (65.5-75.7)	90.3 (87.0-93.6)	30.0 (24.9-35.1)	98.1 (96.6-99.6)
SARC-F of Malmstrom et al	52.9 (47.3-58.5)	85.1 (81.1-89.1)	17.3 (13.1-21.5)	96.8 (94.8-98.8)
Screening grid of Goodman et al	41.2 (35.7-46.7)	86.2 (82.3-90.1)	14.9 (10.9-18.9)	96.1 (93.9-98.3)
Score chart of Ishii et al	100.0 (100-100)	74.1 (69.2-79.0)	14.5 (10.6-18.4)	100.0 (100-100)
Equation of Yu et al	16.1 (12.0-20.2)	60.0 (54.5-65.5)	42.0 (38.9-45.1)	91.1 (87.9-94.3)
<i>Definition of Studenski et al</i>				
2-stage algorithm of the EWGSOP	50.0 (44.4-55.6)	89.8 (86.4-93.2)	27.5 (22.5-32.5)	95.9 (93.6-98.0)
SARC-F of Malmstrom et al	40.9 (35.4-46.4)	84.9 (80.9-88.9)	17.3 (13.1-21.5)	94.9 (92.4-97.4)
Screening grid of Goodman et al	5.88 (3.20-8.50)	83.5 (79.3-87.7)	4.26 (2.0-6.50)	87.6 (83.9-91.3)
Score chart of Ishii et al	90.9 (87.7-94.1)	74.9 (70.0-79.8)	21.7 (17.1-26.3)	99.1 (98.0-100)
Equation of Yu et al	36.4 (31.0-41.8)	81.7 (77.4-86.0)	13.3 (9.50-17.1)	94.3 (91.7-96.9)

Inclusion of 306 older adults.
Prevalence sarcopenia: from 6% to 17%.

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Association between the 5 definitions of sarcopenia and 5 screening tools (n=306)

	Adjusted OR (95%CI) ^a	P-value [*]	AUC (95%CI)
<i>Definition of Cruz-Jentoft et al</i>			
2-stage algorithm of the EWGSOP	3.43 (1.48-7.95)	0.0039	-
SARC-F of Malmstrom et al	1.30 (1.10-1.54)	0.0016	0.710 (0.636-0.785)
Screening grid of Goodman et al	1.03 (1.02-1.04)	<0.0001	0.752 (0.684-0.821)
Score chart of Ishii et al	1.04 (1.03-1.06)	<0.0001	0.856 (0.807-0.906)
Equation of Yu et al	0.71 (0.61-0.84)	<0.0001	0.688 (0.612-0.764)
<i>Definition of Fielding et al</i>			
2-stage algorithm of the EWGSOP	8.25 (3.15-21.6)	<0.0001	-
SARC-F of Malmstrom et al	1.47 (1.23-1.75)	<0.0001	0.764 (0.688-0.840)
Screening grid of Goodman et al	1.04 (1.02-1.05)	<0.0001	0.767 (0.682-0.851)
Score chart of Ishii et al	1.05 (1.03-1.06)	<0.0001	0.841 (0.788-0.894)
Equation of Yu et al	0.62 (0.51-0.76)	<0.0001	0.693 (0.607-0.779)
<i>Definition of Morley et al</i>			
2-stage algorithm of the EWGSOP	6.61 (1.90-22.9)	0.0028	-
SARC-F of Malmstrom et al	1.05 (1.03-2.01)	0.0001	
Screening grid of Goodman et al	1.06 (1.03-1.09)	<0.0001	
Score chart of Ishii et al	1.04 (1.01-1.08)	<0.0001	
Equation of Yu et al	0.58 (0.44-0.76)	<0.0001	
<i>Definition of Chetrov et al</i>			
2-stage algorithm of the EWGSOP	19.8 (7.48-29.8)	<0.0001	
SARC-F of Malmstrom et al	1.49 (1.18-1.87)	0.0006	
Screening grid of Goodman et al	1.03 (1.01-1.05)	0.0007	0.710 (0.672-0.848)
Score chart of Ishii et al	1.04 (1.03-1.06)	<0.0001	0.914 (0.873-0.956)
Equation of Yu et al	0.70 (0.54-0.90)	0.0006	0.719 (0.592-0.856)
<i>Definition of Studenski et al</i>			
2-stage algorithm of the EWGSOP	5.91 (1.83-19.0)	0.0027	-
SARC-F of Malmstrom et al	1.34 (1.13-1.60)	0.0008	0.688 (0.572-0.803)
Screening grid of Goodman et al	0.98 (0.96-0.99)	0.0478	0.600 (0.488-0.712)
Score chart of Ishii et al	1.05 (1.03-1.07)	<0.0001	0.891 (0.831-0.951)
Equation of Yu et al	0.75 (0.59-0.94)	0.0146	0.710 (0.572-0.841)

Discriminate very well sarcopenic from non-sarcopenic subjects

^a Covariates: age, sex, number of comorbidities, number of drugs and cognitive status included in the regression model

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DISCUSSION

Performance of the tools varies greatly depending on the diagnostic definition of sarcopenia applied:

➔ **Consensus for defining sarcopenia is essential**

Each tool significantly associated with sarcopenia diagnosis:

➔ **Relevance of the use of screening tools in practice**

Quality of all the tools for sarcopenia screening:

➔ **When a subject is screened negative, the result can be trusted, avoiding therefore unnecessary diagnostic investigations**

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Better performances:

➔ **The score chart of Ishii *et al***

The choice of using a screening tool made according to means and objectives of the practitioner:

➔ **Efficiency criteria** (*the rapidity of its application, the simplicity of use and administration or the fact it does not require exacting training of the clinician...*)

Biaises may have been introduced owing to the sample selection process:

➔ **Results may not be fully generalizable**

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KEY TAKE-HOME MESSAGE

All the screening tools for sarcopenia **performed well** to identify with a high degree of reliability individuals **who do not suffer from the disease.**

Promotion of their use in clinical practice would allow early and targeted management of sarcopenia to prevent muscular disability.



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THANK YOU

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