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Original Study

Common Ground? The Concordance of Sarcopenia and Frailty Definitions

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A B S T R A C T

Objectives: This study aimed to explore the concordance between definitions of sarcopenia and frailty in a clinically relevant population of geriatric outpatients.
Design: Data were retrieved from a cross-sectional study.
Setting: The study was performed in a geriatric outpatient clinic of a middle-sized teaching hospital.
Participants: The study included 299 geriatric outpatients (mean age 82.4, SD 7.1) who were consecutively referred to the outpatient clinic.
Measurements: Prevalence rates and subsequent concordance evolving from 3 definitions of sarcopenia and 2 definitions of frailty were compared. Definitions of sarcopenia included the European Working Group on Sarcopenia in Older People (gait speed, handgrip strength, muscle mass), International Working Group on Sarcopenia (gait speed, muscle mass) and the definition by Janssen (muscle mass). Definitions of frailty included the Fried frailty phenotype (weight loss, exhaustion, physical inactivity, handgrip strength, walk time) and the definition of Rockwood (use of walking aid, activities of daily living, incontinence, and cognitive impairment).
Results: Prevalence rates for sarcopenia varied between 17% and 22% and between 29% and 33% for frailty. There was little concordance in intraindividual prevalence rates of sarcopenia and frailty using different definitions. None of the outpatients was classified as having sarcopenia and frailty according to all applied definitions. Outpatients with sarcopenia were more likely to be frail than frail outpatients to be sarcopenic.
Conclusion: This study clearly indicates that sarcopenia and frailty are 2 separate conditions based on the current definitions. It is important to diagnose sarcopenia and frailty as separate entities, as each may require specific treatment.

Sarcopenia, defined as low muscle mass and function,[1] and frailty are both conditions that are frequently identified in older people.[2,3] Both conditions are associated with negative health outcomes, such as decreased mobility,[4–6] falls,[6,7] and mortality.[6,8] Sarcopenia can be distinguished in primary and secondary sarcopenia; primary sarcopenia relies on the age-related loss of muscle mass itself and secondary sarcopenia on activity-, nutrition-, and disease-related causes.[9] Frailty is a multifactorial condition and relies on different

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domains, such as physical functioning and cognition.[10] A consensus definition has been reached for neither sarcopenia nor frailty.

Sarcopenia and frailty are mutual risk factors and both conditions can co-occur within a single individual.[11] Sarcopenia and frailty are often used interchangeably in clinical practice; however, both have a different construct and require a different therapeutic approach. Treatment of sarcopenia may be focused on maintaining or increasing muscle mass and strength by combining exercise and adequate protein intake, whereas frailty may require a focus on the underlying diverse pathophysiology of the different domains. Furthermore, prevalence rates of sarcopenia and frailty are highly dependent on the used definition.[12–14] Some interrelationships between sarcopenia and frailty are expected,[15] as muscle function (handgrip strength and gait speed) is included in definitions of both sarcopenia[9,16,17] and the physical frailty phenotype of Fried et al.[6] However, next to muscle function, definitions of frailty include multiple other components that are more indirectly related to the musculoskeletal system,[10] such as incontinence.[18]

This study aimed to explore the concordance between definitions of sarcopenia (by the European Working Group on Sarcopenia in Older Persons [EWGSOP], the International Working Group on Sarcopenia [IWGS] and relative muscle mass as separate diagnostic measure of sarcopenia) and definitions of frailty (by the Fried et al[6] criteria and the Rockwood et al[18] criteria) in a clinically relevant population of geriatric outpatients.

Methods

Study Design

This cross-sectional study included 299 community-dwelling older persons who were consecutively referred to a geriatric outpatient clinic in a middle-sized teaching hospital (Bronovo Hospital, The Hague, the Netherlands) for a Comprehensive Geriatric Assessment (CGA) due to mobility problems (eg, falls, impaired standing balance). The CGA was performed during a 2-hour visit including questionnaires and physical and cognitive measurements by trained nurses and medical staff. No exclusion criteria were applied; inclusion was based on the referral only. Because this research is based on regular care, the need for individual informed consent was waived by the institutional review board of the Leiden University Medical Center (Leiden, the Netherlands). Ethical guidelines were followed in accordance with the Declaration of Helsinki. Not all data on diagnostic criteria for sarcopenia and frailty were available in all 299 geriatric outpatients due to protocol modifications.

Geriatric Outpatients' Characteristics

Body mass index (BMI) in kg/m^2 was determined with measured body mass to the nearest 0.1 kg and measured standing height to the nearest 0.1 cm. Comorbidity was defined as the presence of 2 or more chronic diseases (hypertension, myocardial infarction, chronic obstructive pulmonary disease [COPD], cancer, diabetes mellitus, rheumatoid arthritis, osteoarthritis, Parkinson disease). The Short Physical Performance Battery (SPPB) was used to assess physical functioning.[19] The SPPB comprises a balance test, 4- meter walk test, and chair stand test. The composite SPPB score is the sum of the 3 subscores with a maximum of 12 points.

Definitions of Sarcopenia

Three definitions of sarcopenia were applied comprising 2 sets of diagnostic criteria proposed by the EWGSOP[9] and the IWGS,[20] and 1 single diagnostic criterion by Janssen et al.[5] The EWGSOP definition is based on an algorithm including measures of gait speed, handgrip strength, and absolute muscle mass. The IWGS definition is based on an algorithm including gait speed and absolute muscle mass. The Janssen et al[5] definition includes a single measure of relative muscle mass.

Gait speed was measured over a 4-meter distance at normal pace from a standing start and expressed in meters per second. Handgrip strength was assessed using the maximal value in kilograms of 3 performances on each hand, by using hand-held dynamometry (JAMAR hand dynamometer; Sammons Preston, Inc., Bolingbrook, IL). Muscle mass was measured using direct segmental multifrequency bioelectrical impedance analysis (DSM-BIA). Each definition of sarcopenia includes a different measure of muscle mass: EWGSOP, skeletal muscle mass index (SMI; skeletal muscle [SM] mass/height^2)[9]; IWGS,[20] appendicular lean mass (ALM)/height^2; Janssen et al,[5] relative SM (SM divided by body mass). Low muscle mass was defined using cutoff points by definition: EWGSOP,[21] men $\leq$10.75 kg/m^2; women $\leq$6.75 kg/m^2, IWGS,[20] men $\leq$7.23 kg/m^2, women $\leq$5.67 kg/m^2; Janssen et al,[5] men $<$37%, women $<$28%.

Definitions of Frailty

The definitions of frailty by Fried et al[6] and Rockwood et al[18] were applied because these are frequently used definitions with different accents: physical frailty by Fried et al[6] and the multifactorial approach by Rockwood et al.[18] The Fried et al[6] definition includes 5 criteria: weight loss, exhaustion, physical inactivity, absolute walk time, and handgrip strength. Weight loss was defined as a loss of more than 3 kg in the previous month (approximately 5% weight loss) or more than 6 kg (approximately 10% weight loss) in the previous 6 months.[22] Exhaustion was assessed by the individual question "I feel as if I am slowed down" answered with "very often" or "nearly all the time" on the Hospital Anxiety and Depression Scale (HADS).[23] Geriatric outpatients were classified as physically inactive if they reported a maximum distance of outdoor walking less than 20 minutes, only walking indoors, or not walking at all. Walking time was measured by the 4-meter walk test; absolute time in seconds was used with gender- and height-specific cutoffs for walking time as proposed by Fried et al.[6] Handgrip strength was measured as aforementioned with gender- and BMI-specific cutoffs.[6] Individuals were considered frail in case of presence of 3 or more criteria, prefrail when 1 or 2 criteria were present, and nonfrail when none of the criteria were fulfilled.

The Rockwood et al[18] definition includes mobility, activities of daily living (ADLs), incontinence, and cognitive impairment. Assistance with mobility was defined as the use of a walking aid. ADL was assessed by Katz index: needing assistance with bathing, clothing, toilet, transfers, or eating.[24] Incontinence was omitted from the total Katz score because incontinence is a separate diagnostic criterion within the Rockwood et al[18] definition. Incontinence was defined as incontinence of the bladder and/or bowel. Cognitive impairment was defined as a score below 24 points on the Mini Mental State Examination.[25] The Rockwood et al[18] definition classifies patients in 4 scales. Subjects were considered frail when on scale 3, prefrail when on scale 2, and nonfrail when on scale 0 or 1.

Statistical Analysis

Descriptive statistics were performed to determine prevalence rates of sarcopenia and frailty according to each of the applied definitions and to determine the concordance between the definitions of sarcopenia and frailty. Definitions of sarcopenia were analyzed as dichotomous variables (sarcopenic vs nonsarcopenic) and definitions of frailty were analyzed as categorical variables (frail vs prefrail vs nonfrail). The concordance between the different definitions of sarcopenia and frailty was visualized using a Venn diagram and was performed in a subgroup of 90 outpatients in which data were available on all definitions. Not all data on all diagnostic criteria for sarcopenia and frailty were available in

all geriatric outpatients due to consecutive protocol amendments in which measurements were stepwise-added to the CGA and the data express different numbers for different parameters. Data on BIA were available in 156 consecutive outpatients. Data of 11 outpatients were excluded due to invalid values on measures of segmental muscle mass, leaving 124 outpatients for the present analysis. Data on the Katz index were available in 143 outpatients and data on the HADS in 124 outpatients. Statistical analyses were performed using the Statistical Package for the Social Sciences, version 20 (IBM SPSS Statistics, IBM Corporation, Chicago, IL).

Results

Geriatric Outpatient Characteristics

Table 1 shows the characteristics of the total population of geriatric outpatients. Mean age was 82.4 years (7.1 SD) and 34% were men. Mean BMI was 25.8 (4.5 SD) and comorbidity was present in 37% of the outpatients. Mean handgrip strength and measures of muscle mass (ie, SM relative, SMI, and ALM/height^2) were higher in men compared with women. Exhaustion, use of walking aid, and incontinence were more present in women.

Characteristics of Sarcopenic and Frail Outpatients

Table 2 shows the characteristics of sarcopenic and frail outpatients, stratified by definition. Prevalence rates of sarcopenia were 22.1% using the EWGSOP definition, 19.4% for the IWGS definition, and 17.3% for the Janssen et al[5] definition. According to the Fried et al[6] definition, 28.6% were identified as frail and 45.7% as prefrail. The Rockwood et al[18] definition identified 32.5% as frail and 42.5% as prefrail. Sarcopenia was more present in men and frailty was more present in women. Sarcopenic outpatients had a higher median SPPB score compared with frail outpatients. Low gait speed (<0.8 m/s and <1.0 m/s) was less present in sarcopenic outpatients compared with frail outpatients. Low muscle mass was more present in sarcopenic outpatients compared with frail outpatients. Weight loss, exhaustion, physical inactivity, low handgrip strength, low gait speed according to the Fried et al[6] cutoffs, use of walking aid, incontinence, and cognitive impairment were less present in sarcopenic outpatients compared with frail outpatients.

Concordance Between Definitions of Sarcopenia and Frailty

Table 3 shows the concordance between definitions of sarcopenia and frailty. Of the sarcopenic outpatients using the EWGSOP definition, 8 (42.1%) and 1 (25.0%) outpatients were frail, 8 (42.1%) and 2 (50.0%) prefrail, and 3 (15.8%) and 1 (25.0%) non-frail according to the Fried and Rockwood definition respectively. Of the frail outpatients according to the Fried and Rockwood definition respectively, 8 (36.4%) and 1 (20.0%) were sarcopenic (EWGSOP).

Of the sarcopenic outpatients using the IWGS definition, 6 (46.1%) and 0 outpatients were frail, 4 (30.8%) and 3 (75.0%) pre-frail and 3 (23.1%) and 1 (25.0%) nonfrail according to the Fried et al[6] and Rockwood et al[18] definition, respectively. Of the frail outpatients according to the Fried et al[6] and Rockwood et al[18] definition, respectively, 6 (30.0%) and 0 were sarcopenic (IWGS).

Of the sarcopenic outpatients using the Janssen et al[5] definition, 6 (42.9%) and 1 (16.7%) outpatients were frail, 5 (35.7%) and 2 (33.3%) prefrail and 3 (21.4%) and 3 (50.0%) nonfrail according to the Fried et al[6] and Rockwood et al[18] definition, respectively. Of the frail outpatients according to the Fried et al[6] and Rockwood et al[18] definition, respectively, 6 (27.3%) and 1 (20.0%) were sarcopenic (Janssen et al[5]).

Figure 1 visualizes the distribution of the number of sarcopenic and frail outpatients according to the applied definitions. There was little concordance between the applied definitions of sarcopenia and frailty: none of the outpatients was classified as sarcopenic and frail according to all applied definitions. Of the 90 outpatients, 18 (20.0%) were classified as sarcopenic, 14 (15.6%) as frail, and 15 (16.7%) as sarcopenic and frail, dependent on the applied definition. Forty-three (47.8%) outpatients were classified as nonsarcopenic and nonfrail based on any of the applied definitions.

Discussion

The aim of this study was to explore the concordance between definitions of sarcopenia and definitions of frailty in a clinically relevant geriatric outpatient population. Prevalence rates of sarcopenia and frailty were dependent on the applied definition. There was little concordance in intraindividual prevalence rates of sarcopenia and frailty using different definitions. None of the outpatients were classified as having sarcopenia and frailty according to all applied

Table 1
Characteristics of the Total Population of Geriatric Outpatients, Stratified by Gender

	n	Total, n = 299	n	Men, n = 103	n	Women, n = 196
Characteristics						
Age, y, mean (SD)	299	82.4 (7.1)	103	81.5 (6.9)	196	82.8 (7.2)
BMI, kg/m^2, mean (SD)	280	25.8 (4.5)	98	25.4 (3.4)	182	26.0 (4.9)
Comorbidity, n (%)*	284	105 (37.0)	102	41 (40.2)	182	64 (35.2)
Diagnostic criteria for sarcopenia						
Gait speed, m/s, mean (SD)	283	0.72 (0.27)	99	0.78 (0.29)	184	0.69 (0.26)
Handgrip strength, kg, mean (SD)†	295	25.3 (8.0)	102	33.3 (6.4)	193	21.0 (4.9)
SMI, kg/m^2, mean (SD)	156	9.4 (1.9)	62	10.2 (1.6)	94	8.9 (1.9)
ALM/height^2, kg/m^2, mean (SD)	141	7.2 (1.2)	59	7.8 (0.8)	82	6.7 (1.2)
SM relative, %, mean (SD)	156	37.2 (7.3)	62	40.4 (5.0)	94	35.0 (7.7)
Diagnostic criteria for frailty						
Weight loss, n (%)	185	24 (13.0)	74	10 (13.5)	111	14 (12.6)
Exhaustion, n (%)	124	61 (49.2)	51	20 (39.2)	73	41 (56.2)
Physical inactivity, n (%)	296	129 (43.6)	102	42 (41.2)	194	87 (44.8)
Walk time, seconds, mean (SD)	283	6.6 (3.3)	99	6.0 (2.8)	184	6.9 (3.6)
Use of walking aid, n (%)	296	178 (60.1)	101	49 (48.5)	195	129 (66.2)
Katz ADL score, median (IQR)	143	0 (0–0)	57	0 (0–0)	86	0 (0–1)
Incontinence, n (%)	141	41 (29.1)	56	9 (16.1)	85	32 (37.6)
Cognitive impairment, n (%)	294	71 (24.1)	101	24 (23.8)	193	47 (24.4)

IQR, interquartile range.
*Presence of ≥2 chronic diseases (hypertension, myocardial infarction, COPD, cancer, diabetes mellitus, rheumatoid arthritis, osteoarthritis, Parkinson disease).
†Handgrip strength is also used as a diagnostic criterion for frailty.

Table 2
Characteristics of Subgroups of Sarcopenic and Frail Geriatric Outpatients, Stratified by Definition

	EWGSOP, n = 154		IWGS, n = 139		Janssen et al,[5] n = 156		Fried et al,[6] n = 105		Rockwood et al,[18] n = 40	
	n	Sarcopenic, n = 34	n	Sarcopenic, n = 27	n	Sarcopenic, n = 27	n	Frail, n = 30	n	Frail, n = 13
Characteristics										
Age, mean (SD)	34	80.9 (7.0)	27	83.2 (6.0)	27	79.5 (8.4)	30	81.7 (6.9)	13	83.7 (5.3)
Male	34	30 (88.2)	27	15 (55.6)	27	16 (59.3)	30	10 (33.3)	13	3 (23.1)
Comorbidity*	33	15 (45.5)	26	9 (34.6)	26	13 (50.0)	28	14 (50.0)	11	2 (18.2)
BMI, mean (SD)	34	23.9 (3.1)	27	22.2 (2.4)	27	29.4 (5.4)	29	26.4 (5.0)	10	26.9 (3.7)
SPPB score, median (IQR)	34	6 (4–9)	27	6 (5–9)	27	8 (6–10)	29	4 (2–6)	12	4 (3–7)
Gait speed, m/s, mean (SD)	34	0.67 (0.23)	27	0.68 (0.19)	27	0.80 (0.30)	30	0.50 (0.14)	11	0.60 (0.27)
Handgrip strength, kg, mean (SD)	34	28.6 (6.7)	27	24.4 (6.5)	27	27.3 (7.9)	30	22.2 (6.9)	13	21.1 (7.9)
SMI, kg/m^2, mean (SD)	34	9.0 (1.2)	27	8.0 (0.8)	27	9.2 (1.7)	22	8.8 (0.9)	5	9.6 (1.4)
ALM/height^2, kg/m^2, mean (SD)	33	7.3 (1.1)	27	6.0 (0.8)	24	7.5 (1.2)	20	7.0 (0.9)	4	7.7 (1.2)
SM relative, %, mean (SD)	34	38.1 (5.0)	27	36.1 (4.6)	27	31.3 (4.5)	22	34.9 (5.7)	5	38.6 (3.9)
EWGSOP criteria										
Low gait speed <0.8 m/s	34	27 (79.4)	27	19 (70.4)	27	15 (55.6)	30	30 (100)	11	9 (81.8)
Low handgrip strength†	34	17 (50.0)	27	14 (51.9)	27	9 (33.3)	30	16 (53.3)	13	8 (61.5)
Low SMI‡	34	34 (100.0)	27	17 (63.0)	27	15 (55.6)	22	8 (36.4)	5	1 (20.0)
IWGS criteria										
Low ALM/height2§	33	15 (45.5)	27	27 (100.0)	24	5 (20.8)	20	6 (30.0)	4	0
Low gait speed <1.0 m/s	34	30 (88.2)	27	27 (100.0)	27	22 (81.5)	30	30 (100)	11	10 (90.9)
Janssen criteria										
Low SM relative‖	34	10 (29.4)	27	5 (18.5)	27	27 (100.0)	22	6 (27.3)	5	1 (20.0)
Fried criteria										
Weight loss	30	6 (20.0)	24	5 (20.8)	24	0	30	7 (23.3)	13	1 (7.7)
Exhaustion	19	10 (52.6)	13	6 (46.2)	14	8 (57.1)	30	27 (90.0)	11	6 (54.5)
Physical inactivity	34	16 (47.1)	27	13 (48.1)	27	12 (44.4)	30	23 (76.7)	13	9 (69.2)
Low handgrip strength¶	34	16 (47.1)	27	11 (40.7)	27	13 (48.1)	30	21 (70.0)	11	7 (63.6)
Low gait speed**	34	15 (44.1)	27	9 (33.3)	27	8 (29.6)	30	25 (83.3)	10	6 (60.0)
Rockwood criteria										
Mobility; use of walking aid	34	20 (58.8)	27	16 (59.3)	27	10 (37.0)	30	28 (93.3)	13	10 (76.9)
Katz ADL score, median (IQR)	22	0 (0–2)	13	0 (0–1)	16	0 (0–1)	29	0 (0–2)	13	5 (38.5)
Incontinence	22	3 (13.6)	13	3 (23.1)	16	1 (6.2)	29	15 (51.7)	13	4 (30.8)
Cognitive impairment	34	9 (26.5)	27	6 (22.2)	27	4 (15.4)	30	13 (43.3)	13	5 (38.5)

IQR, interquartile range.
Variables are presented as n (%) unless indicated otherwise.
*Presence of ≥2 chronic diseases (hypertension, myocardial infarction, COPD, cancer, diabetes mellitus, rheumatoid arthritis, osteoarthritis, Parkinson disease).
†Men <30 kg, women <20 kg.
‡Men ≤10.75 kg/m^2, women ≤6.75 kg/m^2.
§Men ≤7.23 kg/m^2, women ≤5.67 kg/m^2.
‖Men <37%, women <28%.
¶Men ≤29 kg (BMI ≤24), ≤30 kg (BMI 24.1–26.0), ≤30 kg (BMI 26.1–28.0), ≤32 kg (BMI >28), women ≤17 kg (BMI ≤23), ≤17.3 kg (BMI 23.1–26.0), ≤18 kg (BMI 26.1–29.0), ≤21 kg (BMI >29).
**Men ≥7 seconds (height ≤173 cm), ≥6 seconds (height >173 cm), women ≥7 seconds (height ≤159 cm), ≥6 seconds (height >159 cm).

definitions. Patients with sarcopenia were more likely to be frail than frail patients to be sarcopenic.

Prevalence Rates of Sarcopenia and Frailty

In this population of geriatric outpatients, the prevalence of frailty was found to be higher than the prevalence of sarcopenia. This is in line with a previous study in Japanese women in which frailty was defined using the Fried et al[6] definition (56.8%) and sarcopenia using the definition of the Asian Working Group for Sarcopenia (AWGS) (8.4%).[26] In contrast, 2 previous studies reported higher prevalence rates for sarcopenia than frailty. In a community care setting, a higher prevalence rate of sarcopenia defined using the EWGSOP definition (23.3%) compared with frailty using the Fried et al[6] definition (8.4%) and the FRAIL (fatigue, resistance, ambulation, illnesses, loss of weight) scale (9.3%) was found in older people.[27] In the Berlin Aging Study, prevalence of sarcopenia, defined as low appendicular lean mass (ALM)/height^2 (25.5%) and low ALM$_{BMI}$ (15.8%), was also found to be higher compared with the prevalence of frailty by the definition of Fried et al[6] (0.9%) in community-dwelling older people.[28] In all 3 studies, frail older people were more likely to be sarcopenic than sarcopenic older people to be frail,[26–28] in contrast to our study in which sarcopenic outpatients were more likely to be frail than frail outpatients to be sarcopenic. An explanation for the conflicting findings is the use of different definitions of sarcopenia[12,13] and frailty,[14] different cutoffs, and different study populations (ie, geriatric outpatients, older people from a community care setting, community-dwelling older people).

Table 3
Concordance Between Definitions of Sarcopenia and Frailty

	Sarcopenic EWGSOP			Sarcopenic IWGS			Sarcopenic Janssen et al[5]		
	Yes	No	Total	Yes	No	Total	Yes	No	Total
Frailty Fried									
Frail	8	14	22	6	14	20	6	16	22
Prefrail	8	31	39	4	34	38	5	34	39
Nonfrail	3	16	19	3	14	17	3	16	19
Total	19	61	80	13	62	75	14	66	80
Frailty Rockwood									
Frail	1	4	5	0	4	4	1	4	5
Prefrail	2	10	12	3	9	12	2	10	12
Nonfrail	1	6	7	1	5	6	3	4	7
Total	4	20	24	4	18	22	6	18	24

Concordance Between Definitions of Sarcopenia and Frailty

There was little concordance between the definitions of sarcopenia and definitions of frailty. This is in line with previous studies in

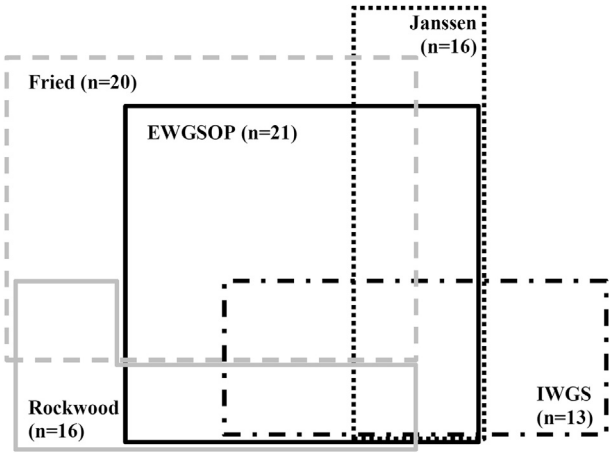

Fig. 1. Number of geriatric outpatients identified as having sarcopenia and frailty according to various definitions. Black lines indicate definitions of sarcopenia; gray lines indicate definitions of frailty. A total of 90 outpatients were evaluated in which data were available on all definitions. Sarcopenic outpatients using definitions of EWGSOP: 23.3%, IWGS: 14.4%, Janssen et al[5]: 17.8%. Frail outpatients using definitions of Fried et al[6]: 22.2%, Rockwood et al[18]: 17.8%. Outpatients not having sarcopenia and nonfrail: 47.8% (n = 43). None of the outpatients was classified as having sarcopenia and frailty according to all applied definitions.

community care settings[27] and community-dwelling older people.[28] However, studies are difficult to compare due to the use of different definitions of sarcopenia and frailty, while consensus on both definitions has not been reached yet.

Little concordance can be explained by the differences in pathophysiology between sarcopenia and frailty.[29–33] Sarcopenia relies only on the musculoskeletal system,[30] whereas the pathophysiology of frailty is more multifactorial and complex because frailty is the outcome of intrinsic and extrinsic changes during the life history trajectory.[32,33] The Fried et al[6] definition showed more concordance with definitions of sarcopenia compared with the Rockwood et al[18] definition. The Fried et al[6] definition assumes frailty as physical frailty as opposed to the Rockwood et al[18] definition including a multidomain approach. Therefore, it was expected to find more concordance between the Fried et al[6] definition and definitions of sarcopenia.

Next to the co-occurrence of both conditions, there were also outpatients who were only sarcopenic (20.0%) or only frail (15.6%). This illustrates that there are different phenotypes of outpatients with respect to sarcopenia and frailty. Due to difference in prevalence rates and the little concordance between definitions of sarcopenia and frailty, these findings clearly indicate that both conditions need to be separately assessed. This is also supported by the finding that low muscle mass was more present in sarcopenic outpatients compared with frail outpatients, whereas low handgrip strength and low gait speed were more present in frail outpatients. Muscle mass is an important diagnostic measure in the assessment of sarcopenia,[5,9,20] whereas handgrip strength and gait speed are measures used in the assessment of both sarcopenia[9] and frailty.[6]

Findings support a differentiation in primary treatment for sarcopenia (ie, focused on the increase of muscle mass and muscle function by combining exercise and adequate protein intake)[34] and frailty (ie, focused on different domains, such as physical functioning, cognition, psychosocial, social, energy, functional independence, fatigue, weight loss, and medication use).[10]

Strengths and Limitations

A strength of this study is the use of a unique clinically relevant population of geriatric outpatients. Another strength is the use of different definitions of sarcopenia and frailty, as no consensus has been reached for either condition. Studies can be compared only when different definitions of sarcopenia and frailty are being used. A limitation is the use of cross-sectional data, the reason why causality cannot be proven. Another limitation is the relatively small sample size due to the availability of data on all diagnostic criteria.

Conclusion

Prevalence rates of sarcopenia and frailty vary within the same population depending on the applied definition and there is little concordance between definitions of sarcopenia and definitions of frailty. Using the current definitions, this study shows that sarcopenia and frailty are 2 separate conditions based on different constructs. This study clearly indicates the importance to diagnose sarcopenia and frailty as separate entities so as to intervene with the appropriate treatment. Furthermore, definitions should be used carefully because prevalence rates are highly dependent on the definition used. Further research should focus on the longitudinal development and causality of sarcopenia and frailty.

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