International Journal of Nursing and Health Care Research

OPEN ACCESS

Pana A, et al. Int J Nurs Health Care Res 6: 1453

www.doi.org/10.29011/2688-9501.101453

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Research Article

SARC-F and SARC-Calf Tools for Nurses to Screen Sarcopenia in Older Adults

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Citation: Pana A, Sourtzi P, Kalokairinou A, Galanis P, Velonaki VS (2023) SARC-F and SARC-Calf tools for Nurses to Screen Sarcopenia in Older Adults. Int J Nurs Health Care Res 6: 1453. DOI: 10.29011/2688- 9501.1014533

Received Date: 17 July, 2023; **Accepted Date:** 27 July, 2023; **Published Date:** 31 July, 2023

Abstract

Purpose This study aimed to compare the validity of SARC-F and SARC-Calf screening tools for sarcopenia to be used by nurses in Greek older adults. **Methods** For the clinical validation of the Greek version of SARC-F, a cross-sectional study was conducted to assess sensitivity, specificity, positive and negative predictive values (PPV and NPV, respectively) of the SARC-F against 4 definitions of sarcopenia. The SARC-F questionnaire was combined with calf circumference. SARC-Calf was developed and assessed against the same definitions of sarcopenia. **Results** One hundred older adults, ≥ 65 years old, (median age 72.50 years old, standard deviation = 9), took part in the clinical validation of the Greek SARC-F and SARC-Calf. Based on the definition used for sarcopenia, sensitivity of SARC-F ranged from 27.0 to 50.0%, specificity from 82.2 to 85.7%, NPVs between 66.7 and 93.8%, and PPVs were always below 60.0%. The SARC-Calf demonstrated improved specificity (95.6 to 98.4%) but lower sensitivity (10.0 to 20.0%). **Conclusions** The Greek version of SARC-F appears to be a useful screening tool for nurses for precisely ruling out community-dwelling older adults without sarcopenia. Nurses could have an important role in the early detection of sarcopenia by implementing the SARC-F screening tool. Further research is needed to assess the SARC-Calf validity in more vulnerable populations.

Keywords: Sarcopenia; SARC-F; SARC-Calf; Validation; Greek; Nurses

Introduction

Sarcopenia is defined as a progressive muscle disorder prevalent among older adults. According to the updated operational definition of sarcopenia by the European Working Group on Sarcopenia in Older People (EWGSOP2) low muscle strength is suggested as a key characteristic of sarcopenia [1]. Detection of low muscle quantity and quality is used to confirm the sarcopenia diagnosis, and additionally, poor physical performance is indicative of severe sarcopenia [1]. The prevalence of sarcopenia varies across different population settings and ethnicities, according to the definitions, the diagnostic methods, and the cut-offs used [2]. Sarcopenia is a risk factor for falls, fractures, disability, dependency, poor quality of life, cognitive impairment, depression, institutionalization, hospitalization, and mortality [3-5]. Considering this, screening for sarcopenia in an early stage is important, because there is a possibility these adverse consequences to be prevented, delayed or sometimes even reversed with early, evidence-based interventions [1].

Nurses' role in early detection of other geriatric health problems is well recognized in the literature. There is evidence that nurses in their daily practice with older adults are involved in cancer [6], frailty [7], delirium [8], falls [9], and nutritional screening [10]. However, the use of screening tools for sarcopenia by nurses is not well documented in the literature. Most studies on sarcopenia screening tools have not used nurses to validate

the tools, although nurses are often the first point of contact for older adults or their families with nutritional or weight or muscle strength loss concerns.

The SARC-F is a widely used screening tool for sarcopenia. In view of its utility in everyday practice, SARC-F has been translated and validated in multiple different languages. Some researchers recommend the SARC-F in combination with the measurement of calf circumference (CC), SARC-Calf, as a screening tool for sarcopenia [11]. SARC-Calf seems a promising screening tool, as it demonstrates higher sensitivity than SARC-F itself [12-14]. The aim of this study is therefore to compare the validity of SARC-F and SARC-Calf screening tools for sarcopenia to be used by nurses in Greek older adults.

Methods

This is part of a larger multicenter study, in collaboration with the Hellenic Association of Gerontology and Geriatrics. The validity of the SARC-F and SARC-Calf tools was assessed in this part of the study, with a cross-sectional design, conducted between July 2020 and October 2022 (recruitment were temporarily paused due to Covid-19 restrictions) in a convenience sample of community-dwelling older adults living in Athens. Participants were recruited either as outpatients or their companions in a General Hospital in Athens or community settings and organizations, a choral group, or church.

Participants who met the following criteria were included; (1) aged 65 years or older; (2) able to walk but may use any aid; (3) able to communicate in Greek language; (4) willing to complete the survey; and (5) provided written consent to participate.

The exclusion criteria were individuals with the following conditions: (1) severe cognitive disorder, making difficult the communication or data collection; (2) an implanted pacemaker or defibrillator; (3) bedridden; (4) unable to communicate with the interviewer; (5) acute or chronic disease influencing the laboratory values, the response to the interview, or the ability to perform the required measurements. All the participants signed a written informed consent form. Participant information was collected through face-to-face interviews with a trained nurse, who was the main researcher of this study. The anthropometric measurements, muscle mass measurement, gait speed test, and handgrip strength test were also performed by the same trained nurse. The study protocol was approved by the Research Ethics Committee of the Nursing Department of the National and Kapodistrian University of Athens and the Scientific Council of the involved hospital.

The SARC-F questionnaire consists of 5 items: Strength, Assistance with walking, Rise from a chair, Climb stairs and fall. The scores range from 0 to 10, with 0 to 2 points for each item. A score equal to or greater than 4 is predictive of sarcopenia and poor outcomes [15]. For the translation and validation of SARC-F into Greek we followed the steps suggested in the methodological report by the European Geriatric Medicine Society (EUGMS) Special Interest Group (SIG) on Sarcopenia. According to this report a sample of between 50 and 100 community-living subjects aged 65 years or older should participate in the study of validation. The translation and cross-cultural adaption of SARC-F questionnaire into Greek has been described elsewhere [16].

Validation of the SARC-F questionnaire

Sensitivity, specificity, and positive and negative predictive values (PPV, NPV, respectively) of the SARC-F were assessed against four definitions of sarcopenia; EWGSOP2 [1], FNIH2 and FNH3 [17,18], IWGS [19]. Muscle strength was assessed by grip strength, which was measured using a digital handgrip dynamometer. Muscle mass was measured using bioelectrical impedance analysis (BIA) device (Tanita RD-545).

Appendicular skeletal muscle mass (ASM), equivalent to appendicular lean mass (ALM), was calculated using the following equation to obtain an ASM value closed to that measured by DXA: ASM/ht^2 (DXA) = 0.04^* BMI – 0.58 Women $+0.69^*$ ASM/ht^2 (BMI = Body Mass Index) [20-21]. The physical performance was measured by the 4-m usual gait speed test. According to the EWGSOP2 criteria sarcopenia is confirmed when low muscle strength and mass are detected. Cut-off points for muscle strength by grip strength are < 27 kg and < 16 kg for men and women, respectively. Cut-off points for muscle mass are $ASM/height^2 < 7$ kg/h^2 for men and $ASM/height^2 < 5.5$ kg/h^2 for women. According to the FNIH criteria, the definition of sarcopenia depends either on two criteria (FNIH2; low muscle strength and mass) or on three criteria (FNIH3; slowness with low muscle strength and mass). Cut-off points for muscle strength by grip strength are < 26 kg and < 16 kg for men and women, respectively. Cut-off points for muscle mass are ASM/BMI < 0.789 for men and < 0.512 for women. Cut-off point for physical performance measured by gait speed is ≤ 0.8 m/s. According to the IWGS definition, sarcopenia is confirmed when both low muscle mass and low physical performance exist. Cut-off points for muscle mass are $ASM/height^2 < 7.23$ kg/h^2 for men and $ASM/height^2 < 5.67$ kg/h^2 for women. Cut-off point for physical performance measured by gait speed is < 1.0 m/s. Finally, the SARC-F was assessed against probable sarcopenia, which is based only on the detection of low muscle strength according to the EWGSOP2 criteria.

The SARC-Calf screening tool

Afterward, CC item was scored as 0 point if the CC was ≥ 31 cm and as 10 points if it was < 31 cm [22]. SARC-F was scored as described above. By adding CC score to the SARC-F score, the SARC-Calf variable was developed. A final score of 11 or more, was classified as risk for sarcopenia and score less than 11 was

classified as no risk for sarcopenia [22]. SARC-Calf was assessed against the above-mentioned definitions of sarcopenia and against the probable sarcopenia.

Statistical Analysis

Demographic, anthropometric characteristics, and clinical features were presented using mean and standard deviation for continuous variables; frequency and percentage were reported for categorical variables.

The characteristics of patients were compared according to the cut-off point of the SARC-F and the P values were assessed using Student's t-test for continuous variables with normal distribution, Mann–Whitney U test for continuous variables with asymmetric distribution and Pearson's Chi-square test (or Fisher's Exact test) for categorical variables. P value < 0.05 was considered statistically significant.

For the clinical validation of the SARC-F the difference of diagnosis between the SARC-F and the 4 operational definitions of sarcopenia was tested by a Pearson's Chi-squared test. Finally, sensitivity, specificity, PPV, and NPV value of the SARC-F according to the 4 operational definitions of sarcopenia and the probable sarcopenia were assessed. Afterward, the same procedure was followed for the validation of the SARC-Calf. Statistical analyses were performed using SPSS 28.

Results

A total of 107 older adults were provided with the opportunity to participate in this study. One-hundred older adults (n = 100) accepted to participate (response rate 93.5%). Reason of refusal was psychological stress. The age range for all the participants was 65-91 years. The median age of the whole study population was 72.50 years old (standard deviation = 9), and 59 participants (59.0%) were women.

Clinical validation of the Greek SARC-F

Among the 100 individuals the SARC-F identified 19 (19.0%) at high risk for sarcopenia. The prevalence rate of sarcopenia based on the SARC-F was 6 (6.0%) men and 13 women (13.0%). Table 1 displays the average, baseline characteristics of the participants who were grouped according to their SARC-F scores. A total score of 4 points and greater was classified as having a high risk for sarcopenia. A statistically significant relationship was found between SARC-F score and number of medications/polypharmacy (p = 0.044, p = 0.037, respectively), CCI (p = 0.042), instability (p < 0.001), walking frequency (p = 0.008), and number of falls in the last year (p = 0.019). Moreover, a statistically significant relationship was found between SARC-F score and muscle strength (p = 0.016) and physical performance (p < 0.001). The participants in the SARC-F ≥ 4 group had a lower mean muscle strength and gait speed. Afterward, probable sarcopenia, as detected via muscle strength, was statistically significant associated with SARC-F (p = 0.008). Depending on the definition used, the prevalence of sarcopenia varied from 10.0% (EWGSOP2, FNIH3) to 37.0% (IWGS) (Table 2).

Characteristics (n = 100)	**SARC-F < 4 (n = 81)**	**SARC-F ≥ 4 (n = 19)**	**P value**
Gender			0.354
Men	35 (43.2%)	6 (31.6%)	
Women	46 (56.8%)	13 (68.4%)	
Age	72.5 ± 6.47	75.5 ± 7.40	0.074
Charlson Comorbidity Index (CCI)	0.60 ± 0.27	0.43 ± 0.34	**0.042**
Total number of medications	3.22 ± 2.38	4.68 ± 3.09	**0.044**

Polypharmacy (≥ 5 drugs daily)	15 (18.5%)	8 (42.1%)	**0.037**
Waist circumference (cm)	98.00 ± 14.48	98.68 ± 10.60	0.847
Pelvis circumference (cm)	109.79 ± 14.48	107.53 ± 9.93	0.520
Calf circumference (cm)	37.22 ± 4.22	35.37 ± 3.56	0.080
Middle arm circumference (cm)	31.09 ± 4.12	31.95 ± 5.28	0.440
Height (m^2)	1.64 ± 0.09	1.60 ± 0.08	0.068
Weight (kg)	77.91 ± 15.52	74.01 ± 10.21	0.300
BMI (kg/ m^2)	29.0 ± 5.59	28.95 ± 3.36	0.970
Probable sarcopenia	11 (13.6%)	8 (42.1%)	**0.008**
Muscle strength (kg)	27.63 ± 9.31	21.97 ± 8.17	**0.016**
Muscle mass - ASM/ht^2 (kg/m^2)	6.43 ± 1.07	6.14 ± 1.04	0.922
Physical performance (m/s)	0.95 ± 0.28	0.63 ± 0.26	**< 0.001**
Number of falls in the last year			**0.019**
0	64 (79.0%)	11 (57.9%)	
1	16 (19,8%)	5 (26.3%)	
2 or more	1 (1.2%)	3 (15.8%)	
Fractures among fallers	11 (73.3%)	4 (80.0%)	1
Instability	20 (24.7%)	13 (68.4%)	**< 0.001**
Exercise frequency			0.724
Never	54 (66.7%)	15 (78.9%)	
Rarely	4 (4.9%)	0 (0%)	
1-2 hours/per week	8 (9.9%)	2 (10.5%)	
More than 2 hours per week	15 (18.5%)	2 (10.5%)	

Walking frequency			**0.008**
Never	29 (35.8%)	12 (63.2%)	
Less than 3 times per week	5 (6.2%)	3 (15.8%)	
More than 3 times per week for at least 15 minutes	47 (58.0%)	4 (21.1%)	
Osteoporosis			0.431
No	37 (45.7%)	11 (57.9%)	
Yes	10 (12.3%)	1 (5.3%)	
Don't know	34 (42.0%)	7 (36.8%)	
Statistically significant differences are marked in bold			

Table 1: Population characteristics based on the SARC-F questionnaire.

Sarcopenia Classification	**Total (n = 100)**	**Men* (n = 41)**	**Women* (n = 59)**	**P value**
Probable Sarcopenia	19 (19.0%)	11 (26.8%)	8 (13.6%)	0.096
SARC-F	19 (19.0%)	6 (14.6%)	13 (22.0%)	0.354
EWGSOP2	10 (10.0%)	7 (17.1%)	3 (5.1%)	0.086
FNIH2	13 (13.0%)	9 (22%)	4 (6.8%)	**0.035**
FNIH3	10 (10.0%)	7 (17.1%)	3 (5.1%)	0.086
IWGS	37 (37.0%)	15 (36.6%)	22 (37.3%)	0.943
*Percentages (%) are presented within gender. Statistically significant differences are marked in bold Abbreviations: EWGSOP2, the European Working Group on Sarcopenia in Older People 2; FNIH, the Foundation for the National Institutes of Health with 2 or 3 criteria, respectively; IWGS, the International Working Group on Sarcopenia				

Table 2: Sarcopenia classification according to different definitions.

Table 3 summarizes the values of sensitivity, specificity, PPV, and NPV, for the SARC-F questionnaire, using EWGSOP2, FNIH2, FNIH3, and IWGS criteria consecutively as the reference standards. The sensitivity of this tool ranged from 27.0% (IWGS) to 50.0% (FNIH3) and the specificity from 82.2% (EWGSOP2) to 85.7% (IWGS). Furthermore, all the PPVs, which indicated the probability of presenting sarcopenia in case of a positive screening test, were always below 60.0%, with a minimum of 15.8% (EWGSOP2) and a maximum of 52.6% (IWGS). NPV values ranged between 66.7% (IWGS) to 93.8% (FNIH3) indicating a high probability of actually not presenting sarcopenia when the SARC-F is negative. Also, SARC-F was assessed against probable sarcopenia, indicating 42.1% sensitivity, 86.4% specificity, 42.1% PPV, and 86.4% NPV.

Then, SARC-Calf was assessed against the same definitions of sarcopenia and its validity results were compared to SARC-F (Table 3). Sensitivity was lower than that of SARC-F. Specificity was improved, ranging from 95.6 to 98.4%. PPV was much higher in all cases except for the FNIH3 definition. NPV was similar to that of SARC-F. The same findings regarding sensitivity, specificity, and NPV were found when SARC-Calf and SARC-F were compared against probable sarcopenia. However, PPV was similar to that of SARC-F.

	Sensitivity (%)	**Specificity (%)**	**PPV (%)**	**NPV (%)**
EWGSOP2				
SARC-F	30.0	82.2	15.8	91.4
SARC-Calf	20.0	96.7	40.0	91.6
FNIH2				
SARC-F	38.5	83.9	26.3	90.1
SARC-Calf	15.4	96.6	40.0	88.4
FNIH3				
SARC-F	50.0	84.4	26.3	93.8
SARC-Calf	10.0	95.6	20.0	90.5
IWGS				
SARC-F	27.0	85.7	52.6	66.7
SARC-Calf	10.8	98.4	80.0	65.3
Probable sarcopenia				
SARC-F	42.1	86.4	42.1	86.4
SARC-Calf	10.5	96.3	40.0	82.1

Abbreviations: PPV, positive predictive values; NPV, negative predictive values; EWGSOP2, the European Working Group on Sarcopenia in Older People 2; FNIH, the Foundation for the National Institutes of Health with 2 or 3 criteria, respectively; IWGS, the International Working Group on Sarcopenia.

Table 3: SARC-F and SARC-Calf validated against different sarcopenia definitions and probable sarcopenia.

Discussion

In this study we carried out the validation of the SARC-F questionnaire into Greek according to the recommendations by EUGMS and we compared its validity with that of SARC-Calf. The results of the validation analysis indicated that SARC-F has a low sensitivity but a high specificity and high NPV. The PPV was low but even very good tests have poor PPV when applied to low-prevalence populations [23]. These findings indicate that SARC-F is an appropriate tool for nurses for ruling out older adults without sarcopenia. This represents a positive property of a screening test, since when older adults score < 4 in SARC-F, it is considered strongly possible that they are no sarcopenic. Therefore, it eliminates the need for various cost and time-consuming device measurements such as muscle assessment by DXA or BIA and attributes to SARC-F the ability to be used as a feasible and suitable tool in community clinical settings.

The SARC-F has previously been validated into Greek by Tsekoura et al. [24]. In that validation process the SARC-F questionnaire was assessed against only one definition (sensitivity 34.4%, specificity 93.2%, PPV 26.4%, and NPV 66.6%) and proved to be reliable on detecting with precision the absence of sarcopenia. These findings, except NPV, are in agreement with the findings of the present study. However, the present study enhances the validity of SARC-F since it is assessed additionally against three sarcopenia definitions. One more difference between the two studies is that the samples were recruited from different cities

which may explain possible differences in sample characteristics.

Results regarding the validation of the SARC-F among community-dwelling older adults in other languages are similar, highlighting the low sensitivity and PPV, and the high specificity and NPV [25-31]. The different validation results in other studies may be due to different methodology or sample characteristic. In the Romanian validation, older adults were recruited from nursing homes but there were strict inclusion criteria and were considered community-dwelling [32]. The mean age of participants in the German (79.1 ± 5.2 years) and the Spanish (Spain) population (81.4 ± 5.9 years) was much higher than the present study [25,33]. The findings of our study are consistent with these in a recent meta-analysis aiming at evaluating the diagnostic accuracy of SARC-F. Depending on the definition used, the sensitivity ranged from 27.0 to 77.0% and the specificity from 63.0 to 91.0% [34]. The authors concluded that despite some limitations, the SARC-F because of the high practicability and specificity remains an effective screening tool for sarcopenia in the older population.

The findings of the present study revealed that SARC-F is superior to SARC-Calf regarding the sensitivity. However, SARC-Calf indicated higher specificity and PPV than SARC-F (except for FNIH3 definition) and similar NPV. Bahat et al. [22] found similar results when they compared SARC-F with SARC-Calf in a sample of Turkish population. On the other hand, other studies indicated improved sensitivity of SARC-Calf in comparison with SARC-F [12-14]. The different prevalence of sarcopenia or the average age of the participants between these studies and our study may explain their improved, but not perfect sensitivity. The performance of SARC-Calf among other populations e.g., nursing home residents or other settings (e.g., hospitals), where the prevalence of sarcopenia is higher, remains to be further investigated.

Furthermore, in the present study, it was found that in the case of the SARC-F ≥ 4 group, muscle strength and physical performance, both basic components of sarcopenia, were statistically significant correlated, enhancing the value of SARC-F as a screening tool for sarcopenia. The risk of probable sarcopenia, assessed by muscle strength, was higher in the group of older adults with SARC-F score ≥ 4, highlighting the significant relationship between probable sarcopenia and SARC-F as screening tool for sarcopenia. There is also a statistically significant association between the SARC-F ≥ 4 group and the number of medications/ polypharmacy. This finding has been also indicated in a previous scoping review. According to this review, sarcopenia or risk for sarcopenia are associated with polypharmacy or the number of medications in community-dwelling older adults, regardless of diagnostic criteria used for sarcopenia [23].

The number of comorbidities, measured by CCI and the number of falls were statistically significant associated with SARC-F, indicating that older adults at risk for sarcopenia may have more than one chronic disease at the same time and higher risk for falls. Tan et al. [24] have also found that SARC-F is associated with higher CCI and higher number of falls in a sample of outpatients. Moreover, the statistically significant association found between SARC-F and instability may explain the higher risk for falls among older adults at risk for sarcopenia. The relationship between SARC-F and walking frequency was also investigated among community-dwelling older Brazilians during the pandemic COVID-19 [25]. Their findings are in agreement with our study indicating that walking frequency (minutes/week) is low in participants with risk for sarcopenia [25].

The SARC-F administration and the assessment of sarcopenia in this study were performed by a trained nurse. The nurse characterized SARC-F as a quick and easy-to-use tool in community-dwelling older adults. The majority of the participants responded to the questions without any difficulty or reluctance. The nurses' vital role in the early detection of sarcopenia by implementing screening tools is not fully recognized in the existing literature [35]. There are only a few studies that involve nurses in sarcopenia screening and most of them concern community or home care nurses [36-40]. However, it is suggested that also hospital-based nurses could contribute to the early detection of sarcopenia, recognizing possible signs of sarcopenia, and implementing screening tools [35]. Compared to other health professionals, nurses work more next to the community-dwelling older adults as well as inpatients. Therefore, they may undertake autonomously the screening process of sarcopenia and refer the individuals at risk to the specialist members of the multidisciplinary team [35].

This study has some strengths and limitations. First, to our knowledge, this is the first study in Greece which attempted to compare the validity between SARC-F and SARC-Calf and to assess it against four currently agreed and commonly used definitions of sarcopenia. Secondly, this study attempted to highlight especially the role of nurses in screening of sarcopenia. On the other hand, we used a BIA device for the assessment of muscle mass, instead of more precise, but expensive and less convenient techniques; magnetic resonance imaging, computed tomography or DXA. Nevertheless, we used a BIA equation and BIA remains under some circumstances an acceptable method for the estimation of muscle mass [41]. In addition, the measurement of CC may in some cases hide a possible sarcopenic obesity due to the intramuscular or subcutaneous adipose tissue deposition in obese subjects [12]. Finally, we included a convenience sample of Greek older people of volunteers, which can limit the generalization of our results to other populations.

Conclusions

The Greek SARC-F demonstrates poor sensitivity, but high specificity and NPV, indicating that nurses can use it and detect with accuracy community-dwelling older adults without sarcopenia, independently of the diagnostic criteria used. The SARC-Calf indicated improved specificity but not sensitivity in comparison with SARC-F. Nurses can significantly contribute to the management of sarcopenia, through its early detection, by applying the SARC-F questionnaire. Further studies are needed to validate the SARC-Calf in different populations and settings with a higher prevalence of sarcopenia. Moreover, nurses may guide future health promotion interventions with content focusing on the prevention of sarcopenia and the identification of older adults at risk through the SARC-F administration.

Acknowledgements:

We would like to thank the Hellenic Association of Gerontology and Geriatrics for the collaboration, giving us the opportunity to conduct this study as part of a larger multicenter study.

Compliance with ethical standards

Funding:

No funding was received for conducting this study.

Conflict of interest:

The authors have no relevant financial or non-financial interests to disclose.

Ethical approval:

The research protocol was approved by the Research Ethics Committee of the Nursing Department of the National and Kapodistrian University of Athens and the Scientific Council of the involved hospital**.**

Consent to participate:

Informed written consent was obtained from all individual participants included in the study.

References

1. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, et al. (2019) Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing 48: 16-31.
2. Tournadre A, Vial G, Capel F, Soubrier M, Boirie Y (2019) Sarcopenia. Joint Bone Spine. 86: 309-314.
3. Chen X, Cao M, Liu M, Liu S, Zhao Z, et al. (2022) Association between sarcopenia and cognitive impairment in the older people: a meta-analysis. Eur Geriatr Med 13: 771-787.
4. Li Z, Tong X, Ma Y, Bao T, Yue J (2022) Prevalence of depression in patients with sarcopenia and correlation between the two diseases: systematic review and meta-analysis. J Cachexia Sarcopenia Muscle 13: 128-44.
5. Woo J (2017) Sarcopenia. Clin Geriatr Med 33: 305-314.
6. Kagan SH, Maloney KW (2017) Cancer Screening and Early Detection in Older People: Considerations for Nursing Practice. Semin Oncol Nurs 33: 199-207.
7. Warnier RMJ, van Rossum E, Du Moulin MFMT, van Lottum M, Schols JMGA, et al. (2021) The opinions and experiences of nurses on frailty screening among older hospitalized patients. An exploratory study. BMC Geriatr 21: 624.
8. Jeong E, Park J, Lee J (2020) Diagnostic test accuracy of the Nursing Delirium Screening Scale: A systematic review and meta-analysis. J Adv Nurs 76: 2510-2521.
9. Enderlin C, Rooker J, Ball S, Hippensteel D, Alderman J, et al. (2015) Summary of factors contributing to falls in older adults and nursing implications. Geriatr Nurs NYN 36: 397-406.
10. Browne S, Geraghty A, Corish C (2022) Advances in knowledge of screening practices and their use in clinical practice to prevent malnutrition. Proc Nutr Soc 81: 41-48.
11. Nawi SNM, Khow KS, Lim WS, Yu SC (2019) Screening Tools for Sarcopenia in Community-Dwellers: A Scoping Review 48: 201-216.
12. Barbosa-Silva TG, Menezes AMB, Bielemann RM, Malmstrom TK, Gonzalez MC, et al. (2016) Enhancing SARC-F: Improving Sarcopenia Screening in the Clinical Practice. J Am Med Dir Assoc 17: 1136-1141.
13. Kera T, Saida K, Higuchi D, Shinohara T, Onozawa H, et al. (2022) Utility of SARC-F in daycare facilities for older people. Geriatr Gerontol Int 22: 889-893.
14. Yang M, Hu X, Xie L, Zhang L, Zhou J, et al. (2018) Screening Sarcopenia in Community-Dwelling Older Adults: SARC-F vs SARC-F Combined With Calf Circumference (SARC-CalF). J Am Med Dir Assoc 19: 277.e1-277.e8.
15. Malmstrom T, Morley J (2013) SARC-F: A Simple Questionnaire to Rapidly Diagnose Sarcopenia. J Am Med Dir Assoc 14: 531-532.
16. The 11th Hong Kong International Nursing Forum.
17. Dam TT, Peters KW, Fragala M, Cawthon PM, Harris TB, et al. (2014) An Evidence-Based Comparison of Operational Criteria for the Presence of Sarcopenia. J Gerontol A Biol Sci Med Sci 69: 584-590.
18. Studenski SA, Peters KW, Alley DE, Cawthon PM, McLean RR, et al. (2014) The FNIH Sarcopenia Project: Rationale, Study Description, Conference Recommendations, and Final Estimates. J Gerontol A Biol Sci Med Sci 69: 547-558.
19. Fielding RA, Vellas B, Evans WJ, Bhasin S, Morley JE, et al. (2011) Sarcopenia: an undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences. International working group on sarcopenia. J Am Med Dir Assoc 12: 249-256.
20. Buckinx F, Reginster JY, Dardenne N, Croisiser JL, Kaux JF, et al. (2015) Concordance between muscle mass assessed by bioelectrical impedance analysis and by dual energy X-ray absorptiometry: a cross-sectional study. BMC Musculoskelet Disord 16: 60.
21. Beaudart C, Bruyère O, Geerinck A, Hajaoui M, Scafoglieri A, et

al. (2020) Equation models developed with bioelectric impedance analysis tools to assess muscle mass: A systematic review. Clin Nutr ESPEN 35: 47-62.

22. Bahat G, Oren MM, Yilmaz O, Kılıç C, Aydin K, et al. (2018) Comparing SARC-F with SARC-CalF to Screen Sarcopenia in Community Living Older Adults. J Nutr Health Aging 22: 1034-1038.

23. Grimes DA, Schulz KF (2002) Uses and abuses of screening tests. Lancet Lond Engl 359: 881-884.

24. Tsekoura M, Billis E, Tsepis E, Lampropoulou S, Beaudart C, et al. (2020) Cross-cultural adaptation and validation of the Greek Version of the SARC-F for evaluating sarcopenia in Greek older adults. J Musculoskelet Neuronal Interact 20: 505-512.

25. Parra-Rodríguez L, Szlejf C, García-González AI, Malmstrom TK, Cruz-Arenas E, et al. (2016) Cross-Cultural Adaptation and Validation of the Spanish-Language Version of the SARC-F to Assess Sarcopenia in Mexican Community-Dwelling Older Adults. J Am Med Dir Assoc 17: 1142-1146.

26. Beaudart C, Locquet M, Bornheim S, Reginster JY, Bruyère O (2018) French translation and validation of the sarcopenia screening tool SARC-F. Eur Geriatr Med 9: 29-37.

27. Kim S, Kim M, Won CW (2018) Validation of the Korean Version of the SARC-F Questionnaire to Assess Sarcopenia: Korean Frailty and Aging Cohort Study. J Am Med Dir Assoc 19: 40-45.e1.

28. Kera T, Kawai H, Hirano H, Kojima M, Watanabe Y, et al. (2019) SARC-F: A validation study with community-dwelling older Japanese adults. Geriatr Gerontol Int 19: 1172-1178.

29. Akarapornkrailert P, Muangpaisan W, Boonpeng A, Daengdee D (2020) Validation of the Thai version of SARC-F, MSRA-7, and MSRA-5 questionnaires compared to AWGS 2019 and sarcopenia risks in older patients at a medical outpatient clinic. Osteoporos Sarcopenia 6: 205-211.

30. Krzymińska-Siemaszko R, Deskur-Śmielecka E, Kaluźniak-Szymanowska A, Styszyński A, Wieczorowska-Tobis K (2020) Polish version of SARC-F to assess sarcopenia in older adults: An examination of reliability and validity. PLoS ONE 15: e0244001.

31. Perna S, Gasparri C, Ferraris C, Barrile GC, Cavioni A, et al. (2022) Validation of the Italian Version of the SARC-F Questionnaire to Assess Sarcopenia in Older Adults. Nutrients 14: 2533.

32. Gasparik A, Demián MB, Pascanu I (2020) Romanian Translation and Validation of the SARC-F Questionnaire. Acta Endocrinol Buchar Rom 16: 216-222.

33. Drey M, Ferrari U, Schraml M, Kemmler W, Schoene D, et al. (2020) German Version of SARC-F: Translation, Adaption, and Validation. J Am Med Dir Assoc 21: 747-751.e1.

34. Lu JL, Ding LY, Xu Q, Zhu SQ, Xu XY, et al. (2021) Screening Accuracy of SARC-F for Sarcopenia in the Elderly: A Diagnostic Meta-Analysis. J Nutr Health Aging 25: 172-182.

35. Pana A, Sourtzi P, Kalokairinou A, Velonaki VS (2022) Nurses' Key Role in the Early Detection of Sarcopenia among Older People. Nurs Arch

36. Özkaya Sağlam B, Küçükgüçlü Ö (2021) Yaşlılarda Sarkopeni ve Hemşirelik. Dokuz Eylül Üniversitesi Hemşire Fakültesi Elektron Derg 461-470.

37. Roberts H, Lowry A, Sayer A (2014) Assessment and management of older people with sarcopenia. Nurs Older People 26: 20-22.

38. Brown WJ, McCarthy MS (2015) Sarcopenia: What Every NP Needs to Know. J Nurse Pract 11: 753-760.

39. Jackson KL, Hunt D, Chapa D, Gropper SS (2018) Sarcopenia-A baby boomers dilemma for nurse practitioners to discover, diagnose, and treat. J Nurs Educ Pract 8: 77.

40. Silva RF, Figueiredo M do LF, Darder JJT, Santos AMR dos, Tyrrell MAR (2020) Sarcopenia screening in elderly in primary health care: nurse knowledge and practices. Rev Bras Enferm [Internet]. Associação Brasileira de

41. Gonzalez MC, Barbosa-Silva TG, Heymsfield SB (2018) Bioelectrical impedance analysis in the assessment of sarcopenia. Curr Opin Clin Nutr Metab Care 21: 366-374.