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ORIGINAL ARTICLE

Cross cultural adaptation of the Greek sarcopenia quality of life (SarQoL) questionnaire

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ABSTRACT

Purpose: To translate and validate into the Greek language and setting the Sarcopenia Quality of Life (SarQoL®) questionnaire.

Methods: A convenience sample of 176 Greek elderly people (136 females, 40 males; aged 71.19 ± 7.95 years) was recruited, 50 of which (36 females, 14 males) were diagnosed sarcopenic. Questionnaire was back-translated and culturally adapted into Greek according to international guidelines. To validate the Greek SarQoL®, we assessed its validity (discriminative power, construct validity), reliability (internal consistency, test–retest reliability) and floor/ceiling effects. Participants were divided into sarcopenic and non-sarcopenic. Sarcopenic subjects apart from the Greek SarQoL (SarQoL^{GR}) filled out the Greek versions of two generic questionnaires; Short Form-36 and EuroQoL 5-dimension.

Results: The Greek SarQoL questionnaire was translated without major difficulties. SarQoL^{GR} mean scores were 52.12 ± 11.04 (range: 24.74–71.81) for sarcopenic subjects and 68.23 ± 14.1 (range: 24.83–94.81) for non-sarcopenic ones. Results indicated good discriminative power across sarcopenic and non-sarcopenic subjects ($p = 0.01$), high internal consistency (Cronbach's alpha of 0.96) and excellent test–retest reliability (ICC = 0.96, 95% CI = 0.95–0.97). Neither a floor nor a ceiling effect was observed.

Conclusions: The Greek SarQoL was found to be a reliable and valid measure of quality of life for sarcopenic patients. It is therefore, available for use in future clinical research and practice.

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➤ IMPLICATIONS FOR REHABILITATION

- The Greek version of the SarQoL® questionnaire is a valid and reliable outcome measure for assessing patients with sarcopenia.
- The Greek SarQoL is recommended to be use in clinical settings and research.
- The Greek SarQoL® questionnaire is available online www.sarqol.org.

Introduction

Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength with a risk of adverse outcome, such as physical disability, and death [1–3]. It is associated with an obvious decline in quality of life. Complete assessment of sarcopenic patients should provide evidence of an impact on patients' Health related quality of life [4,5]. Quality of life assessments via questionnaires are important and necessary in order to understand the needs of elderly people and people with sarcopenia [6,7]. Physicians and therapists should consider screening quality of life in sarcopenic patients in different settings [1,6].

Until recently, quality of life in patients with sarcopenia was assessed by generic tools [4,6,8], as there were no specific validated patient-based instruments for measuring quality of life in those with sarcopenia [4,5].

In 2015, Beaudart et al. [4] developed the first sarcopenic-specific, self-administrated quality of life questionnaire, the SarQoL® questionnaire. The questionnaire includes 55 items enrolled into 22 questions, rated on a 4-point Likert scale of frequency (often, sometimes, rarely, never) or intensity (a lot, moderately, a bit, not at all). SarQoL® is organized into seven domains of quality of life (Physical and Mental Health, Locomotion, Body Composition, Functionality, Activities of Daily Living, Leisure activities, Fears) and the total scoring of the SarQoL® questionnaire ranges from 0 (worst imaginable quality of life) to 100 (best imaginable quality of life). It takes approximately 10 min for patients to fill in the questionnaire [4]. The SarQoL® has been developed and validated in French [9] and also translated and validated in English [10] Romanian [11] and Dutch language [12]. The SarQoL® has been already adapted to 20 languages [13], without however, having as yet its psychometric properties being tested.

In Greece, despite the high prevalence of sarcopenic patients found in one recent study [14], where, 29.2% of a sample of 154 elderly were diagnosed as sarcopenic in Western Greece, there are no patient-based outcome measures for the evaluation or management of patients with sarcopenia.

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Given the above, the aim of this paper was to cross-culturally translate, and validate the SarQoL® into the Greek language and setting.

Methodology

This study followed two main steps. The first step consisted of the translation process and the second, consisted of the psychometric evaluation of the Greek version of the SarQoL®. The study was approved by the Ethics Committee of the Technological Educational Institute of Western Greece.

Greek translation of the SarQoL®

For the translation procedure, guidelines for forward and backward cross–cultural adaptation were followed [15]. The translation was performed after receiving official permission of the questionnaire developer, Dr Beaudart C. The translation part was articulated in five stages.

1. The initial forward translation from English to Greek by two independent bilingual translators, which were both Greek native speakers
2. The two forward translations were synthesized and produced the first consensus Greek version of the SarQoL®
3. The synthesis version was back translated in English (by one independent bilingual blinded to the original English version and having English as their first language)
4. An expert committee compared the backward translations with the original questionnaire and produced the pre- final Greek version (second version) of the SarQoL®
5. This pre-final version was tested in a pilot study. It was administered to 15 elderly people with variable educational levels, to confirm the comprehensibility and syntax of all questions. The participants were asked whether they fully understood all items and whether they had problems with the formulation of the questions. Following the pilot, a final meeting was organized, where all translators discussed the comments made by the patients within the pilot. Thus, following this meeting the third and final version of the Greek SarQoL ($SarQoL^{GR}$) questionnaire was developed.

Psychometric testing of the greek SarQoL

Participants

The study's cohort for the validation of the SarQoL® consisted of 176 individuals recruited from two sited; the University Hospital of Rio, Greece and the laboratory of Technological Educational Institute of Western Greece. Any person entering both sited for whatever reason (appointment or visit), aged over 60 years of age and having the Greek language as their maternal language was requested to participate in the study, following informed consent. All participants agreed to participate and signed an informed consent form. Participants also had a Mental State Examination (MMSE) [6] which consisted of a 30-point questionnaire to assess their cognitive function. Participants with dementia and/or patients with a pacemaker, and/or patients with an amputated limb and/or patients with BMI >50 were excluded from the study because of the requirements of the device measuring muscle mass (Biolectrical impendence analysis). Participants were divided into two groups: sarcopenic and non-sarcopenic.

Assessment of sarcopenia

Sarcopenia was defined according to the European Working Group on Sarcopenia in Older People (EWGSOP): (1)Using the cut-off points indicated in the EWGSOP consensus [1], low muscle mass was classified as Skeletal Muscle Mass Index <5,67 kg/m^2 for women and <7.2 kg/m^2 for men and was assessed by bioelectrical impedance analysis – BIA (Tanita BC-601). Fat free mass was measured by BIA and skeletal muscle mass (SMM) was calculated by the following equation: SMM (kg) = 0.566 * FFM (fat free mass). Skeletal muscle mass index (SMMI) was calculated as skeletal muscle mass (kg)/height squared (m^2) [16]. During the body composition analysis, the subjects were dressed in light clothes in order to measure total and segmental (upper and lower limb) fat mass and muscle mass. Participants removed their socks, stood on two metallic electrodes on the floor scale barefoot, and held metallic grip electrodes placed in the palm of their hands with their fingers wrapped around the handrails. In order to ensure the reliability of the measurements the subjects were recommended to have a bowel movement within 30 min before the measurement, and also not consume any alcoholic beverages and meals for at least 48 h and 4 h, respectively before the tests. All analyses was carried out by the same examiner.

(2) A muscle strength <20 kg for women and <30 kg for men assessed by a hydraulic hand dynamometer (Saehan). Each participant had three measurements with the dominant hand. The highest value was used.

(3) Physical performance was assessed with the 4 m test. Values under <0.8 m/s in gait speed indicated poor physical performance [1,4,7].

For the diagnosis of sarcopenia, EWGSOP recommends using the presence of both low muscle mass plus low muscle function (strength or performance) and has suggested a conceptual staging of "presarcopenia", "sarcopenia" and "severe sarcopenia". The "presarcopenia" stage is characterized by low muscle mass without impact on muscle strength or physical performance. The "sarcopenia" stage is characterized by low muscle mass, plus low muscle strength or low physical performance. "Severe sarcopenia" is the stage identified when all three criteria are met (low muscle mass, low muscle strength and low physical performance [1].

Discriminative power

The ability of the questionnaire to discriminate participants with sarcopenia and non-sarcopenia was assessed by the comparisons between the total score of the SarQoL® questionnaire and between the individual domains scores, for participants with sarcopenia and non-sarcopenia [4]. It was assumed that quality of life is better in subjects without sarcopenia compared to subjects diagnosed sarcopenic.

Internal consistency

Internal consistency is the estimation of the questionnaire's homogeneity [10].

Floor and ceiling effects

Floor and ceiling effects were defined when a high percentage of the population had the lowest or the highest score, respectively. Floor and ceiling effects higher than 15% were considered to be significant [17].

Construct validity

The validity of a measurement tool determines whether the research truly measures that which it was intended to measure or

Table 1. Characteristics of the participants ($n = 176$).

	Total sample ($n = 176$)	Sarcopenic participants ($n = 50$)	No sarcopenic participants ($n = 126$)
Sex			
Women	136 (77.27%)	37 (74%)	99 (78.5%)
Men	40 (22.72%)	13 (26%)	27 (21.5%)
Age	71.19 (SD = 7.95)	72.10 (SD = 7.7)	70.7 (SD = 8)
BMI	26.6 (SD = 3,85)	27.68 (SD = 3.49)	23.9 (SD = 3.36)
Number of Drugs	2.63 (SD = 1.28)	3.5 (SD = 1.28)	2.28 (SD = 1.46)
Number of Comorbilities	2.22 (SD = 1.13)	2.96 (SD = 1.13)	1.93(SD = 0.05)
MMSE	29 (28–30)	29 (28–30)	29 (28–30)

SD: Standard Deviation, BMI: body mass index, MMSE: Mini Mental State Examination.

how truthful the research results are [18]. For the purposes of the present study construct validity was assessed using convergent validity and divergent validity. Convergent validity shows that an instrument is highly correlated with instruments measuring similar variables. Divergent validity shows that an instrument is poorly correlated to instruments that measure different variables [19]. The correlation between the SarQoL® and other questionnaires or domains of questionnaires which were supposed to have similar dimension (convergent validity) or different dimension (divergent validity) was assessed.

Construct validity analysis was undertaken only for the sarcopenic participants. The diagnostic tools that were used for this analysis were: The Greek version of the SarQoL [10], the Greek version of the Short Form-36 questionnaire (SF-36) [20] and the EuroQoL 5-dimension (EQ-5D) [21]. The correlation between the SarQoL and the other two questionnaires was assessed. Sarcopenic participants were asked to complete the three questionnaires. The SF-36 questionnaire is composed of 36 items measuring 8 Health related QoL domains (Physical Functioning, Role Limitation due to physical problems, Bodily Pain, General Health, Vitality, Social Functioning, Role Limitation due to emotional problems and Mental Health) [22]. The EQ-5D questionnaire records the level of self-reported problems according to five dimensions (Mobility, Self-care, Usual Activities, Pain/Discomfort and Anxiety/Depression), with each dimension having three levels: no problems, some problems and extreme problems [23].

For the convergent validity, domains from the SF-36 questionnaire were assumed to be similar such as D1- Physical Functioning, D2-Role limitations due to physical health, D3-Pain, D4-General Health, and D5-Vitality, and were compared with SarQoL^{GR} total score. From the EQ-5D questionnaire, dimensions of usual activities and mobility were compared with SarQoL^{GR} total score.

And for the divergent validity, dimensions were compared referring to emotional health problems and the general notion of wellbeing (From SF-36: D6-Social functioning, D7-Role limitations due to emotional problems, and D8-Mental Health, from EQ-5D: Self-care, Anxiety-depression, and Pain-discomfort).

Test–retest reliability

Reliability relates to the consistency of a measure [19]. The intraclass correlation coefficient (ICC) was used to test the reliability between the first and the retest overall score of the SarQoL questionnaire and individual domain scores of the SarQoL®. All participants completed the final version of the questionnaire twice within 14 days. They were questioned about having any health change during the past 2 weeks. The results of the participants who did not report any health difference over this 2-week interval were used in analysis ($n = 176$).

Data analysis

Internal consistency has been measured by Cronbach's alpha coefficient. Test–retest reliability between the first and the retest scores of the SarQoL® questionnaire by Intarclass Correlation Coefficient [$ICC_{(2,1)}$]. The correlation coefficient model used in the present study was $ICC_{(2,1)}$; two way random effects, absolute agreement, singe rater/measurement [24]. Values between 0.70 and 0.80 demonstrated good internal consistency and values above 0.80 indicate very good internal consistency [14,25,26].

Normality of continuous variables was tested with the Shapiro–Wilk test. Validity was measured via correlations between the SarQoL and the other two questionnaires (SF-36 and EQ-5D). To measure correlation between the SarQoL® and other questionnaires, we used Pearson correlation coefficient was used for normality distributed data and Spearman's correlation coefficient for the not normally distributed data. An independent sample T-test was performed to assess the difference of overall quality of life and domain scores between sarcopenic and non-sarcopenic subjects. Statistical significance was set at $p < 0.05$. All analyses described were performed using IBM SPPS Statistics 20.0.

Results

Translation

The 22 questions of the SarQoL® questionnaire were translated without any major difficulties. There were only two points of discussion regarding the forward translation of the words "frail" (in question 16) and "DIY" (in question 3), which were solved within the first translators' meeting. A pretest in the third and prefinal version was performed on 15 subjects.

Psychometric analysis

The SarQoL® was given to a sample of 200 people visiting the University Hospital of Rio, Greece and the laboratory of the Technological Educational Institute of Western Greece. A total of 178 participants completed the questionnaire (response rate (89%); 2 questionnaires comprised more than 20% of missing data and were thus, excluded from analyses. Therefore, 176 questionnaires were used for analyses in this study. This sample was composed of 136 female subjects (77.27%) and 40 men (22.72%) with a median age of 71.19 (SD = 7.95) years. All subjects self-completed the questionnaire on paper format. Based on the algorithm developed by the EWGSOP [1,19], 50 subjects (36 women and 14 men) were diagnosed as sarcopenic The study population consisted of sarcopenic patients with different stages of sarcopenia according to EWGSOP (pre sarcopenia: 9 participants; sarcopenia: 25 participants; severe sarcopenia: 16 participants). Table 1 presents the characteristics of the population of sarcopenic and non-sarcopenic subjects.

Table 2. Scores of the Greek SarQoL (representing discriminative power) among sarcopenic and non-sarcopenic participants.

	Non–sarcopenic participants ($n = 126$)		Sarcopenic participants ($n = 50$)			
	Mean score (Minimum-Maximum)	95% CI	Mean score (Minimum-Maximum)	95% CI	p value*	Risk ratio
Total score	68.23 (24.83–94.81)	65.64–70.67	52.12 (24.74–71.81)	48.98–55.26	<0.001	1.92
Physical and Mental Health (D1)	69.98 (31.10–103.54)	67.18–72.67	54.43 (30–81.10)	50.78–58.07	<0.001	1.96
Locomotion (D2)	73.15 (13.89–94.44)	69.04–77.01	49.27 (13.89–87.50)	43.8–54.75	<0.001	1.73
Body composition (D3)	68.48 (1.67–108.33)	65.28–71.64	61.96 (25–91.67)	49.63–59.1	<0.001	2.28
Functionality (D4)	73.24 (34.62–96.67)	70.49–75.92	54.36 (13.46–87.5)	50.13–57.73	<0.001	1.87
Activities of daily living (D5)	63.73 (20–100)	60.9–66.42	32.07 (15.38–80)	42.53–50.46	<0.001	1.26
Leisure activity (D6)	49.98 (0–100)	45.84–53.85	46.5 (0–87.5)	27.7–36.44	<0.001	2.34
Fears (D7)	86.52 (50–100)	83.9–88.92	77.63 (50–100)	73.47–81.78	<0.001	2.26

*p values between sarcopenic and non-sarcopenic patients.

Table 3. Correlations of the SarQoL® total score of the questionnaire with each domain (internal consistency) for the sample ($n = 176$).

	Pearson's r (p value)	95% CI
Physical and Mental Health (D1)	0.75 ($p < 0.001$)	0.63–0.85
Locomotion (D2)	0.65 ($p < 0.001$)	0.45–0.82
Body composition (D3)	0.45 ($p < 0.001$)	0.27–0.61
Functionality (D4)	0.78 ($p < 0.001$)	0.66–0.87
Activities of daily living (D5)	0.68 ($p < 0.001$)	0.54–0.81
Leisure activity (D6)	0.53 ($p < 0.001$)	0.41–0.63
Fears (D7)	0.55 ($p < 0.001$)	0.46–0.64

Table 4. Test–retest reliability of the SarQoL® ($n = 176$).

	Test retest reliability ICC 95% CI	SEM*
Physical and Mental Health (D1)	0.97 (0.97–0.98)	2.42
Locomotion (D2)	0.98 (0.97–0.98)	3.15
Body composition (D3)	0.84 (0.79–0.88)	6.95
Functionality (D4)	0.97 (0.88–0.98)	2.7
Activities of daily living (D5)	0.91 (0.88–0.93)	5.04
Leisure activity (D6)	0.91 (0.89–0.94)	6.23
Fears (D7)	0.64 (0.52–0.70)	9.17
Total score	0.96 (0.95–0.97)	2.75

*SEM: standard measurement error.

Discriminative power

Sarcopenic subjects presented a quality of life score of 52.12 (24.74–7.81, SD = 11.04) compared to a score of 68.23 (24.83–94.81, SD = 14.1) of the non sarcopenic ones ($p < 0.001$) (Table 2). Sarcopenic individuals have had significantly lower scores in all domains.

Internal consistency

The Cronbach's alpha coefficient of the SarQoL® questionnaire was 0.96, indicating a high level of internal consistency (Table 3).

Test–retest reliability

An excellent agreement between test-retest of the SarQoL^{GR} was also yielded (ICC = 0.96, 95% CI 0.95–0.97). For individual domains, ICCs ranged from 0.64 to 0.98 with the lowest ICC being found for the domain Fears (ICC = 0.64, 95% CI 0.54–0.72) (Table 4).

Floor and ceiling effects

There was neither floor nor ceiling effects. No subject presented either the lowest score or the highest score at the SarQoL® questionnaire.

Construct validity

Results of construct validity are all presented in Table 5. Mostly, good to strong correlations were found across the SarQoL® with both, the SF-36 subscales and the EQ-5D questionnaire.

When comparing similar (to the SarQoL) domain scores (convergent validity) with SF-36 and EQ-5D questionnaires, correlations (Pearson's *r)* ranged between 0.42 to 0.9 for the SF-36 General Health and Physical Functioning subscales, respectively, and between 0.48 and 0.77 for the EQ-5D Mobility and Utility Score, respectively (all correlations having highly statistical significance, $p < 0.001$).

When comparing different domains (divergent validity), weaker correlations were found between SarQoL^{GR} and the two questionnaires. In particular, correlations across SarQoL and SF-36 ranged between 0.27 (Social Functioning subscale) and 0.88 (Mental Health subscale), whereas correlations across SarQoL and EQ-5D were all moderate, ranging between 0.44 (Self-care subscale) and 0.55 (Anxiety-Depression subscale); (again all correlations yielded highly statistical significant p vaues, $p < 0.001$).

Discussion

The present study aimed to develop and validate the Greek version of the SarQoL® questionnaire. The process of cross-cultural adaptation was presented with no major issues arising, resulting in a thorough, complete and comprehensible Greek SarQoL version. The SarQoL Greek version (download able at the official site http://www.sarqol.org/sites/sarqol/pdf/Questionnaire_SarQoL_GR.pdf) was used in the validity study.

In the current validation procedure, 176 subjects participated and completed the questionnaires at two occasions. Fifty subjects were diagnosed sarcopenic based on the algorithm developed by the European Working Group on Sarcopenia in Older People and complete 3 questionnaires; the Greek SarQoL (SarQoL^{GR}) as developed in its final Greek version, and 2 generic ones already adapted into Greek, the Short Form-36 questionnaire (SF-36) and the EuroQoL 5-dimension (EQ-5D).

Overall, the results showed satisfactory psychometric characteristics of the translated Greek version of the SarQoL® questionnaire. The psychometric properties analyses showed that the Greek version of the questionnaire is able to discriminate sarcopenic subjects from non-sarcopenic ones. Quality of life seems better for non-sarcopenic subjects with a quality of life score of 52.12 for the sarcopenic ones compared to a score of 68.23 of the non-sarcopenic ones. The different domains also were lower in sarcopenic patients. These results are in agreement with similar psychometric analyses of the English, the Romanian and the French version of the SarQoL® [9–11]. The association between sarcopenia and poorer quality of life has been supported in previous studies. Sarcopenic subjects seems to demonstrate a

Table 5. Correlations of the SarQoL® with SF-36 and EQ-5D questionnaires (construct validity) amongst sarcopenic participants ($n = 50$).

	Total score of the SarQol^{GR}	95% CI
Convergent validity		
SF-36 Physical Functioning$^{(s)}$	$r = 0.9$**	0.77–0.97
SF-36 Bodily pain$^{(p)}$	$r = 0.53$**	0.32–0.72
SF-36 General Health$^{(p)}$	$r = 0.42$**	0.13–0.68
SF-36 Vitality$^{(p)}$	$r = 0.45$**	0.23–0.63
Divergent validity	$r = 0.27$**	0.02–0.53
SF-36-Social functioning$^{(p)}$	$r = 0.88$**	0.75–0.94
SF-36 Mental Health$^{(p)}$	r-=0.41**	0.18–0.63
SF-36 Role limitation due to physical problems$^{(p)}$	$r = 0.33$*	0.12–0.98
SF-36 Role limitation due to emotional problems$^{(p)}$		
Convergent validity		
EQ-5D Utility score$^{(s)}$	$r = 0.77$**	0.58–0.91
EQ-5D Mobility$^{(s)}$	$r = 0.48$**	0.18–0.68
EQ-5D Usual activities$^{(s)}$	$r = 0.62$**	0.35–0.80
Divergent validity	$r = 0.46$**	0.10–0.74
EQ-5D Pain-discomfort$^{(s)}$	$r = 0.55$**	0.32–0.77
EQ- 5DAnxiety-depression$^{(s)}$	$r = 0.44$**	0.23–0.60
EQ-5D Self-care$^{(s)}$		

(s) Spearman r (scores normally distributed).
(p) Pearson r (scores not normally distributed).
**p value <0.001.
*p value >0.001.

significantly high proportion of problems relating to several dimensions of quality of life. The impact on sarcopenia on quality of life is assessed in all studies by generic tools [6]. However, these tools may not be sensitive enough to detect subtle effects of this specific condition on quality of life [4]. Previous studies using the SF-36 questionnaire for this purpose failed to show a reduced quality of life in sarcopenic subjects [27,28]. During the development of the SarQoL® questionnaire, only questions related to sarcopenia (e.g. muscle mass, muscle strength) have been included in the questionnaire [4,10] and is not surprising to find a lower quality of life for Greek sarcopenic subjects.

The test–retest reliability has been found to be excellent for the total score 0.96 (91% CI 0.95–0.97), which is more or less similar to the French version 0.91 (95% CI 0.82–0.95) and the English version 0.95 (95% CI 0.92–0.97). In the study conducted by Gasparik et al. [11] due to issues related to limited accessibility to Romanian elderly the test-retest reliability evaluation was not performed [9]. Finally, for domain 7 "Fears", a fair reliability score was yielded. Results were also low in that domain in another study [9] and this could partly be explained in both studies by the low number of items included in these domains. To confirm the reliability of the SarQoL®, measurement of the test–retest reliability performed after a two-week interval in Greek participants. The two-week interval seems a good compromise between the stability of the measure and the absence of memory bias [9].

Construct validity analyses have also showed that the SarQoL® questionnaire has good correlations with various subscales of the two Quality of Life questionnaires used in the present study (SF-36 and EQ-5D). A rho value >0.5 considered as strong correlation, 0.35 to 0.5 as moderate correlation, and 0.2 to 0.34 as weak correlation [29]. In particular, two of the SF-36 subscales (Physical Function and Mental Function) were highly correlated with SarQoL ($r > 0.85$), the Social Function subscale was poorly correlated ($r = 0.27$), whereas, the remaining subscales were moderately correlated (r ranging between 0.41–0.53). As far as the EQ-5D was concerned, most correlations were moderate (r ranging between 0.44 and 0.55), except from two subscales (Usual Activities and Utility Score), which yielded stronger associations (r being 0.62 and 0.77, respectively). As SF-36 and EQ-5D are quality of life questionnaires, poor associations were not necessarily expected between the SarQoL® and the aforementioned questionnaires. Furthermore, it is not unreasonable to expect the SarQoL® to be highly correlated with domains which are supposed to evaluate similar dimensions (such as the SF-36 Physical Functioning domain, which yielded very strong associations), and, at the same time, have weaker associations with less related domains (such as SF-36 Social Function). These findings, in addition to the more pronounced differences in scores across sarcopenic patients justifies the unique utility of this newly developed assessment tool for sarcopenic populations. In support to these findings, our results are more or less similar to the French, the Romanian, the English and the Dutch version of the questionnaire [9–12], when correlated against the SF-36 and EQ-5D questionnaires, indicating good construct validity cross-culturally.

Comorbilities could also play a role in the total score of quality of life questionnaire. Different concomitant conditions are likely to be important in terms of their impact on health outcomes. The present study utilized calculated the mean score for comorbidities, which was found to be 2.22 (SD = 1.13). However, it must be noted that comorbidity analysis is an issue across studies as no gold standard exists as yet. Measures of comorbidity are categorized according to whether they are based on individual conditions or simple counts, on dysfunction/function of organ systems, on conditions that have been weighted and combined into indices or based on alternative approaches [30]. Given the importance of comorbidity, it is important to consider how comorbidities could influence the total score of the SarQoL. Future work could focus on the impact of comorbidities in care of sarcopenic patients.

Sarcopenia is associated with healthy outcomes and an obvious decline in quality of life [6]. Therapeutic intervention programs targeting sarcopenia are increasing and this questionnaire can be used to assess the relevance of these interventions and their effectiveness in terms of change in quality of life [21]. The Greek SarQoL is a tool available for Greek health staff and gives the great advantage to use it in Greek patients with sarcopenia.

Implications for further research

This is the first study to perform a complete official cross cultural adaptation of the SarQoL® into Greek. SarQoL® is the first quality of life questionnaire specific to sarcopenia. This study is important, supporting this reliable and valid instrument in clinical settings and research within Greece. Further research on assessing responsiveness by means of detectable changes following treatment is required.

Our study presented some limitations. Firstly, the sensitivity to change of the questionnaire was not assessed. However the participants who completed the initial SarQoL® questionnaire are part of the SarcoPhage study, and in perspective, the original developer of the questionnaire will be able to give answers on this matter [4,11]. A second limitation of our study is related to the fact that we could not use dual energy X-ray absorptiometry (DXA) for muscle mass assessment. However, use of BIA has been reported in an increasing number of publications over the last decade [31]. BIA is a noninvasive, quick, safe and inexpensive method of measuring body composition. Under standard conditions (measurement at the same hours, etc.), can provide safe data for health professionals [1,32]. The accurate measurement of muscle mass is a crucial step for classifying sarcopenic subjects

[33]. All proposed definitions of sarcopenia (including the EWGSOP's) include the measurement of muscle mass, but the techniques and threshold values used vary across studies [34]. In recent years, four main techniques have been commonly used to estimate muscle mass: bioelectric impedance, dual energy X-ray absorptiometry, computed tomography, and magnetic resonance imaging to replace anthropometry. Each technique rely on different technologies and assess different aspects of muscle mass (e.g. total body muscle mass, appendicular muscle mass, skeletal muscle mass). Each technique has limitations and in particular, there is a dearth of information on accuracy. Moreover, none of the methods are fully standardized. There is a need to develop a reference standard against which alternative techniques can be evaluated [34]. In this study the formula which was used [SMM (kg) = 0.566 * FFM] was validated on individual and group data and compared with SMM data calculated from 24 h creatinine excretion in a group of healthy subjects as well [35]. Researchers for this validation formula used the Tanita BC 532 model which has comparable BIA technology with Tanita BC 601. As reference methods are not available for identifying low skeletal muscle mass in clinical practice, the European Group on Sarcopenia in Older People accept bioelectrical impedance analysis as an option for sarcopenia assessment [36]. However from a clinical and epidemiological point of view, it is important to have a consensual technique [34].

In English and French validations [9,10], muscle mass was measured by dual-energy x-ray absorptiometry, in the Dutch with BIA, while in the Romanian validation, muscle mass was estimated with the Lee equation (using weight, height, gender, age and race) [11].

Thirdly, given the relatively low number of sarcopenic patients, further, subgroup analysis (by staging the sample's sarcopenia based on the 3 stage EWGSOP process) was not used. This is a clinically important issue that certainly merits further exploration. However, none of the other cross-cultural adaptations have undertaken such analysis. So further work on this is definitely needed. Finally the participants in this study constituted a convenience sample. In turn, women could feel *a priori* more concerned by muscle disorders than a random population sample. This could perhaps explain the small number of male participants compared to females (40 versus136) in the present study.

Conclusions

In conclusion, the SarQoL® Greek questionnaire is now available and can be used in Greek population. The psychometric properties indicated that the Greek version of the SarQoL® is valid, consistent and reliable. Further research is required in order to investigate the ability of the questionnaire on assessing the clinical changes after treatment.

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Disclosure statement

The authors report no declarations of interest.

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