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Original Research



# Validation of the Hungarian Version of the SarQoL® Questionnaire and Its Association with the SARC-F Screening Tool

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## Abstract

BACKGROUND: Following the publication of a culturally adapted version of the original SarQoL® questionnaire in Hungarian language, we aimed to test its psychometric properties and its association with the SARC-F screening instrument.

DESIGN: This cross-sectional validation study recruited elderly people from 2 nursing homes and an endocrinology clinic. All participants were screened for sarcopenia with the SARC-F tool, had their muscle mass measured with bioelectrical impedance analysis, as well as grip strength and gait speed. Sarcopenia was diagnosed with the EWGSOP2 criteria. Participants completed the SarQoL questionnaire, the SF-36, the EQ-5D and the EQ-VAS. Validation consisted of analyzing discriminative power, internal consistency, construct validity and floor- and ceiling effects. A multivariate regression model was used to evaluate the association between QoL, the SARC-F questionnaire, and a number of demographic and clinical variables.

RESULTS: A total of 70 participants, aged 80.00 (68.50 – 82.50) years, were included. Discriminative power between sarcopenic and nonsarcopenic subjects was found for all domains, except domain 7 (Fears) when dividing study population based on the SARC-F score. We also found significantly lower QoL for domains 4 (Functionality) and 5 (Activities of daily living) when splitting participants based on muscle strength (Probable sarcopenia - EWGSOP2 definition). All domains showed a strong or moderate correlation with the total SarQoL score. Conceptually similar domains of other generic QoL questionnaires significantly correlated with the total SarQol score, confirming its convergent validity. Low correlations were found with different domains (divergent validity). No floor or ceiling effects were observed. Using a regression model, the components "strength" and "stair climbing" of the SARC-F questionnaire were significantly associated with the QoL of our patients assessed with the SarQoL instrument.

CONCLUSION: Sarcopenia risk assessed with the Sarc-F instrument was significantly associated with QoL measured with the SarQol questionnaire. High internal consistency, convergent and divergent validity and no floor and ceiling effects characterised the Hungarian language SarQoL® questionnaire. Due to some limitations, further multi-center designed studies are needed to verify the validity of the SarQol questionnaire.

*Key words: Sarcopenia, quality of life, translation, validation.*

## Introduction

Since the introduction of the notion of sarcopenia (1995) as an age-associated loss of muscle mass (1), a considerable amount of research has been conducted globally. The operational definition of sarcopenia introduced in 2010 by the European Working Group on Sarcopenia in Older People (EWGSOP) represented a major change at that time, as it added muscle function to former definitions based only on detection of low muscle mass (2). To reflect scientific evidence built over the last decade, the same working group (EWGSOP2) updated in 2018 (3) their original definition, bringing to the forefront muscle strength, as it is recognised that strength is better than mass in predicting adverse outcomes (4-7). In order to foster its use in clinical settings, the new working group (EWGSOP2) elaborated an algorithm for sarcopenia case-finding, diagnosis and severity determination. According to this: sarcopenia is probable when low muscle strength is detected (3). .

The number of patients with sarcopenia is expected to increase significantly over the next 30 years, posing a serious challenge for public health (7). Early detection and quality of life evaluation should become a priority to allow us to undertake timely actions to prevent future effects on health and quality of life (QoL) (8).

The consequences of sarcopenia on QoL are difficult to evaluate and therefore are quite poorly studied. The SarcoPhAge study suggested that sarcopenic subjects have a significantly worse QoL in the domains of physical function compared to non-sarcopenic subjects (9). The few studies assessing the QoL in sarcopenic subjects used generic QoL questionnaires, such as Short Form 36 (SF-36) and EuroQol 5- dimension (EQ-5D). Generic tools do not cover exhaustively all the areas of potential dysfunction concerned in this geriatric syndrome (9, 10).

That is why, Beaudart et al. developed the first disease-specific quality of life questionnaire (Sarcopenia Quality of Life / SarQoL®), consisting of 55 items translated into 22 questions, covering 7 domains of health-related dysfunction: Physical and mental health, Locomotion, Body composition, Functionality, Activities of daily living, Leisure activities, and Fears (11). SarQoL® has already been translated to 30

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languages, and its psychometric properties have been evaluated in 10 different studies. These have consistently shown that the questionnaire is a valid and reliable instrument, and that it is responsive to changes in QoL over time (11-22).

The translation of a standard instrument needs to be meaningful to the target population in terms of the used concepts and how they are expressed. Simply translating into another language does not ensure cultural equivalence (23-24). We have previously provided and published (25) a translated and culturally adapted version of the original SarQoL® questionnaire in Hungarian language, following the international protocol of translation (forward translation to Hungarian, by two independent translators, text review of the consensual version by a specialist in linguistics, a bilingual expert panel, back translation, pre-testing, cognitive interviewing, final version). The current study was proposed to investigate whether the Hungarian version of the SarQoL® questionnaire possesses equivalent psychometric properties to the original-, and the other versions of the questionnaire. The objective of this study is thus to evaluate the discriminative power, construct validity, floor- and ceiling effects and internal consistency of the Hungarian version of the SarQoL® questionnaire in a cross-sectional sample of older Hungarian participants. The secondary objective of this study was to evaluate the association, or lack thereof, between QoL measured with the SarQoL® questionnaire and the SARC-F screening instrument.

## Methods

### *Study population*

Volunteers of both sexes were recruited from the Endocrinology Clinic of the County Hospital of Marosvásárhely the "Kálvin János" nursing home in Târgu Mureș and the Nyárádszereda nursing home in Nyárádszereda. Potential participants were included if they were older than 65 years and had a body mass index below 30 kg/m$^2$. Demographic and clinical characteristics have been evaluated by interviews and discussions with the residents and the medical staff of the nursing home. We excluded individuals with a BMI > 30 kg/m$^2$, active tumor, heart failure, a history of cerebrovascular accident, mental illness, inability to understand the questionnaire or other comorbidities known to have an impact on muscle mass and strength (malabsorption syndrome, Parkinson's disease, physical disabilities). All participants provided written informed consent and the current study was carried out in compliance with the declaration of Helsinki.

### *Screening and diagnosis of sarcopenia*

All included participants were screened for sarcopenia using the SARC-F questionnaire, which translates the difficulty a person experiences with regards to strength, walking, rising from a chair, climbing stairs and falls to a score between 0 and 10. A score equal or greater than 4 is indicative of sarcopenia and poor outcomes (2, 6).

Participants were then evaluated on muscle strength using a Jamar hydraulic hand dynamometer. Two measurements were taken for each hand, and the highest value (in kg) was registered. Skeletal muscle mass (in kg) was measured using bioelectrical impedance analysis (Tanita BC-420). This technique evaluates the impedance (or opposition) to the flow of an electric current through the body fluids contained mainly in the lean tissue, determining the values corresponding to the quantity (27). Skeletal muscle mass was divided by height-squared to obtain the ASM/Ht$^2$ value. Lastly, we evaluated physical performance. Gait speed was assessed in meters per second over a 4-meter straight track (participants instructed to walk at their usual pace) while chair rise ability was tested measuring the time (with a stopwatch in seconds) taken to transfer from seated to a standing position and back to sitting (standard height chair with straight back) five times (5XSST).

The results for muscle mass, muscle strength and physical performance were used to diagnose sarcopenia according to the EWGSOP2 algorithm. Participants were considered to be probably sarcopenic, if their handgrip strength was lower than 27 kg for men or 16 kg for women. Sarcopenia was confirmed when participants presented with low handgrip strength and low muscle mass, defined as ASM/Ht$^2$ <7.0 kg/m$^2$ for men and <5.5 kg/m$^2$ for women (3).

### *Study instruments*

Apart from the Hungarian version of the SarQoL® questionnaire, each participant also completed the Short-Form 36-item (SF-36) questionnaire, the EuroQoL 5-Dimension 3-level (EQ-5D-3L) questionnaire and the associated visual analogue scale (EQ-VAS).

The SF-36 is a multi-item generic health survey that uses 36 questions to measure functional health and wellbeing from the patient's perspective, measuring eight domains: "Physical Functioning", "Role limitation due to physical problems", "Bodily Pain", "General Health Perceptions", "Vitality", "Social Functioning", "Role limitations due to emotional problems" and "Mental Health". The EQ-5D-3L is another standardized measure of health status composed of five questions encompassing five dimensions of health (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) associated with a Visual Analogue Scale, which records the respondent's self-rated health on a scale from 0-100. The EQ-5D descriptive system is used to calculate an index score, which represents the utility value for current health (21).

### *Psychometric properties*

This study evaluated the discriminative power, also referred to as known-groups-validity, of the Hungarian version of the SarQoL® questionnaire. This aspect evaluates whether the questionnaire can discriminate between groups with different clinical characteristics. In this particular situation, the hypothesis is that the sarcopenic group will have significantly lower QoL than the non-sarcopenic group. This analysis will be repeated for probable sarcopenia versus probably

**Table 1.** Baseline characteristics

| | All (n=70) | Low grip strength (n=30) | Normal grip strength (n=40) | p-value |
|---|---|---|---|---|
| Age (years) | 80.00 (68.50 – 82.50 | 81.00 (78.50 – 83.50) | 73.00 (63.25 – 81.75) | 0.004* |
| Gender (women) | 54 (77.1%) | 22 (73.3%) | 32 (80.0%) | 0.511† |
| BMI (kg/m²) | 27.95 ± 4.47 | 26.04 ± 4.17 | 29.33 ± 4.21 | 0.002 ‡ |
| Grip strength (kg) | | | | |
| Women | 17.46 ± 7.62 | 10.14 ± 2.74 | 22.49 ± 5.48 | <0.001‡ |
| Men | 28.73 ± 13.40 | 18.21 ± 6.79 | 39.24 ± 9.27 | <0.001‡ |
| Gait speed (m/s) | 0.726 ± 0.322 | 0.551 ± 0.230 | 0.858 ± 0.321 | <0.001‡ |
| Chair stand test (s) | 15.29 (11.72 – 20.39) | 18.20 (14.00 – 24.33) | 13.83 (11.08 – 16.60) | 0.003* |
| SARC-F score | 2.50 (1.00 - 4.00) | 3.00 (2.00 -6.00) | 2.00 (0.00 – 4.00) | 0.006* |

* Mann-Whitney U-test; † Pearson's Chi-square test; ‡ Student's T-test

not sarcopenic, and SARC-F score ≥4 versus SARC-F score ≤3. Secondly, we looked at the internal consistency of the questionnaire, which quantifies the degree to which the items in the questionnaire are homogeneous and measure the same concept. The third property examined the construct validity of the Hungarian SarQoL® (25), which determines whether the questionnaire actually measures the construct (here: QoL) it claims to measure. This is evaluated using hypotheses on the expected correlations between the SarQoL® questionnaire and domains from other questionnaires that are theorized to measure similar constructs (convergent validity) or different constructs (divergent validity). Lastly, we examined the frequency tables to determine whether any floor or ceiling effects were present. A maximum of 15% of participants who obtained the lowest score (0) or the highest score (100) was considered acceptable.

### *Statistical methods*

The normality of distribution was evaluated with the Shapiro-Wilk test and by examining the histogram of each variable. Those that were Gaussian have been reported as mean ± standard deviation, non-gaussian variables are reported as median (25th percentile – 75th percentile). P-values for significant differences between 2 groups were calculated with the Student T-test or the Mann-Whitney U-test, depending on normality. The internal consistency of the SarQoL® questionnaire was assessed using Cronbach's Alpha test, where a value between 0.7 and 0.95 is interpreted as adequate internal consistency. To measure correlation between the total SarQoL® score and each domain score, as well as the SarQoL® and different domains of other questionnaires (for divergent and convergent validity), we used Spearman's or Pearson's correlation coefficients, in function of normality of distribution. We also investigated the relation between quality of life, the SARC-F questionnaire, and a host of covariates, chosen on their significance in an univariate regression analysis, through a multivariate linear regression model. Analyses described above were performed using SPSS 17.0, with a level of significance of $\alpha = 0.05$.

## Results

The median age of the 70 included participants (16 men, 54 women) was 80 (68.5-82.5) years. Average SarQol score was 64.14 points. Within the sample, 25 (35.7%) participants were identified as being at high risk of sarcopenia with a SARC-F score ≥4. Thirty (42.9%) participants presented with low grip strength and were thus categorized as probably sarcopenic, but none of them were confirmed to be sarcopenic after measurement of their muscle mass. Table 1 presents the characteristics of the individuals included in the study sample.

### *Discriminative power*

Because no participants were diagnosed as sarcopenic according to the EWGSOP2 criteria, we compared QoL between participants with low grip strength (probable sarcopenia) versus normal grip strength, and between participants with a SARC-F score ≥4 points (high risk of sarcopenia) versus <4 points. These two analyses are presented in tables 2 and 3. When comparing QoL based on grip strength, we found significantly lower QoL for domains 4 (Functionality) and 5 (ADL), but were unable to demonstrate significantly different QoL for the other 5 domains and the o verall QoL score. When we divided the sample according to the SARC-F score, we did obtain significantly lower QoL in the group of participants at high risk for sarcopenia, for all domains and the overall QoL score, with the exception of domain 7 (Fears, p=0.055).

### *Internal consistency*

The measurement of internal consistency was done using Cronbach's alpha and had a value of 0.887, indicating a high level of internal consistency.

All domains showed a significant strong or moderate correlation (Spearman's correlations) with the total SarQoL score ranging from r = 0.930 (domain 4. "Functionality") to r = 0.429 (domain 7. "Fears"), with a very strong significance of p < 0.001.

**Table 2.** Discriminative power of the SarQoL® questionnaire on grip strength

| | Low grip strength (n=30) | Normal grip strength (n=40) | p-value |
|---|---|---|---|
| Domain 1: Physical and mental health | 64.4 ± 19.36 | 67.6 ± 16.22 | 0.456* |
| Domain 2: Locomotion | 60.93 ± 22.14 | 66.75 ± 17.81 | 0.227* |
| Domain 3: Body composition | 64.87 ± 19.13 | 70.94 ± 13.76 | 0.127* |
| Domain 4: Functionality | 64.98 ± 17.84 | 73.69 ± 16.14 | 0.036* |
| Domain 5: Activities of daily living | 51.65 ± 18.34 | 60.91 ± 18.32 | 0.040* |
| Domain 6: Leisure activities | 33.30 (16.60 – 41.60) | 33.30 (33.30-49.90) | 0.153 † |
| Domain 7: Fears | 87.50 (87.50-100.00) | 87.50 (87.50-96.88) | 0.637 † |
| Overall QoL score | 60.11 ± 16.57 | 66.93 ± 14.07 | 0.067* |

* Student T-test; † Mann Whitney U test

**Table 3.** Discriminative power of the SarQoL® questionnaire on SARC-F score

| | High risk (n=25) | Low risk (n=45) | p-value |
|---|---|---|---|
| Domain 1: Physical and mental health | 55.31 ± 14.76 | 72.29 ± 16.12 | <0.001* |
| Domain 2: Locomotion | 47.33 ± 13.04 | 73.66 ± 16.48 | <0.001* |
| Domain 3: Body composition | 58.17 ± 14.61 | 73.99 ± 14.68 | <0.001* |
| Domain 4: Functionality | 54.15 ± 10.81 | 78.74 ± 13.63 | <0.001* |
| Domain 5: Activities of daily living | 42.91 ± 14.77 | 64.74 ± 16.11 | <0.001* |
| Domain 6: Leisure activities | 33.30 (16.60-33.30) | 33.30 (33.30-58.20) | 0.001† |
| Domain 7: Fears | 87.50 (87.50-87.50) | 87.50 (87.50-100.00) | 0.055† |
| Overall QoL score | 50.31 ± 10.10 | 71.61 ± 12.36 | <0.001* |

* Student T-test; † Mann Whitney U test

### *Convergent and divergent validity*

We compared the total score of the SarQoL questionnaire with similar and different domains of the EuroQol-5D and the SF 36 questionnaires. The conceptually similar domains of Physical functioning, Role limitation and Vitality of the SF 36 questionnaire and domains of Mobility, Usual activities and EQ-VAS of EuroQol questionnaire were significantly correlated with the total SarQoL score, while low correlations were found with the conceptually different domains (Role limitation emotional, Self-care, Pain/discomfort) of the SF-36, EQ-5D questionnaires. (Table 4).

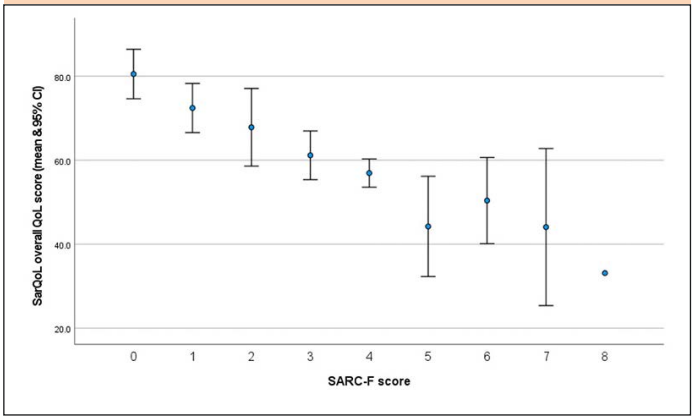
### *Floor and ceiling effects*

We looked at the proportion of subjects with the maximum and minimum score possible, and found no evidence for the presence of floor or ceiling effects for the SarQoL questionnaire.

### *Relation between quality of life, SARC-F and covariates*

To quantify the relationship between QoL, as measured with the Overall score of the SarQoL questionnaire, and the five indicators of the SARC-F questionnaire (strength, walking, rising from a chair, climbing stairs and falls) we constructed a multivariate regression model with the overall SarQoL score as the dependent variable, and as independent variables the five SARC-F indicators as well as clinical characteristics that were significantly associated with QoL in a univariate regression analysis (age, chair stand test, gait speed, education level and grip strength).

**Figure 1.** Overall QoL score for each of the SARC-F scores




This model, displayed in table 5, obtained an R-squared of 0.700, but only the stair climb question and the strength question of the SARC-F were significantly associated with QoL (respectively p=0.034 and p=0.005). The apparent relation between the SARC-F and quality of life is visually represented in figure 1, an error plot of the overall quality of life score for each score category of the SARC-F questionnaire.

**Table 4.** Correlation of the total SarQoL score and the individual domains of EQ-5D and SF-36 questionnaires

| Convergent validity | | | Divergent validity | | |
|---|---|---|---|---|---|
| | r | p | | r | p |
| SF-36 PF | 0.854 | <0.001 | SF-36 SF | 0.085 | 0.531 |
| SF-36 RLP | 0.538 | <0.001 | SF-36 RLE | 0.307 | 0.020 |
| SF-36 BP | 0.509 | <0.001 | SF-36 MH | 0.176 | 0.190 |
| SF-36 GH | 0.419 | 0.001 | EQ-5D SC | -0.427 | 0.001 |
| SF-36 VIT | 0.521 | <0.001 | EQ-5D PD | -0.387 | 0.003 |
| EQ- 5D MO | -0.738 | <0.001 | EQ-5D AD | -0.214 | 0.109 |
| EQ-5D UA | -0.577 | <0.001 | | | |
| EQ-VAS | 0.550 | <0.001 | | | |

PF= physical functioning; RLP= role limitation physical; BP= bodily pain; GH= general health; VIT= vitality; MO= mobility; UA= usual activities; SF= social functioning; RLE= role limitation emotional; MH= mental health; SC= self-care; PD= pain/discomfort; AD= anxiety/depression

**Table 5.** Relation between quality of life and covariates

| | beta | p-value |
|---|---|---|
| Age | 0.013 | 0.913 |
| Chair stand test | -0.064 | 0.584 |
| Gait speed | -0.214 | 0.098 |
| Education | 0.167 | 0.098 |
| Grip strength | -0.076 | 0.533 |
| SARC-F strength | -0.344 | 0.005 |
| SARC-F assistance with walking | 0.069 | 0.573 |
| SARC-F rise from chair | -0.202 | 0.084 |
| SARC-F stair climbing | -0.293 | 0.034 |
| SARC-F falls | -0.101 | 0.306 |

## Discussion

This study investigated the psychometric properties of the previously translated Hungarian version of the SarQoL questionnaire, and examined its relationship with the 5 items that make up the SARC-F questionnaire as well as the distribution of QoL for each level of the SARC-F score.

While 30 participants presented with low grip strength, we were unable to diagnose anyone as sarcopenic because none of the participants presented with low muscle mass. In our estimation, two factors may be at play here. First, we evaluated muscle mass with bioelectrical impedance analysis, a technique that is less precise than dual-energy x-ray absorptiometry, and which is dependent on the hydration status of the patient being measured. It is possible that our muscle mass measurements are biased towards exaggerated muscle mass because of the difficulty in controlling hydration status. Secondly, as we recruited our patients in a hospital, it may be that the grip strength measurements are biased towards lower grip strength, because of the circumstances that have led them to the hospital. It is not possible for us to establish in any fashion whether these hypotheses have manifested themselves in our study, but we do not discount that they may have played a role in terms of the prevalence of sarcopenia and probable sarcopenia in our sample.

Due to the absence of sarcopenic participants, as diagnosed with the EWGSOP2 criteria, we looked at the discriminative power of the SarQoL questionnaire between participants with normal and low grip strength, and between participants at high or low risk of sarcopenia according to the SARC-F questionnaire. Somewhat surprisingly, we found good discriminative power for the Overall QoL score when categorizing the sample according to SARC-F score, but not between low and normal grip strength. We did find significantly lower QoL scores of the SarQoL questionnaire for domains 4 and 5 when comparing the participants with low grip strength with the normal-grip-strength-group, but not for the other domains. We also observe standard deviations around the main domain scores of 16 points or more in both groups, indicating that the variability of the scores was too great for our sample size. In contrast, all but one of the domains (D7) were significantly lower in the group categorized as being at risk of sarcopenia with the SARC-F questionnaire, compared to not-at-risk.

The internal consistency of the questionnaire was demonstrated to be excellent, with an alpha value of 0.887, in line with previous validations that have consistently found alpha values above 0.8.

The construct validity analysis proved that the overall QoL score of the SarQoL questionnaire significantly correlated with similar domains linked to muscle performance, like physical functioning (0.854), role limitation due to physical health (0.538) and vitality (0.521) of the SF-36 questionnaire and mobility (-0.738) of the EuroQol 5D questionnaire. We can thus confirm the convergent validity of the SarQoL questionnaire. Meanwhile, there were low correlations with other, different dimensions, as: role limitation due to emotional problems (0.307), self care (-0.427) and pain/discomfort (-0.387) of the SF-36 and EuroQol 5D generic questionnaires, proving a divergency with different parameters.

Comparing our results with other translated versions of the SarQol, we observe similar performances: internal consistency (Cronbach's alpha) ranges between 0.87-0.96. Discriminative

power was found in these studies to be between 0.020 and <0.001. Construct validity measurements prove - similarly to other SarQol validations - our questionnaire's ability to measure the construct of interest: quality of life affected by sarcopenia (13-24).

Summarizing the international data we can affirm that the Hungarian SarQol questionnaire has a reasonable discriminative power, validity and reliability when compared with other translations across numerous countries and languages (11-24).

In order to find whether the 5 items of the SARC-F questionnaire are significantly associated with QoL, we performed a regression analysis. Among the included covariates two aspects of the SARC-F questionnaire were significantly associated with the overall score of the SarQoL questionnaire. Furthermore, figure 1 shows that overall QoL steadily decreased for each point added to the score of the SARC-F. This relation between QoL in sarcopenia and the SARC-F questionnaire is in concordance with the results of previous studies (25-29), which show sarcopenia risk status to be significantly associated with the SarQoL score, with participants at high risk of sarcopenia having worse QoL compared to those not at high risk. These results highlight the importance of early screening for sarcopenia with the SARC-F questionnaire.

Our study unfortunately has some serious limitations. For financial and efficiency reasons, we applied BIA to estimate skeletal muscle mass instead of the more accurate but expensive methods, like DXA. Other methodological limitations are related to the recruitment process, such as our male to female ratio, which reflects the gender imbalance in nursing homes and clinics. However, we also excluded certain comorbidities known to have an impact on muscle mass and strength, but other comorbidities the QoL of the patient in our sample. Regrettably, this information was not collected so the possible influence of these on our results could not be quantified.

Because of the cross-sectional nature of this study, itself a result of the short hospitalisation periods and accessibility of our patients in the clinic, we were unable to assess the reliability of the Hungarian SarQoL questionnaire in a test-retest design. We recognize that this measurement property is important, and it is our hope that future studies may have the opportunity to evaluate this measurement property in a Hungarian sample.

In conclusion, the present study evaluated a number of measurement properties of the previously translated, culturally equivalent, Hungarian version of the SarQoL questionnaire. Our results on the discriminative power of the SarQoL questionnaire were inconclusive, but we found high internal consistency, confirmed convergent and divergent construct validity and demonstrated the absence of floor and ceiling effects. However, due to some limitations further multi-center designed studies will be needed to verify the reliability of the Hungarian SarQol questionnaire. We also demonstrated a significant association between 2 items of the SARC-F instrument and QoL, and found steadily decreasing QoL for each point added to the SARC-F score.

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*Conflict of interest:* Charlotte Beaudart is a shareholder of SarQoL sprl. All other authors have no conflicts to declare.

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