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RESEARCH PAPER

Patients' preferences for quality-of-life aspects in sarcopenia: a best–worst scaling study

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Key summary points

Aim To assess the relative importance of the 14 items of the SF-SarQoL, a short-form quality-of-life questionnaire for sarcopenia.

Findings Overall, community-dwelling older people considered feeling a reduction of physical capacity, balance problems and reduction of leg strength as the most important quality-of-life aspects.

Message Older people considered some QoL aspects to be more important than others. Adequate management of sarcopenia should take into account the patient's own priorities to maximize benefit to the patient.

Abstract

Purpose As information on patients' preferences regarding quality-of-life aspects in sarcopenia is lacking, this study aims to assess the relative importance of the 14 items of a QoL questionnaire designed for sarcopenia (the SF-SarQoL) using a best–worst scaling (BWS) survey.

Methods Participants, aged 65 years or older and community dwelling, who previously participated in the SarcoPhAge study, received a BWS survey via the mail. An object case BWS was selected in which participants completed 12 choice tasks, picking the most and least important aspect from 4 out of 14 SF-SarQoL items for each task. Relative importance scores (RIS) were estimated using Hierarchical Bayes modelling. A cluster analysis was also conducted to investigate whether several profiles with regards to QoL preferences were present.

Results A total of 163 participants were included, aged 75 (IQR: 73–81) years old, and mostly women ($n = 107$; 65.6%). Two items were found to be significantly more important than others: "feeling a reduction of physical capacity" (RIS = 11.26), and "having balance problems" (RIS = 11.09). The least important items were "experiencing difficulty carrying heavy objects" (RIS = 2.89), and "feeling a reduction in muscle mass" (RIS = 3.82). We found relatively weak evidence for the presence of two clusters. One cluster prioritized items related to falls where the second prioritized items related to feeling physically capable.

Conclusion Not all QoL aspects were equally important. The relative weight of each QoL aspect may be used to interpret QoL results obtained with the SF-SarQoL or to inform target outcomes in interventional studies.

Keywords Sarcopenia · Quality of life · SarQoL · Best–worst scaling · Cluster analysis

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Introduction

Sarcopenia, the skeletal muscle disorder characterized by a loss of muscle strength and function, can have a significant impact on those affected. It has been shown to be associated with a number of adverse outcomes such as mortality, functional decline, disability, falls and hospitalization [1]. This impact on a personal level cascades into impact on the health systems that provide care to people with sarcopenia, and economic studies have found significantly higher healthcare costs for sarcopenic people both in a hospital setting as well as in the community [2].

Previous research in sarcopenia has mainly focused on so-called hard outcomes (such as mortality or hospitalizations), but interest in the lived experience of sarcopenic patients has been steadily growing. More and more studies are reporting results for quality of life (QoL), mostly concluding that sarcopenic people have lower quality of life compared to non-sarcopenic people [3]. Other examples of patient-reported outcomes are pain, physical function, satisfaction with care, etc. A recent working group organized by the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (ESCEO) emphasized that inclusion of a patient-reported outcome measure (PROM) in clinical trials of pharmaceutical interventions for sarcopenia is highly desirable [4]. The FDA has also encouraged the appropriate use of PROMs in regulatory studies, and has observed a 500% increase in the number of pre-market submissions that include PROMs between 2009 and 2015 [5].

A number of generic QoL questionnaires (i.e., designed for use across different populations) are regularly used in sarcopenia research, most notably the SF-36 and the EQ-5D. A QoL questionnaire specifically designed for sarcopenia, called the Sarcopenia Quality of Life (SarQoL®) questionnaire, has also been available since 2015 [6]. The SarQoL® is recommended for use with older, community-dwelling individuals experiencing a loss in muscle strength and function. It is based on a multidimensional concept of QoL, encompassing 55 items from 7 domains of health-related dysfunction: physical and mental health, locomotion, body composition, functionality, activities of daily living, leisure activities, and fears [6, 7]. Recently, a shorter version of the SarQoL® questionnaire was developed, which reduced the length of the questionnaire from 55 to 14 items [8]. The SF-SarQoL questionnaire is available from the website www.sarqol.org in multiple languages.

Most QoL instruments translate the individual responses gathered with the tool in question into one or several scores, representing domains of QoL or the global level of QoL of the respondent. This approach is necessary for quantitative research on groups of people but reduces the complex concept of QoL to a number on a scale. While very useful, it should not be controversial to say that a single score does not tell us the whole story about a person's QoL. Researchers can often delve deeper into the gathered QoL results, by looking at domain scores or even the item responses themselves, which is already an improvement over an overall score. However, this does not take into account that not all aspects of QoL are created equal: some items are likely to be considered more important by patients than others.

This type of information, the importance of one aspect/item/outcome in relation to others, can be obtained through choice modelling, of which the most frequently used designs are the discrete choice experiment (DCE) and best–worst scaling (BWS). DCE and BWS are already regularly employed to gauge patients' preferences regarding treatments [9, 10]. Recently, a DCE was also used to look at which clinical outcomes were considered important by sarcopenic older persons, the first study of its kind in sarcopenia [11, 12]. Interestingly, the participants of this study identified QoL as one of the 5 most important outcomes for sarcopenia interventions [12]. In comparison to a DCE, the BWS method is considered to be less cognitively demanding, gathers additional information on the least preferred option and is capable of capturing preferences for a longer list of items/attributes [10, 13].

The primary objective of the present study was to establish a ranking from most to least important for the 14 aspects of QoL included in the SF-SarQoL® questionnaire using the best–worst scaling technique. The secondary objective of this study was to explore whether different profiles were present within the sample with regards to their ranking of the 14 aspects of QoL with the help of a cluster analysis.

Methods

Population

This study recruited older, community-dwelling people who had previously participated in the Sarcopenia and Physical Impairment with Advancing Age (SarcoPhAge) study. This is a 5-year cohort study, carried out in the Liège region of Belgium, which focused on a range of musculoskeletal indicators. All participants were aged 65 years and older at inclusion, with a body mass index below 50 kg/m^2 and without amputated limbs. Details on this study and several articles on different results have previously been published [14]. For the best–worst scaling study presented in this article, 314 individuals who had participated in the interviews for the 4th (July 2017 to September 2018) and/or 5th (June 2018 to November 2019) year of follow-up of the SarcoPhAge study, and for whom demographic and clinical data from these interviews were available, were contacted with

an invitation to participate in February/March 2020. The research protocol (n° 2012/277) and its amendment dated 19/12/2019 were approved by the Ethics Committee of the University Teaching Hospital of Liège.

Study design

Patient preferences were elicited through an object (case 1) BWS survey. This type of choice experiment was first developed by Jordan J. Louvière in 1987, and its use in healthcare research was proposed in 2005 [13, 15]. The objective of this type of choice experiment is to place objects (in this case different aspects of QoL) on an underlying, subjective, latent scale by having volunteers complete choice tasks in which they are asked to indicate the "best" (in this case: most important for QoL) and "worst" (in this case: least important for QoL) object from 3 or more options [15]. By analyzing choice frequency, for both "best" and "worst" choices, utility values can be calculated for each object, and a ranking from best to worst can be established [13].

The 14 items of the SF-SarQoL questionnaire constituted the list used to create the choice tasks in the BWS survey [8]. Twelve choice tasks of 4 items were presented to each participant to strike a balance between obtaining as much information as possible, without creating too much response burden. An example of a choice task from the BWS survey can be found in Fig. 1. Sawtooth Software was used to generate 2 versions of the BWS survey. The design algorithm of the Sawtooth software is considered to be similar to the Balanced Incomplete Block Design and takes into account frequency balance, orthogonality, connectivity and positional balance [16]. Participants were randomly assigned to receive either version A or B using IBM SPSS software.

Participants received a paper copy of the BWS questionnaire through the postal service. They completed the questionnaire at home and returned it through the mail using an included pre-paid envelope.

Participants also received and completed the SF-SarQoL questionnaire itself at the same time as the BWS survey. This shorter version of the SarQoL® measures overall QoL through 14 items and has been validated for use in sarcopenia [8]. It provides a single score between 0 and 100 points, with higher scores indicating better QoL.

Clinical and demographic information was obtained from the interviews conducted at the 5th year of the SarcoPhAge study. If no data was collected at the 5th year interview (because of drop-out or missing data), the information collected at the 4th year of follow-up was used. Muscle mass was evaluated with dual x-ray absorptiometry, and muscle strength with a hydraulic hand dynamometer. We used the EWGSOP2 criteria to determine the sarcopenia status of each participant. Those with low grip strength, defined as < 27 kg for men and < 16 kg for women, were considered to be probably sarcopenic. If the persons with low grip strength also presented with low muscle mass, defined as an appendicular skeletal muscle mass divided by height-squared (ASM/Ht^2) < 7.0 kg/m^2 for men and < 5.5 kg/m^2 for women, they were diagnosed as sarcopenic [17]. Participants also completed the SARC-F questionnaire, a screening tool which identifies those with a high probably of being sarcopenic through 5 questions on strength, assistance with walking, rising from a chair, climbing stairs and falls. Participants who scored 4 or more points (on a scale between 0 and 10) were considered to be likely sarcopenic [18].

Statistical analysis

The distribution of the continuous demographic and clinical variables was evaluated by looking at the Shapiro–Wilk test, histograms, Q-Q plots, and the distance between mean and median. Variables that were normally distributed are presented as mean ± standard deviation, those that are not presented as median (25th percentile–75th percentile). Binary variables are presented as absolute and relative frequencies [*n*(%)].

Relative importance scores (RIS) were estimated using Hierarchical Bayes estimation modelled using multinomial logit. The raw RIS were rescaled so that the sum of all RIS was 100 [16]. RIS are presented as mean (95% confidence interval of the mean). A fit statistic was calculated for each

Fig. 1 Example of a choice task in the BWS survey (translated from the original French)

In the table below, the participant has indicated that experiencing difficulty during activities of moderate effort is the most important aspects with regards to their quality of life, and reducing their leisure activities the least important.

Least important		**Most** important
	Feeling a reduction of the strength in your arms	
	Experiencing difficulty during activities of moderate effort	**X**
	Having problems with your balance	
X	Reducing your leisure activities	

respondent, quantifying the probability that a participant has answered in a random manner. Surveys with a fit statistic below 0.25, indicating a significant probability of random responses by the participant, were excluded [19].

Subgroup analyses were conducted between men and women, as well as between those with normal and low grip strength (defined as < 27 kg for men and < 16 kg for women). These two variables were chosen because of their importance in interpreting any QoL outcomes if these subgroups showed to place different importance on aspects of QoL. Additional subgroup analyses were performed (and presented in Appendix 1) comparing RIS between version A and version B of the BWS survey, between SARC-F score ≥ 4 points and < 4 points, between sarcopenic and non-sarcopenic participants (EWGSOP2 diagnostic criteria), between those aged ≤ 75 years and > 75 years old and between those with lower QoL (≤ 47 points for the SF-Sar-QoL) and those with higher QoL (> 47 points). *p* values were calculated with Student *T* test and Mann–Whitney *U* test.

We carried out a cluster analysis on the obtained RIS using the Two-Step cluster strategy with the log-likelihood distance measure using logarithmically transformed versions of the 14 RIS. The number of clusters is selected by the software using the Bayesian Information Criterion. The overall goodness-of-fit of the cluster solution was evaluated with the silhouette measure of cohesion and separation, which ranges from -1 to 1. In a good cluster solution, the intra-cluster distances are small (high cohesion between elements in the same cluster) and the inter-cluster distances are large (good separation between elements from different clusters) [20]. A silhouette coefficient < 0.25 indicates the absence of a substantial cluster structure; a value from 0.26 to 0.50 is considered a weak structure that could be artificial; from 0.51 to 0.70 translates to a reasonable structure; and from 0.71 to 1 the cluster solution is considered to be strong [21].

RIS were estimated and rescaled using Sawtooth Software. All statistical manipulations were carried out using SPSS v27.0.0.0. *p* values ≤ 0.05 were considered to be significant.

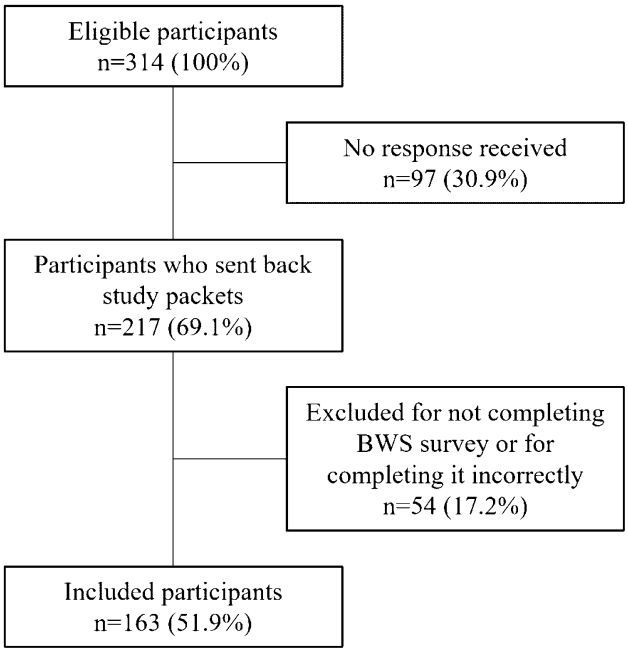

Fig. 2 Flow-chart of participants eligible and included in this study

Table 1 Clinical and demographic characteristics (*n* = 163)

	Median (IQR) or *n*(%)
Age (years)	75.0 (73.0–81.0)
SF-SarQoL QoL (0–100 points)	46.9 (27.0–66.1)
Gender	
Men	56 (34.4%)
Women	107 (65.6%)
Grip strength	
Low[a]	49 (30.1%)
Normal	113 (69.3%)
Sarcopenia	
Yes	11 (6.7%)
No	152 (93.3%)

[a] < 27 kg for men and < 16 kg for women

Results

Population

Out of the 314 study candidates contacted, 163 (52%) sent back the completed BWS survey and were included in the dataset. Detail on the flow of participants throughout this study is provided in Fig. 2. Of these 163 people, 74 (45.4%) completed version A of the BWS survey, and 89 (54.6%) completed version B. The missing response rate per choice task ranged from 0 (%) to 6 (3.7%) observations, which makes for an average completion rate of 98.3% for the "best" choices and 98.1% for the "worst" choices. The mean fit statistic was 0.537 ± 0.110 and no participant was excluded because of a fit statistic below 0.25. Participants had a median age of 75.0 (73.0–81.0) years, and most were women (*n* = 107, 65.6%). Additional characteristics are provided in Table 1.

Relative importance of the 14 QOL aspects

Relative importance scores calculated for the 14 aspects of QOL included in the SF-SarQoL questionnaire are

presented in Table 2 and Fig. 3. The participants considered that "feeling a reduction in their physical capacity" [11.26 (10.37–12.14)], "having balance problems" [11.09 (9.91–12.27)], and "feeling a reduction of the strength in your legs" [9.03 (8.30–9.77)] were the 3 most important aspects of QoL in sarcopenia. On the other end of the spectrum, they considered "feeling a reduction of the strength in your arms" [4.35 (3.75–4.96)], "feeling a reduction in your muscle mass" [3.82 (3.15–4.49)], and "having difficulty carrying heavy objects" [2.89 (2.19–3.59)] as the least important aspects of QoL. Relatively large 95% confidence intervals were found, and consequently an important number of items have overlapping intervals. Roughly speaking, items can be grouped together in 3 groups: the 2 items on feeling a reduction in physical capacity and experiencing balance problems are significantly more important than all other items. Next up are 8 items whose confidence intervals overlap: leg strength, difficulty during moderate effort, feeling weak, difficulty getting up from the floor, limiting movements, fatigue during moderate effort, fatigue while walking, and walking distance. Lastly, a third group of items are clearly less important than the items mentioned so far: leisure activities, arm strength, muscle mass and carrying heavy objects. It is important to add that this is a relative assessment, rating whether one item is more important than another, not an absolute assessment, rating whether an item is important or not.

Table 2 also presents the results separated by gender and grip strength. We did not find important differences in the way men and women or people with low and normal grip strength valued the 14 QoL aspects. Only the item "limiting movement" was significantly different in terms of relative importance score between men and women [8.29 (7.10–9.48) vs 6.60 (5.89–7.31); $p=0.011$]. The comparison on grip strength also yielded a single significantly different RIS, in this case for the item "difficulty getting up from the floor, which was considered more important by participants with low grip strength [9.89 (7.48–12.30) vs 6.94 (5.60–8.27); $p=0.024$].

The results of the additional subgroup analyses on BWS version (A versus B), SARC-F (≥ 4 points versus <4 points), sarcopenia status (sarcopenia versus no sarcopenia), age (≤ 75 years versus >75 years), and QoL (SF-SarQoL score ≤ 47 points versus >47 points) are available in Appendix 1. In short, while we did find minor differences between the RIS values when comparing between groups on several characteristics, none of these differences upend the global results of the analysis on the complete sample.

Table 2 Relative Importance Scores ($n=163$)

Label	All	Gender			Grip strength		
		Men	Women	*p* value	Normal	Low	*p* value
Reduction physical capacity	11.26 (10.37–12.14)	11.35 (9.75–12.94)	11.21 (10.13–12.30)	0.889	11.55 (10.44–12.65)	10.55 (9.01–12.09)	0.314
Balance problems	11.09 (9.91–12.27)	10.96 (8.77–13.15)	11.15 (9.73–12.58)	0.881	11.05 (9.62–12.48)	11.34 (9.11–13.56)	0.826
Reduction strength legs	9.03 (8.30–9.77)	9.42 (8.12–10.71)	8.83 (7.93–9.74)	0.458	8.58 (7.71–9.45)	10.10 (8.69–11.50)	0.064
Difficulty during moderate efforts	8.60 (7.88–9.32)	8.85 (7.68–10.02)	8.48 (7.55–9.41)	0.634	8.89 (8.00–9.78)	7.96 (6.66–9.26)	0.247
Feeling physically weak	8.06 (7.19–8.92)	7.08 (5.52–8.63)	8.57 (7.52–9.62)	0.108	7.84 (6.74–8.93)	8.50 (7.03–9.97)	0.494
Difficulty getting up from the floor	7.78 (6.61–8.96)	7.56 (5.72–9.4)	7.90 (6.36–9.44)	0.786	6.94 (5.60–8.27)	9.89 (7.48–12.30)	0.024
Limiting movement	7.18 (6.56–7.8)	8.29 (7.10–9.48)	6.60 (5.89–7.31)	0.011	7.54 (6.76–8.32)	6.43 (5.40–7.45)	0.108
Fatigue during moderate effort	7.09 (6.41–7.77)	6.67 (5.55–7.8)	7.31 (6.44–8.18)	0.382	7.40 (6.54–8.26)	6.41 (5.28–7.53)	0.190
Fatigue while walking	7.00 (6.09–7.92)	6.98 (5.35–8.61)	7.02 (5.89–8.14)	0.971	6.85 (5.70–7.99)	7.34 (5.76–8.93)	0.627
Reduction walking distance	6.82 (5.82–7.83)	7.01 (5.17–8.86)	6.73 (5.51–7.95)	0.792	6.72 (5.49–7.96)	7.02 (5.17–8.86)	0.794
Reduction leisure activities	5.02 (3.90–6.14)	4.16 (2.38–5.95)	5.47 (4.03–6.92)	0.275	3.86 (6.62–4.55)	4.19 (2.29–6.08)	0.391
Reduction strength arms	4.35 (3.75–4.96)	4.63 (3.67–5.59)	4.20 (3.42–4.99)	0.512	4.53 (3.81–5.26)	3.96 (2.80–5.13)	0.398
Reduction muscle mass	3.82 (3.15–4.49)	3.93(2.65–5.2)	3.76 (2.97–4.55)	0.820	3.67 (2.86–4.49)	4.12 (2.88–5.37)	0.546
Difficulty carrying heavy objects	2.89 (2.19–3.59)	3.12 (1.95–4.29)	2.76 (1.87–3.65)	0.630	3.20 (2.33–4.07)	2.20 (0.98–3.43)	0.201

Average importance (100/14) is 7.14. Items are presented from most important to least important according to RIS

CI = confidence interval

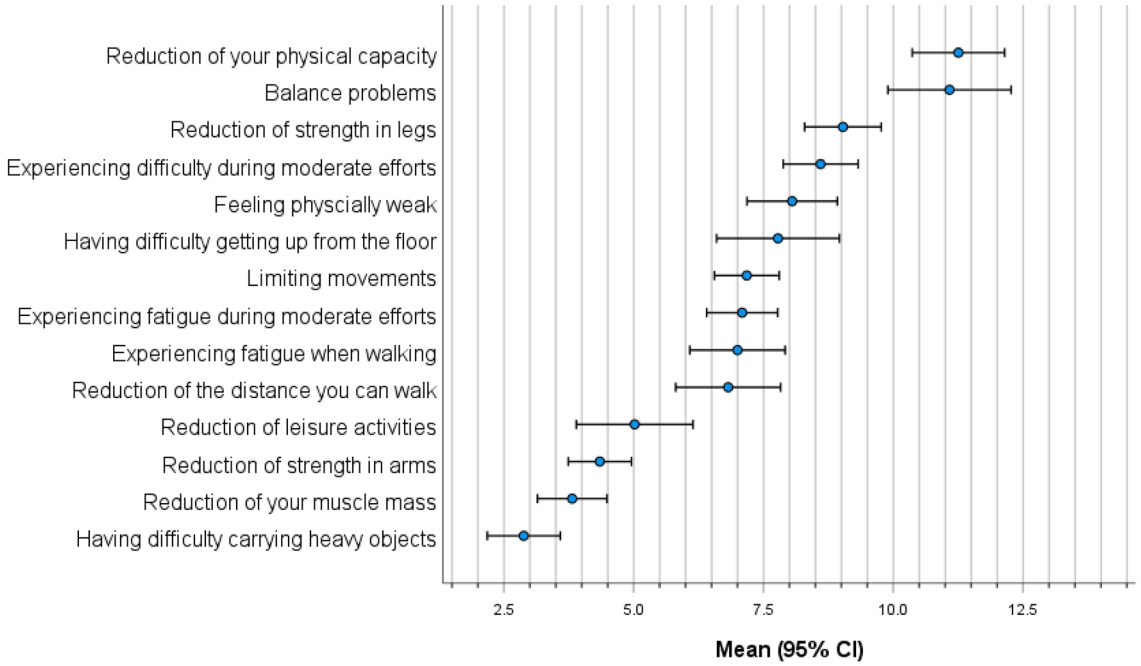

Fig. 3 Relative importance scores

Cluster analysis

The cluster analysis detected 2 distinct clusters within the sample. The value for the silhouette measure of cohesion and separation was 0.3, indicating that the cluster solution found is relatively weak and should be interpreted with caution. The largest cluster had 88 members, while the second cluster was slightly smaller at 75 members. Relative importance scores and rank for the 14 aspects of quality of life are presented for each cluster in Table 3. Overall, cluster 1 found items related to falls (i.e., getting up from the floor, leg strength and balance) to be the most important and cluster 2 prioritized feeling physically capable. Both clusters shared the item "balance problems" in their top 3 of most important items, and "carrying heavy objects" as 1 of the 3 least important items.

Discussion

This study suggests that older people do not consider all items of musculoskeletal QoL represented in the BWS survey to be equally important. The ranking established in this study showed the QoL aspects "reduction of your physical capacity" and "experiencing balance problems" to be the most important. Within the sample described in this article, two different profiles were found with regards to the importance placed on certain aspects of musculoskeletal QoL. While the silhouette measure indicated that the structure found was weak, and that it could be artificial, it is not hard to imagine that there are likely different groups with different sets of priorities with regards to QoL. While we would caution against over-interpreting these results based on this sample alone, the choices made within the 2 clusters seem to make sense in that they coalesce around two themes: falls and physical capacity. The first one, falls, had already been identified in a previous study using focus groups, but the second one, physical capacity, had not yet been put forward [12].

To our knowledge, this is the first study to demonstrate the relative importance of different aspects of QoL in a quantative manner in sarcopenia. Unfortunately, because of the highly specific nature of the SF-SarQoL, and its focus on musculoskeletal aspects of QoL that are relevant to sarcopenic patients, we are unable to directly compare our findings with other studies, because of the heterogeneity of the items studied under the umbrella of the concept of QoL. There are however a limited number of studies which have investigated how older people think about QoL and what aspects they consider to be more or less important, employing broader concepts of QoL than used in our own BWS survey.

A thematic synthesis by Van Leeuwen and colleagues compiled a number of qualitative studies on the subject and is the most thorough overview of what QoL means to older people. The authors included 48 studies, incorporating the perspectives of more than 3400 older community-dwelling people from Western countries. From this vast amount of

Table 3 RIS and ranking per cluster

	Cluster 1 ($n=88$)		Cluster 2 ($n=75$)	
	RIS	Ranking	RIS	Ranking
Reduction physical capacity	8.84 (7.66–10.02)	4	14.1 (13.05–15.14)	1
Balance problems	10.04 (8.32–11.76)	3	12.31 (10.71–13.91)	2
Reduction strength legs	11.21 (10.2–12.22)	2	6.48 (5.73–7.23)	10
Difficulty during moderate efforts	7.43 (6.57–8.29)	5	9.98 (8.83–11.12)	4
Feeling physically weak	4.84 (3.98–5.71)	13	11.82 (10.72–12.93)	3
Difficulty getting up from the floor	11.54 (9.93–13.16)	1	3.37 (2.26–4.48)	11
Limiting movement	6.35 (5.63–7.08)	8	8.15 (7.12–9.18)	6
Fatigue during moderate effort	5.87 (5.10–6.63)	10	8.53 (7.41–9.65)	5
Fatigue while walking	6.64 (5.34–7.95)	7	7.43 (6.12–8.73)	7
Reduction walking distance	6.95 (5.54–8.35)	6	6.68 (5.19–8.17)	8
Reduction leisure activities	3.64 (2.22–5.05)	14	6.65 (4.89–8.40)	9
Reduction strength arms	6.26 (5.39–7.14)	9	2.11 (1.63–2.59)	12
Reduction muscle mass	5.39 (4.43–6.35)	11	1.97 (1.22–2.73)	13
Difficulty carrying heavy objects	4.98 (3.86–6.11)	12	0.43 (0.22–0.63)	14

information, they distilled nine QoL domains: health perception, autonomy, role and activity, relationships, attitude and adaptation, emotional comfort, spirituality, home and neighborhood, and financial security. They also stress the interconnections between domains and the ripple effect of changes in a particular domain on the other domains. This exhaustive synthesis however was not set up to indicate which aspects or domains of QoL are the most important, or to establish a hierarchy among the nine domains, favoring instead the broadest possible concept of QoL [22].

In terms of quantitative research, there are three studies that have surveyed the relative importance of different aspects of QoL in the specific population of older people. Molzahn and colleagues published the results of a secondary analysis of the WHOQOL-OLD pilot study in 2011. In this article, they present data collected from 7401 people aged 60 years or older from 22 countries on the importance of 31 facets of QoL. The participants in this study considered ADL, general health, sensory abilities, mobility, autonomy, and energy to be the most important QoL facets, in the order presented. With regards to the least important facets, they singled out sex-life, opportunity to learn new skills, social participation, and a positive body image and appearance [23]. While the items in the Molzahn study and our own survey are too dissimilar to compare head-to-head, it is interesting to note that the concepts considered important to the older people in the Molzahn study, such as ADL, general health, mobility, and autonomy, are well represented in the SF-SarQoL, while the concepts considered less important are not represented. A second study, carried out by Ratcliffe and colleagues and published in 2017, recruited 500 younger people (18–64 years) and 500 older people (65 + years) who performed two preference elicitation experiments (ranking and successive BWS) aimed at establishing a hierarchy of 12 quality of life dimensions. The older sample found the dimensions independence, physical mobility, control, and mental health particularly important in the ranking experiment, with similar results for the BWS task. While the items in this study are again too dissimilar to our own BWS survey, we note the importance that the participants of our study placed on their physical capacity, balance, and strength in the legs, and hypothesize that these items may be considered as prerequisites for independence and physical mobility, considered important in the Ratcliffe study. This study also demonstrated that the preferences of younger and older people with regards to QoL are different [24]. Lastly, Uy and colleagues conducted a BWS experiment in Singapore of which they published the result in 2018. They sought to establish a ranking of 27 health-related QoL domains and recruited 603 participants aged between 21 and 88 years old to do this. The BWS results placed the domain "self-care" at the top of the hierarchy, followed by "healing and resistance to illness" and "social relationships". At the other end of the scale, the participants considered "having a satisfactory sex life" as the least important aspect of HRQoL, followed by "having a normal physical appearance", and "interacting with others" [25]. However, because of the earlier finding that QoL preferences are different between older and younger participants, these results should be interpreted with caution.

As with any study, there are some methodological and practical limitations that need to be addressed. A first limitation is that, because of the recruitment and administration methods of this study, there is the potential for non-response bias. A total of 314 potential participants were contacted, and we received responses from 217 of them, a 69% response

rate. Out of those 217, a further 54 participants either did not complete the BWS survey at all, or failed to complete the survey correctly (e.g., multiple "best" choices for a single choice task). This means that we were able to include 52% of the people we contacted, and 75% of the people who participated, in the final analyses. When we compared the 163 participants included in this analysis with the 54 that responded but were excluded, we did not find a significant difference for age ($p=0.300$), gender ($p=0.183$) and probable sarcopenia/low grip strength ($p=0.155$). We did however find that a larger proportion of the sarcopenic participants in the sample were unable or unwilling to complete the choice tasks, compared to the non-sarcopenic participants (52% completion rate versus 78%; $p=0.011$). The 54 excluded participants also had significantly lower QoL [33.33 (18.27–44.55) vs. 45.99 (27.65–65.38) points on a scale from 0 to 100 measured with the SF-SarQoL; $p=0.001$] compared to the 163 included participants. This phenomenon may be related to the relative burden of the choice task, which may have been perceived as greater by sarcopenic participants and by those that already had substantially reduced quality of life. A second limitation is the sample size itself. Although there are currently no guidelines for minimum sample size for BWS surveys available in the literature, a review from 2016 found a median sample size of 175 participants (range: 15 to 803) for 26 object case BWS studies, in line with our own sample of 163 participants [10]. However, the relatively large confidence intervals found for the relative importance scores, which prohibit us from clearly separating some items, would likely have been narrower with a greater sample. This is especially noticeable for the items ranked at the middle of the importance hierarchy, where there are 8 items with overlapping confidence intervals. A third limitation of this study is that it was conducted in a single setting, namely older, community-dwelling volunteers from the Liège province in Belgium. Without further data it is uncertain whether our results can be generalized to the wider population of older people in Belgium or whether the results of this study are transferable to other countries.

This study could however open up some perspectives for the future. The ranking established could assist in a more detailed analysis of QoL data obtained with the SF-SarQoL, either by an item-based analysis taking into account the relative ranking of the item in question, or by creating a preference-weighted overall QoL score for the SF-SarQoL. It could also inform specific targets for improvement in interventional studies or inspire the design of interventions so as to increase the effect on physical capacity, balance, and leg strength.

In conclusion, this study provides the first data on the relative importance of different aspects of QoL in the context of sarcopenia from the subjective perspective of the patient. We established a ranking of 14 aspects of QoL on importance and showed that there were two clusters present in the sample with different priorities with regards to QoL.

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Author contributions AG, CB, OB, MH and J-YR designed the study. AG, ML and CB collected the data. AG and MH performed statistical analysis. AG wrote the first draft of the manuscript. All authors provided feedback on the manuscript and approved the final draft.

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Availability of data and material Data and materials are available upon request from the corresponding author.

Code availability Not applicable.

Declarations

Conflict of interest CB, J-YR & OB are shareholders of SarQoL sprl, a spin-off of the University of Liège. All other authors declare no conflicts of interests.

Ethical approval This study received the approval of the Ethics Committee of the University Teaching Hospital of Liège in an amendment approved on 19/12/2019 to research protocol n° 2012/277.

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

Consent for publication Not applicable.

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