Original Research

Translation and Validation of the Greek "Minnesota Living with Heart Failure" Questionnaire

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Introduction: The Minnesota Living with Heart Failure Questionnaire (MLHFQ) is an important measurement instrument for assessing the health-related quality of life (HRQOL) among heart failure patients. The purpose of this study was to translate and validate the MLHFQ in the Greek language.

Methods: Three hundred forty-four consecutive adult patients from three General Hospitals, two in Athens and one in another part of the country, who were diagnosed with chronic heart failure, and 347 healthy controls were enrolled in the study from March 2009 to March 2010. The questionnaire instrument was translated from English, back-translated, and reviewed by a committee of experts. The psychometric measurements that were performed included reliability coefficients and Explanatory Factor Analysis (EFA), using a Varimax rotation and Principal Components Method. In a further step, confirmatory analysis (CFA)—known as structural equation modeling—of the principal components was conducted.

Results: The internal consistency of the Greek MLHFQ version was found to be 0.97, using Cronbach's alpha coefficient. An exploratory factor analysis identified two domains that accounted for 72.5% of the variance of MLHFQ items; the area under the ROC curve was calculated at 0.942 and the logistic estimate for the threshold score of 24.50 provided the model with 95.1% sensitivity and 99.8% specificity. Additionally, the CFA demonstrated that the two-factor model offered a very good fit to our data.

Conclusions: Our data indicate that the Greek MLHFQ is a reliable and valid tool for assessing HRQOL among patients with heart failure. Health professionals can use it in their clinical practice to improve their evaluation of these patients.

Heart failure (HF) is a serious, chronic syndrome and represents the final common pathway of many heart diseases. It is characterized by exacerbated neurohormonal activity, low exercise tolerance, a short survival time, and poor health-related quality of life (HRQOL).[1] The prevalence of HF has increased in recent decades and an estimated 6.5 million people in Europe, 5.7 million people in the USA, and 2.5 million people in Japan have HF. In the USA, the annual incidence of HF approaches 10 per 10,000 in the population over 65 years of age,[2] while in Europe about 3.6 million patients are diagnosed with HF every year. In Greece, it is estimated that approximately 200,000

patients suffer from HF and every year there are 30,000 new cases.[3]

HF is associated with a limitation of physical activity, withdrawal from activities and social contacts, depression, sleep disorders, dyspnea, fatigue, loss of muscular mass, dietary restrictions, difficulties in maintaining sexual relations, progressive loss of self-reliance, side effects of the medications, and recurrent hospitalizations.[4-6] All the above conditions have a considerable impact on the patient's HRQOL and could explain why patients with HF are found to have a worse HRQOL when compared to the general population or to patients suffering from other chronic diseases, such as cancer, arthritis, chronic obstructive pulmonary disease, and coronary artery disease.[7-10]

Nowadays, the healthcare sciences have progressed from just saving lives to improving quality of life, an outcome that is increasingly being recognized as a major aim of heart failure patient treatment. To date, two forms of HRQOL questionnaire are available, the first being generic in its content and the second disease-specific. Generic instruments have been developed for use in a wide range of patients, whereas disease-specific tools include items directly related to a medical condition and are expected to be more sensitive to changes in the clinical condition.[11,12] The Minnesota Living with Heart Failure Questionnaire (MLHFQ) is a disease-specific HRQOL instrument; it is also the most widely known and used. This tool has been adapted for use in over 32 languages and has demonstrated good psychometric properties in numerous studies.[13]

Although the MLHFQ has been translated and used in several Greek studies, the Greek version of the questionnaire had not yet been validated. Therefore, the aim of this study was to translate this instrument into Greek and to validate it in that form. More specifically the study's objectives were to:

- Develop the Greek version of the MLHFQ via a translation and back-translation procedure.
- Examine the factorial structure of the Greek MLHFQ and assess the structural estimation modeling approach of this tool with the use of confirmatory factor analysis (CFA).
- Evaluate the sensitivity, specificity and predictive value of the Greek MLHFQ in assessing and detecting poor quality of life in patients with heart failure.

Methods

The Minnesota Living with Heart Failure Questionnaire

The MLHFQ is a 21-item questionnaire that includes 8 items on physical aspects, 6 on emotional aspects, and 7 other items that cover social, work, and sexual topics. It measures the patient's perception of how chronic heart failure symptoms have affected their life during the preceding month. Each item is graded on a scale of 0 to 5, with the resulting global summed score ranging between 0 and 105.[14] Higher scores indicate a worse HRQOL.

Greek version of MLHFQ – translation and pilot study

Permission to translate the original MLHFQ into a Greek version was obtained from the University of Minnesota, which holds the copyright. The 21 items of the MLHFQ were translated by two independent bilingual translators. Another bilingual and a native English speaker, who had no knowledge of the original instrument, back-translated the re-conciliated Greek version. The backward translation was sent to a group of English experts (this group included a cardiologist, a cardiac nurse, and a psychologist) for their comments, which were incorporated into the translated English version of the questionnaire. Further to the above, the research team agreed that a cross-cultural adaptation process is important when an instrument is used in a different language, setting, and time, in order to reduce the risk of introducing bias into the study. Therefore, both the translated and the back-translated version were compared by an expert committee. The committee was comprised of two medical doctors, two registered nurses and a psychologist. All members of the committee were fluent in both English and Greek and had specialization and working experience in the field of heart disease. The questionnaire was adjusted according to advice from the committee. In a further step and as part of the cultural adaptation process, in-depth interviews were implemented in 10 patients, aiming to assess their understanding regarding the questionnaire, with the purpose of revealing inappropriately interpreted items and translation alternatives. The participants gave their feedback regarding the clarity of each item, the relevance of the content to their situation, the comprehensiveness of the instructions and their ability to complete it on their own. They were also encouraged to make suggestions when necessary. Finally, written comments made by the participants were included in the final Greek version of the MLHFQ.

Study population and data collection

Adult patients diagnosed with heart failure, confirmed by echocardiography and laboratory tests, were asked to participate in our study. Patients' recruitment took place between March 2009 and March 2010. Patients were recruited from three general hospitals, two in Athens and one in another part of the country. The inclusion criteria for entering the study were documented diagnosis of HF, age more than 18 years old, verbal communication ability, and fluency in spoken and written Greek. Exclusion criteria included hemodynamic instability and neurological disorders. All participants were informed about the purpose of the study and were asked to provide written informed consent prior to their participation.

A total of 520 patients were approached, of whom 411 agreed to participate in the study (response rate 79.0%). Twenty-five patients (6.1%) were excluded as they lacked any documented diagnosis of HF and 42 (10.2%) because of the Greek language restrictions. Finally, 344 patients met the inclusion criteria and comprised the final sample of the study.

The New York Heart Association (NYHA) functional classification was used to assess the extent of HF. All patients were classified as NYHA III or IV. A sample of healthy participants (n=347) was also recruited and made up the control group in our study. Controls were recruited from the outpatient clinics of the hospitals participating in the study, during their visit for a yearly check up, ENT, or eye examination. Yearly check up included a blood and urine test, and a measurement of patients' blood pressure, heart and respiratory rate. Controls were matched to cases by age and sex and had no history of comorbidities, including diabetes mellitus, hypertension, cancer, respiratory failure, renal failure, musculoskeletal, or psychiatric disease. The control group was used in the receiver operating characteristic (ROC) analysis.

Both patients and healthy participants completed the MLHFQ questionnaire in the presence of a nurse. All participants enrolled in the study provided written informed consent, after receiving a complete description of the study and having the opportunity to ask for clarification. A cover letter accompanied the questionnaires, explaining the purpose of the study, providing the researchers' affiliation and contact information, and clearly stating that the answers would be confidential and the anonymity in the final data reports guaranteed (Ethical committee's approval: No 383/ 04.08.2008).

Statistical Analysis

Descriptive characteristics were calculated for the sociodemographic and medical history variables of the sample. Reliability coefficients measured by Cronbach's alpha were calculated for the MLHFQ in order to assess the reproducibility and consistency of the instrument. The underlying dimensions of the scale were checked with an explanatory factor analysis using a Varimax rotation and the Principal Components Method as a usual descriptive method for analyzing grouped data.[15] Factor analysis, using principal component analysis with Varimax rotation, was carried out to determine the dimensional structure of the MLHFQ using the following criteria: (a) eigenvalue >1;[16] (b) variables should load >0.50 on only one factor and less than 0.40 on other factors; (c) the interpretation of the factor structure should be meaningful; and (d) the scree plot is accurate if the means of communalities are above 0.60.[17] Computations were based on a covariance matrix, as all variables were receiving values from the same measurement scale.[18] A Bartlett's test of sphericity with $p<0.05$ and a Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy of 0.6 were used in performing this factor analysis. A factor was considered as important if its eigenvalue exceeded 1.0.[16] As the factor analysis found two independent domains, subsequent Cronbach's alpha calculations were performed separately for each domain, highlighting how the items group together.

Additionally, a confirmatory analysis—also called structural equation modeling—of the principal components was conducted by STATA 12 to confirm that the scale items principally load on to that factor and correlate weakly with other factors, to assess tests for significance of factor loadings and the orthogonality of factors. A model, based on *a priori* information form exploratory factor analysis, was constructed in order to specify latent factors, their component variables, and the intercorrelations of the response variables. Maximum likelihood STATA estimates, t-values, error terms, correlation of independent variables, and a goodness-of-fit test for the specified model were performed.

The sensitivity and specificity were calculated at several cutoff scores for the MLHFQ. A ROC analysis was carried out; this method allows the display of all the pairs of sensitivity and specificity values achievable as the threshold is changed from low to high scores, plotting the true-positive rate (sensi-

tivity) on the vertical axis and the false-positive rate (one minus specificity) on the horizontal axis. The area under the ROC curve (AUC) is a quantitative indicator of the information content of a test and may be interpreted as an estimate of the probability that a heart disease patient picked at random will, at each threshold, have a lower test score than a healthy participant.

Results

The participants' demographic characteristics are shown in Table 1 (patients and controls). Almost 64% of the sample were men; more than half (n=372, 54%) were aged 65-79 and 24% (n=167) were ≥80 years old. The majority of the participants (98%) were Greek, while in the patient group 12 non-Greek participants were recruited (p=0.001). All of the participants in the patient group were classified as having severe heart failure based on the NYHA classification (NYHA III or IV). The most common self-reported comorbidities were hypertension (63.4%) and diabetes mellitus (42.5%) (Table 2).

The Greek version of the MLHFQ had the same structure and metrics as the original version. The median score and the quartiles of all the MLHFQ questions are presented in Table 3. The communalities for the Greek MLHFQ questions are presented in Table 4. The internal consistency characteristics of the Greek MLHFQ showed good reliability, as Cronbach's alpha was 0.97 for the total scale (Items 1-21).

The exploratory factor analysis of the 21 items of the MLHFQ revealed two orthogonal d (KMO measure of sampling adequacy = 0.967 and Bartlett's test of sphericity = 16149.35, df=210, p<0.001). Factor analysis indicated that there are two principal factors in the model and these explained 72.53%, as presented in Table 5. The first factor (F1) includes the following items: 1 (swelling in ankles/legs), 2 (sit/lie down during the day), 3 (trouble walking or climbing stairs), 4 (difficulty in working around the house or yard), 5 (difficulty in visiting places away from home), 6 (sleep discomfort), 7 (difficulty sharing time with others), 8 (difficulty in working), 9 (difficulty in doing sports), 10 (sexual inactivity), 11 (eating disorders), 12 (difficulty in breathing), 13 (decreased strength/energy), and 14 (need of hospitalization) and this was termed ''Physical status''. The second factor (F2) is composed of the following items: 15 (cost for medical care), 16 (treatment side effects), 17 (feeling of being a burden to family/friends), 18 (loss of self-control), 19 (feel worried), 20 (difficulty in concentrating), and 21 (feel depressed) and represents "Emotional status". Cronbach's alpha was 0.968 and 0.929 for F1 and F2, respectively.

Confirmatory factor analysis was conducted to determine whether the data were consistent with the *a priori* specified model suggested by explor-

Table 1. Demographic characteristics of the study population.

	Total n (%)	Patients n (%)	Controls n (%)	p-value
Sex:				0.99
Men	442 (64.0)	220 (64.0)	222 (64.0)	
Women	249 (36.0)	124 (36.0)	125 (36.0)	
Age (years):				1.00
≤50	6 (0.9)	3 (0.9)	3 (0.9)	
50-64	167 (21.1)	83 (24.1)	84 (24.2)	
65-79	372 (53.8)	185 (53.8)	187 (53.9)	
≥80	146 (24.2)	73 (21.2)	73 (21.0)	
Nationality:				0.001
Greek	679 (98.3)	332 (96.5)	347 (100.0)	
Non-Greek	12 (1.7)	12 (3.5)	0 (0.0)	

Table 2. Patients' clinical characteristics.

	Patients n (%)
Severity of heart failure:	
NYHA III	247 (71.8)
NYHA IV	97 (28.2)
Comorbidities	
Diabetes mellitus:	
No	198 (57.5)
Yes	146 (42.5)
Hypertension:	
No	126 (36.6)
Yes	218 (63.4)
Cancer:	
No	317 (92.1)
Yes	27 (7.9)
Respiratory failure	
No	265 (77.1)
Yes	79 (22.9)
Renal failure	
No	304 (88.4)
Yes	40 (11.6)
Musculoskeletal disease	
No	324 (94.2)
Yes	20 (5.8)
Psychiatric disease	
No	328 (95.3)
Yes	16 (4.7)
Other chronic disease	
No	316 (91.8)
Yes	28 (8.2)

Table 3. Median and quartiles (q25, q75) of the 21 MLHFQ items.

Item	Did your heart failure prevent you from living as you wanted during the past month (4 weeks) by:	Median	q25	q75
Q1	causing swelling in your ankles or legs?	1.00	0.00	3.00
Q2	making you sit or lie down to rest during the day?	2.00	0.00	4.00
Q3	making your walking about or climbing stairs difficult?	3.00	1.00	4.00
Q4	making your working around the house or yard difficult?	2.00	0.00	2.00
Q5	making your going places away from home difficult?	2.00	0.00	4.00
Q6	making your sleeping well at night difficult?	2.00	0.00	3.00
Q7	making your relating to or doing things with your friends or family difficult?	1.00	0.00	3.00
Q8	making your working to earn a living difficult?	2.00	0.00	4.00
Q9	making your recreational pastimes, sports or hobbies difficult?	2.00	0.00	4.00
Q10	making your sexual activities difficult?	2.00	0.00	5.00
Q11	making you eat less of the foods you like?	2.00	0.00	3.00
Q12	making you short of breath?	1.00	0.00	3.00
Q13	making you tired, fatigued or low on energy?	2.00	0.00	4.00
Q14	making you stay in a hospital?	1.00	0.00	3.00
Q15	costing you money for medical care?	1.00	0.00	3.00
Q16	giving you side effects from treatments?	0.00	0.00	2.00
Q17	making you feel you are a burden to your family or friends?	1.00	0.00	3.00
Q18	making you feel a loss of self-control in your life?	1.00	0.00	3.00
Q19	making you worry?	2.00	0.00	3.00
Q20	making it difficult for you to concentrate or remember things?	1.00	0.00	2.00
Q21	making you feel depressed?	1.00	0.00	3.00

Table 4. Inter-item correlation matrix for Greek MLHFQ.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
Q1	1.00																				
Q2	0.71	1.00																			
Q3	0.66	0.83	1.00																		
Q4	0.65	0.84	0.88	1.00																	
Q5	0.65	0.81	0.87	0.92	1.00																
Q6	0.67	0.72	0.72	0.73	0.74	1.00															
Q7	0.67	0.75	0.77	0.81	0.81	0.75	1.00														
Q8	0.64	0.79	0.80	0.85	0.85	0.75	0.82	1.00													
Q9	0.60	0.70	0.73	0.75	0.75	0.70	0.74	0.83	1.00												
Q10	0.48	0.47	0.45	0.46	0.45	0.50	0.47	0.56	0.65	1.00											
Q11	0.60	0.63	0.64	0.64	0.64	0.61	0.65	0.62	0.58	0.43	1.00										
Q12	0.62	0.72	0.75	0.73	0.76	0.76	0.73	0.77	0.69	0.47	0.62	1.00									
Q13	0.59	0.76	0.77	0.79	0.80	0.73	0.76	0.81	0.72	0.43	0.64	0.78	1.00								
Q14	0.57	0.68	0.68	0.70	0.70	0.66	0.65	0.70	0.62	0.43	0.55	0.78	0.71	1.00							
Q15	0.58	0.65	0.69	0.71	0.72	0.68	0.67	0.69	0.61	0.37	0.57	0.72	0.70	0.79	1.00						
Q16	0.62	0.59	0.60	0.62	0.62	0.61	0.62	0.61	0.56	0.32	0.58	0.65	0.63	0.66	0.71	1.00					
Q17	0.58	0.63	0.66	0.72	0.71	0.63	0.71	0.72	0.64	0.36	0.53	0.70	0.71	0.64	0.71	0.70	1.00				
Q18	0.54	0.63	0.63	0.67	0.67	0.59	0.64	0.69	0.57	0.35	0.47	0.66	0.69	0.65	0.66	0.62	0.80	1.00			
Q19	0.50	0.60	0.60	0.65	0.63	0.56	0.60	0.66	0.57	0.36	0.48	0.62	0.69	0.60	0.65	0.59	0.74	0.81	1.00		
Q20	0.43	0.42	0.46	0.48	0.48	0.45	0.46	0.43	0.38	0.18	0.33	0.46	0.50	0.36	0.47	0.48	0.57	0.58	0.58	1.00	
Q21	0.54	0.56	0.56	0.59	0.59	0.60	0.59	0.57	0.55	0.37	0.50	0.63	0.63	0.56	0.60	0.59	0.65	0.69	0.68	0.70	1.00

atory factor analysis, in order to evaluate whether the data fit the model adequately. The two-factor model was based on correlated factors that derived from the factor analysis using principal component analysis with varimax rotation. The two latent variables Physical Status (Questions 1-14) and Emotional Status (Questions 14-21) were strongly correlated ($r=0.89$, $p<0.05$) using the maximum likelihood method (Figure 1). Estimates, standard error, t-values, error terms, and r^2 for all the questions that included each of the latent variables are presented in Table 6. The error terms were correlated significantly (with a range of 0.16 to 0.70). Goodness-of-fit statistics were also estimated: root mean

Table 5. Exploratory factors and explained variance after rotation for the Greek MLHFQ.

Factors		Rescaled loadings	Eigenvalues		Rotation sums of squared loadings		
			Factor 1	Factor 2	% of variance	Cumulative variance	Cronbach's alpha
Factor I	Question 1	0.763	0.670	0.384			
	Question 2	0.863	0.790	0.396			
	Question 3	0.879	0.791	0.419			
	Question 4	0.906	0.786	0.468			
	Question 5	0.904	0.784	0.469			
	Question 6	0.841	0.742	0.420			
	Question 7	0.873	0.756	0.453	42.66	42.66	0.968
	Question 8	0.902	0.818	0.422			
	Question 9	0.827	0.811	0.311			
	Question 10	0.558	0.699	0.022			
	Question 11	0.727	0.684	0.310			
	Question 12	0.869	0.705	0.511			
	Question 13	0.883	0.694	0.546			
	Question 14	0.815	0.652	0.490			
Factor II	Question 15	0.829	0.579	0.602			
	Question 16	0.768	0.482	0.626			
	Question 17	0.836	0.481	0.736			
	Question 18	0.804	0.396	0.791	29.87	72.53	0.929
	Question 19	0.777	0.374	0.775			
	Question 20	0.596	0.104	0.821			
	Question 21	0.748	0.335	0.778			

Table 6. Estimates (maximum likelihood) for the Greek MLHFQ.

Latent variable	Independent variables	Estimates	Standard error	Measurement equations t values	Error terms	R^2
Physical	Q1	0.75	Constrained	24.75	0.44	0.56
status	Q2	0.88	0.05	24.71	0.23	0.77
	Q3	0.89	0.05	24.93	0.22	0.78
	Q4	0.91	0.05	25.70	0.17	0.83
	Q5	0.91	0.05	25.70	0.17	0.83
	Q6	0.84	0.05	23.50	0.29	0.70
	Q7	0.88	0.05	24.87	0.22	0.78
	Q8	0.91	0.05	25.83	0.16	0.83
	Q9	0.83	0.05	23.10	0.31	0.69
	Q10	0.55	0.06	14.62	0.70	0.30
	Q11	0.72	0.05	19.68	0.48	0.52
	Q12	0.86	0.05	23.92	0.27	0.73
	Q13	0.88	0.05	24.72	0.22	0.78
	Q14	0.79	0.05	21.68	0.38	0.62
Emotional	Q15	0.82	Constrained	24.45	0.33	0.67
status	Q16	0.77	0.03	26.58	0.40	0.60
	Q17	0.89	0.38	28.39	0.20	0.80
	Q18	0.86	0.04	25.54	0.20	0.74
	Q19	0.82	0.04	24.78	0.33	0.67
	Q20	0.63	0.04	17.63	0.60	0.40
	Q21	0.77	0.04	22.73	0.41	0.59

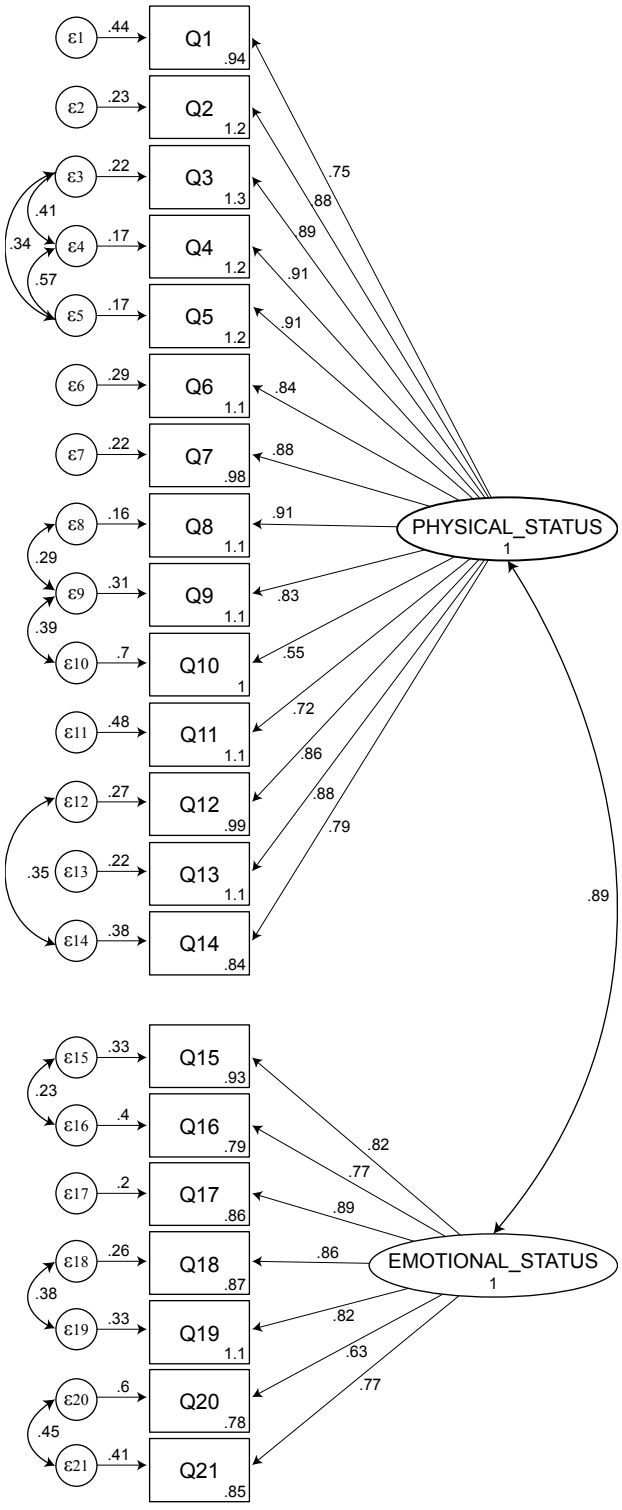

Figure 1. Confirmatory factor analysis for the Greek MLHFQ.

square error of approximation (RMSEA)=0.088; comparative fit index (CFI)=0.941; Tucker–Lewis index (TLI)=0.930; standardized root mean square residual (SRMR)=0.037; coefficient of determination (CD)=0.992. All factor loadings were statistically significant at a level of $p<0.05$. Figure 1 shows that there was a strong positive correlation between Physical Status and Emotional Status.

The Greek version of the MLHFQ was well accepted by the patients. It was easy and took only a short time (approximately 10 minutes) to complete. The questions appeared to be relevant, reasonable, unambiguous and clear. Therefore, face validity was considered to be very good. The overall accuracy of the Greek MLHFQ as an instrument for assessing the HRQOL among heart failure patients can be described as the area under its ROC curve, calculated as 0.942 (SD=0.009, Asymp. Sig <0.0001) (Figure 2). Table 7 presents the sensitivity and specificity values for different cutoff values in the ROC analysis. A 24.50 cutoff score for the MLHFQ provided the best sensitivity (95.1%) and specificity (99.8%).

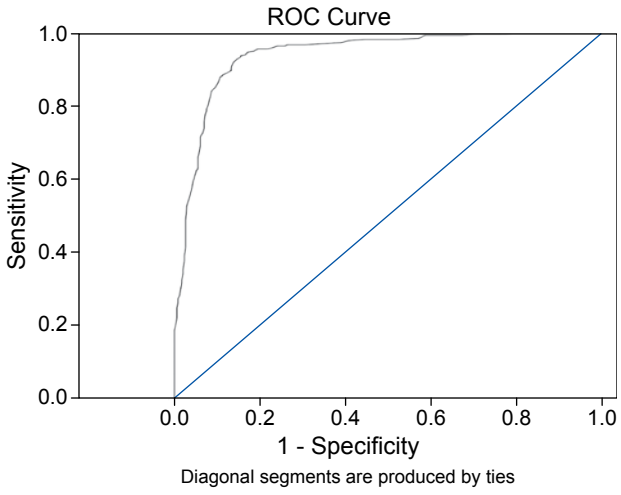

Figure 2. Receiver operating characteristic (ROC) curve for the Greek MLHFQ.

Table 7. Sensitivity and specificity values of different cutoff scores of the Greek MLHFQ -I for identifying level of quality of life.

Threshold scores	Sensitivity (%)	Specificity (%)
22.50	95.60	78.40
23.50	95.60	80.70
24.50	95.10	99.82
25.50	94.80	83.00
26.50	94.20	83.30

Discussion

MLHFQ is a non-generic, disease-specific instrument for assessing the quality of life among heart failure patients. Our validation study provided a Cronbach's alpha equal to 0.97, the factor analysis identified two main factors, and further analysis indicated a satisfactory Cronbach's alpha for those two factors. Those domains explained 73% of the total variance. The ROC analysis presented the highest sensitivity and specificity at an overall cutoff score of 24.50, which can be considered as the cutoff score under which HRQOL can be assessed accurately among severe heart failure patients. To our knowledge, this is the first study to validate the Greek MLHFQ questionnaire, which should therefore be incorporated into research and clinical practice in order to allow comparison of the results from different national studies. An important advantage of our study is the fact that it is the first study to perform a ROC analysis, which provided us with a cutoff score for assessing HRQOL accurately among patients with heart failure, and that the findings of the EFA were further explored using the CFA statistical technique.

The MLHFQ has been translated into more than 32 different languages, which has led to different results, such as identifying two to four factors when using factor analysis.[13,19-21] The overall Cronbach's alpha for the Greek MLHFQ was found to be similar to those reported by Portuguese and Chinese validation teams (Cronbach's alpha equal to 0.95 and 0.97, respectively), which is interpreted as high internal consistency for the questionnaire.[1,22] In contrast, a Dutch validation study[21] reported a Cronbach's alpha equal to 0.80 and a Brazilian study 0.85 for the total score (0.85 for the physical domain and 0.64 for the emotional domain).[23] A Spanish research team validated the MLHFQ in primary care settings, where Cronbach's alpha ranged from 0.79 to 0.94 for the various MLHFQ dimensions.[12] The variation in Cronbach's alpha can be partially explained by the different methodological approaches and the different cultural background in specific populations. The cumulative variance of the Greek validated questionnaire is similar to the Spanish (66%) and Chinese (71%) versions. Similarities in the reliability rates between the Greek, the Spanish and the Chinese versions show the strong association between the individual items of the same scale in different settings. However, based on the information provided in the published papers for the Spanish and Chinese versions, we cannot draw any conclusions regarding the possible reasons underlying these similarities. We can only assume that the similar methodological approach adopted for the translation, validation, and cultural adaptation for the Chinese version and the cultural similarities between Greece and Spain may have affected the reported rates.

Factor analysis of the Greek scale loaded all items and provided two Factors: the "Physical subscale" (Q1-Q14) and the "Emotional subscale" (Q15-Q21). The factor analysis of the Greek questionnaire revealed the significance of all 21 items included in the original. Comparing the structure of the Greek MLHFQ with those of other countries, both discrepancies and similarities were identified. Similarly, in a factor analysis performed by the original developer, two subscales were also identified: the physical subscale consisted of eight items (Q2-Q7, Q12-Q13), whereas the emotional subscale consisted of five items (Q17-Q21), excluding items Q1, Q8-Q11, Q14-Q16. In addition, a Spanish validation of the questionnaire in primary care settings also provided two factors: factor I (items Q2-Q7, Q12-Q13) and factor II (Q17-Q21), excluding items Q1, Q8-Q11, and Q14-Q16. In contrast, the factor analysis of the Chinese version revealed three factors: a physical subscale (Q1-Q3, Q6, Q11-Q14 and Q16), an emotional subscale (Q17-Q21), and a social subscale (Q4, Q5, and Q7). Based on this comparative analysis of the results of the factor analysis for the same tool in different settings, we can infer that there are certain methodological and cultural implications underlying these differences. Methodological differences may refer to the study design, the recruitment strategy, the questionnaire's translation process, and the cultural adaptation process. In addition, each country's and individual's cultural and educational background play a significant role in the reported similarities and differences in the factor analysis.

The confirmatory factor analysis demonstrated that the two-factor model tested offered a desirable fit to our data. As for the fit indices of this analysis, RMSEA (0.088) is very close to the suggested cutoff point of 0.08,[24] while the value of SRMR (0.037) is under the cutoff point of 0.05.[25] Furthermore, the value of CFI (0.941) is satisfactory, exceeding the suggested value of 0.90.[26] The above mixed results suggest that there is space for further research in this area in order to replicate our findings.

The effectiveness of the MLHFQ in assessing

health-related HRQOL over the range of cutoff scores proposed was confirmed by the ROC analysis. In our study, the high sensitivity (95.1%) of the 24.50 score cutoff allows the use of this cutoff score in the clinical assessment of HRQOL. If a health care professional would like to use the Greek MLHFQ for HRQOL assessment among patients with heart failure, then we suggest that these different cutoffs should be used. This means that the MLHFQ may be used as a tool for the early detection of low quality of life among this specific disease group. Our ROC analysis is in line with the study results of Behlouli et al, who estimated that a score of <24 on the scale represents a good HRQOL, a score between 24-45 represents a moderate HRQOL, and a score >45 represents a poor HRQOL.[11] No additional information regarding the sensitivity and specificity of this scale among different countries was identified. MLHFQ could be adopted in daily clinical practice and may allow health care professionals to implement specific interventions with the aim of improving patients' everyday life, rather than being focused solely on the treatment of specific disease symptoms and signs. In addition, the Greek MLHFQ provides a basis for a holistic view of the patient and therefore may facilitate a dialogue with patients who have a low HRQOL.

Limitations of the study

Our study had some limitations. Firstly, the MLHFQ is a self-administered questionnaire, which means that information bias might have affected our findings. Furthermore, no additional information regarding participants' socioeconomic profile was collected; thus, it was not possible to perform a sensitivity analysis in order to further evaluate the validity of the scale. Another limitation of this study is the fact that it was not possible to use a gold-standard tool for the purpose of the ROC analysis, as to our knowledge there are no other validated tools in the Greek language for assessing quality of life among patients with heart failure.

Conclusions

The Greek version of the MLHFQ has shown satisfactory reliability and the factor analysis indicated two factors that were of interest. We can therefore assert that it is a reliable and valid tool for identifying HRQOL among patients with severe (NYHA III or IV) heart failure. Healthcare professionals can use it in their clinical practice to improve the identification of patients with a compromised HRQOL. The Greek version of the MLHFQ provides a holistic approach for measuring HRQOL. Given its cross-cultural characteristics, it will allow comparisons between countries and will provide a particularly useful measure of HRQOL in multicenter international studies. Future cross-sectional and cohort studies are recommended, aiming to inform clinical practice and to guide the development of specific interventions for improving HRQOL among heart failure patients.

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