



## Validation of the Arabic Version of the Minnesota Living with Heart Failure Questionnaire

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### ABSTRACT

**Background:** The Minnesota Living with Heart Failure Questionnaire (MLHFQ) is commonly used to measure quality of life (QOL) in patients with heart failure (HF). We examined the psychometric properties and cultural validity of an Arabic version of the MLHFQ.

**Methods:** An observational cross-sectional study was conducted with 210 adult HF outpatients. Patients were interviewed with the Arabic MLHFQ and the Patient Health Questionnaire (PHQ-9). Cronbach's alpha coefficient and confirmatory factor analysis were conducted. Patients with different NYHA classes and HF-hospitalization histories were compared on QOL to test known-group validity.

**Results:** The confirmatory factor analysis yielded 3 factors: physical, emotional, and social. Three items (4, 8, and 15) had low loadings. The overall Cronbach's alpha coefficient was 0.92. There were significant differences in MLHFQ by PHQ-9 categories, NYHA class, and HF-hospitalization history.

**Conclusions:** This Arabic version of MLHFQ is valid and reliable and can be used in Arabic-speaking Lebanese HF populations.

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### Introduction

Heart failure (HF) is a chronic illness characterized by debilitating symptoms such as dyspnea, ankle edema, among others, which limit patients' functioning and affect their quality of life (QOL).<sup>1</sup> Consequently, QOL has become an important outcome used to assess the effectiveness of HF treatment.<sup>1,2</sup> QOL is a multi-dimensional broad concept that incorporates the individual's perception of his/her health status, psychosocial status and other aspects of life.<sup>3</sup> In Lebanon, a country with a population of 4.5 million, Tatari et al.<sup>4</sup> reported a prevalence of HF of 1.8%. The annual total direct cost of HF treatment was calculated at 103 673 535 USD, which was almost one third

**Abbreviations:** CFA, confirmatory factor analysis; CFI, Confirmatory Fit Index; HF, heart failure; MLHFQ, Minnesota Living with Heart Failure Questionnaire; NYHA, New York Heart Association; QOL, quality of life; PHQ-9, Patient Health Questionnaire-9; RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Square Residual; TLI, Tucker–Lewis Index

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the extrapolated cost based on United States (US) statistics (268 370 607 USD).<sup>4</sup> Moreover, a study documented significant readmission rate of HF patients ranging from 15% at one month following hospital discharge to 27.9% at 3 months, with the majority (73.61%) of readmissions due to HF exacerbations.<sup>5</sup> Given the significance of this health problem in Lebanon, and in an attempt to evaluate the burden of HF on patients, it is important to measure its impact on their lives. Since QOL is influenced by one's culture, it is important that the measure of QOL be sensitive to the Lebanese culture.

Many instruments are available to measure QOL. Some tools are generic, such as the Sickness Impact Profile and the Rand SF-36 that were reviewed by Coelho et al in 2005,<sup>1</sup> whereas others are specific to the disease in question. In HF patients, specific measures of QOL include the Chronic Heart Failure Questionnaire; the Minnesota Living with Heart Failure Questionnaire (MLHFQ); the Quality of Life Questionnaire in Severe Heart Failure and the Kansas City Cardiomyopathy Questionnaire, which were reviewed by Garin et al.<sup>6</sup> The Minnesota Living with Heart Failure (MLHFQ) is the most commonly used instrument specifically in HF patients.<sup>2,6</sup> This instrument was chosen since it focused on addressing the impact of the illness on patients' function and is simple, thus can be used with patients of all levels of education. Some

investigators in the Arab world translated and used the MLHFQ in their studies,<sup>7–9</sup> but none of them tested its psychometric properties based on the cultural context of their country. This study aimed to examine the psychometric properties and cultural validity of an Arabic translated version of the MLHFQ as a disease-specific measure of health related QOL in HF patients in Lebanon. The specific aims were to evaluate the MLHFQ's internal consistency, and its content, cultural, construct, and known-group validity.

## Methods

### *Study design and population*

This study was approved by the Institutional Review Board of the American University of Beirut, and the administration of the medical center where the study was conducted (NUR.SN.26/SBS-2017-036D). The study was conducted using an observational cross-sectional design. The sample included 210 Lebanese patients recruited from a tertiary referral medical center in Beirut, during their visit to the outpatient cardiology department. Inclusion criteria were: adults ( $\geq 18$  years) diagnosed with chronic HF with an ejection fraction  $< 50\%$ . Patients were excluded if they had a history of an acute coronary event in the preceding three months, or in case of severe cognitive impairments that interfere with their ability to participate in the interview. Patients were screened for severe cognitive impairment by asking them three questions about their orientation ability: name, place and date.

All patients who visited the outpatient cardiology department between November 2017 and December 2018 and who fulfilled our inclusion/exclusion criteria were referred to participate by their treating physician. If interested to participate, the patients were approached by the research interviewer. After the patient provided a written informed consent, the researcher proceeded with the face-to-face interview. The interview was conducted in an empty room to ensure privacy. Participants' answers to the interview questions were written on a hard copy of the questionnaire. Out of 228 patients who were approached, 18 patients declined participation, yielding a 91.4% response rate.

### *Measures*

The following instruments were used:

#### *The MLHFQ*

The MLHFQ was used to measure the QOL.<sup>2</sup> This instrument, developed by Thomas Reector in 1984, is considered the most widely used for measuring QOL in HF patients. The questionnaire includes 21 items rated on a 6-point Likert scale, ranging from 0 (for no) to 5 (for very much). The patient is asked to indicate how much HF is affecting his/her daily life over the past month. This measure has a summative score ranging from 0 to 105. The higher the score, the lower the QOL.<sup>2</sup> Psychometric studies of the MLHFQ yielded Cronbach's alpha coefficients ranging from 0.84 to 0.95 for the total score.<sup>10</sup> The factor structures reported by investigators from various countries ranged between 2 and 3.<sup>2,10–17</sup> Reector and Cohn<sup>2</sup> reported physical and emotional factors; however, other investigators<sup>10,13–16</sup> reported an additional third factor for the social domain of QOL. There was consistency among all investigators in the identified emotional factor, which included items 17–21.<sup>2,10–17</sup> The social factor items varied between 3 and 6 items, with items 8–10 commonly reported among 4 out of 5 studies.<sup>10,13–16</sup> The physical factor items ranged between 8 and 12, with items 2–6, 12 and 13 commonly identified in the studies reviewed by Bilbao et al.<sup>12</sup> Factor analyses showed better model fit for the 2-factor structure compared with the 3-factor structure. Investigators who tested the 3-factor model reported varying levels of stability of the 3 factors, with some items having factor loading  $< 0.40$ .<sup>12</sup>

#### *The Patient Health Questionnaire-9 (PHQ-9)*

The PHQ-9 is a 9-item screening instrument for depression with four answer options per item (0 for not at all, 1 for several days, 2 for more than half of the days, and 3 for nearly every day).<sup>18</sup> Each patient is asked to rate how often he/she was bothered by the symptoms mentioned in each item over the last two weeks. Sample items include: Little interest or pleasure in doing things, poor appetite or overeating, thoughts that you would be better off dead or hurt yourself. The American Heart Association recommended using the PHQ-9 as a screening tool for depression in cardiac patients.<sup>19</sup> The PHQ-9 has a summative score that ranges from 0 to 27, indicating the level of depression. Patients who score 5–9, 10–14, 15–19, and 20–27 represent mild, moderate, moderately severe, and severe depressive symptoms, respectively.<sup>18</sup> Psychometrics of the PHQ-9 were tested in HF patients;<sup>20</sup> criterion validity was supported, and Cronbach alpha coefficient was reported as 0.82. The Arabic version of the questionnaire was used, where the reliability and validity of this instrument were supported in a previous study, with a Cronbach's alpha coefficient of 0.88.<sup>21</sup>

#### *Demographic and clinical variables*

In addition, patients were asked about their age, marital status, education, income, smoking and alcohol intake, as well as physical activity and medications they are taking. Medical records were sought for medical history data, left ventricle ejection fraction and New York Heart Association (NYHA) class.

#### *Translation and cultural validation*

##### *Translation*

The MLHFQ was first translated to the Arabic language independently by a professional translator and a bilingual Arabic-English speaking health professional with expertise in medical terminology. We chose to translate it twice in order to ensure that the translation was accurate by reconciling the difference between translators and following the recommendation of Flaherty et al.<sup>22</sup> The two translated versions were examined and found to be equivalent, except for minor editorial differences in the version translated by the health professional; so we chose the version translated by the professional translator. Next, the Arabic version was back-translated to the English language by another professional translator and compared to the original English version. The original and back-translated versions were semantically equivalent.

##### *Cultural validation*

After translation and back translation, the Arabic version of the questionnaire was evaluated for cultural appropriateness and conceptual relevance by three health professionals who are experts in HF and familiar with cardiovascular terminologies: a nursing faculty member specialized in cardiovascular nursing, a cardiology clinical nurse specialist and a cardiologist specialized in HF. The rating was on a scale of 1 (not at all) to 4 (very). The panel of experts were asked to examine whether all questionnaire items were clear, unambiguous and appropriate to the Lebanese culture on one hand, and whether each of the items fit the concept of QOL, along the 3 dimensions (physical, emotional and social) on the other hand. A content validity index for each item was calculated by noting the proportion of the 3 experts that rated the item as 3 or 4 on conceptual relevance, and for the whole scale as the proportion of items out of the 21 that were rated 3 or 4.<sup>23</sup> All the items of the MLHFQ were rated by the experts as 3 or 4. Also, all three experts rated each item as 3 or 4. Thus, the content validity index was 1 per item and for the whole scale.

##### *Pilot testing*

Prior to the main study, the translated Arabic version of the MLHFQ was tested on 5 patients who fit the eligibility criteria. This

step aimed to examine whether the items of the questionnaire were clear and understood by the patients, whether they reflected the QOL from their perspective and evaluate the ease of the administration of the survey. The results did not suggest the need to change any item in the questionnaire. Data of this pilot testing was not included in the sample of the main study.

### Statistical methods

Data were entered and analyzed using the Statistical Package of the Social Sciences (SPSS) version 24 and R version 3.5.3 for windows. The sample size was determined based on the need for confirmatory factor analysis (CFA), for which at least 10 subjects were needed per item.<sup>24</sup> Descriptive analyses were calculated as frequencies and percent (%) for categorical variables, and as means and Standard Deviations (SD) for continuous variables to describe the sample characteristics and scale scores. The internal consistency reliability was tested using the Cronbach alpha coefficient, along with inter-item correlations.

Two confirmatory factor analyses (CFAs) were performed using the Maximum Likelihood method. The first CFA tested the 2-factor model (items 2–7,12,13 for the physical factor and items 17–21 for the emotional factor) proposed by Rector and Cohn who developed the MLHFQ.<sup>2</sup> Among investigators who reported a 3-factor structure for the MLHFQ, the model by Garin et al.<sup>10</sup> had the best results in terms of fit indices. Thus, the second CFA tested the 3-factor model (items 1–6,12,13 for the physical factor, items 17–21 for the emotional factor, and items 8–10,15 for the social factor). Tucker–Lewis Index (TLI) and Confirmatory Fit Index (CFI) were used to assess the goodness of fit of the model. Values of at least 0.90 were considered acceptable. Also, values between 0.05 and 0.10 for the Root Mean Square Error of Approximation (RMSEA) and <0.08 for the Standardized Root Mean Square Residual (SRMR) were used to indicate an acceptable model fit.<sup>25</sup> Factor loadings of the items were accepted if at least 0.40.<sup>26</sup>

For known-group validity, we tested the hypothesis that patients with higher NYHA class and those who were hospitalized for HF exacerbation in the past 6 months would score higher on the MLHFQ than their counterparts. Thus, patients with various NYHA classes were compared on the MLHFQ using ANOVA. Patients who were hospitalized for HF exacerbation in the past 6 months were compared to those who were not using the independent sample *t*-test. We tested the hypothesis that patients with poor QOL are more likely to have depression compared to those with good QOL by dividing the sample based on the PHQ-9 score into 3 groups: no to minimal depression, mild to moderate, and moderately severe to severe depression and compared each group on the total MLHFQ score and subscale scores using ANOVA.

## Results

### Sample characteristics

A total of 210 outpatients participated in the study, with their characteristics shown in Table 1. The majority of the patients were males, married, and had obtained less than high school education. The mean age was 64.26 ± 15.18, with a range of 18–94 years. Almost half of the sample was employed and earned less than 1000 USD per month. Almost half the sample was from Beirut and one third from Mount Lebanon.

Over half of the patients had a history of hypertension or dyslipidemia. Other comorbidities included coronary artery disease, diabetes, and atrial fibrillation. Moreover, 41.9% of the patients were overweight (25 ≤ BMI < 30) and 37.1% obese (BMI > 30), 49.0% non-smokers, and 68.6% not physically active. The sample was equally distributed by NYHA class and ejection fraction category. The mean score of the MLHFQ was 24.84 ± 18.25 and that of the PHQ-9 was 7.46 ± 5.53, with most patients (87.6%) having no to moderate depressive symptoms.

**Table 1**  
Characteristics of the sample (N = 210)

Characteristics	N (%)
<b>Age; mean ± SD</b>	64.26 ± 15.18
<b>Gender: Male</b>	157 (74.8)
<b>Educational level</b>	
Less than high school	91 (43.3)
High school level	33 (15.7)
University level	86 (41.0)
<b>Marital status</b>	
Single	19 (9.0)
Married	156 (74.3)
Others	35 (16.7)
<b>Employment status</b>	
Employed	87 (41.4)
Not employed	77 (36.7)
Retired	46 (21.9)
<b>Monthly income</b>	
<500 USD	27 (12.9)
500 USD–999 USD	65 (31.0)
> 1000 USD	118 (56.2)
<b>Physically active outside home/work</b>	66 (31.4)
<b>Smoking status (cigarette/nargileh)</b>	
Yes	40 (19.0)
No	103 (49.0)
Ex-smokers	67 (31.9)
<b>Body mass index (BMI); mean ± SD</b>	28.63 ± 4.92
<b>Comorbidities</b>	
Hypertension	119 (56.7)
Dyslipidemia	111 (52.9)
Coronary artery disease	100 (47.6)
Type-2 Diabetes Mellitus	74 (35.2)
Atrial fibrillation	45 (21.4)
Other (Cancer, Chronic obstructive pulmonary disease)	17 (8.1)
<b>Ejection fraction; mean ± SD</b>	32.60 ± 8.28
<b>NYHA functional class</b>	
NYHA I	80 (38.1)
NYHA II	68 (32.4)
NYHA III	62 (29.5)
<b>Hospitalized past 6 months for HF exacerbation</b>	74 (35.2)
<b>PHQ-9</b>	
Total score; mean ± SD	7.46 ± 5.53
No to minimal depressive symptoms	82 (39.0)
Mild to moderate depressive symptoms	102 (48.6)
Moderately severe to severe depressive symptoms	26 (12.4)
<b>MLHFQ score; mean ± SD</b>	24.84 ± 18.25

HF: heart failure; MLHFQ: Minnesota Living with Heart Failure Questionnaire; NYHA: New York Heart Association; PHQ-9: Patient Health Questionnaire-9; SD: Standard Deviation.

### Factor analysis

The results of the first CFA on the entire sample showed an acceptable overall fit of the data to the model proposed by Rector et al. (CFI = 0.924, TLI = 0.907, RMSEA = 0.10, SRMR = 0.052,  $\chi^2 = 211.73$  with  $p < 0.001$ ). The loadings of items on the corresponding factors were high and positive, ranging between 0.70 and 0.93 for all items except for item 4, which was borderline at 0.40. A high positive significant correlation of  $r = 0.79$  ( $p < 0.001$ ) was found between the physical and the emotional factor.

The results of the second CFA showed slightly better overall fit of the data to the model proposed by Garin et al. (CFI = 0.927, TLI = 0.914, RMSEA = 0.079, SRMR = 0.048,  $\chi^2 = 267.98$  with  $p < 0.001$ ). However, some items showed factor loading <0.40 (items 4, 8, and 15) while the loadings for the other items ranged between 0.41 and 0.93. The standardized factor loadings are displayed in Fig. 1.

### Internal consistency reliability

The internal consistency was tested using Cronbach's alpha coefficient for the total MLHFQ score and the three subscales as identified by the CFA (Table 2). Cronbach's alpha values were high for the total

score (0.92) as well as for the physical subscale (0.87) and the emotional subscale (0.93), but low for the social subscale. The inter-item correlations showed no inter-items correlation with >0.80.

*Known-groups validity*

Results of the ANOVA comparing depression groups on the MLHFQ and its subscale scores showed statistically significant differences among the 3 groups and within each pair of depression groups. As shown in Fig. 2, comparing the 3 depression groups (as per the PHQ-9), the mean scores of the MLHFQ and its subscales increase significantly and consistently from the none to minimal depression to the moderately severe to severe depression group.

The results of the ANOVA testing the difference in MLHFQ scores between the different NYHA classes are shown in Fig. 2. There was a significant difference in the MLHFQ total score between the different NYHA groups (NYHA I:  $10.34 \pm 9.26$  vs. NYHA II:  $21.91 \pm 7.91$  vs. NYHA III:  $46.79 \pm 13.66$ ;  $p < 0.001$ ). Using ANOVA with Post-hoc Bonferroni multiple comparisons, significant differences in MLHFQ scores were also noted within each pair of NYHA class. In addition, patients having a previous hospitalization in the past 6 months due to HF exacerbation had significantly worse QOL than those who were not hospitalized, as shown by the significant difference in the mean scores of the total scale and subscales of the MLHFQ between the two groups ( $p < 0.001$ ). On the other hand, there was no difference in MLHFQ scores by ejection fraction group.

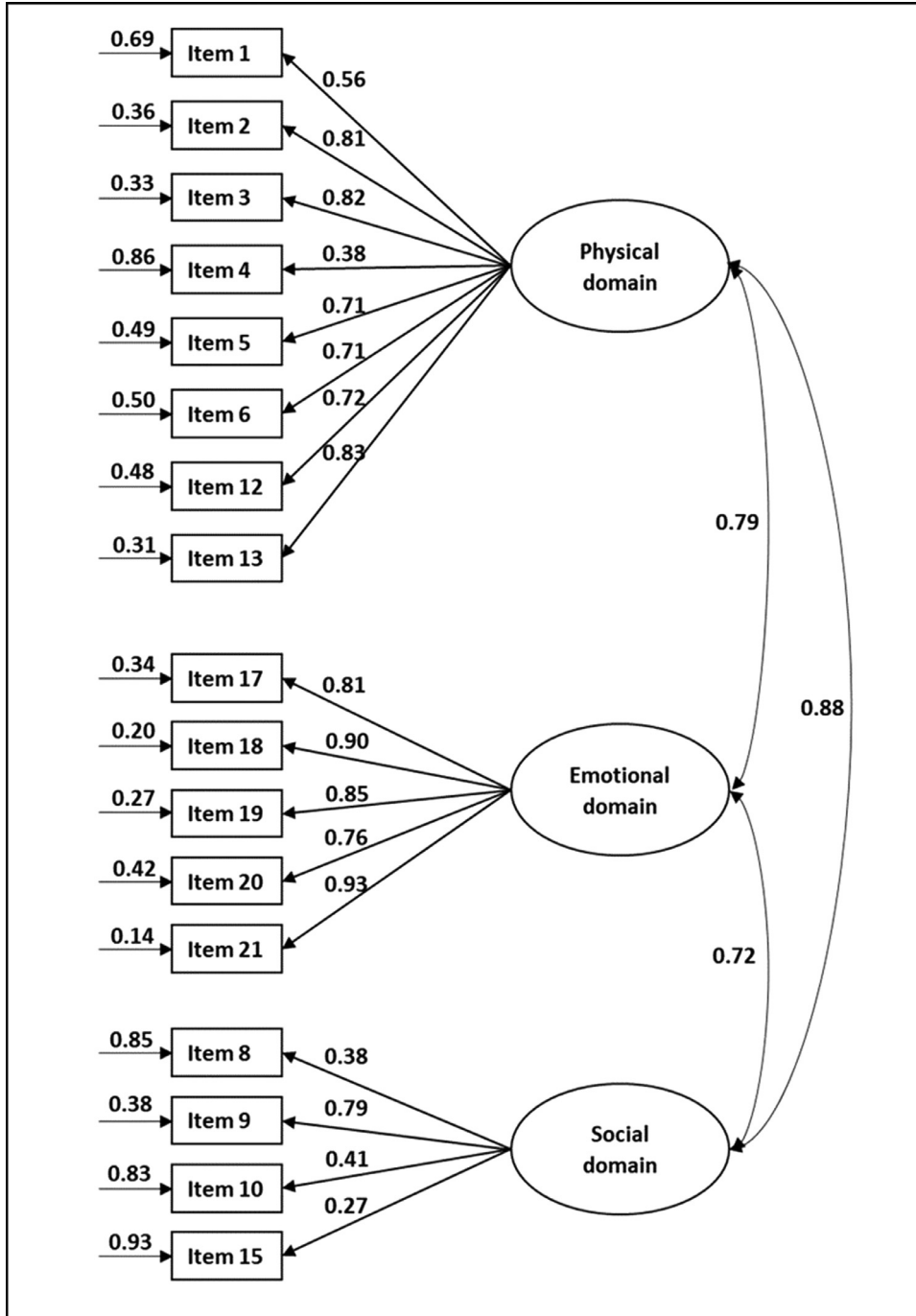


Fig. 1. CFA based on the 3-factor model proposed by Garin et al., including correlation between factors, factor loadings, and errors.

**Table 2**  
Reliability of the MLHFQ scores

MLHFQ	Number of items	Potential range	Actual range	Mean $\pm$ SD	Cronbach alpha
Total score	21	0–105	1–80	24.84 $\pm$ 18.25	0.92
Physical subscale	8	0–40	0–34	11.44 $\pm$ 8.47	0.87
Emotional subscale	5	0–25	0–24	7.59 $\pm$ 6.92	0.93
Social subscale	4	0–20	0–18	3.74 $\pm$ 3.33	0.53

MLHFQ: Minnesota Living with Heart Failure Questionnaire; SD: Standard Deviation.

## Discussion

The current study examined the psychometric properties of an Arabic version of the MLHFQ using a sample of Lebanese outpatients with HF. The results of the CFA along with the good reliability and content, cultural, and discriminant validity supported the appropriateness of this Arabic version for use with Arabic-speaking Lebanese HF patients.

Several investigators proposed a 3-factor model with a third factor for the social dimension of QOL.<sup>10,13–16</sup> Bilbao et al.<sup>12</sup> compared the different factor structures reported by several authors, and supported in their analyses the validity of the MLHFQ physical and emotional subscales proposed by Rector et al. The authors also analyzed the third social factor in various models through Rasch analysis and reported that it was unstable. The results of the fit indices for the different factor structures showed that the best results were for Garin et al. as a 3-factor model.<sup>10</sup> Based on that, this study tested the

validity of the MLHFQ as a 3-factor model with physical, emotional and social domain, by testing the fit of the Lebanese data to the model of Garin et al.<sup>10</sup>

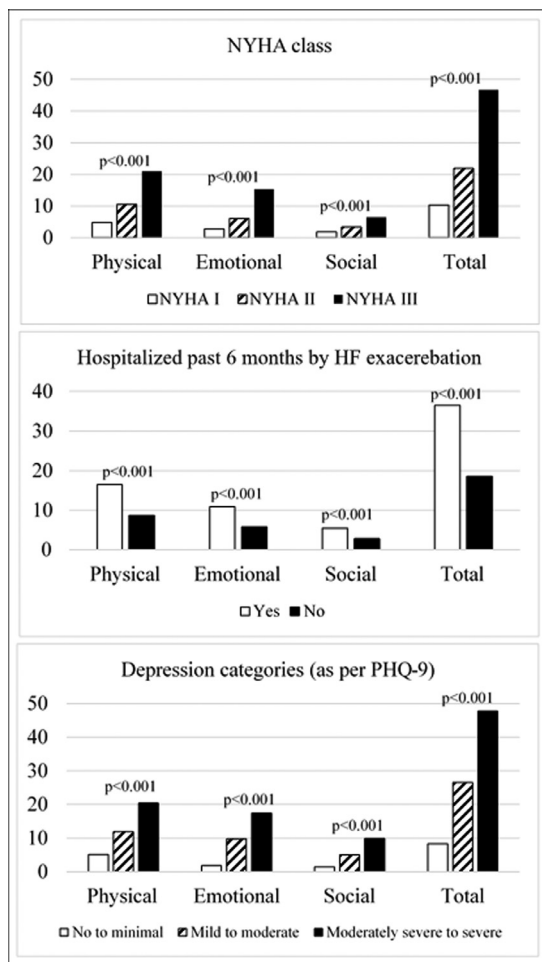
The results obtained in this study for the CFA were satisfactory. The fit indices and factor loadings indicate that the 3-factor version does have adequate structural validity and adequate fit to the model proposed by Garin et al.<sup>10</sup> although few items had low loadings, mostly from the social factor. Compared to Garin et al.<sup>10</sup> the RMSEA in this study indicated a good fit with a value of 0.079 vs. 0.065, and the CFI and TLI showed an adequate fit with values of 0.927 and 0.914 vs. 0.949 and 0.988, respectively. Item 4 (*making your working around the house or yard difficult*) loaded 0.38 on the physical factor, which is slightly  $<0.40$ , similar to what was reported by Garin et al. This may be explained by the fact that most of our sample were living in Beirut and Mount Lebanon, urban areas where people live in apartment buildings with no backyards. In addition, item 8 (*working to earn money difficult*) loaded  $<0.40$  on the social factor, which is lower to the loading by Garin et al. (0.549), possibly because most of our sample (58.6%) were not employed or were retired, thus this item may not have been relevant to this sample. The same applies to item 15 (*costing you money for medical care*) that also loaded low on the social factor in this study and Garin's (loading 0.274), and this can be explained by having more than half of our patients (56.2%) with a monthly income  $\geq 1000$  USD. The minimum wage in Lebanon is 500 USD per month.

The Cronbach alpha of the total scale and the subscales supported the internal consistency of this instrument except for the social subscale. Garin et al.<sup>10</sup> reported Cronbach alpha of 0.72 for the social subscale and  $>0.90$  for the physical and emotional subscales. The inter-item correlation revealed no items with correlation  $>0.80$ ; this indicates the lack of multicollinearity and the absence of overlapping items. Similar results were reported in other studies.<sup>2,11,12</sup> The social subscale had only 4 items and its Cronbach alpha coefficient was 0.53. The Cronbach alpha for this scale ranged in other studies between 0.4 in Norway and 0.82 in Hungary.<sup>10</sup> The low Cronbach alpha coefficient for the social subscale (0.53) could be explained by the fact that the items of this scale are measuring different concepts, as is reflected in the factor loadings of 2 out of the 4 items. In addition, item 8 (*making your working to earn a living difficult*) was not relevant to the sample, which included mostly retired patients.

This version of the MLHFQ was found to significantly different between patients with different HF severities, but not by ejection fraction categories. Patients with more severe HF symptoms manifested by advanced NYHA class and those hospitalized in the past 6 months were more prone to impairment in their QOL than their counterparts. Also, the physical, emotional, and social subscales were able to significantly distinguish between these patients. All these findings are consistent with the results of other studies.<sup>10–15</sup>

Results showed significant differences in the MLHFQ total and subscale scores between the depression groups, similar to other studies that reported that the lower the QOL the more likely the patient would be depressed.<sup>27,28</sup> One confounder that can partially explain the strong association between MLHFQ and PHQ-9 is gender. In a secondary analysis, females were found to have significantly higher MLHFQ scores and higher PHQ-9 scores than males.

From a research perspective, the items that did not load strongly (4, 8, and 15), namely asking about the effect of HF on one's ability to



**Fig. 2.** Mean for the MLHFQ scale and subscales by NYHA, hospitalization, and PHQ-9 categories. HF: heart failure; MLHFQ: Minnesota Living with Heart Failure Questionnaire; NYHA: New York Heart Association, PHQ-9: Patient Health Questionnaire-9.

work around the house, work to earn a living and on costing money for medical care depend a lot on the sample studied in terms of age, employment status, place of residence and insurance status. These items may be kept for clinical use so that patients who are in financial need may be provided with social services to support their medical care.

### Study limitations

This study had some limitations. The sample size was adequate to conduct a CFA, but it was not enough to do first an exploratory factor analysis and then confirm the results obtained by a CFA. Although the patients were recruited from a referral medical center with a referral unit specific for HF patients, there still a concern about the representativeness of this sample to the population, given that the majority of patients came from Beirut and Mount Lebanon. The sample also included only patients with ejection fraction <50%; thus, the findings may not be generalizable to patients with preserved ejection fraction ( $\geq 50\%$ ).

We used less stringent criteria in evaluating the fit indices since this study is done in a different culture and using a different language of the MLHFQ, which may affect the results of the CFA. Using more stringent criteria such as those by Hu and Bentler<sup>29</sup> would show that the CFI is close to the 0.95 cutoff; however the RMSEA falls short of meeting the acceptable cutoff value of less than 0.06. Thus further testing is needed. Nevertheless, the Arabic MLHFQ can be used in the Lebanese population as a measure of QOL.

### Conclusions

This is the first study that examines the psychometric properties of an Arabic version of the MLHFQ. The results of this study provided beginning evidence of aspects of reliability and validity in this Arabic-speaking Lebanese HF population. The MLHFQ can be used to track the effectiveness of treatments, in tandem with other physiologic measures.

### Declaration of Competing Interest

None.

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