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Translation and psychometric evaluation of the Spanish version of the Heart Failure-Specific Health Literacy

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ABSTRACT

Aim: To translate and adapt the Heart Failure-Specific Health Literacy Scale (HFS-HLS) for Castilian Spanish (i.e., the Spanish spoken in Spain) and to evaluate its psychometric properties in patients with heart failure visited in primary care centres.

Methods: Forward and back translations were used to translate and adapt the HFS-HLS, and a panel of experts assessed the validity of the adaptation until consensus was achieved. Face validity was explored through cognitive debriefing with 20 patients. Psychometric properties were examined for test-retest reliability (intra-class correlation index) and internal consistency (Cronbach's α), concurrent and discriminant validity (Pearson correlation coefficient) using the HLS-EU-Q16 and EHFScBS health literacy scales, and construct validity using confirmatory factor analysis and fit indices. Differences in mean results for the adapted instrument and between subgroups were examined with ANOVA tests.

Results: The linguistically and culturally adapted Castilian Spanish HFS-HLS (Cast-Span HFS-HLS) was administered to 195 participants. Overall fit parameters for three dimensions of confirmatory factor analysis were adequate. Test-retest reliability showed an intraclass correlation coefficient of 0.89 (95 % CI: 0.80–0.94) for the total HL scale and 0.87, 0.86, and 0.89 for the functional, communicative, and critical subcales, respectively. The internal consistency for the total HL was good (Cronbach **α** = 0.80), and for the three sub-scales were **α** = 0.88

Abbreviations: AMG, adjusted morbidity group; ANOVA, analysis of variance; BHLSQ-3, Brief Health Literacy Screening Tool 3 Questions; CFA, confirmatory factor analysis; Cast-Span-HFS-HLS, Castilian Spanish Heart Failure-Specific Health Literacy Scale; CFI, comparative fit index; CI, confidence interval; Df, degrees of freedom; EHFScBS, European Heart Failure Self-Care Behaviour Scale; GFI, goodness-of-fit index; HF, heart failure; HFS-HLS, Heart Failure-Specific Health Literacy Scale; HL, health literacy; HLS-EU-Q16, 16-item European Health Literacy Survey Questionnaire; HLS-EU-Q47, 47-item European Health Literacy Survey Questionnaire; ICC, intraclass correlation coefficient; NYHA, New York Heart Association; REALM, Rapid Estimate of Adult Literacy in Medicine; RMSEA, root mean square error of approximation; SAHLSA, Short Assessment of Health Literacy for Spanish Adults; SD, standard deviation; SE, standard error; SDU, standard drink unit; TLI, Tucker-Lewis index; TOFHLA, Test of Functional Health Literacy in Adults; WHO, World Health Organization; $\chi 2$, chi-square.

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(Functional), **α** = 0.55 (communicative), and **α** = 0.79 (critical). Results of the new adapted instrument were associated with both the HLS-EU-Q16 (r = 0.37, 95 % CI: 0.24–0.49; p < 0.001) and the EHFScBS (r = -0.14; 95 % CI: −0.28 to −0.004). The Cast-Span HFS-HLS showed that overall HL scores were significantly lower in older, female, and individuals with lower educational attainment (p < 0.001).

Conclusions: The Cast-Span HFS-HLS is valid and reliable instrument that can usefully test health literacy in community-dwelling patients with heart failure.

1. Introduction

Health literacy (HL), as defined by the World Health Organization (WHO), *'represents the personal knowledge and competencies that accumulate through daily activities, social interactions and across generations. Personal knowledge and competencies are mediated by the organizational structures and availability of resources that enable people to access, understand, appraise, and use information and services in ways that promote and maintain good health and wellbeing for themselves and those around them'* [1]. HL can be explained in terms of 3 dimensions, namely, functional HL, communicative HL, and critical HL, referring to reading and writing skills, information gathering and transmission skills, and critical information evaluation, respectively, and reflecting a patient's capacity to analyse and use information so as to exercise greater control over life events and situations [2].

Poor HL, as a barrier to appropriate self-care, leads to increased mortality and hospitalization, poor treatment adherence, lower quality of life [3,4], and a higher risk of hospital readmission and emergency department visits [5]. Poor HL is associated with older age groups, lower socioeconomic status, lower educational attainment, more comorbidities, and less effective physician-nurse-patient communications [6].

Health literacy (HL) has significant clinical implications for patients with chronic conditions, including those with heart failure (HF). HF is a cardiovascular condition that places a substantial burden on healthcare systems worldwide, with recent increase primarily associated to aging populations [7,8]. In Spain, the prevalence of HF in individuals over 80 years old is 9 % [9]. In high-income countries, approximately 30–50 % of HF patients have been found to have poor HL, as assessed by general HL questionnaires [10]. Effective management of HF requires patients to develop self-care behaviours (such as engaging in regular exercise, understanding and administering diuretics, reducing sodium intake, controlling fluid consumption, and adhering to immunization schedules, especially in the presence of cardiovascular risk factors) while actively monitoring symptoms [11,12]. To ensure optimal self-care, primary healthcare providers should routinely assess HL levels in HF patients using condition-specific HL tools that address the unique challenges of this population.

Since 2005, several HL measurement instruments have been developed, mostly in English and subsequently adapted to other languages [13,14]. In the European Union (EU), the 47-item European Health Literacy Survey Questionnaire (HLS-EU-Q47) questionnaire, designed to assess HL at the population level in 8 EU countries [15], was further developed as the HLS-EU-Q16, a shorter 16-item version designed to streamline administration time [16]. In Spain, HL in patients with HF has been assessed using generic HL questionnaires, mainly the HLS-EU-Q47 [17], the Short Assessment of Health Literacy for Spanish Adults (SAHLSA) [18], and the Brief Health Literacy Screening Tool-3 Questions (BHLSQ-3) [5]. However, HF patients may require an assessment of their HL using disease-specific items, as is done with other conditions [19–21], and currently, no HL instrument specifically

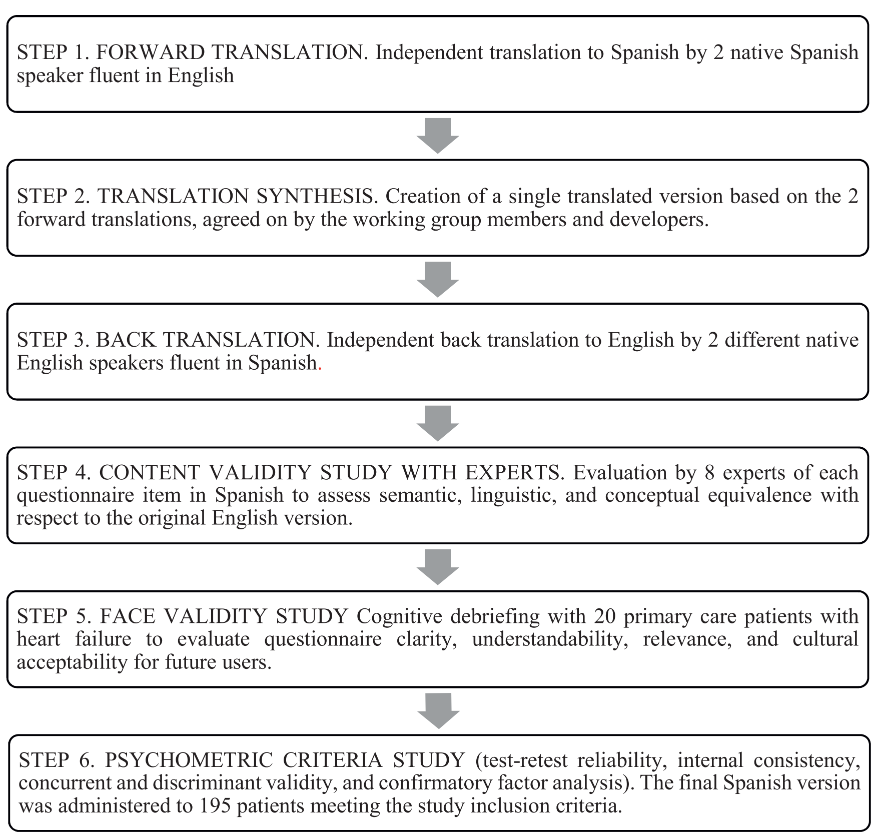

Fig. 1. Flowchart depicting translation, cultural adaptation, and validation of the Castilian Spanish version of the Heart Failure Specific Health Literacy Scale.

adapted for HF patients exists in Spanish.

The Heart Failure-Specific Health Literacy Scale (HFS-HLS), specifically designed to screen HL in patients with HF, consists of 3 dimensions: functional HL, communicative HL, and critical HL [22]. It has been adapted and tested for the Chinese [23], Persian [24], and Korean [25] languages, but not for Spanish. Therefore, this study aimed to translate and adapt the HFS-HLS for Castilian Spanish (i.e., the Spanish spoken in Spain) and to evaluate its psychometric properties in patients with heart failure and visited in the primary care setting.

2. Methods

2.1. Study design

We implemented a cross-sectional study design to translate and adapt the HFS-HLS to Castilian Spanish (Cast-Span-HFS-HLS) and to evaluate its psychometric properties. The study setting was primary care centres in the city of Barcelona (Spain).

2.2. The HFS-HLS

The HFS-HLS was developed by Matsuoka et al. (2016) to specifically assess HL in patients with HF [22]. It includes 12 items that measure 3 HL domains: functional HL, i.e., 'the ability to read and write' (items 1–4); communicative HL, i.e., 'the ability to gather and transmit information' (items 5–8); and critical HL, i.e., 'the ability to critically examine information' (items 9–12) [2]. Responses are scored using a 4-point Likert scale: 1 =inapplicable 2 =rarely applicable; 3 =sometimes applicable; 4 =strongly applicable. Scores for each item range from 1 to 4, with higher scores reflecting greater HL. The HFS-HLS comprises three domains: functional, communication, and critical. Internal consistency was $\alpha = 0.73$ for the functional subscale, $\alpha = 0.68$ for the communicative subscale, and $\alpha = 0.69$ for the critical subscale. Cronbach's α for the total scale was 0.71. Intraclass Correlation Coefficient (ICC) values of 0.88–0.90 indicated good test-retest reliability.

2.3. Study participants

Participants were patients with a registered diagnosis of HF in their medical records, followed up in primary care centres. Inclusion criteria were as follows: age $\geq$ 18 years; New York Heart Association (NYHA) functional class I, II, or III; $\geq$ 1 visit with a primary care physician or nurse in the previous 12 months; and voluntary participation in the study after receiving an explanation of the purpose of the study and fully understanding its details. Exclusion criteria were as follows: NYHA functional class IV; total or severe dependency (Barthel index $\leq$35); severe mental disorder; cognitive impairment (Pfeiffer's Short Portable Mental Status Questionnaire >2 errors); advanced chronic disease and need for palliative care with life expectancy under 12 months; verbal communication issues, including any type of aphasia or language difficulties hindering effective communication in the study social environment.

2.4. Translation and adaptation procedure

Authorization was obtained from the HFS-HLS authors [22] before proceeding with translation and adaptation. The 6 steps described in Beaton et al. [26], as depicted in Fig. 1, were applied.

2.4.1. Forward translation, translation synthesis, and back translation (steps 1–3)

The original version of the scale was independently translated into Spanish by 2 native Spanish-speaking translators fluent in English. The translators were instructed to maintain the original structure as much as possible, to ensure that the resulting scale maintained its semantic, idiomatic, cultural, and conceptual equivalence. Both translations were then compared and reviewed by the research team, with a focus on ensuring conceptual equivalence and linguistic consistency. Corrections and adjustments were made as necessary, and the 2 translations were combined in a single translation. This new Spanish version was independently back-translated to English by 2 different native English-speaking translators fluent in Spanish, i.e., with no previous knowledge of the scale (to ensure that the back translation correctly reflected the Spanish).

2.4.2. Validity study with experts (step 4)

A panel of experts evaluated the translated scale to ensure semantic, idiomatic, cultural, and conceptual equivalence with the original English version [26]. In several rounds, the panellists rated each item on a scale from 1 (no equivalence) to 10 (full equivalence). The panellists were also given the opportunity to suggest additions or deletions. After each round, suggestions were analysed and were then consulted with the panel. This iterative process continued until consensus regarding wording was achieved, defined as 80 % agreement [26].

2.4.3. Face validity study and psychometric criteria study (steps 5 and 6)

With a view to studying face validity, readability, understandability, and acceptability, the scale was piloted with 20 primary care patients with HF meeting the inclusion criteria. On a weekly basis over 4 weeks, 5 patients from the 20 completed the scale and subsequently individually participated in a cognitive debriefing interview in which they were asked to evaluate wording, understandability, and instructions for responding to the items. Their suggested modifications were then assessed for incorporation in the scale, with improvements progressively made by means of each iteration building on the previous iteration. Finally, the scale construct was psychometrically evaluated for test-retest reliability, internal consistency, concurrent and discriminant validity, and through confirmatory factor analysis (CFA).

2.5. Data collection and measurement

At baseline (study enrolment), participants were asked to complete the Cast-Span-HFS-HLS. They also completed the generic HLS-EU-Q16 [16] and the 12-item self-administered European Heart Failure Self-Care Behaviour Scale (EHFScBS) [27]. The HLS-EU-Q16 was scored on a 4-point Likert scale (very difficult, difficult, easy, and very easy) with an option for 'don't know/no answer.' According to the authors' guidelines [16], responses were dichotomized: 'very difficult' and 'difficult' were scored as 0, while 'easy' and 'very easy' were scored as 1. Each participant's total score was calculated by summing the scores across all 16 items. The EHFScBS, covering various self-care behaviours, was scored on a 5-point Likert scale between 1 (totally agree) and 5 (totally disagree). The overall score ranged from 12 to 60, reflecting best and worst self-care, respectively [27].

Demographic data were collected either directly from the patient or their medical record, as follows: age, sex, education level, marital status, employment status, visual impairment (no impairment, impaired vision corrected with glasses, impaired vision even with glasses), hearing impairment (no impairment, impaired hearing improved by hearing aids, impaired hearing even with hearing aids), and finally, HF details (year of diagnosis, NYHA functional class, adjusted morbidity group (AMG) [28], hospital admissions in the previous 12 months, alcohol consumption, tobacco use, and self-care for HF). Sex of participants was defined based on self-report.

To assess Cast-Span-HFS-HLS test-retest reliability, the instrument was re-administered after 2 weeks under the same conditions. This time interval was considered sufficient to avoid changes occurring in the absence of any specific educational intervention.

2.6. Sample size and data analysis

The optimal sample size was determined based on Cronbach's α precision criteria [29], which provides a theoretically grounded approach to ensuring adequate reliability estimation. The original HFS-HLS had a Cronbach's α of 0.71 [22]. We assumed Cronbach's α values of 0.5 for the null hypothesis and 0.8 for the alternative hypothesis (considered very good internal consistency). The minimum required sample size was calculated as 174 participants and would ensure sufficient statistical power for reliability. For the test-retest reliability study, the ICC for the original HFS-HLS was 0.881 (ICC >0.7 is considered acceptable), indicating that 31 participants were required. For both calculations we set α= 0.05 for a 95 % confidence interval (CI)) and β= 0.20 (power 80 %).

Patient characteristics were first explored through means, standard deviation (SD) and absolute and relative frequencies. Construct validity of the Cast-Span-HFS-HLS was tested using CFA and the 3-factor model as proposed for the original HFS-HLS [18]. Fit was assessed with the following incremental indexes: comparative fit index (CFI), goodness-of-fit index (GFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) as the absolute fit index. If CFI, GFI, and TLI were > 0.9, and RMSEA was < 0.08, then the model fit was considered acceptable. CFA results were expressed as standardized regression coefficients.

Test-retest reliability was analyzed with the two-way mixed, single score ICC (A,1) [30]; we expected an ICC> 0.76, which is considered adequate for measurement variations in the same patients [31]. Internal consistency was assessed with Cronbach's α for the total HL scale and for the three sub-scales. Correlation coefficients were calculated for the three sub-scales and the total scale. Concurrent validity for the Cast-Span-HFS-HLS and the HLS-EU-Q16 was analysed using Pearson's correlation coefficient, and discriminant validity was analysed in terms of scores for the Cast-Span-HFS-HLS and EHFScBS for 2 groups classified according to self-care. Finally, mean differences in Cast-Span-HFS-HLS scores across the three sub-scales were analysed by subgroup characteristics, including age, sex, educational level, NYHA functional class, drug prescriptions, and AMG, using analysis of variance (ANOVA).

For all statistical tests, significance was set to p < 0.05 for a 95 % CI. Analyses were performed using CRAN R software v4.2.2 [32] using the lavaan [33], semplot [34] and psych cita packages [35].

3. Results

3.1. Forward and back translation content and face validity study

The translators made some changes to adapt to the medical environment in Spain. Thus, in items 1, 2, and 3, '*…prescriptions and pamphlets from hospitals and pharmacies…*' was changed to '*… information received (prescription, leaflets) in the health centre, hospital, or pharmacies…*'; in item 4, '*…handbooks and documents from hospitals and pharmacies…*' was replaced with '*…notebooks, self-monitoring sheets, and documents received from the health centre, hospital, or pharmacies…*'; and in item 5 '*medical professionals*' was replaced by '*family doctors and nurses*'.

The experts made some changes to the wording of items. In item 5, '*I have been able to have satisfactory conversations regarding heart failure with…*' was changed to '*I have been able to talk about heart failure with…*'; in item 7, '*…edema…*' was changed to '*…swelling in my legs…*'; and in items 9 and 12, '*I have gathered knowledge….*' and '*I have gathered information…*' were changed to '*I have looked for information…*' and '*I have sought more information…*'. Consensus between the experts was > 80 % after 3 rounds.

Since the face validity study revealed that participants had difficulty grasping the meaning of certain items due to the way they were expressed, certain modifications were made. Regarding responses, rather than *'not applicable', 'rarely applicable', 'sometimes applicable'*, and *'strongly applicable'* as used in the original scale, responses were changed as follows: to *'very difficult', 'difficult', 'easy',* and *'very easy'* for items 1–4; *'never', 'sometimes', 'almost always',* and *'always'* for items 5–8; and *'totally disagree', 'disagree', 'agree',* and *'totally agree'* for items 9–12. As for the wording, this was changed in items 1–4 to an open-ended format consonant with the responses; to exemplify, for item 4, the statement '*It is difficult to write in handbooks and documents from hospitals and pharmacies*' was changed to '*Writing in notebooks, self-monitoring sheets, and documents received from the health centre, hospital, or pharmacies is ….*'. Finally, for items 9–12, participants suggested clarifying comments in the instructions.

Table 1
Patient sociodemographic and clinical characteristics.

Characteristics	n (%) n = 195
Age, mean (SD) years	78.29 (9.73)
Age quartiles	
< 73.5	49 (25.13 %)
> 73.5	49 (25.13 %)
> 80	49 (25.13 %)
> 85.5	48 (24.62 %)
Sex, female	102 (52.31 %)
Education	
None/primary	38 (19.49 %)
Lower secondary	62 (31.79 %)
Upper secondary/vocational	66 (33.85 %)
University	29 (14.87 %)
Occupational status	
Employed	13 (6.67 %)
Retired	177 (90.77 %)
Disability	5 (2.56 %)
Marital status	
Widowed	57 (29.23 %)
Married	106 (54.36 %)
Divorced	18 (9.23 %)
Single	14 (7.18 %)
Visual acuity	9 (4.62 %)
Impaired (with/without glasses)	
Hearing acuity	
Hearing aid use	19 (9.74 %)
Impaired (with/without hearing aids)	11 (5.64 %)
New York Heart Association (NYHA) functional class	
NYHA I	57 (29.23 %)
NYHA II	96 (49.23 %)
NYHA III	42 (21.54 %)
Polypharmacy	171 (87.69 %)
≥ 5 drugs	
Adjusted morbidity group (AMG)	
1	11 (5.64 %)
2	10 (5.13 %)
3	67 (34.36 %)
4	107 (54.87 %)
Hospitalizations previous year	
No	122 (62.56 %)
1–2	62 (31.79 %)
> 2	11 (5.64 %)
Tobacco use	
Non-smoker	121 (62.05 %)
Ex-smoker	58 (29.74 %)
Smoker	16 (8.21 %)
Alcohol consumption	
Abstemious	120 (61.54 %)
Moderate*	75 (38.46 %)
Barthel index	
Moderate dependence (65–90)	52 (6.67 %)
Independent (>90)	137 (70.26 %)

* Moderate: standard drink unit (SDU) 1 per day women, 2 per day men.

3.2. Psychometric criteria study

3.2.1. Patients characteristics

A total of 195 patients – mean age 78.29 (SD=9.23) years, 47.69 % women – completed the study. NYHA functional class was I (29.23 %) or II (49.23 %) and morbidity complexity was high, at AMG 3 (34.36 %) and AMG 4 (54.87 %). Around one third of patients had been hospitalized in the previous year, most (87.69 %) were on a prescription regimen of ≥ 5 drugs, most were independent in terms of activities of daily living (Barthel index 93.08, SD=11.47), and more than half were

Table 2
Cast-Span Heart Failure-Specific Health Literacy Scale items: means and factor loadings by dimensions.

Item & dimension	Estimate	SE	P-value	Standardized coefficient
Functional				
#1	1	Ref		0.57
#2	1.095	0.084	< 0.001	0.63
#3	1.091	0.08	< 0.001	0.62
#4	0.926	0.089	< 0.001	0.53
Communicative				
#5	1			0.65
#6	1.184	0.163	< 0.001	0.77
#7	0.264	0.12	0027	0.17
#8	0.634	0.149	< 0.001	0.41
Critical				
#9	1			0.73
#10	0.701	0.11	< 0.001	0.51
#11	0.955	0.11	< 0.001	0.70
#12	1.337	0.137	< 0.001	0.98

Fit indexes

χ2	df	CFI	GFI	TLI	RMSEA	95 % CI RMSEA
102.33	51	0.944	0.917	0.927	0.072	0.05–0.09

CFI: comparative fit index; GFI: goodness-of-fit index; Ref: reference category; RMSEA: root mean square error of approximation; TLI: Tucker-Lewis index.

Table 3
Cast-Span Heart Failure-Specific Health Literacy Scale: inter-item correlation and Cronbach's α values.

Dimension	Item	Mean	SD	Skewness	Discrimination	α if item deleted	Cronbach's α (95 % CI)
Functional	#1	3.02	0.72	−0.52	0.75	0.85	0.88 (0.88–0.91)
	#2	2.86	0.73	−0.25	0.77	0.84	
	#3	2.81	0.70	0.01	0.8	0.83	
	#4	2.92	0.75	−0.46	0.67	0.88	
Communicative	#5	2.85	0.99	−0.20	0.42	0.41	0.55 (0.55–0.65)
	#6	3.09	0.91	−0.59	0.49	0.36	
	#7	2.58	0.97	0.25	0.21	0.58	
	#8	2.74	1.18	−0.27	0.26	0.56	
Critical	#9	2.06	1.05	0.46	0.62	0.73	0.79 (0.79–0.83)
	#10	2.29	1.04	0.11	0.47	0.8	
	#11	2.58	1.02	−0.28	0.57	0.75	
	#12	2.34	1.07	0.02	0.74	0.66	
Total HL							0.80 (0.77–0.85)

living with partners (54.36 %). Patient characteristics are summarized in Table 1.

3.2.2. *Construct analysis*

CFA fit parameters, referring to the original scale with three dimensions, were adequate: chi-square ($\chi2$ =102.33, df=51; $p < 0.001$, GFI=0.917, CFI=0.944, TLI=0.927, and RMSEA=0.072. Estimates and standardized coefficients of items for their assigned dimensions were aligned with the original construct. The CFA testing of the three-dimension construct showed statistically significant standardized factor loadings ($p < 0.05$). However, item 7 had a lower standardized coefficient (0.18) and item 8 was close to 0.4. Table 3 summarizes results and indexes, and Fig. 2 graphically depicts the construct along with item estimates.

3.2.3. *Reliability and item discrimination*

The ICC for the test-retest study, completed by 31 patients, for the total scale was 0.96 (95 % CI: 0.93–0.98), and for the three subscales of functional, communication, and critical, were 0.93, 0.92, and 0.94, respectively. There was no significant variation from the baseline to the 15-day scores (Table A1, Online Appendix). Cronbach's α for all items was 0.80 (95 % CI: 0.77; 0.85) and 0.88, 0.55, and 0.79 for the three subscales, respectively. The total HL scale and the three sub-domains were highly correlated, with values > 0.7 (Table A2, Online Appendix). The mean inter-item correlation was 0.281, and item discrimination (corrected item-total correlation for each item) ranged between 0.12 and 0.59 (Table 3).

3.2.4. *Concurrent and discriminant validity*

A positive and statistically significant association was observed between Cast-Span-HFS-HLS scores and HLS-EU-Q16 scores ($r = 0.37$; 95 % CI: 0.24–0.49, $p < 0.001$), while the correlation between Cast-Span-HFS-HLS and EHFScBS scores ($r = -0.14$; 95 % CI: −0.28 to −0.004) showed that mean HL scores were higher for better self-care than for poorer self-care (33.24 vs 31.30; $p < 0.005$).

3.2.5. *Subgroup differences*

Overall, HL from the critical dimension scores were significantly lower in older patients (9.27 vs. 1.83; $P < 0.001$), female patients had lower scores in functional and critical HL dimensions ($P < 0.05$), and individuals with lower educational attainment had lower values in functional and communicative HL sub-scales ($P < 0.005$). No subgroup differences were observed for NYHA class, drug prescription, or AMG across the HL scale and sub-scales. All results are in Table 4.

4. Discussion and conclusion

4.1. *Discussion*

In this study, we translated and adapted the HFS-HLS for Castilian Spanish and evaluated its psychometric properties in patients with HF (NYHA functional class I-III) treated in primary care centres in Spain. Overall, the findings indicate that the Cast-Span-HFS-HLS is both valid and reliable except for the communicative subscale. To the best of our knowledge, this study is the first to develop a reliable tool to specifically assess HL in patients with HF in Spain.

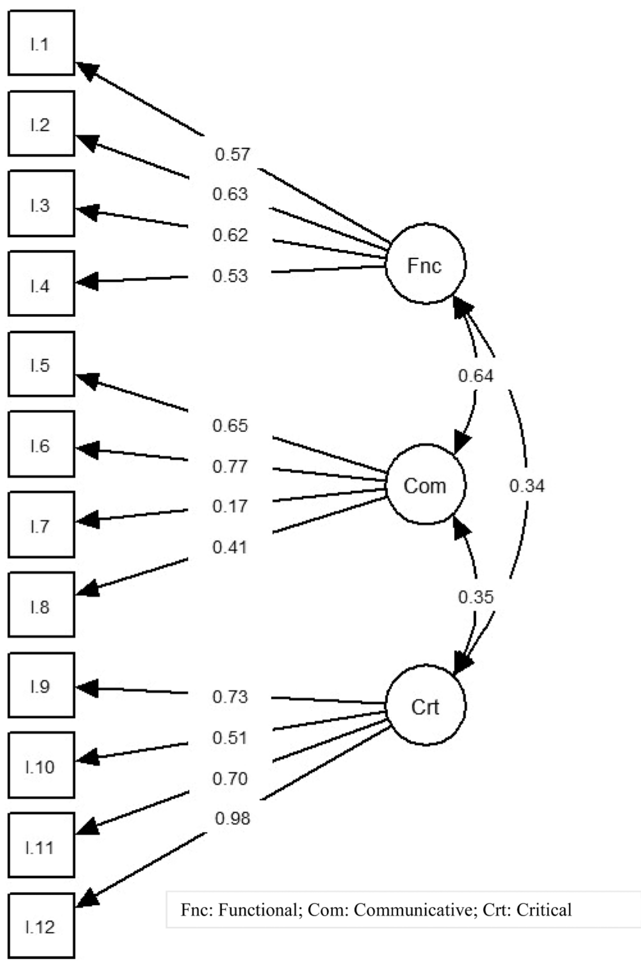

Fig. 2. Confirmatory factor analysis results (factor loadings).

The Cast-Span-HFS-HLS was developed using forward and back translation [26], as used in other studies to develop the HFS-HLS for other languages [23–25]. We made adjustments to ensure semantic equivalence and to adapt to the medical environment. A similar adaptation to the medical environment was reported for items 1, 2, and 3 of the Chinese version [23]. Face validity analysis of the Spanish version showed that participants did not fully understand items 1–4, a difficulty not reported in the other adaptation studies [23–25]. Consequently, to ensure that the original meaning was not lost, these items were minimally modified to be consonant with Likert-scaled response options that improve clarity, given that obtaining reliable responses in questionnaires depends on the respondent's ability to read and interpret both the item and the response scale [36].

The CFA results were consistent with those for the original HFS-HLS [22] and also for the Persian [24] and Korean [25] versions. In the Chinese version, three factors were extracted after a subscale switch of items 8 and 9 [23]. Items 7 and 8 had weaker loadings than in other language versions. The adaptation of the new Cast-HFS-HLS followed the same validation process as its original version, using classical test theory to examine the psychometric properties.

The Cast-HFS-HLS demonstrated good internal consistency ($\alpha = 0.80$), exceeding the original scale ($\alpha = 0.71$). The Communicative HL subscale showed relatively low reliability (α Cast-HFS-HLS = 0.55 vs. α HFS-HLS = 0.68). In contrast, the Functional and Critical HL subscale exhibited higher consistency (α Cast-HFS-HLS = 0.88 vs. α HFS-HLS = 0.73 and α Cast-HFS-HLS = 0.79 vs. α HFS-HLS = 0.69). These findings align with the original scale report [22], the communicative subscale tends to have a lower internal consistency than the rest of the subscales [22, 24, 25]. In our opinion, may be attributed to the heterogeneous content of the items within this dimension.

The concurrent validity test results, for which we used the HLS-EU-Q16 [15], showed a positive association between Cast-Span-HFS-HLS and HLS-EU-Q16 scores. This indicates that the scores from both scales are moderately correlated when administered concurrently. Those findings are similar to those of the Korean study, which reported a significant relationship and moderate correlation ($r = 0.34–0.36$; $p < 0.001$) between the Korean HFS-HLS and the BHLSQ-3 [25]. In Matsuoka's study [22], the HFS-HLS could not be compared (in 2016)

Table 4
Cast-Span Heart Failure-Specific Health Literacy Scale. Differences across groups for the total HL and the three sub-scales. Ref: reference category. SD: Standard Deviation. SE: Standard Error. P-values were calculated with logistic or linear regression models.

	Total HL		Functional		Communicative		Critical	
Group	**Mean (SD)**	**P-value**	**Mean (SD)**	**P-value**	**Mean (SD)**	**P-value**	**Mean (SD)**	**P-value**
Age quartiles								
<73.5	32.1 (6.15)	ref	11.6 (2.47)	ref	11.26 (2.65)	ref	9.27 (3.1)	ref
≥ 73.5	33.5 (6.53)	0.503	11.96 (2.34)	0.839	11.59 (2.58)	0.761	9.98 (3.46)	0.366
80	31.2 (6.76)	0.013	11.55 (2.72)	0.309	10.98 (2.66)	0.149	8.71 (3.43)	0.004
≥ 85.5	29.4 (5.63)	< 0.001	10.83 (2.46)	0.016	10.71 (2.68)	0.053	7.83 (2.98)	< 0.001
Sex								
Female	32.1 (6.33)	ref	11.59 (2.46)	ref	11.255 (2.68)	ref	9.25 (3.24)	ref
Male	33.3 (6.54)	0.011	12.09 (2.32)	0.005	11.38 (2.56)	0.509	9.78 (3.27)	0.023
Education level								
None/primary	32.3 (6.29)	ref	11.7 (2.4)	ref	11.37 (2.6)	ref	9.26 (3.26)	ref
Lower secondary	31.6 (6.03)	0.132	11.23 (2.05)	0.127	11.19 (2.8)	0.375	9.21 (3.45)	0.294
Upper secondary/vocational	32.6 (6.06)	0.022	11.92 (2.43)	0.003	11.12 (2.46)	0.445	9.58 (3.11)	0.108
University	35.4 (6)	< 0.001	13.17 (2.28)	< 0.001	12.45 (2.25)	0.008	9.76 (3.15)	0.121
New York Heart Association (NYHA) functional class								
NYHA I	32.1 (6.52)	ref	11.58 (2.52)	ref	11.25 (2.72)	ref	9.26 (3.28)	ref
NYHA II	32.2 (6.19)	0.936	11.62 (2.43)	0.665	11.35 (2.53)	0.477	9.25 (3.32)	0.685
NYHA III	31.7 (6.46)	0.648	11.29 (2.4)	0.308	11.36 (2.8)	0.555	9.07 (3.31)	0.548
Polypharmacy								
>5 drugs	32	ref	11.7 (5.54)	ref	10.99 (2.65)	ref	9.32 (3.35)	ref
< 5 drugs	31.8	0.801	11.83 (2.57)	0.635	10.62 (2.63)	0.213	9.38 (3.45)	0.876
Adjusted morbidity group (AMG)								
AMG 1	32.1	ref	11.66 (2.56)	ref	11.29 (2.7)	ref	9.16 (3.38)	ref
AMG 2	31.8 (4.26)	0.792	11.6 (2.32)	0.715	11.2 (1.99)	0.769	9 (3.37)	1
AMG 3	31.7	0.673	11.21 (2.59)	0.333	11.04 (2.77)	0.567	9.4 (3.38)	0.708
AMG 4	32.4 (6.26)	0.959	11.81 (2.43)	0.814	11.37 (2.59)	0.84	9.25 (3.22)	0.809

with the Test of Functional Health Literacy in Adults (TOFHLA) and the Rapid Estimate of Adult Literacy in Medicine (REALM), due to the absence of Japanese versions; instead, comparisons were made with scores for motivation, information sources, and HF knowledge, and similar approaches to comparison were adopted in the Chinese [23] and Persian [24] studies.

The significant correlations between the HLS-EU-Q16 and the EHFScBS with the Cast-Span-HFS-HLS indicate that both instruments assess health literacy and self-care. The small correlation coefficients may be attributed to the fact that the HLS-EU-Q16, a generic health literacy instrument and the only one available in Spanish, was designed for the general population. In contrast, our sample consisted entirely of older adults (mean age: 78 years) with generally low levels of educational attainment.

Discriminant validity test results indicated that the Cast-Span-HFS-HLS can effectively distinguish HL levels in patients. The Cast-Span-HFS-HLS successfully identified a low HL level as a risk factor for poorer self-care, as already reported in the literature [3,37]. A strength of our study is having conducted discriminant validity testing, omitted in previous adaptation studies [22–25]. We reported similar significant between-group differences to Matsuoka et al. [22]: mean overall HL score was significantly lower in older patients, female patients, and individuals with lower educational attainment. Those health determinants have consistently been directly associated with HL levels in several studies with HF patients [3,10].

4.2. Practice implications

Implementing the Cast-Span-HFS-HLS is anticipated to improve self-care practices among HF patients and provide critical insights into HL. Nurses are ideally positioned to systematically screen and document patients' HL levels. This easily administered test can help establish a comprehensive HL profile, fostering more effective communication and enhancing health information exchanges between patients and healthcare providers [4,38,39].

4.3. Limitations

The Cast-Span-HFS-HLS was assessed through self-reported responses, which may slightly overestimate health literacy (HL) levels, as patients with lower literacy might feel embarrassed and attempt to conceal their lack of knowledge. Despite this limitation, self-reports are a scientifically validated and widely used method for measuring complex constructs, such as HL.

4.4. Conclusions

Our findings for the Cast-Span-HFS-HLS, as adapted from the original HFS-HLS, indicate that it can usefully test HL levels in Spanish-speaking patients with HF. The Cast-Span-HFS-HLS incorporates the necessary semantic and cultural adaptations to ensure its suitability for the Spanish population. Its satisfactory psychometric properties indicate that it faithfully reflects the original HFS-HLS, as confirmed by reliability (internal and temporal consistency) and internal construct testing.

Ethics approval and consent to participate

The Jordi Gol Institute of Primary Care Research Ethics Committee approved the study (PI 4R19/214). All participants gave written and verbal informed consent to participate. The researchers complied with Declaration of Helsinki directives, and all local legislation concerning biomedical studies, data protection, and respect for human rights. Participant identities and data were pseudo-anonymized using codes, and all data were handled anonymously in our analyses.

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CRediT authorship contribution statement

Luis Gonzalez-de Paz: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Elisenda Garcia Puig:** Writing – review & editing, Validation, Data curation. **Caterina Checa:** Writing – review & editing, Data curation. **Elena Mañes López:** Writing – review & editing, Validation, Data curation. **Carolina Lapena-Estella:** Writing – review & editing, Validation, Data curation. **Campillo-Zaragoza Beatriz:** Writing – review & editing, Validation, Methodology, Data curation. **Hernández Martínez-Esparza Elvira:** Writing – original draft, Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation **Santesmases-Masana Rosalia:** Writing – original draft, Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Consent for publication

Not applicable.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2025.108732.

Data Availability

The datasets used and/or analysed in this study are available from the corresponding author on reasonable request.

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