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Cross-cultural adaptation and psychometric properties of the Argentine version of the shoulder pain and disability index (SPADI) in patients with shoulder disorders

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Background: Shoulder disorders are some of the leading causes of musculoskeletal conditions with a significant economic impact worldwide. The Shoulder Pain and Disability Index (SPADI) questionnaire has proved to be a valid and useful tool for the assessment of disability; however, reporting of properties in several languages has been inconsistent, and the quality of the studies available is low. Moreover, there is only one version in Spanish, designed in Spain, which does not consider the linguistic differences existing in Argentina. Therefore, the aim of the present study was to conduct the cross-cultural adaptation of the SPADI and assess its reliability, validity, responsiveness, and interpretability in subjects with shoulder disorders.

Materials and methods: The study was conducted following the COSMIN Guidelines (COnsensus-based Standards for the Selection of health Measurement INstruments). We included Argentine residents, older than 18 years of age, referred to physiotherapy for shoulder disorders.

Results: A total of 101 patients were evaluated. Reliability was acceptable with an intraclass correlation coefficient of 0.89. The standard error of measurement and minimal detectable change were 2.18 and 6.05, respectively. Construct validity was excellent, and responsiveness was high. Also, the minimal clinically important difference was 18.46 points, the substantial clinical benefit was 27.69 points, and the symptom acceptable level value was 21.35 points.

Conclusion: A cross-cultural adaptation of the Argentine version of the SPADI was conducted. This version proved to be valid, reliable, and responsive with interpretability values.

Musculoskeletal shoulder disorders are common in the general population with a global prevalence of 55.2% and affect 62 individuals every 1000 inhabitants a year.[22] This condition is one of the main complaints in physiotherapy units with an economic impact associated with the use of healthcare services and work absenteeism.[16,44]

Patient progress evaluation through self-reported outcome measures is part of a consistent recommendation from high-quality clinical practice guidelines for the management of shoulder conditions.[21] The Shoulder Pain and Disability Index (SPADI) questionnaire was designed to assess pain and disability in patients with shoulder disorders.[32] This tool is simple, fast, valid, reliable, and easy to understand.[20] Although there are several patient-reported outcome measures for assessing the shoulder, the SPADI is one of the most widely used and recommended instruments with the best psychometric properties.[42] Moreover, a systematic review

This study was approval by the Ethics Committee of Durand Hospital, Buenos Aires City Argentina (record number: 8316). All included participants were signed an informed consent to participate in the study.

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conducted by Struyf et al reports that baseline higher scores on the SPADI was a prognostic factor for chronification of nontraumatic shoulder pain.[35]

This tool has been both translated into several languages and adapted to different cultures and populations; however, more than half of these versions do not followed the latest COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines, with an incomplete and inconsistent report of all the different measurement properties included in the scale.[20] Currently, there is only one version available in Spanish, which was designed for the Spanish population.[24]

Even though in Spain and Argentina, as well as in other Latin American countries, Spanish is the main language spoken, linguistic differences may affect interpretation of the questionnaire items.[3] For example, the translation of the term English "jumper" in Spain is "jersey", while in Argentina it is "abrigo".

An adequate validation and cross-cultural adaptation of the SPADI in Argentina will lead to a better care of patients with shoulder disorders and foster research in the region as well as the drafting of a complete report of psychometric properties of the tool according to the COSMIN guidelines.

Therefore, the aims of this study are to conduct the cross-cultural adaptation of the SPADI to the Spanish spoken in Argentina (SPADI-Ar) and to assess the validity, reliability, responsiveness, and interpretability in a sample of subjects with shoulder disorders.

Materials and methods

Design

A prospective, observational, longitudinal design was conducted according to the COSMIN guidelines.[27] The protocol was approved by the ethics and research committee of the institution where the investigation was carried out. Before the initiation of the study, the authorization of the main author of the questionnaire was obtained.

Population

Argentine residents over the age of 18 referred to physiotherapy for shoulder disorders by primary care musculoskeletal physicians were consecutively included. Patients with communication and/or understanding difficulties, patients with bilateral shoulder pain, shoulder pain reproduced by either active or passive movements of the cervical spine, patients with a personal history of rheumatic, systemic, or neurological conditions, patients with musculoskeletal conditions in other body locations, and those who refused to sign the informed consent were excluded from the study.[29] Subjects who did not attend follow-up visits were withdrawn from the study.

Procedure

Phase 1: cross-cultural adaptation

This process was conducted following the recommendations of Beaton et al.[3] Based on the valid and reliable version for the Spanish population, a committee of experts, including a sociologist and two physiotherapists with at least 14 years' experience, reviewed the translated version and made modifications as required to develop the SPADI-Ar, evaluating the conceptual, semantic, and content equivalence to then be used with the Argentine population.[3,24] (Supplementary Figure S1) Then, a pilot test was conducted with the first 10 patients recruited for the study, and difficulties related to the questionnaire were identified.[33] Also, the completion and scoring time of the SPADI-Ar were recorded for feasibility.

Phase 2: evaluation of the psychometric properties

Data were collected by physiotherapists with between 1 and 14 years' of experience in the clinical care of this population. All the evaluators attended a 90-minute theoretical practical training session on the use and scoring of the questionnaires used in this study. Measurements were obtained at three different time points. During the first measurement time (T1), demographic variables and the questionnaire scores of the SPADI-Ar, American Shoulder and Elbow Surgeons questionnaire (ASES-p), disabilities of arm, shoulder, and hand (DASH), and numerical pain rating scale (NPRS) were recorded.[13,30,39]

During the second measurement time (T2), SPADI-Ar and the global rating of change (GROC) within 24 and 72 hours of T1 were obtained; during this period, the patients did not receive treatment in order to favor the clinical stability and avoid recall bias.[18]

The third measurement time (T3) was at discharge or at one month of the treatment, whatever first. In this period, the subjects completed the same questionnaires as in T1 again apart from the GROC and answered one question to know whether they considered their clinical status as acceptable at that point to assess the patient acceptable symptomatic state (PASS).[31]

Patients' diagnosis was based on the staged approach for rehabilitation classification of shoulder disorders approach, and the classifications were based on 4 groups (rotator cuff-related shoulder pain, frozen shoulder, glenohumeral instability, and others).[23] The staged approach for rehabilitation classification of shoulder disorders considered a 3-level diagnostic paradigm with a screening process of red and yellow flags, pathoanatomic labeling and a rehabilitation classification.[23] All the participants received treatment as from T2, in a nonstructured manner, which included 30-60-minute rehabilitation sessions, 1-3 times a week, and also therapeutic exercises guided by the healthcare professional who carried out the initial assessment according to the impairment detected and patient's irritability level.[23]

The data obtained were included in a follow-up template and later in a Microsoft Excel (Microsoft Corp., Redmond, WA, USA) template for analysis.

Assessment tools

Shoulder pain and disability index, Argentine version

This is a self-administered questionnaire designed to evaluate pain and disability associated with musculoskeletal conditions of the shoulder. This tool includes 13 items, 5 related to pain and 8 related to disability evaluated with a numerical scale.[5,32] Each domain, as well as the total, is transformed into a score from 0 to 100, with the highest scores indicating more disability.

American Shoulder and Elbow Surgeons questionnaire, patient self-report section

This is a tool evaluating shoulder function and includes two subscales. Pain is assessed by asking the patient to score pain at rest using a 10 cm visual analog scale. Moreover, function is measured with a score indicating the level of difficulty to perform 10 activities with the affected shoulder through a 4-point Likert-like scale.[30]

Disabilities of arm, shoulder, and hand

It is a self-administered questionnaire useful to measure disability as perceived by the patient to perform different activities of daily living and symptoms, such as pain, stiffness, and loss of strength in the upper limb. It includes 30 items with a score ranging from 0 to 100, with the highest scores indicating more disability.[13]

Numerical pain rating scale

It includes 11 points for the patient to score pain as experienced in the last week while moving the shoulder. The score ranges from 0 ("no pain") to 100 ("worst imaginable pain").[39]

Global rating of change

Global rating of change was assessed verbally in T3, asking the patient the following question: "About your shoulder pain, how do you feel now as compared to the first visit?" Five optional answers were offered to the patient as follows: "worse," "a bit worse," "the same," "a bit better," and "better."[18]

Variables

Reliability

Reliability test-retest. This indicates whether the questionnaire has the same result considering different measurements when the conditions of the test have not changed.[28] The SPADI-Ar scores were compared using measurements obtained 24-to-72 hours apart in clinically stable subjects, that is, with the score "the same" in the GROC scale in the T2 evaluation.[18]

Internal consistency. This is a correlation indicator among the different items included in the questionnaire. The items measuring the same dimension are assessed for homogeneity, which means they assess the construct intended for measurement.[28]

Standard error of measurement (SEM). This is the difference obtained in the score not attributable to a real change in the construct under evaluation.[28]

Validity

Construct validity. This is the correlation level a specific evaluation tool has with other measurements, with these measurements being consistent with the theoretical constructs to be measured.[28] Therefore, the correlation between the SPADI-Ar, NPRS, DASH, and ASES-p was studied. The hypothesis stated a moderate-to-strong positive correlation between the SPADI-Ar and DASH and a moderate-to-strong negative correlation between SPADI-Ar and ASES-p.[6,43] Moreover, a moderate positive correlation between the SPADI-Ar and the NPRS was hypothesized.[1]

Structural validity. This property is part of the construct validity and is about how the scoring of a particular instrument accurately reflects all the dimensions of the constructs to be measured. The confirmatory factor analysis was used to study whether the factorial structure of the Argentine version of the questionnaire matched that reported by the author in the original study.[28]

Responsiveness

This is the capacity of an instrument to detect changes in time.[26] As there is no gold standard for disability assessment, responsiveness was studied through the longitudinal construct validity analyzing the correlation between changes obtained in the SPADI-Ar between T1 and T3, with the scores obtained in the other questionnaires administered.[26] A hypothesis was made for a moderate-to-strong positive correlation between SPADI-Ar and DASH and a moderate-to-strong negative correlation between SPADI-Ar and ASES-p.[1,26,34,43] Also, a positive moderate correlation between SPADI-Ar and NPRS was hypothesized.[19]

Interpretability

Ceiling and floor effect. The ceilling and floor effect describes the scoring distribution in a scale. This effect was considered when 15% of the participants or more had a maximum or minimum score in the subscales or in the total score of the questionnaire in T1.[36]

Minimal detectable change (MDC). It is the smallest change detected by the tool and considered as a real change beyond the SEM.[36]

Minimal clinically important difference (MCID). It is the smallest difference observed in the domain of interest patients consider either beneficial or deleterious.[36] The estimation of this difference was based on the SPADI-Ar score change of patients who answered "a bit better" or "better" in the GROC.

Substantial clinical benefit (SCB). This derives from the SPADI-Ar score change of patients who answered "better" in the GROC and is used to identify patients above the improvement threshold of the MCID.[15]

Patient acceptable symptomatic state (PASS). It is a landmark for patient well-being.[31] It is useful to know the SPADI-Ar score reflecting an acceptable patient status, for which the following question was asked in T3: "considering your functional level and shoulder pain, and how this affects your activities of daily living, do you consider your present status is acceptable if it persisted all your life?", with a yes or no answer.

Statistical analysis

A sample including 100 subjects was required, considering the quality criteria suggested in the literature.[37]

The Shapiro–Wilk test and a bar graph for graphic assessment were used to evaluate the normal aspect of the sample. The continuous numerical variables with a normal distribution were reported as mean and standard deviation (SD) otherwise as median and interquartile range (IQR). The categorical variables were expressed as the presentation number and percentage.

The intraclass correlation coefficient (ICC) was used for reliability together with the corresponding 95% confidence intervals (CI 95%), with an acceptable value of $\geq$0.70.[36] A 2-way random effect model was used, (ICC 2.1).[36]

Internal consistency was assessed through the Cronbach's alpha coefficient considering adequate values between 0.70 and 0.95.[36] The SEM was estimated with the following formula: $SD \times \sqrt{(1 - CI)}$.[36]

For the assessment of structural validity, the confirmatory factor analysis models were used, and for the comparative adjustment index, the Tucker–Lewis index and the roof mean squared error of approximation and the standardized root mean square residual were used as indicators.[10]

The Spearman's rho coefficient was used for the analysis of the construct validity and longitudinal validity. Values were considered very weak (0-0.19), weak, 0.20-0.39), moderate (0.40-0.69), strong (0.70-0.89), and very strong (0.90-1) for the construct validity.[14] Responsiveness was considered high, moderate, or poor if less than 25%, between 25 and 50%, and more than 50% of the hypothesis was rejected, respectively.[37]

The MDC was estimated with the SEM and the following formula: $MDC = 1.96 \times \sqrt{2}$ x SEM. Also, a Bland–Altmann graph was made including the corresponding limits of agreement at 95%, representing the differences between the SPADI-Ar score in T1 and T2, as compared to the mean of both measurements.

Different methods have been described in the literature for the analysis of interpretability. In this study, the anchor-based method was used, with external criteria to set a minimum change threshold correlated with a variation in the tool to be considered clinically important.[38] A receiver operating characteristic curve was designed to establish the optimal cut off point through the Youden index, for

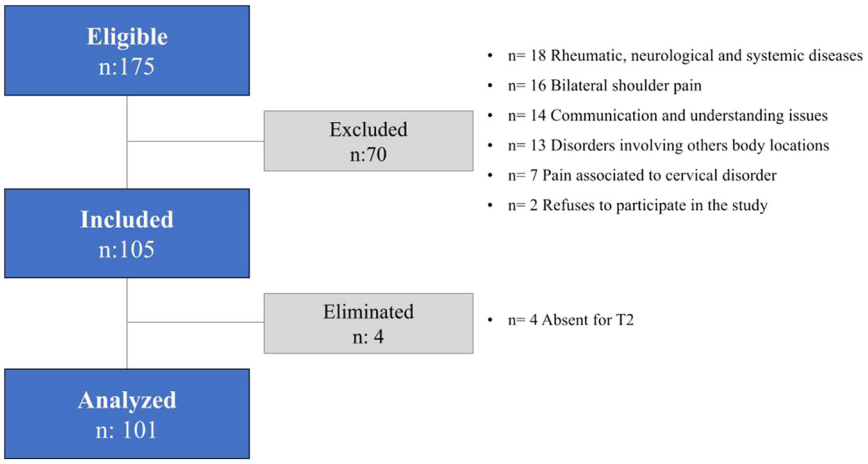

Figure 1 Flowchart. *T2*, second measurement time.

those patients who reported to be "a bit better" and "better" in the GROC for the MCID and "better" for the SCB.

PASS value estimation was based on the same model, comparing the SPADI-Ar score with the results of the question above. Also, the area under the curve (AUC) was estimated to assess the discriminatory capacity, considering a value of 0.5 without discriminatory capacity, between 0.5 and 0.7 as poor, between 0.7 and 0.8 as acceptable, and over 0.8 as excellent, as well as sensitivity and specificity.[17]

For all the analyses the R software version 4.2.1.20 was used. A $P \leq .05$ was considered statistically significant.

Results

The study was conducted between January 2023 and January 2024. The flowchart appears in Figure 1. The clinical and demographic characteristics of the patients at the time of inclusion appear in Table I.

None of the participants had any difficulty when interpreting the questionnaire. The time needed to complete and score the questionnaire was 156 (SD 76) seconds and 48.1 (SD 13.4) seconds, respectively.

Reliability

Test-retest reliability

SPADI-Ar reliability was acceptable, with an ICC of 0.89 (CI 95% 0.84; 0.93), 0.77 (CI 95% 0.67; 0.85) for the pain domain, and 0.86 (CI 95% 0.80; 0.91) for the disability domain.

Internal consistency

The internal consistency of the SPADI-Ar was acceptable, with a Cronbach's alpha of 0.94 (CI 95% 0.92; 0.95), and 0.87 (CI 95% 0.82; 0.90) for the pain subscale and 0.93 for disability (CI 95% 0.90; 0.95). The mean value for the item-item correlation for the pain domain was 0.59 and 0.69 for disability, respectively. The remaining correlation values are reported in Table II.

Validity

Construct validity

Construct validity showed a strong positive correlation between SPADI-Ar and DASH (Rho = 0.75), moderately positive between SPADI-Ar and NPRS (Rho = 0.56), and moderately negative between SPADI-Ar and ASES-p. (Rho = −0.49).

Table I
Clinical and demographic characteristics.

Age, years, mean (SD)	51.7 (13.6)
Female gender, n (%)	60 (59.4)
Occupation, n (%)	
Manual - demanding	45 (44.6)
Manual - light	16 (15.8)
Graduate professional	16 (15.8)
Retired	13 (12.9)
Unemployed	11 (10.9)
Level of schooling, n (%)	
Tertiary or university	37 (36.6)
High school	37 (36.6)
Primary school	20 (19.8)
Primary school, incomplete	7 (6.9)
Diagnosis, n (%)	
Rotator cuff-related shoulder pain	58 (57.4)
Frozen shoulder	17 (16.8)
Glenohumeral Instability	4 (4)
Others	22 (21.8)
Duration of pain, months, mean [Min, Max]	3 [0; 60]
Baseline variables	
SPADI-Ar median [IQR]	66 [50; 82]
SPADI-Ar pain median [IQR]	74 [54; 86]
SPADI-Ar disability median [IQR]	62.5 [42.5; 77.5]
NPRS median [IQR]	7 [5; 9]
ASES-p mean (SD)	50.1 (21.6)
ASES-p VAS median [IQR]	4.5 [1; 1.7]
DASH mean (SD)	46 (19.8)

DASH, disabilities of arm, shoulder, and hand; *NPRS*, numerical pain rating scale; *SPADI-Ar*, shoulder pain and disability index, Argentine version; *ASES-p*, American Shoulder and Elbow Surgeons questionnaire, patient self-report section; *VAS*, visual analog scale.

Structural validity

Considering the results of the confirmatory factor analysis applied in the two subscales of the questionnaire, pain and disability, acceptable values for all the indicators were found and can be seen in Table III. Figure 2 shows the two-factor adjusted model considering pain and disability that exhibited a good adjustment (comparative adjustment index = 0.93; Tucker–Lewis index = 0.91; roof mean squared error of approximation = 0.08; and standardized root mean square residual = 0.06).

Responsiveness

Responsiveness was high. Table IV includes the correlations between changes in SPADI-Ar and DASH, NPRS, and ASES-p.

Table II
Item-item correlation for the SPADI-Ar questions.

Question	Pain					Disability								Total
	1	2	3	4	5	1	2	3	4	5	6	7	8	
Pain														
1	1.00	0.58	0.56	0.39	0.47	0.42	0.40	0.45	0.31	0.42	0.49	0.47	0.2	0.4
2		1.00	0.61	0.47	0.61	0.50	0.48	0.49	0.33	0.44	0.49	0.59	0.40	0.61
3			1.00	0.72	0.66	0.59	0.48	0.62	0.44	0.49	0.65	0.57	0.52	0.74
4				1.00	0.58	0.65	0.43	0.53	0.53	0.52	0.61	0.48	0.62	0.72
5					1.00	0.41	0.36	0.47	0.41	0.46	0.50	0.48	0.42	0.64
Disability														
1						1.00	0.78	0.78	0.57	0.64	0.71	0.60	0.70	0.80
2							1.00	0.75	0.44	0.50	0.62	0.56	0.67	0.66
3								1.00	0.50	0.63	0.68	0.62	0.62	0.74
4									1.00	0.75	0.53	0.47	0.52	0.68
5										1.00	0.53	0.58	0.56	0.76
6											1.00	0.55	0.63	0.75
7												1.00	0.55	0.70
8													1.00	0.73
Total														1.00

SPADI-Ar, shoulder pain and disability index, Argentine version.

Table III
Construct validity with confirmatory factor analysis and Varimax rotation.

	Factor 1 loadings	Factor 2 loadings
Factor 1		
Pain when pushing something with the affected arm?	0.21	0.76
Pain when touching the back of your neck?	0.45	0.63
Difficulty when washing your back?	0.82	0.22
Difficulty when carrying a heavy object (4.5 kg)?	0.53	0.49
Difficulty when placing an object on a high shelf?	0.63	0.49
Difficulty when putting on your trousers?	0.59	0.41
Difficulty when washing your hair?	0.85	0.33
Factor 2		
Pain when reaching out for something on a high shelf?	0.38	0.77
Worst pain you've ever felt?	0.28	0.57
Pain when you lie on your affected side?	0.33	0.64
Difficulty buttoning up your shirt?	0.52	0.37
Difficulty when picking something from your back pocket?	0.69	0.34
Difficulty when putting on a T-shirt or coat?	0.76	0.39

Interpretability

Fifty-two (52) of the 101 patients (51.5%) reported feeling "better" and 41 (40.6%) "a bit better" in the GROC in T3. Seven patients (6.9%) and 1 (0.9%) selected the "same" and "worse" options, respectively, in this evaluation.

Ceiling and floor effect

No ceiling and floor effect were seen. Only one patient of the sample had a maximum score in T1, and none of the patients obtained a minimum score.

Standard error of measurement and minimal detectable change

The SEM was 2.18 points, whereas the MDC was 6.05 points. Figure 3 shows the Bland–Altman graph with the corresponding limits of agreement at 95%.

Minimal clinically important difference and substantial clinical benefit

The MCID was 18.46 points and the AUC was 0.75 (CI 95% 0.55; 0.96), with sensitivity and specificity values of 0.67 and 0.75, respectively. SCB was 27.69 points with an AUC of 0.86 (CI 95% 0.79; 0.93) and a sensitivity of 0.80 and specificity of 0.76. Figure 4 shows the AUC of MCID and SCB.

Patient distribution and change in the SPADI-Ar classified according to the anchor method and MCID appear in Figure 5.

Patient acceptable symptomatic state

The SPADI-Ar score reflecting the PASS was 21.35 with an AUC of 0.66 Figure 6.

Discussion

The cross-cultural adaptation of the SPADI-Ar was performed successfully. This version turned out to be feasible, valid, and reliable for the assessment of disability in patients with musculoskeletal disorders of the shoulder. These findings were associated with an acceptable internal consistency and high responsiveness. Also, the tool proved to be interpretable with an acceptable discriminatory capacity for MCID, excellent for SCB, and poor for PASS. This was conducted according to the COSMIN guidelines, completing the measurement properties of the questionnaire.[20,27]

In this study, an acceptable test-retest reliability was observed with the results matching the validations previously conducted in other countries.[1,2,4,7,8,41] Similarly, internal consistency and the item-item correlation in the subdomains were acceptable and adequate, respectively.[1,2,32]

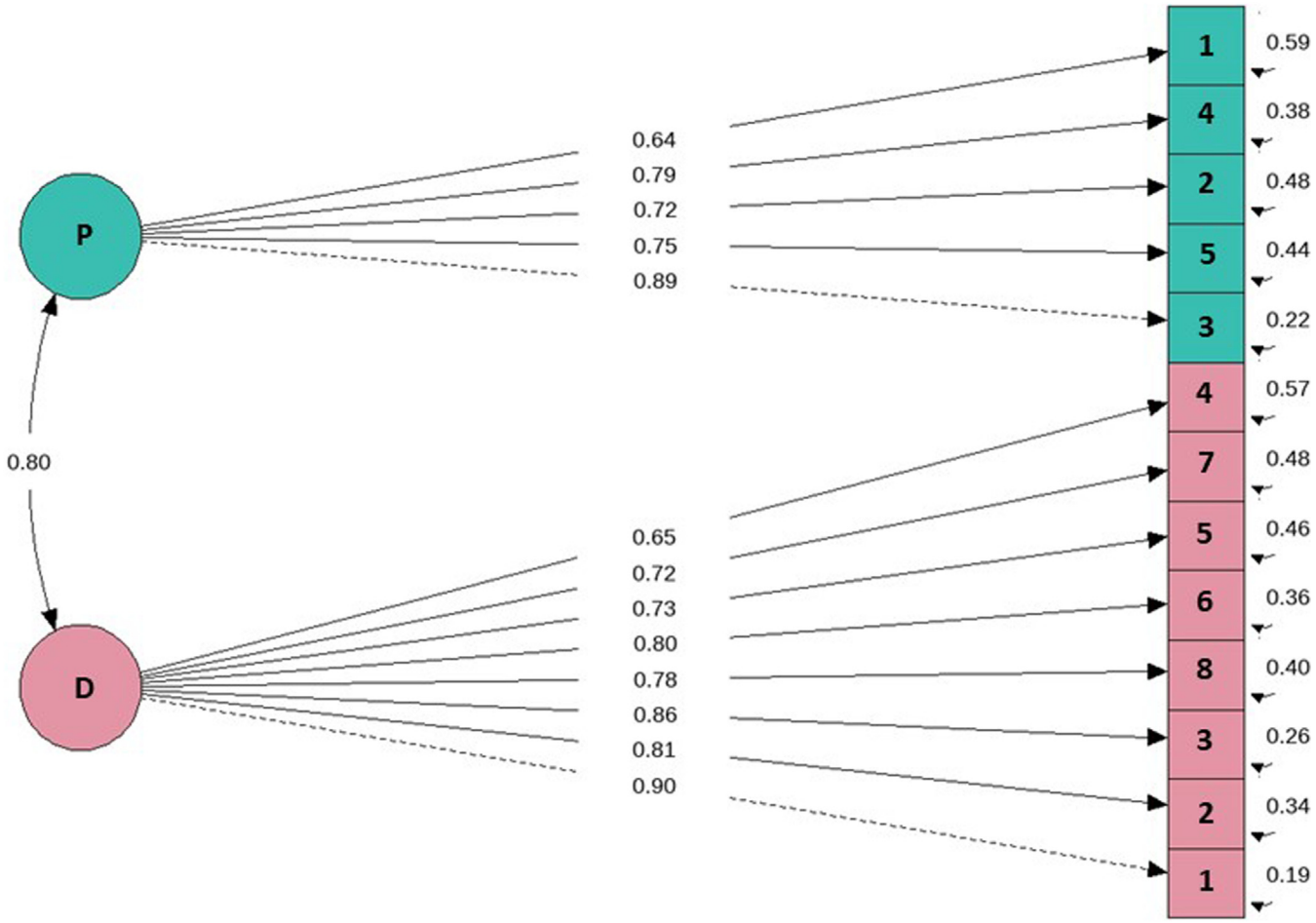

Figure 2 Factor analysis with two-factor adjusted model; pain and disability. The green shading shows components of the pain domain, while the pink shading denotes components related to the disability domain of the SPADI-Ar with the number of every question in each square. The fit indices associated with the confirmatory factor analysis model indicated satisfactory structural validity. *D*, disability domain; *P*, pain domain; *SPADI-Ar*, shoulder pain and disability index, Argentine version.

Table IV
Correlation between the Δ score between T1 and T3.

	ΔSPADI-Ar	ΔDASH	ΔNPRS	ΔASES-p
ΔSPADI-Ar	1	0.60	0.52	−0.34
ΔDASH		1	0.31	−0.45
ΔNPRS			1	−0.30
ΔASES-p				1

DASH, disabilities of arm, shoulder, and hand; *NPRS*, numerical pain rating scale; *SPADI-Ar*, shoulder pain and disability index, Argentine version; *ASES-p*, American Shoulder and Elbow Surgeons questionnaire, patient self-report section.

In a systematic review, including the measurement properties of the different SPADI versions, a small percentage of studies reported the construct validity, with methodological defects as the initial hypotheses were not confirmed.[20] In our study, we were able to confirm 100% of the hypotheses initially set.

A strong correlation between SPADI-Ar and DASH was seen, although one of the questionnaires exhibits a specific approach for the shoulder, whereas the other one assesses the whole upper limb. Also, the correlation between SPADI-Ar and NPRS was moderate. This is to be expected for in some shoulder conditions pain is not present, however, other symptoms, such as stiffness or instability, are.[23] Moreover, the values obtained are similar to those previously reported by other authors in spite of using different tools for pain assessment.[1,24] Finally, the correlation between SPADI-Ar and ASES-p was moderate, with similar results to those reported by Vascellari et al.[43] This could be explained by the differences between both questionnaires, as the inclusion of pain during active movement in the SPADI-Ar and the questions 9 and 10 of the ASES-p that depends on the patient's activity level. Also, it is important to take into consideration that, besides both tools being similar, the constructs of them are different.

The findings obtained after the analysis for longitudinal validity support confirmed 100% of the initial hypotheses, which results in a high responsiveness. This variable has already been reported in different ways in the literature; however, the approach recommended in our study has been used as well as that used by De Graaf et al with similar results.[20,26,40]

The SEM in SPADI-Ar was 2.18 points, with an MDC of 6 points. These results are similar to those obtained by Sudarshan et al, which were 2.1 and 5.7, respectively, that are the lowest values reported in the literature.[19,34,42,45]

The MCID reported in our study was similar to the validations conducted in the Netherlands and Norway and higher than that reported in the Nepalese version.[12,19,42] Variability may be influenced by several factors, such as the expected perspective of change, the baseline levels of the sample, and the method used for estimation.[11,38] The anchor-based model was used in this study, as recommended over the distribution-based method, for it uses external criteria to define a minimum threshold of change in the patient correlated with a tool variation, which might be considered clinically important.[11]

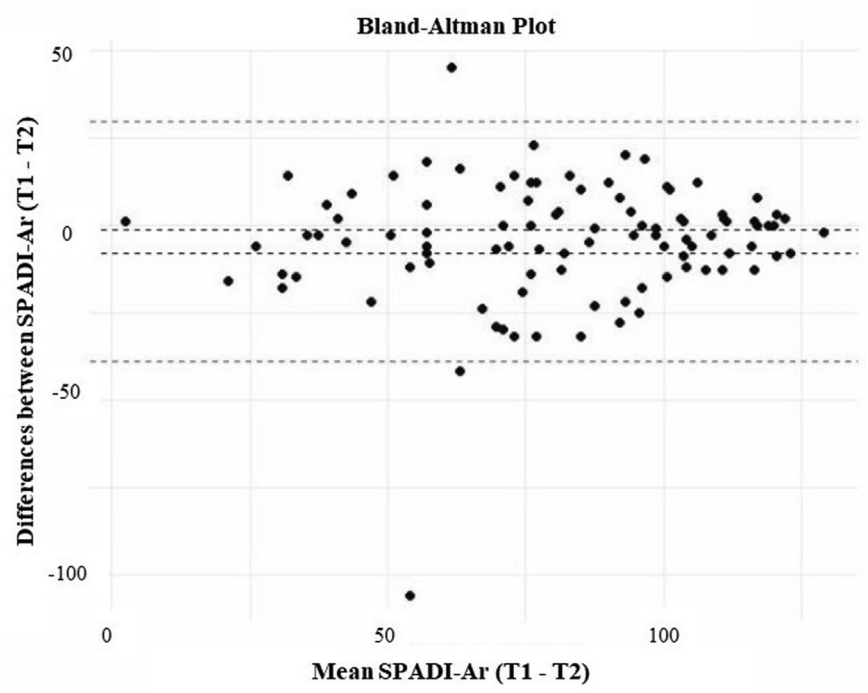

Figure 3 Bland–Altman Plot. *SPADI-Ar*, shoulder pain and disability index, Argentine version; *T1*, first measurement time; *T2*, second measurement time.

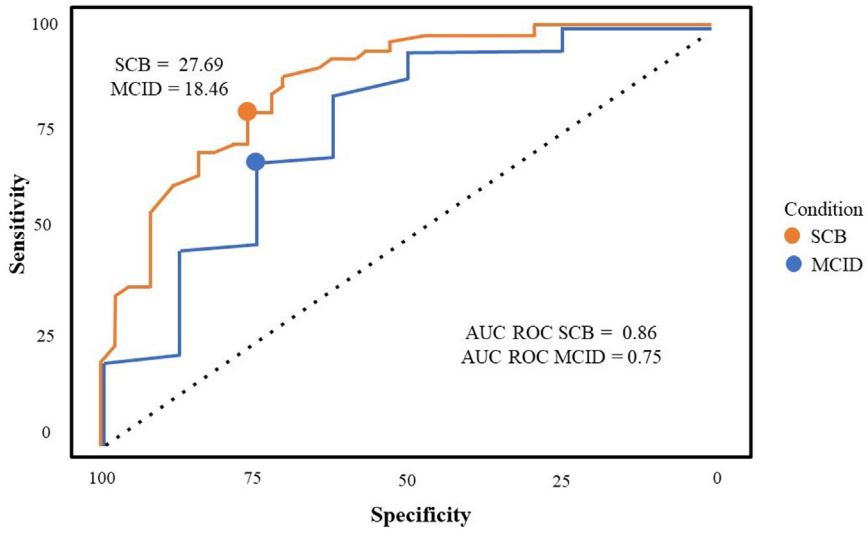

Figure 4 ROC curve of SCB and MCID. *AUC*, area under the curve; *ROC*, receiver operating characteristic; *MCID*, Minimal clinically important difference; *SCB*, substantial clinical benefit.

Furthermore, the verbal GROC scale was used for the assessment, whereas the Nepalese version used the numerical GROC scale.[19] The MCID score was higher than the MDC, indicating that it exceeds the SEM, meaning it is a valid measure for significant clinical changes in time.

The SPADI questionnaire has been translated into several languages, cross-culturally adapted, and validated for several populations. However, this is the first study reporting SCB and PASS.[20] This information might be useful for the design of rehabilitation programs and outcome follow-up of patients with shoulder disorders.

However, the PASS value obtained shows a poor discriminatory capacity. This may be due to the fact that this question was asked at 1 month or at treatment discharge. Considering that more than half of our patients complained of pain associated with the rotator cuff and roughly 25% of our patients presented frozen shoulder, the follow-up time might have been insufficient to achieve acceptable changes in symptomatology.[9,25] Therefore, it is advisable not to consider this value in isolation for treatment decision-making, but to consider it together with the SCB, as this value exhibited an excellent discriminatory capacity.

In terms of limitations, we consider that the number of evaluators involved in data collection might have had an impact on the results. However, all the participants had experience in the management of patients with shoulder disorders and also participated in training sessions before the initiation of the study for adequate data collection and scoring of the questionnaires.

As for the strengths, it is important to underline that this study was conducted according to the COSMIN guidelines. Moreover,

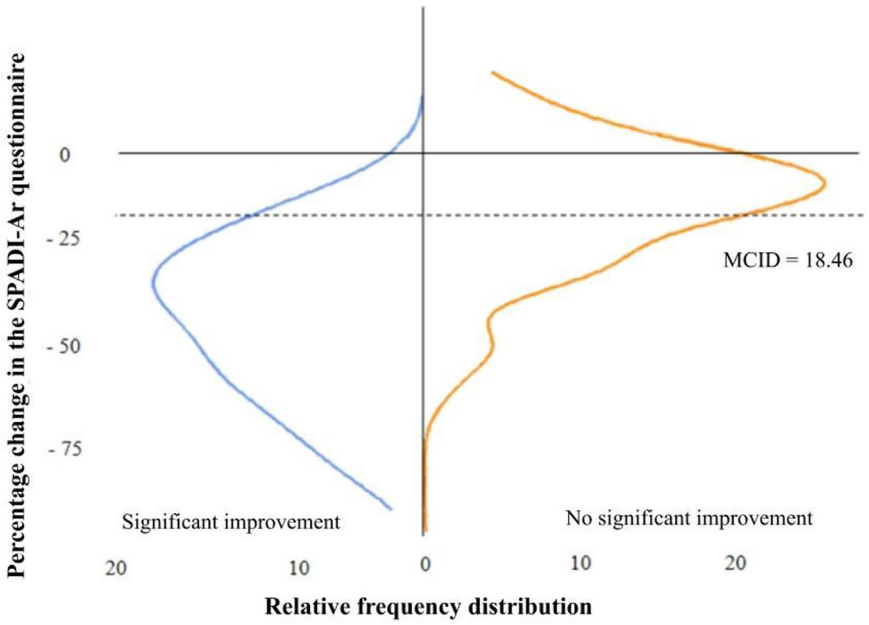

Figure 5 Score change distribution in SPADI-Ar. In the *Left Upper Quadrant*, false negative results appear (patients who have improved according to the anchor but do not exceed the MCID in SPADI-Ar). In the *Right Lower Quadrant*, the false positive results appear (patients who have not improved according to the anchor but have exceeded MCID in SPADI-Ar). *MCID*, Minimal clinically important difference; *SPADI-Ar*, Shoulder pain and disability index, Argentine version.

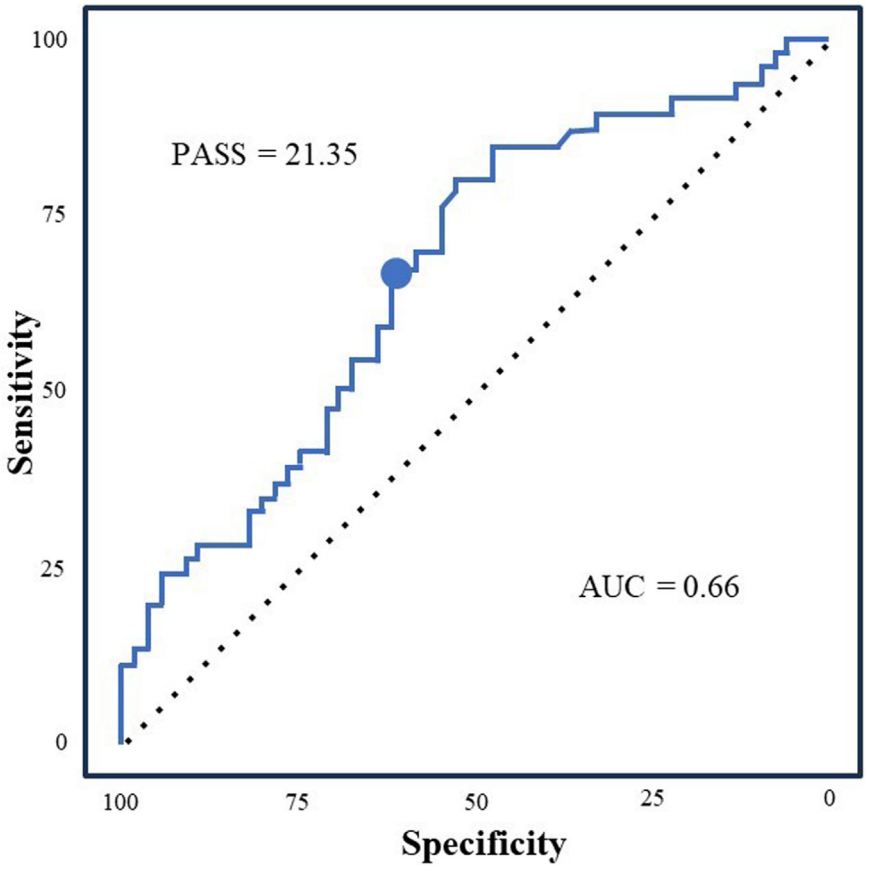

Figure 6 PASS ROC curve. *PASS*, patient acceptable symptomatic state; *AUC*, area under the curve; *ROC*, receiver operating characteristic.

reliability evaluation was carried out considering the subjects who remained clinically stable according to the GROC, and a washout period was defined to decrease the recall bias. Despite the limitations mentioned, the findings of the present study complete the assessment of all psychometric properties of the SPADI-Ar. The results on validity, reliability, and responsiveness

indicate that this measurement tool could be useful for clinical decision-making and research purposes in the future. To interpret changes throughout treatment in the SPADI-Ar, clinicians should consider the following values: 6.05 (MDC) for real changes without clinical significance, 18.46 (MCID) for the smallest changes with clinical impact, and 27.69 (SCB) for substantial changes in clinical status. For discharge criteria, an absolute SPADI-Ar score of 21.35 (PASS) could be considered, as it was related to an acceptable state. As we mentioned earlier, this value should not be considered in isolation. These results could only be generalized to individuals or groups of patients with shoulder disorders who share similar characteristics to the sample included in this study.

Conclusion

The cross-cultural adaptation of the SPADI-Ar was conducted. This tool proved to be valid, reliable, and responsive when evaluating disability in patients with shoulder disorders. Moreover, interpretability values, such as MCID, SCB, and PASS, were reported as well in this population.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jseint.2024.11.008.

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