ORIGINAL ARTICLE

Nr 2023;13 (3):383-393

Cross-Cultural Adaptation and Validation of the Italian Version of the Spine Functional Index

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DOI:
10.32098/mltj.03.2023.05

LEVEL OF EVIDENCE: 4

SUMMARY

Purpose. The Spine Functional Index (SFI) was developed to assess spinal function based on the idea of a single kinetic chain concept for the entire spine. The SFI has been translated into Spanish, Turkish, Simplified Chinese, Korean, Persian and Polish with accepted psychometric properties. The aim of this study is to translate and culturally adapt the SFI into Italian language and to verify the construct validity and reliability of this version.

Methods. The English version of the SFI has been translated according to international guidelines. The measurement properties (construct validity and reliability) have been tested according to COSMIN checklists. A total of 230 patients were included in this study. Exploratory Factor Analysis (EFA) was used to analyze structural validity. Cronbach's α was calculated to assess the internal consistency and the Intraclass Correlation Coefficient (ICC) was calculated to estimate the reliability. The Functional Rating Index (FRI), the Oswestry Disability Index (ODI), the Neck Disability Index (NDI), the EuroQol Health Questionnaire 5 Dimensions (EQ-5D) and a Visual Analogue Scale (VAS) were used to assess the validity of the construct.

Results. All the items were similar in meaning to the originals. EFA showed a mono-factorial structure. Cronbach's α was 0.743 and the ICC was 0.914 (95%CI 0.864-0.945). The Pearson's Correlation Coefficient showed significant correlations ($p < 0.01$) between SFI and FRI, ODI, NDI, EQ-5D and VAS items.

Conclusions. The study provided an Italian version of the SFI with good reliability and construct validity. The results of current study suggest that the Italian version of the SFI can be applied by physicians and researchers to measure the spine functional status in Italian population.

KEY WORDS

Spine Functional Index; cross-cultural adaptation; internal consistency; reliability; validity.

INTRODUCTION

Musculoskeletal disorders affect various structures including muscles, tendons, ligaments, joints and spinal discs. Those located at the level of the spine are the most frequent musculoskeletal disorders. Musculoskeletal disorders of the spine (low back pain and neck pain) are a major global concern due to their high morbidity and the resulting economic loss. Low back pain and neck pain have the highest prevalence in the adult population and affect almost 10% of the world's population. They are also the most common causes of long-term pain and physical disabilities, which prevent patients from going to work and worsen their quality of life (1, 2).

Rehabilitation treatment is based on careful clinical evaluation, which assumes a role of equal importance to the therapy itself. Therefore, it becomes necessary to have objective measuring instruments available that can provide indications on the patient's health status: this role is played by patient-reported outcome measures.

In recent years, the use of patient-reported outcome measures (PRO measures) in clinical practice has been increasingly recommended. These measures are able to detect statistically significant information on individual body districts, their functions and the patient's quality of life; thus, allowing the formulation of a diagnosis, a classification of the severity of the disease, an estimation of the prognosis, patient monitoring and treatment regulation. In addition to the elaboration of the therapeutic plan, these tools are also extremely useful to monitor their effectiveness in a completely objective manner. PRO measures provide objective answers that help physicians, health care professionals and researchers to monitor patients' progress and to understand if their health status has changed (3, 4).

In this way physicians, health care professionals and researchers can assess and understand much more quickly how the patient's health, functional status and symptoms have changed over time or in response to an intervention. This is applicable to a wide range of conditions, diseases and injuries and helps progressive management through recognition of effects on the patient's abilities (5).

Patients with pain or symptoms arising at the spinal column level can be assessed through PRO measures by determining their functional status and level of health (3, 6). These PRO measures may be regional, designed to assess a region of the body, or they may be specific to a single joint, condition or pathology.

Most of the PRO measures related to the spine are divided into sub-regions of the neck and back, which prevents their use in the assessment of the entire spine (6-8). In contrast, there are fewer PRO measures that assess the spine from cervical to lumbar as a single kinetic chain (6). Unfortunately, many of the outcome measures reported by patients for the entire spine have been criticized for clinical and practical limitations.

The PRO measures that do not evaluate the spinal column as a whole unit and that are commonly used in Italy are: the Oswestry Disability Index (ODI), the Roland Morris Disability Questionnaire (RMDQ), the Bournemouth Questionnaire (BQ) for low back pain, the Neck Disability Index (NDI), the Neck Bournemouth Questionnaire (NBQ) and the Neck Pain and Disability Scale for neck pain (9-14).

While the PRO measures that evaluate the spine as a single kinetic chain that are usually used in Italy are: the Functional Rating Index (FRI) and the Core Outcomes Measures Index (COMI) (15, 16).

The Spine Functional Index (SFI) is a PRO measure proposed to evaluate the spine as a whole unit. Published in 2013, the SFI has proven to have good clinical properties for both psychometric and practical characteristics (17). These include reliability, validity and internal consistency, specificity regarding spinal problems, sensitivity, easy understanding, speed of compilation, quick and easy scoring (17, 18). The results also showed clinimetric properties preferable to FRI for the evaluation of the entire spine (17, 19).

SFI has been culturally adapted in Spanish, Turkish, Simplified Chinese, Korean, Persian and Polish, with good psychometric properties (20-25). Currently no validated Italian version of the SFI has been published. It is therefore important to adapt the SFI in an Italian version.

The aims of this study were: 1) to translate and culturally adapt the English version of SFI into Italian and 2) to test the measurement properties of the Italian version of SFI according to the COSMIN checklist.

METHODS

The research group of this study is composed of rehabilitation professionals from the Sapienza University of Rome and Department of Rome Aerospace Medicine.

Authors certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all participants for being included in the study. Institutional Review Board approval was not required because the administration of these tool was part of the usual process of assessment of these individuals in clinical practice, the research involved the analysis of data collected such that individual subjects cannot be identified in any way (26).

Translation and cultural adaptation

The translation and cultural adaptation of the original version of the SFI into the Italian version was done using a forward and backward method as summarized in **figure 1**. Two independent Italian-language translators with good knowledge of English and external to the work have translated the original version of SFI, producing two different independent versions in Italian. In the next step, an Italian native speaker and out-of-work translator, who had not been involved in any of the previous translations, optimized the two translations and produced a single one in Italian. In the third phase, the version obtained from the optimization process was then independently translated into the original language by two bilingual translators who were not aware of the original version of the questionnaire. In the last phase, the two backward trans-

lated versions of the questionnaire were compared with the original by a focus group composed of three physiotherapists who corrected some spelling, grammar or other errors to minimize the differences from the original version by creating a single version, in order to reach a consensus on the semantic, idiomatic, experiential and conceptual equivalence between the Italian version and the original version of the SFI (27, 28).

Figure 1. Flowchart of the Spine Functional Index (SFI) translation from English to Italian.

Participants

A total of 230 patients diagnosed with musculoskeletal disorders of the spine participated in our study.
All participants were recruited between April and July 2020 and, before joining the study group, signed informed consent and were made aware of the study's objective.
The criteria for inclusion were musculoskeletal pain or symptoms at the level of the spine.
The exclusion criteria were age under 18 years, poor understanding of the Italian language, pregnancy, presence of infections, tumors, fractures, osteoporosis, structural deformity, inflammatory or neurological diseases and cauda equina syndrome.
77 patients performed the re-test after one week. This means that after seven days, 77 individuals have re-tested only and exclusively the SFI, so that its reliability can be known.

Questionnaire administration

All 230 study participants have compiled the SFI and the five comparison scales that we will see later. Since the study was conducted between April and July 2020, due to the impossibility of administering the assessment scales in person, all questionnaires were administered remotely using the Google Forms platform.
A single link was sent to all participants that included informed consent, four mandatory assessment scales (SFI, FRI, EQ-5D and VAS) and two optional ones (NDI and ODI) administered depending on whether the participant had received a diagnosis of neck pain or low back pain, respectively.

Spine Functional Index (SFI)

The SFI is a regional PRO measure consisting of 25 items. Each item has an answer option on a three-point Likert scale: "Yes", "Partially" and "No". These three response options are equivalent to 1, ½ and 0, respectively. It is the same patient who, by completing the scale, will indicate the most appropriate value that best represents his or her situation. It takes about one minute to complete. The score is calculated by adding the 25 items, then multiplied by four and subtracted by 100 to provide a percentage scale that indicates a score related to the functional status of the patients. Therefore, the scale has a total score range from 0% (maximum disability) to 100% (no disability). Up to two missing answers are allowed (17).

Functional Rating Index (FRI)

FRI is a regional PRO measure containing 10 items each rated on a five-point Likert scale. The score for each item varies from 0 to 4 points, where 0 indicates no pain or full ability in functions, and 4 indicates the worst possible pain or inability to perform a certain function, for a maximum total score of 40. The final score is calculated by adding the scores of the 10 items, is then divided by the maximum total score achievable and multiplied by 100% to obtain a percentage scale. The score varies from 0% (no pain or disability) to 100% (worst pain or disability). Only one missing answer is allowed (15).

Oswestry Disability Index (ODI)

The ODI is a PRO measure containing 10 six-point items that assess low back pain. Each item has a score ranging from 0 (no pain/problem) to 5 (maximum pain/problem). The total score is obtained from the sum of the scores of the 10 items, is then divided by the maximum total score achievable and multiplied by 100% to obtain a percentage scale, whose value can vary from 0% (no disability) to 100% (maximum disability). Only one missing answer is allowed. The questionnaire is completed in about 5 minutes and the score is assigned in less than 1 minute (9).

Neck Disability Index (NDI)

The NDI is a PRO measure containing 10 six-point items that evaluate neck pain. Each item can assume a score ranging from 0 (no pain or disability) to 5 (maximum pain or disability), for a total score between 0 and 50 which is interpreted as follows: 0 to 4 - no disability; 5 to 14 - mild disability; 15 to 24 - moderate disability; 25 to 34 - severe disability; greater than 34 - full disability. You can also provide a percentage result by dividing the total score obtained by the maximum total score achievable and then multiplying by 100% to obtain a percentage scale. It is allowed until a missing answer (12).

EuroQol Health Questionnaire 5 Dimensions (EQ-5D)

The EQ-5D is a widely used 6-item questionnaire, not disease-specific, which has proven to be valid and reliable in the Italian population (29). It consists of 5 items with a three-point answer option, representing various aspects of health: mobility, personal care, habitual activities, pain/discomfort/malaise and anxiety/depression. Respondents can independently assess their health in each area by reporting if they have no problems (score 1), some problems (score 2) or extreme problems (score 3). At the end of the questionnaire there is also a visual analogical scale of 100 mm, through which the respondent indicates the self-perceived state of health classifying it between the "worst imaginable state of health" (score 0) and the "best imaginable state of health" (score 100).

Visual Analogue Scale (VAS)

The VAS is represented by a horizontal line, 100 mm long, delimited at its extremities. Patients make a mark along this line, at the point that most accurately expresses the perceived pain. At the point where the sign is located, a score from 0 to 100 is assigned that corresponds exactly to the millimeters that make up the scale. The maximum score is therefore 100 and corresponds to the maximum degree of pain and disability.

Statistical analysis

Statistical analysis was performed by Statistical Package for the Social Sciences (SPSS) 25.00, following the checklist "Consensus-Based Standards for the Selection of Health Status Measurement Instrument" (COSMIN), the reliability and construct validity of the culturally adapted scale were evaluated (30, 31).
The descriptive analysis was used to analyze the data obtained from the sample and the administration of the scales: the average and the standard deviation (DS) of the variables were calculated, as shown in **table I**.

Internal consistency

To verify the internal consistency, Cronbach's α was calculated, the values of α should be in a range of 0.70-0.90 as an indicator of satisfactory homogeneity of the elements within the total scale, otherwise high redundancy is expected for values above 0.90.

Reliability

To assess the reliability of the test-retest, the SFI was administered twice (after seven days to 77 patients) so that the Intraclass Correlation Coefficient (ICC) could be calculated, which should be higher than 0.70 (32). Reliability was good when ICC = 0.70 or more.

Measurement error

To evaluate error, the standard error of measurement (SEM) and minimal detectable change (MDC_{90}) were used. The SEM was calculated as an element from the mean square error (MSE) from the analysis of variance, ANOVA. The MDC is the minimum change in a patient's score that ensures the change is not the result of measurement error. The MDC90 was calculated using the formula: $MDC = SEM \times 1.65 \times \sqrt{2}$, where 1.65 is the z-value that reflects the 90% CI of no change and √2 indicates two measurements assessing change (34).

Validity

Structural validity was determined from maximum likelihood extraction (MLE) with the a-priori extraction requirements being satisfaction of three criteria: Scree Plot inflection, Eigenvalue > 1.0 and variance > 10%. The recommended minimum ratio of five participants-per-item was satisfied (32). Exploratory Factor Analysis (EFA) indicated a single factor structure was likely, therefore more 100 participants were required (35).

Construct validity

In order to evaluate the validity of the SFI construct, participants also compiled a copy of the FRI, ODI, NDI, EQ-5D and VAS (ODI and NDI were compiled according to whether the patient suffered from low back pain or neck pain respectively) to calculate the Pearson Correlation Coefficient (r). This value is necessary to establish the correlation between the SFI score and other instruments to demonstrate the validity of the construct. The correlation values were classified as follows: low: r = 0.00-0.30; moderate: r = 0.30-0.60; high: r ≥ 0.60. The level of significance was set for a P-value less than or equal to 0.05 (36).

Content validity

Floor and ceiling effect are considered to be present if more than 15% of the participants are measured in the maximum or minimum limit score of any PROM. Floor and ceiling effects were calculated in the group of 230 patients for the SFI test-retest and for other tools.

RESULTS

Translation and cross-cultural adaptation

The translation and cultural adaptation were done following the guidelines, and all items corresponded consistently to the original version (**appendix 1**).

Characteristics of the participants

A total of 230 patients diagnosed with musculoskeletal disorders of the spine participated in our study. All participants were recruited between April and July 2020 and, before joining the study group, signed the informed consent and were made aware of the study's objective.

There were 44 patients with neck disorders, 109 patients with back disorders and 77 patients with both regional disorders. Analyzing qualitatively the participants, it can be noted that of the 230 subjects considered, 137 were female (59.6%) and 93 were male (40.4%). In addition, the participants had an average age of 39.06 years (± 15.68), an average height of 170.40 cm (± 8.97) and an average weight of 69.46 kg (± 13.38).

Exploratory factor analysis

For factor analysis the correlation matrix for the Italian version of the SFI was determined as suitable from the Kaiser-Meyer-Oklin values (0.890) and Barlett's Test of Sphericity, as reported in **table II**. This indicated that the correlation matrix was unlikely to be an identity matrix and was therefore suitable for MLE. The Scree Plot (**figure 2**) indicated a one-factor solution as determined by satisfaction of all three *a-priori* factors of the Scree Plot inflection point, Eigenvalue > 1.0 and variance > 10%. EFA revealed a satisfactory percentage of total variance explained by the one factor at 30.2%. The items loading for the one-factor solution for the MLE method are shown in **table III**.

Table I. Descriptive analysis: demographic characteristics.

	n	Minimum	Maximum	Mean	Standard deviation
Age	230	18	88	39.06	15.68
Height (cm)	230	148	196	170.40	8.97
Weight	230	42.0	113.0	69.46	13.38
		Frequency	**Percentage**	**Percentage Validity**	**Cumulative percentage**
Female		137	59.6	59.6	59.6
Male		93	40.4	40.4	100.0
Total		**230**	**100.0**	**100.0**	

Mean and standard deviation of SFI.

Table II. Kaiser-Meyer-Oklin values and Barlett's Test of Sphericity of the Italian version of the Spine Functional Index (SFI).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity
0.890	
Approx. Chi^2	1965.605
df	300
Sig.	.000

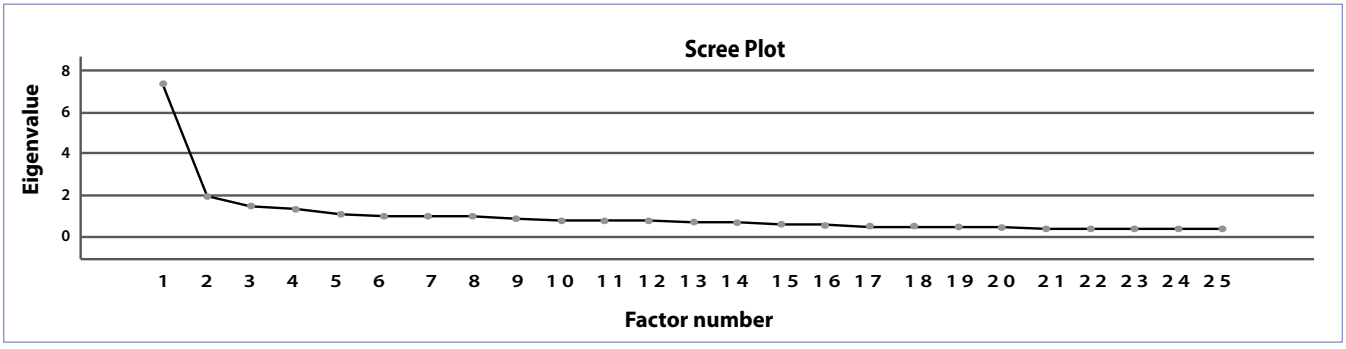

Figure 2. Scree plot of the Italian spinal functional index (SFI).

Table III. Factor loading items for the one-factor solution of the Italian version of the Spine Functional Index (SFI).

Factor	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	7.568	30.274	30.274	6.977	27.907	27.907	2.818	11.272	11.272
2	1.913	7.651	37.925	1.326	5.306	33.213	2.358	9.433	20.705
3	1.458	5.831	43.756	.863	3.452	36.665	2.108	8.434	29.139
4	1.313	5.252	49.008	.839	3.355	40.020	1.781	7.124	36.263
5	1.071	4.282	53.290	.568	2.271	42.291	1.507	6.028	42.291
6	.997	3.987	57.278						
7	.955	3.821	61.099						
8	.922	3.686	64.786						
9	.842	3.369	68.154						
10	.780	3.121	71.275						
11	.714	2.857	74.132						
12	.701	2.805	76.938						
13	.656	2.625	79.562						
14	.623	2.492	82.055						
15	.602	2.407	84.461						
16	.517	2.069	86.531						
17	.481	1.923	88.454						
18	.475	1.901	90.355						
19	.443	1.772	92.127						
20	.385	1.540	93.667						
21	.366	1.462	95.129						
22	.346	1.385	96.514						
23	.315	1.260	97.774						
24	.292	1.169	98.943						
25	.264	1.057	100.000						

Extraction method: maximum likelihood.

Internal consistency

The internal consistency of the SFI was examined through Cronbach's α to verify the homogeneity between the items. The SFI was found to have a good internal consistency, with a Cronbach α of 0.893. This value is between 0.70 and 0.90, showing that the questionnaire has a good internal consistency, which means a good interrelation between the items on the scale. In addition, as can be seen in **table IV**, all items are actually relevant to the scale: if one of them were to be eliminated, the value of Cronbach's α would tend to decrease, thus reducing the internal consistency of the scale.

Reliability and measurement error

SFI was administered to patients twice after 7 days, the Intraclass Correlation Coefficient (ICC) was used to assess the reliability between test and retest. The test-retest reliability, covering only 77 patients of the 230 considered, was good with an Intraclass Correlation Coefficient (ICC) of 0.914 with SEM = 3.51 and MDC 90% CI = 8.17%, as reported in **table V**. The value is above 0.70, demonstrating good instrument stability. This means that following repeated administrations to the same patient after 7 days, the two versions obtained from administrations to the subject are almost identical.

Construct validity

To the participants were also administered the Italian versions of the FRI, ODI, NDI, EQ-5D and VAS so that the construct validity of the SFI could be calculated. The correlation between the SFI scores and the other scales considered was evaluated through the calculation of the Pearson Correlation Coefficient, as reported in **table VI**. Through this statistical test the correlation of the SFI with the FRI is 0.666, with the ODI 0.681, with the NDI 0.574, with the EQ-5D -0.541, and with the VAS 0.438. All correlations are statistically significant ($p < 0.01$). Therefore, the SFI has a good construct validity.

Table IV. Internal consistency: Cronbach's α.

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Item 1	7.507	17.145	.166	.897
Item 2	7.263	16.665	.419	.890
Item 3	7.457	16.249	.459	.890
Item 4	7.480	16.782	.304	.893
Item 5	7.615	16.540	.467	.889
Item 6	7.417	16.493	.455	.890
Item 7	7.452	15.991	.579	.886
Item 8	7.674	16.767	.402	.891
Item 9	7.422	16.107	.560	.887
Item 10	7.530	15.868	.703	.884
Item 11	7.326	16.435	.405	.891
Item 12	7.813	17.393	.322	.892
Item 13	7.541	16.154	.590	.886
Item 14	7.459	16.567	.401	.891
Item 15	7.276	16.398	.520	.888
Item 16	7.709	16.415	.601	.887
Item 17	7.746	16.665	.575	.888
Item 18	7.602	16.253	.572	.887
Item 19	7.611	16.886	.326	.892
Item 20	7.315	16.714	.336	.893
Item 21	7.589	16.264	.520	.888
Item 22	7.537	16.170	.534	.888
Item 23	7.448	15.882	.611	.886
Item 24	7.643	16.418	.492	.889
Item 25	7.654	16.054	.656	.885

Mean and variance if the item is deleted and for each individual item.

Table V. Reliability: Intraclass Correlation Coefficient (ICC) between the test and the retest of 77 participants.

	Intraclass Correlationb	95%CI		F Test with True Value 0			
		Lower bound	Upper bound	Value	df1	df2	Sig.
Average measures	.914[c]	.864	.945	11.780	76	76	.000

Two-way mixed effects model where people effects are random and measures effects are fixed; [a]the estimator is the same whether the interaction effect is present or not, but no result obtained corresponds to the description; [b]Type A intraclass correlation coefficients using an absolute agreement definition; [c]this estimate is computed assuming the interaction effect is absent because it is not estimable otherwise; CI: confident interval.

Table VI. Validity: Pearson Correlation Coefficient between SFI, FRI, ODI, NDI, EQ-5D and VAS.

		SFI	FRI	ODI	NDI	EQ-5D	VAS
SFI	Pearson Correlation	1	.666**	.681**	.574**	-.541**	.438**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
FRI	Pearson Correlation	.666**	1	.850**	.667**	-.716**	.593**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
ODI	Pearson Correlation	.681**	.850**	1	.701**	-.666**	.587**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
NDI	Pearson Correlation	.574**	.667**	.701**	1	-.500**	.379**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
EQ-5D	Pearson Correlation	-.541**	-.716**	-.666**	-.500**	1	-.511**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
VAS	Pearson Correlation	.438**	.593**	.587**	.379**	-.511**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	

**Correlation is significant at the 0.01 level (2-tailed).

Content validity

In any PROM weren't found the floor and ceiling effects. Only one patient had the maximum score in the SFI test, no one in the retest and no one in the other tools.

DISCUSSIONS

The purpose of this study is to produce an Italian version of The Spine Functional Index (SFI) that has good validity and reliability.

Translation and cultural adaptation have produced a version which is coherent with the original.

As demonstrated by the results, the SFI is an excellent tool for the evaluation of the spine as a whole unit, in order to be able to simultaneously highlight the presence of neck and back problems.

Gabel *et al.* found that it took 2 minutes to complete the questionnaire, which was acceptable during clinical practice (17). In our study, it was not practical to record the time to complete the SFI because all participants were asked to complete several questionnaires at a time.

As a result of the Exploratory Factor Analysis (EFA), it was shown that the questionnaire had a mono-factorial structure. The internal consistency was evaluated by calculating Cronbach's α, which was equal to 0.893. Moreover, as shown in **table IV**, all the items are actually relevant to the scale: if one of them was eliminated, the value of Cronbach's α would tend to decrease, thus reducing the internal consistency of the scale. Anyway, the Italian version of the SFI has good levels of internal consistency. The values are slightly lower than the previous validations, but it is still possible to compare them; in previous studies, the Cronbach α of SFI was found respectively 0.911 in the original version (17), 0.91 in the Chinese validation (22), 0.88 in the Korean validation (23), 0.80 (between 0.78 and 0.82) in the Persian validation (24), 0.90 (between 0.89 and 0.90) in the Polish validation (25), 0.85 (between 0.80 and 0.88) in the Spanish version (20), 0.85 (between 0.80 and 0.88) in the Turkish version (21).

For the test-retest analysis, as in the other validations, a time interval of one week was used. This means that after seven days, 77 individuals compiled only and exclusively the SFI again, so that their reliability could be known. In this validation, as shown in **table V**, the Intraclass Correlation Coefficient (ICC) is 0.914 (0.864-0.945). The value is higher than 0.70, demonstrating a good stability of the instrument. Also in this case, it is possible to compare the results with those of previous studies, where the ICC was 0.972 in the original version (17), 0.96 in the Chinese validation (22), 0.94 in Korean validation (23), 0.96 (0.83-0.98) in Persian validation (24), 0.97 (0.96-0.98) in Polish validation (25), 0.96 (0.93-0.98) in Spanish validation (20), 0.93 (0.75-0.95) in Turkish validation (21). Considering the ICC values, it is possible to say that the Italian version of the SFI has a very

good stability: this indicates that after repeated measurements, the instrument offers comparable results.
To verify the validity of the SFI construct, to all participants was also administered a copy of the Italian version of the FRI, ODI, NDI, EQ-5D and VAS (ODI and NDI were compiled according to whether the patient suffered from low back pain or neck pain respectively). The agreement between the answers given by the subjects was measured by the Pearson Correlation Coefficient, showing all statistically significant correlations with a value of p less than 0.01. As can be seen in **table VI**, the Italian validation has good correlations with the scales used as comparison, as well as the previous validations. As far as the association with FRI is concerned, the Italian version has shown to have a strong correlation, as well as the Chinese validation (22), where the Pearson r is 0.66. The Korean (23) and Turkish (21) versions have shown, instead, a moderate correlation (0.57, 0.52). Also, with the ODI, the Italian validation shows a strong correlation. In this case the previous versions, Chinese (22) and Turkish (21), show a strong correlation, with a Pearson r of 0.75 and 0.71 respectively. Regarding the correlation with the NDI, this is moderate, according to the Chinese (22), Korean (23), Persian (24), Spanish (20) and Turkish (21) validations, with a Pearson r of 0.61, 0.53, 0.57, 0.46 and 0.58 respectively. The Italian validation and the EQ-5D have a moderate inverse correlation, as well as the Spanish version (20), whose Pearson r is -0.42. Finally, in the Italian validation the correlation with the VAS was found to be moderate, according to the Chinese version (22), where the Pearson r is 0.48.
The comparability of the results obtained indicates that the SFI remained stable within the different cultures.

CONCLUSIONS

This study consists of translation, cultural adaptation and validation of the Spine Functional Index (SFI). The Italian version of the SFI has good psychometric properties: it has a good internal consistency, a good test-retest analysis and a very good construct validity, so it is proven that the SFI is a valid and reliable tool to evaluate the spine as a whole unit, in order to be able to highlight the presence of neck and back problems at the same time.
In conclusion, the questionnaire is short, intuitive, easy to understand and to administer.
This scale is a useful tool for clinicians, and especially for physiotherapists to assess the grade of pathological condition and then to set up a good rehabilitation program also allowing to evaluate the progress achieved after rehabilitation.

FUNDINGS

None.

DATA AVAILABILITY

Data are available under reasonable request the corresponding author.

CONTRIBUTIONS

All authors contributed equally to the manuscript and read and approved the final version of the manuscript.

ACKNOWLEDGMENTS

Special thanks to Prof. Brophy for permitting us to have Italian version of this instrument.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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Appendix 1. Italian version SFI.

SPINE FUNCTIONAL INDEX (SFI)

NOME_____TIPO DI LESIONE_____DATA_____
☐ Collo ☐ Dorso ☐ Lombare

Cortesemente, completare il seguente schema: la colonna vertebrale può rendere difficile svolgere alcune attività di vita quotidiana che normalmente eseguivi. Questo elenco contiene delle frasi che le persone solitamente utilizzano per descrivere la loro condizione. Rispondi al questionario in base ai sintomi avvertiti alla colonna negli ultimi giorni. Se una voce descrive la tua condizione, spunta la casella. Se non la descrive per niente, lasciala vuota. Se la descrive solo in parte, inserisci il segno "1/2".

A causa della mia schiena:

1_____ Sto a casa la maggior parte del tempo.
2_____ Cambio continuamente posizione per trovare sollievo.
3_____ Evito i lavori pesanti (es. pulire, sollevare oltre 5 kg, giardinaggio, etc).
4_____ Riposo più spesso.
5_____ Chiedo ad altre persone di svolgere compiti al mio posto.
6_____ Ho dolori/problemi quasi tutto il tempo.
7_____ Ho difficoltà a sollevare e trasportare oggetti (es. borse, spesa oltre 5 kg).
8_____ Il mio appetito adesso è diverso.
9_____ Le passeggiate, lo svago abituale e le attività sportive sono state influenzate.
10____ Ho difficoltà nello svolgimento dei normali lavori domestici o familiari.
11____ Dormo peggio.
12____ Ho bisogno di assistenza nella cura del mio corpo (es. lavarmi ed igiene personale).
13____ Ne risente lo svolgimento delle abituali attività giornaliere (lavoro, contatti sociali).
14____ Sono più irritabile e di cattivo umore.
15____ Mi sento più debole e/o indolenzito.
16____ È compromessa la mia indipendenza negli spostamenti (guidare, mezzi pubblici).
17____ Ho bisogno di aiuto o sono più lento nel vestirmi.
18____ Ho difficoltà a muovermi nel letto.
19____ Faccio fatica a concentrarmi e/o leggere.
20____ Ho problemi nella posizione seduta.
21____ Ho difficoltà a sedermi ed alzarmi dalla sedia.
22____ Riesco a stare in piedi solo per brevi periodi di tempo.
23____ Ho difficoltà ad accovacciarmi e/o inginocchiarmi.
24____ Ho problemi a tendere il braccio verso il basso (es. prendere oggetti, mettere i calzini).
25____ Salgo le scale più lentamente o uso il corrimano.

PUNTEGGIO SFI: Per dare un punteggio alla parte superiore - somma le caselle spuntate:

_____ **TOTALE (PUNTI SFI)** Scala 100: 100 - (Totale × 4) = ___ %

MDC (90% CI) = Collo: 6.9% o 1.7 punti; Dorso e lombare: 5.9% o 1.5 punti; Tutta la colonna: 6.5% o 1.6 punti

Variazioni in difetto possono essere dovute ad errori.