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ARTICLE

Validation and psychometric evaluation of the Italian version of the Spinal Cord Injury Secondary Conditions Scale

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Abstract

Study design Validation cross-sectional study.

Objective To adapt the Spinal Cord Injury Secondary Conditions Scale (SCI-SCS) to Italian and to assess the validity and reliability of this instrument.

Setting Multicentre study in outpatient clinics of three urban spinal units across Italy.

Methods After a five-step translation/validation process, the Italian SCI-SCS was administered in a toolset composed of a sociodemographic questionnaire, the Modified Barthel Index, the Short-Form 8, the Patient Health Questionnaire 9, and the General Anxiety Disorder 7. The Italian SCI-SCS construct validity was assessed through exploratory factor analysis (EFA). The internal consistency and test–retest reliability of the instrument were evaluated using Cronbach's α and the intraclass correlation coefficient (ICC) for the total scale and its subscales. Pearson's correlation coefficient with all administered instruments was calculated to evaluate the concurrent validity.

Results One-hundred fifty-six participants were recruited from February to October 2018. EFA suggested a three-factor structure explaining 45% of the total variance. After experts' consideration about the clinical relevance of its components, a final version of the Italian SCI-SCS with four different subscales and 15 items was proposed. The total scale Cronbach's α was 0.73. The ICC agreement for test–retest reliability was 0.91. Correlations of the Italian SCI-SCS with the administered instruments were statistically significant ($p < 0.05$), highlighting congruent hypothesized relations.

Conclusion Findings of this study provided a first psychometric evaluation of the SCI-SCS. The modified Italian version of this tool may represent a valuable instrument for the longitudinal assessment of the impact of secondary conditions in people with SCI.

Introduction

Individuals often present physical or psychological secondary conditions (SCs) after spinal cord injury (SCI) that are directly or indirectly connected to reduced functionality, social participation [1], and quality of life (QOL) [2]. The most frequently described SCs in people with SCI are genitourinary problems (particularly urinary tract infections) [3], bowel management or incontinence [4], sexual dysfunction [5], pressure ulcers [6], pain [7], spasticity [8] and issues related to circulatory [9], respiratory, and musculoskeletal systems [3].

The treatment of SCs requires frequent hospital readmissions, ranging from 36 to 40% in the first 2 years after SCI [6, 10], leading to a substantial increase on direct and indirect costs when the loss of work-related productivity is considered [11]. Furthermore, multiple SCs often occurs

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simultaneously following SCI [12]. SCs therefore have the potential to exacerbate each other and generate serious health complications [13]. A rise in the life expectancy of people with SCI [14], associated with a heightened risk of chronic diseases, indicates that the number of SCs will increase over the next few years [3]. Given the importance of the early and standardized identification of SCs in individuals with SCI, the validation of the Spinal Cord Injury-Secondary Conditions Scale (SCI-SCS), a specific assessment tool designed to identify SCs, was undertaken [15].

The SCI-SCS is a quick and simple questionnaire developed in 2007 to identify the impact of SCs following SCI. This 16-item instrument is an adaptation of the Secondary Condition Questionnaire designed by Seekins and Ravesloot for people with disabilities [16]. It encompasses the most common SCs related to SCI, including skin, pain, cardiovascular, respiratory, musculoskeletal, metabolic, sexual, bladder, and bowel dysfunctions. Items composing the SCI-SCS are self-reported and designed to focus exclusively on physiological issues that can be managed or prevented by people with SCI. Therefore, psychological and environmental conditions are excluded from the SCI-SCS [15]. Assessment of SCs is restricted to those occurring in the previous 3 months and is measured on a 4-point Likert scale with ordinal items: "not existing or insignificant"; "mild or infrequent"; "moderate or occasional"; and "significant or chronic". The total attainable score is 48 with higher scores indicating increased SCs.

The SCI-SCS was developed in English and has been used in its original form, or with minor changes, in studies across North America [17], Australia [18], and Switzerland [12]. It has shown satisfactory psychometric properties, even when administered by telephone. However, although the value of conducting factor analysis on the SCI-SCS has been suggested [15, 19], it has never been performed. Additionally, to be used in non-English-speaking countries, the SCI-SCS must be cross-culturally adapted to verify its measurement properties, as well as the semantic and conceptual equivalence to the original version. Therefore, this study aimed to adapt the SCI-SCS into Italian and assess the reliability and validity of the questionnaire for people with SCI.

Methods

A cross-sectional design was applied. To determine sample size, quality criteria for the evaluation of validation studies included in the COSMIN® checklist were used. A minimum of seven participants for each item were considered sufficient to test scale dimensionality [20]. Between February and October 2018, a consecutive sample of individuals with SCI who attended the outpatient clinics in spinal units of the Città della Salute e della Scienza Hospital of Turin, the Careggi Hospital of Florence and the Cannizzaro Hospital of Catania was enrolled. Participants met the following criteria: (i) traumatic or non-traumatic SCI who were (ii) American Spinal Injury Association Impairment Scale A to D classification, (iii) aged 18 or older, (iv) discharged from rehabilitation for at least six months, and (v) native and Italian speaking. Individuals with a mixed diagnosis (e.g., brain injury) or recognized cognitive disorders were excluded to avoid possible reductions to the clinical utility of study findings.

Translation and cross-cultural validation

As recommended by Sousa [21], the process of cross-cultural validation of the SCI-SCS consisted of the following phases:

Phase I: forward translation

Translation of the SCI-SCS and its instructions from English to Italian was performed by two bilingual independent translators whose native tongue was Italian. One translator worked in a clinical setting and the other in an educational setting. A colloquial version was maintained to retain the concepts of the original version, and a literal translation was performed using both medically and culturally appropriate expressions.

Phase II: synthesis

Both translations of the SCI-SCS were submitted to the research team that then assembled, summarized, rechecked, and reviewed the final version of the scale. The inconsistencies were resolved by discussion, and a common adaptation was eventually shared. None of the items on the original scale was excluded.

Phase III: backward translation

The final version of the SCI-SCS was translated from Italian to English by a certified translator whose native tongue was English. This translation was submitted to the author of the scale who confirmed the conceptual equivalence of the Italian version, despite some vocabulary differences, and authorized its administration. This phase ended when a definitive Italian version was obtained.

Phase IV: expert committee

The Italian SCI-SCS was presented to a panel of six healthcare professionals and six people with SCI to determine its content validity. Content validity refers to the

extent to which the items on the Italian SCI-SCS were objectively representative of the physiological SCs, which characterize SCI. Members of the panel were asked to independently rate each item of the instrument on a five-point Likert scale, ranging from 0 (not representative) to 5 (strongly representative). The Italian SCI-SCS scored 0.95 for its content validity index/average, and all items reached the 0.78 cutoff value, indicating validity [22].

Phase V: preliminary testing

A pilot study was conducted to evaluate the face validity of the Italian SCI-SCS. Face validity refers to the extent to which the questionnaire appears to measure the most common physiological SCs in people with SCI. A sample of 12 individuals with SCI who met the inclusion criteria was recruited and asked to complete the SCI-SCS to assess if the items appeared, at face value, to be an appropriate measure of SCs. Items were evaluated according to a ten-point Likert scale ranging from 0 (not appropriate) to 10 (strongly appropriate). The Italian SCI-SCS obtained a face validity value of 9.78 out of 10. Data obtained from this sample were not included in the study.

The Italian adaptation of the SCI-SCS was approved and considered appropriate for use in combination with the following psychometric tests.

Procedure

Participants were enrolled during follow-up appointments at each spinal unit's outpatient clinic. Administration time for the entire set of instruments ranged from 15 to 20 min and was completed in a separate area to ensure the privacy of participants. The following data were collected:

Sociodemographic information was collected using a purposefully designed questionnaire. Participants information was gathered on age, gender, marital status, level of education, employment, cohabitation, number of children, economic status, and healthcare utilization. Clinical information concerning SCI was self-reported. Level of injury was dichotomized in tetraplegia if the injury was above T1, and paraplegia if the injury was below T1. The injury completeness was subdivided into motor complete or motor incomplete. Moreover, etiology (traumatic/non-traumatic) and time since injury were collected. Date and reason for last hospitalization data were collected from patients' medical records.

Functional independence of participants was assessed with the Modified Barthel Index (MBI). This monodimensional scale consists of ten items describing ability to complete activities of daily living and demonstrates excellent psychometric properties (Cronbach's $\alpha = 0.88$) in a SCI population [23]. MBI scores range from 0 (total dependence) to 100 (independence). While the Spinal Cord Independence Measure (SCIM) may be more sensitive [24], the MBI was selected as a reliable, brief instrument that, could be completed more easily by participants.

Secondary Conditions were measured using the 16-item Italian translation of the SCI-SCS [15]. To ensure test–retest reliability and evaluate the stability of the questionnaire throughout time, the first 20 participants were asked to come back to the spinal unit's outpatient clinic and complete the scale a second time 48 h after the first administration. This time frame was considered valuable to avoid that participants' clinical conditions might change and reduce their drop out.

Quality of Life was evaluated using the Short-Form 8 (SF-8). This eight-item instrument assesses the dimensions of general health, physical functioning, role-physical domains, vitality, bodily pain, mental health, social functioning and role-emotional domains, showing excellent psychometric properties (Cronbach's $\alpha = 0.85$) [25]. It provides physical component summary (PCS) and mental component summary (MCS) scores, facilitating comparisons between different versions of short-form questionnaires [26]. Norm-based scoring such that values more or <50 are considered better or worse than expected for the general population, is used. An Italian cross-cultural validated version of SF-8 has previously been used in different clinical contexts [27].

Depression was assessed with the Patient Health Questionnaire 9 (PHQ-9), a multipurpose instrument for screening the severity of depression and the presence of suicidal ideation [28]. It is composed of nine items incorporating depression diagnostic criteria with depressive symptoms. PHQ-9 scores range from 0 to 27 identifying mild, moderate, moderately severe and severe depression. The PHQ-9 has been used with an SCI population and shown excellent internal consistency (Cronbach's $\alpha = 0.83$) [29].

Anxiety was measured with the General Anxiety Disorder 7 (GAD-7). This seven-item self-administered questionnaire provides scores ranging from 0 to 21 identifying mild, moderate and severe anxiety [30]. It has been assessed as moderately good at screening panic, social anxiety, and post-traumatic stress disorders and has been used on several populations affected by chronic diseases, showing positive psychometric qualities (Cronbach's $\alpha = 0.92$) [31].

Data analysis

The results of the administered tools, as well as the sociodemographic and clinical characteristics of participants, were described using descriptive statistical analysis (means, standard deviations and frequencies). The construct validity of the SCI-SCS was assessed by performing an exploratory factor analysis (EFA). A principal axis factoring was applied

with a Promax Rotation, assuming that the factors of the scale were correlated. The appropriateness of the sample for factor analysis was supported by the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. The threshold value of 0.80 was considered satisfactory for the KMO to indicate an adequate sample, while a significance level of < 0.05 on Bartlett's test represented the homogeneity of item variances [32]. The factors that attained an eigenvalue ≥ 1 were retained, and a minimum factor loading coefficient of 0.30 was required to maintain each item in the scale. Items that loaded in more than a factor with a coefficient ≥ 0.30 were removed [33].

The reliability and validity of the SCI-SCS were evaluated for the total scale and each dimension identified through EFA. Cronbach's α-coefficient was used to test the internal consistency reliability of the SCI-SCS and its tentative dimensions; values of 0.70 and above were considered satisfactory [34]. Floor and ceiling effects were deemed present if 15% or more of participants scored the lowest or the highest attainable values on the SCI-SCS. Skewness between –1 and 1 was considered satisfactory. The test–retest reliability was calculated to verify the stability of the scale, and the intraclass correlation coefficient (ICC) was used to demonstrate how the total variability in the SCI-SCS scores obtained during the two administrations could be explained by patient variability.

Because of the lack of a comparable questionnaire, the developers of the original SCI-SCS tested its concurrent validity by correlating its total score with participants' clinical variables and a measure of health-related quality of life. The hypotheses to be tested in this study were broader. Specifically, it set out to explore the hypothesis that, as in Kalpakijan [15], the total score of the Italian SCI-SCS was negatively correlated with physical function (PCS); in addition, this evaluation has been corroborated with functional independence (MBI), level of injury and its completeness. Moreover, since it has been shown the influence of SCs on psychological well-being of people with SCI [35], it was hypothesized a positive correlation of the Italian SCI-SCS total score and MCS, PHQ-9 and GAD-7. To test these hypotheses, a Pearson product moment correlation was calculated. A value of ± 0.30 was considered to be a weak correlation, a value of ± 0.50 was considered a moderate correlation, and a value of ± 0.70 was considered a strong correlation [34]. Statistical analysis of all data collected was carried out using the SPSS statistical package (version 22; IBM SPSS Statistics, Armonk, NY). The level of significance was set at $p < 0.05$.

Results

Sociodemographic data of 156 participants are presented in Table 1. Most participants had a traumatic injury ($n = 130$; 84.4%) and paraplegia ($n = 101$; 64.7%). A minority of the sample sustained a SCI in the last 3 years ($n = 30$; 19.2%) and a third of participants had a complete (ASIA A) injury ($n = 58$; 37.4%). The most frequent cause of rehospitalization was bladder related issues ($n = 60$; 39.1%). The SCs mostly reported as occasional or chronic by participants were joint and muscle pain ($n = 94$; 60.3%), urinary tract infections ($n = 91$; 58.7%), and spasticity ($n = 86$; 55.1%), respectively.

Table 1 Sample characteristics

Variables	% (*n*)	Mean	SD
Age (years)		50.17	14.44
Males	80.8% (126)		
Tetraplegia	35.3% (55)		
Incomplete injury (ASIA B,C,D)	62.6% (97)		
Non-traumatic injury	15.6% (24)		
Married/partner	58.9% (90)		
Education			
Primary school	10.9% (17)		
Middle school	26.3% (41)		
High school	46.8% (73)		
University	16.0% (25)		
Unemployed	24.5% (38)		
Presence of children	48.7% (76)		
Presence of informal caregivers	54.5% (84)		
Hospitalization during the last year	55.8% (87)		
Modified Barthel Index (MBI)		60.16	27.27
SF-8 physical component summary (PCS)		42.62	9.54
SF-8 mental component summary (MCS)		48.54	10.82

SD standard deviation

Construct validity

The normality and sphericity measures on the SCI-SCS were performed through the KMO and Bartlett's sphericity tests. The KMO test attained a value of 0.812, and Bartlett's test provided a value of 452.99 ($df = 120$; $p = 0.00$). Therefore, the sample was considered acceptable for factor analysis, which identified a three-factor structure for the Italian SCI-SCS accounting for 44.97% of the total variance. Table 2 shows the factor loadings for each item and the four items to be excluded from the scale. Although not psychometrically robust, items referring to "autonomic dysreflexia", "orthostatic hypotension", and "circulatory problems" were considered relevant indicators of autonomic cardiovascular dysfunction by the panel of experts involved in the study and maintained in the final version of the instrument. Therefore, the Italian SCI-SCS is composed of

Table 2 Factor loadings for the 16 items in the Spinal Cord Injury Secondary Conditions Scale (SCI-SCS)

Items	Factor 1	Factor 2	Factor 3	Name of factor
8. Bowel dysfunction	**0.63**	0.05	0.01	Genitourinary and bowel
7. Bladder dysfunction	**0.62**	−0.15	0.11	
10. Sexual dysfunction	**0.60**	−0.06	−0,09	
9. Urinary tract infections	**0.54**	0.10	0.20	
4. Contractures	0.00	**0.61**	−0.10	Muscle structures and pain
16. Joint and muscle pain	0.09	**0.60**	0.03	
15. Chronic pain	−0.06	**0.58**	0.04	
3. Muscle spasms (spasticity)	0.07	**0.46**	−0.07	
1. Pressure sore(s)	0.10	−0.19	**0.56**	Skin, breathing, and metabolism
14. Respiratory problems	−0.13	0.28	**0.48**	
6. Diabetes mellitus	−0.15	0.16	**0.44**	
2. Injury caused by loss of sensation	0.19	−0.19	**0.38**	
11. Autonomic dysreflexia[a]	0.28	0.22	−0.16	Circulatory and autonomic
12. Postural hypotension[a]	0.35	0.42	−0.11	
13. Circulatory problems[a]	0.29	0.10	0.29	
5. Heterotopic bone ossification[b]	−0.16	0.26	0.16	

[a]Items included in the Italian SCI-SCS after evaluation of their clinical relevance

[b]Excluded item

Table 3 Cronbach's alpha coefficients, means, standard deviations and skewness of the Italian SCI-SCS and its subscales

	Cronbach's alpha	Mean	SD	Skewness
Genitourinary and bowel	0.72	5.73	3.34	0.071
Muscle structures and pain	0.70	6.10	3.35	0.074
Skin, breathing, and metabolism	0.59	2.55	2.38	−0.783
Circulatory and autonomic	0.62	2.73	2.34	−0.564
Italian SCI-SCS total score	0.73	17.11	7.61	0.017

SD standard deviation

15 items, grouped into three four-item subscales, rated from 0 to 12, entitled: "genitourinary and bowel;" "muscle structures and pain;" and "skin, breathing and metabolism," and a three-item subscale entitled "circulatory and autonomic". Thus, the maximum attainable score for the Italian SCI-SCS is 45 (Supplementary Appendix 1).

Reliability

Table 3 summarizes the Cronbach's α of the Italian SCI-SCS scale and its four dimensions, their means, standard deviations and skewness. There were few remarkable floor effects in the "skin, breathing and metabolism" (27%) and in the "circulatory and autonomic" (25%) subscales, in which score distributions were negatively skewed. Cronbach's α-coefficient of the total 15 items scale was found to be 0.73. The subscales "genitourinary and bowel" and "muscle structures and pain" showed acceptable scores ≥ 0.70, while the "skin, breathing and metabolism" and "circulatory and autonomic" dimensions had questionable values. The final 15 items version of the Italian SCI-SCS and its subscales showed a good test–retest reliability with a total ICC of 0.91 (C.I. = 0.78–0.96), and respectively: "genitourinary and bowel" an ICC of 0.90 (C.I. = 0.76–0.96); "muscle structures and pain" an ICC of 0.89 (C.I. = 0.72–0.95); "skin, breathing and metabolism" an ICC of 0.86 (C.I. = 0.65–0.95); and "circulatory and autonomic" an ICC of 0.87 (C.I. = 0.70–0.95).

Concurrent validity

All correlations between the 15 items Italian SCI-SCS and other administered questionnaires were found to be statistically significant ($p < 0.05$), as shown in Table 4. The PHQ-9 obtained the highest correlation ($r = 0.43$; $p < 0.001$), indicating a nearly moderate direct correlation with the quantity and severity of SCs reported by participants. Furthermore, a weak direct correlation ($r = 0.30$; $p < 0.001$) was found with the GAD-7. All other correlations were negative, showing an inverse effect between variables.

Table 4 Correlation between the Italian SCI-SCS and other administered questionnaires

Questionnaire	*p*-value	Pearson's *r*
Modified Barthel Index (MBI)	0.016	−0.20
SF-8 Physical component summary (PCS)	< 0.001	−0.36
SF-8 Mental component summary (MCS)	0.014	−0.21
Patient health questionnaire 9 (PHQ-9)	< 0.001	0.43
General anxiety disorder 7 (GAD-7)	< 0.001	0.30
Tetraplegia	0.003	0.29

In particular, the amount of SCs showed a weak correlation ($r = –0.36$; $p < 0.001$) with the PCS subscale of the SF-8, whereas the MCS subscale of the SF-8 ($r = –0.21$; $p < 0.05$) and MBI ($r = –0.20$; $p < 0.05$) highlighted very weak correlations. Tetraplegia was weakly correlated ($r = 0.29$; $p < 0.05$) with the score obtained on the 15 items Italian SCI-SCS, while no statistically significant correlation ($r = 0.06$; $p = 0.47$) was observed with the injury completeness.

Discussion

This study aimed to produce an Italian translation, cross-cultural validation and analysis of the psychometric properties of the SCI-SCS in a sample of community-dwelling people with SCI. As recommended [21], the cross-cultural validation was comprehensively performed through translation of the scale into Italian, backward translation, evaluation of its content and face validity, ensuring that the intended meaning of the original version was retained in the translated version.

Factor analysis was used to assess the construct validity of the Italian SCI-SCS, identifying a three-factor structure that accounted for 45% of the total variance. The internal consistency of the questionnaire showed an acceptable Cronbach's α-value of 0.73, comparable to the values obtained in previous studies [15, 18, 19]. Test–retest reliability results were comparable with previous studies, suggesting acceptable reliability of the instrument over time [15, 18]. Moreover, floor effects identified in the subscales "skin, breathing and metabolism" and "circulatory and autonomic" could be related to the high number of participants who highlighted the absence of diabetes, respiratory problems or autonomic dysreflexia, as confirmed by the negative skewness obtained in these subscales and supporting the previous results highlighting the low prevalence of these complications in SCI population [15, 19].

Furthermore, correlations identified between the Italian SCI-SCS and the questionnaires used to test the concurrent validity of the scale were entirely significant and congruent in their interactions. These findings illustrate the validity of the Italian SCI-SCS, confirming the already identified relationship between SCs and physical function in people with SCI and partially contradicting Kalpakjian, who has not found a correlation between the level of injury and SCs [15]. Moreover, the positive correlations of the Italian SCI-SCS with the PHQ-9 and the GAD-7 were consistent with prior studies that identified the occurrence of SCs and, in particular, pain, that affected the psychological well-being of people with SCI [35, 36].

The prevalence of SCs identified in this study was comparable with those obtained by Kalpakjian [15] and New [19], although sexual dysfunction scores were lower in the current sample. Genitourinary conditions were previously identified as the most common cause of hospital readmissions in SCI, accounting for nearly one third of all rehospitalization [10]. Additionally, bowel and sexual dysfunctions were often present at the same time as bladder incontinence and were found to act as predictors of individuals' health status [37]. Chronic pain, reduced muscle strength and spasticity were common issues following SCI and were associated with decreased QOL and social participation [7, 8]. Additionally, people with SCI have a high prevalence of shoulder pain, which was frequent in females, individuals with complete injuries, contractures and pain, due to repetitive biomechanical load [38]. Complications affecting skin were also well-recognized as common in people with SCI living in the community, leading to high rehospitalization costs [10, 12]. As a result of improvements in life expectancy and survival in the SCI population, diabetes and its related complications, as well as respiratory problems due to the increasing rates of people with tetraplegia [14], are likely to represent challenges for future healthcare professionals, and warrant further exploration. Although four items should be removed from the final version of the questionnaire, those related to circulatory and autonomic dysfunctions were maintained in the Italian SCI-SCS. Autonomic dysreflexia is a potentially life-threatening condition, which may be difficult to identify due to a misinterpretation of the symptoms [39]. Furthermore, cardiovascular diseases, such as heart failure, coronary arterial disease and atrial fibrillation, were found to be the second major cause of death in people with SCI [9]. The item describing heterotopic ossification did not reach the requested value to be retained in the final version of the questionnaire. Moreover, it charged on all of the three identified factors, reducing the likelihood of inserting into a specific dimension and was removed after the experts' consideration. Thus, this item was considered not capable to identify this particular complication, which has nonspecific clinical signs and symptoms and requires a radiologic investigation for its diagnosis [15, 19, 40]. The final items included in the four subscales of the Italian SCI-SCS are therefore considered to be a comprehensive representation of the physiological SCs affecting people with SCI.

This study represents a first exploration and factorial evaluation of the SCI-SCS. However, limitations have also been identified. Since the questionnaire assesses a complex construct in which components present different features and causes, the psychometric robustness may have been affected by the low highlighted prevalence and relationship of items. Data were gathered from people with SCI during routine follow-up appointments, and thus may not be representative of the community-dwelling SCI population of Italy. Future studies that combine the use of the Italian SCI-SCS with an objective evaluation are recommended in order to test the predictive value of this instrument. Additionally, to avoid any substantial alteration of meaning in the Italian SCI-SCS, the literal translation of the original version was maintained, albeit some skepticism has previously been raised about the items concerning sexuality and bladder dysfunctions [18, 19].

Since the original SCI-SCS was already focused exclusively on physiological conditions, the revised Italian version was also unable to assess psychological or environmental aspects related to SCI. These aspects have been recognized as contributing to SCs, and a combination of targeted questionnaires would be appropriate to provide a complete understanding of the interactions between physical and psychosocial SCs. While self-reported instruments represent a valuable tool in the identification of SCs, integrated evaluation of SCs in individuals with SCI should combine a complete clinical assessment, performed by a healthcare professional, with the use of diagnostic tests to better identify complex health issues.

Finally, study findings may have been influenced by participants' characteristics. Data in the current study were obtained from a sample of people with SCI with a high prevalence of incomplete injuries who are likely to present with less SCs but more depression and spasticity [12]. More exhaustive analyses of differences in the occurrence of SCs across demographic and SCI characteristics are required for the development of healthcare prevention and support policies designed to these populations.

Conclusion

The findings of this study evaluated the psychometric properties of the SCI-SCS and supported the validity and reliability of its Italian version as a potentially useful instrument to measure the self-reported occurrence of SCs of people with SCI. This modified instrument will provide a valuable tool for research studies exploring the impact of SCI-related SCs in an Italian-speaking population. Taking the disruption of social life and the high costs associated with SCs in people with SCI into account, the extensive use of a reliable assessment tool is essential to both identify the impact of SCs in the lives of individuals with SCI and to plan tailored follow-up interventions.

Data archiving

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

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Author contributions AC was responsible for designing and writing the study protocol, and for submitting the study to the ethical committee. He was also responsible for writing the report, coordinating the recruiting centers, and interpreting results. MC was responsible for the database managing, analyzing data, and interpreting results. He contributed to writing the report. SA and SF were responsible for designing and writing the study protocol. BB, LC, SA and SM were responsible for recruiting the participants and managing the data. They provided feedback on the report. EV and SC provided feedback on the report.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Ethical approval (Resolution no. CS2/596, March 13, 2018) was granted by the Città della Salute e della Scienza di Torino, Mauriziano Hospital, ASL TO 1 Research Ethics Committee, Turin, Italy. All recruitment centers gave their authorization for participation in the study. Additionally, all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed.

Informed consent All participants provided written, informed consent and anonymity was maintained throughout the research process.

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