

# Reliability and validity of the Spinal Cord Injury Secondary Conditions Scale among the Turkish population with spinal cord injury

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## ABSTRACT

**Objectives:** The study aimed to determine the reliability and cross-cultural validation of the Turkish translation of the Spinal Cord Injury Secondary Conditions Scale (SCI-SCS) in individuals with spinal cord injuries (SCIs).

**Patients and methods:** After the translation/validation process, the SCI-SCS was administered to 93 patients (69 males, 24 females; mean age: 47.9±14.3 years; range, 18 to 78 years) with SCI, diagnosed according to the American Spinal Injury Association impairment scale (grades from A to D), with at least one year after the injury, recruited between December 2022 and July 2023. Fifty-seven patients rated the SCI-SCS two to three days apart to investigate the test-retest reliability. Correlations between the first rates of the SCI-SCS and the Spinal Cord Independence Measure III (SCIM-III), Spinal Cord Injury Spasticity Evaluation Tool, Penn Spasm Frequency Scale, 36-item Short Form Health Survey (SF-36), Beck Depression Inventory, Beck Anxiety Inventory, and the pain-DETECT questionnaire were investigated for the evaluation of convergent validity.

**Results:** There were 65 patients with paraplegia and 28 patients with tetraplegia. The SCI-SCS showed good internal consistency ( $\alpha=0.753$ ). The three-factor model demonstrated a good fit to the data (relative chi-square=1.12, comparative fit index=0.981, Tucker-Lewis index (TLI)=0.977, root mean square error of approximation=0.037, standardized root mean square residual=0.120). The test-retest reliability was excellent, with an intraclass correlation coefficient of 0.79 (95% confidence interval 0.67-0.87). There were statistically significant correlations between the total SCI-SCS and all other administered questionnaires, except for the social function, emotional, physical, and general health domains of SF-36 and the self-care, total, and mobility subscales of SCIM-III.

**Conclusion:** The study demonstrated that the 14-item SCI-SCS represents a valuable scale for the assessment of secondary conditions among the Turkish population with SCI.

**Keywords:** Reliability, secondary health conditions, spinal cord injury, validity.

People living with spinal cord injury (SCI) experience a range of secondary health conditions that impact their quality of life besides their significant impairments. The term “secondary health condition” is a health issue that is either a direct result of the impairment or an indirect factor that is related to the impairment.<sup>[1]</sup>

The frequency of health conditions varies greatly, but the most common secondary health conditions reported by individuals with SCI are sexual problems, chronic pain, bladder dysfunction, spasms, joint and muscle pain, bowel dysfunction, cardiovascular problems, contractures, urinary

tract infections, pressure sores, and postural hypotension.<sup>[2]</sup> These conditions may induce considerable added economic expense apart from the immediate impact on the daily lives of people with SCI. To prevent or reduce the incidence of these conditions, early identification and appropriate assessment are necessary.

Patient-reported outcome measures enable patients to report their symptoms and daily functioning and help healthcare services provide the care that patients need and require. In recent years, numerous investigations have incorporated the utilization of the Spinal Cord Injury Secondary Conditions Scale

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(SCI-SCS) as a tool for evaluating secondary health conditions in individuals with SCI.<sup>[2-8]</sup>

The SCI-SCS is a simple and self-reported questionnaire developed by Kalpakjian et al.<sup>[9]</sup> in 2006. It is adapted from the generic Seekins Secondary Condition Questionnaire for people with injury-related disabilities.<sup>[10]</sup> This self-reported 16-item questionnaire is designed to target mainly physiological conditions or health-related behaviors that can be prevented or managed. The 16 items are scored on a 4-point ordinal scale ranging from 0 (not experiencing issues in the last three months or insignificant problem) to 3 (significant or chronic problem). The total score ranges from 0 to 48 and is derived by adding the scores for each item. Higher scores indicate greater problems with secondary conditions.<sup>[9]</sup>

The SCI-SCS, whether employed in its unaltered state or subject to marginal modifications, has received great attention nowadays. Studies on the psychometric properties and the Italian version of the scale were done.<sup>[11,12]</sup> The validity and inter-rater reliability of the telephone-based version of the SCI-SCS was also investigated.<sup>[13]</sup>

For an instrument to be used globally, it must be translated and adapted to the culture of its users. In this study, we aimed to adapt the SCI-SCS to the Turkish population and subsequently evaluate the reliability and cross-cultural validity of the Turkish translation of the SCI-SCS in patients with SCI. Due to the absence of a scale comparable to SCI-SCS, we planned to use Spinal Cord Independence Measure III (SCIM-III), Spinal Cord Injury Spasticity Evaluation Tool (SCI-SET), Penn Spasm Frequency Scale (PSFS), 36-item Short Form Health Survey (SF-36), Beck Depression Inventory (BDI) and pain-DETECT questionnaire (PDQ) for the assessment of convergent validity.

## PATIENTS AND METHODS

Ninety-three patients (69 males, 24 females; mean age: 47.9±14.3 years; range, 18 to 78 years) diagnosed with SCI and classified according to the American Spinal Injury Association impairment scale, with grades ranging from A to D, and who sustained their injuries at least one year prior were recruited from the inpatient and outpatient rehabilitation units of the University of Health Science, Fatih Sultan Mehmet Training and Research Hospital between December 2022 and July 2023. Exclusion criteria included the presence of associated

cognitive deficits, a primary disability that was not caused by SCI, and a clinically unstable medical condition, such as a terminal illness that would have compromised participation in the study. Data were collected through structured interviews, physical evaluations, and by applying self-administered questionnaires.

### Translation procedure

Translation of the SCI-SCS to Turkish was performed in accordance with the recommended reports for translation and cultural adaptation.<sup>[14]</sup> Three medical doctors, who were native Turkish speakers and were fluent in English, provided an independent translation of the SCI-SCS. After reconciliation of the three translations into a unified rendition, this resultant forward translation underwent retranslation into the original language by another medical doctor who remained unaware of the original SCI-SCS. This medical doctor was born and was living in an English-speaking country and was fluent in Turkish. Subsequent to the harmonization process, consensus was reached among all participants involved in the translation endeavor regarding the prefinal version of the translation.

### Content and face validity

To ascertain the appropriateness of the preliminary questionnaire's content, content validity indices were computed for both individual items and the overall scale employing the Delphi method. Nine experts were enlisted to assess the extent to which each item correlated with or encapsulated a designated domain, utilizing a 4-point Likert scale. The scoring criteria were as follows: 1=not relevant, 2=somewhat relevant, 3=relevant, and 4=highly relevant. Additionally, experts provided feedback and recommendations concerning each item and the overarching formulations of the questionnaire. The content validity ratio value was calculated as 0.76 and the content validity index value as 0.97. According to these results, it was determined that the content validity was provided on the both item and scale basis.<sup>[15]</sup> Furthermore, the expert's recommendations were taken into consideration in revising certain wordings and phrasings of the questionnaire items.

The last version of the questionnaire was pretested with 10 patients with SCI who met the inclusion criteria. They were requested to complete the SCI-SCS to evaluate if the items appeared, at face value, to be a suitable measure for assessing secondary conditions.

The participants commented that they had no difficulties understanding the items. Data acquired from this sample were excluded from the study's analysis. After ensuring that the meanings of the words were understood, the final version was reached.

### Procedure

For the scoring procedure of the SCI-SCS, the patients were given the SCI-SCS leaflet (Appendix 1). For illiterate patients, caregivers were asked to read the leaflet. Fifty-seven patients rated the SCI-SCS, two to three days apart to investigate the test-retest reliability. The SCI-SCS is adapted from the Secondary Condition Questionnaire specifically tailored for individuals with disabilities.<sup>[10]</sup> Developed by Kalpakjian et al.,<sup>[9]</sup> it evaluates the subjective experiences of secondary conditions in individuals with spinal cord injuries (SCI).

The SF-36 is arguably among the most extensively utilized patient-reported outcome measures for evaluating health-related quality of life. It was originally designed as a generic health measure but has been adapted for use across various disease populations and has demonstrated applicability among patients with SCI.<sup>[16]</sup>

The SCIM-III assesses performance in activities of daily living and mobility in patients with SCI. It is a 17-item scale with three subdomains of self-care, respiration and sphincter control, and mobility.<sup>[17]</sup> The Turkish version of the scale was adapted by Kesiktas et al.<sup>[18]</sup>

Beck Depression Inventory is a widely used, 21-item, self-reported questionnaire that measures characteristic attitudes and symptoms of depression.<sup>[19]</sup> Beck Anxiety Inventory (BAI) is a self-reported questionnaire measuring 21 common somatic and cognitive symptoms of anxiety.<sup>[20]</sup>

The PSFS was first created to measure the effectiveness of intrathecal baclofen in the treatment of spasticity in patients with SCI. It is a self-reported measure with items on 5-point scales that assess a patient's perception of spasm frequency.<sup>[21]</sup>

The SCI-SET is a self-reported questionnaire that assesses the problematic and useful effects of spasticity on daily life in patients with SCI. It was translated and cross-culturally adapted to the Turkish population.<sup>[22]</sup>

The PDQ is a simple, self-administered questionnaire that was designed to screen for neuropathic signs and symptoms without physical examination. It was endorsed by the International Spinal Cord Society as an assessment tool for

SCI-related neuropathic pain.<sup>[23]</sup>

Correlations between the first rates of the SCI-SCS and the SCIM-III, SCI-SET, PSFS, SF-36, BDI, BAI, and PDQ were investigated for the evaluation of convergent validity.

### Statistical analysis

Statistical analyses were performed using the NCSS (Number Cruncher Statistical System) 2020 (NCSS, Kaysville, UT, USA), R version 4.3.2, and Jamovi version 2.3. Descriptive statistics (means, standard deviations, and frequencies) were used to present sociodemographic and clinical characteristics of participants, as well as the results of the administered tools. Using the sample calculation method developed by Yazıcıoğlu and Erdoğan,<sup>[24]</sup> it was calculated that at least 92 people should be included in the study with a 5% sampling error using the simple random sampling method.

Item analyses were performed for the validity assessment, and each item was evaluated with item difficulty index and item discrimination. The verification of the obtained factors was performed with the Lisrel 9.1 and lavaan, semTools and psych modules of R programs where confirmatory factor analysis (CFA) was performed based on the factor structure described by Conti et al.<sup>[12]</sup> Diagonally weighted least squares estimation method was used for CFA fit since it is robust to nonnormality, particularly when the items are highly skewed or kurtotic. The relative chi-square ( $\chi^2/df$ ), root mean square error of approximation (RMSEA), the comparative fit index (CFI), and standardized root mean square residual (SRMR) were used as fit measures where  $\chi^2/df < 3$ , CFI  $> 0.90$ , RMSEA  $< 0.08$ , and SRMR  $< 0.08$ , indicating thresholds for a good fit. The ordinal Cronbach's alpha coefficient was employed to evaluate internal consistency.<sup>[25]</sup>

The intraclass correlation coefficient (ICC) was utilized for the assessment of test-retest reliability. Interpretation of ICC values was as follows: poor  $\leq 0.40$ ; fair = 0.40-0.59; good = 0.60-0.74; and excellent = 0.75-1.00.<sup>[26]</sup>

Spearman's rank correlation coefficient was utilized to identify the association between the SCI-SCS and SCIM-III, SCI-SET, PSFS, SF-36, BDI, BAI, and PDQ.<sup>[27]</sup> Statistical significance was accepted as  $p < 0.05$ .

## RESULTS

Sociodemographic information and characteristics of the participants are presented in Table 1. The total

duration of SCI was 1-43 years. Most participants had paraplegia (n=65; 69.9%), and the most frequent etiology of SCI was falls (n=30; 32.3%). Scoring distributions of the SCI-SCS are shown in Table 2.

### Test-retest reliability and internal consistency

All of the items except heterotopic ossification showed excellent test-retest reliability, with a total ICC of 0.79 (95% confidence interval 0.67-0.87,  $p < 0.001$ , Table 3). SCI-SCS showed good internal consistency ( $\alpha = 0.753$ ). Removal of any item from the factor did not increase reliability. However, in the item-total test correlation, heterotopic ossification did not show a significant correlation with the total score (Table 4).

### Construct validity

The CFA was employed as the primary evaluation method, adhering to the factor structure delineated by Conti et al.<sup>[12]</sup> Our initial endeavor mirrored

the four-factor model proposed by Conti et al.,<sup>[12]</sup> yielding Cronbach's alpha reliability coefficients of 0.28, indicative of suboptimal reliability. Subsequent scrutiny revealed that the four-factor model failed to yield a positive definite covariance matrix of latent variables. In response to this, we amalgamated two highly correlated latent variables, "skin, breathing, and metabolism" and "circulatory and autonomic" into a singular latent variable. Additionally, we made the decision to exclude the item concerning urinary tract infections due to its notably low loading factor of 0.270. For constructs with categorical indicators, Zumbo et al.'s<sup>[25]</sup> "ordinal alpha" was given, which is calculated from polychoric (polyserial) correlation, not Pearson correlations.

Considering these findings, a refinement strategy by grouping related items with similar impacts and identifying clusters of interrelated components was pursued, yielding improved outcomes. The new

**TABLE 1**  
Demographics and characteristics of participants (n=93)

	n	%	Mean±SD	Median	Min-Max
Age (year)			47.9±14.3	50	18-78
Sex					
Male	69	74.2			
Female	24	25.8			
Marital status					
Married	72	77.4			
Single	21	22.6			
Education					
Illiterate	4	4.3			
Primary/secondary school	51	54.8			
High school	22	23.7			
University	16	17.2			
Work					
Working	14	15.1			
Not working	79	84.9			
Duration of spinal cord injury (year)			8.84±7.13	6	1-43
Paraplegia/tetraplegia					
Paraplegia	65	69.9			
Tetraplegia	28	31.1			
Spinal cord injury levels					
Cervical	28	30.1			
Thoracal	59	63.4			
Lumbosacral	6	6.5			
AIS					
A	20	21.5			
B	20	21.5			
C	16	17.2			
D	37	39.8			

SD: Standard deviation; AIS: American Spinal Injury Association Impairment Scale.

**TABLE 2**  
Number of scores in each item of SCI-SCS

	Not a problem	Mild or infrequent problem	Moderate or occasional problem	Significant or chronic problem
	n	n	n	n
Pressure sore(s)	73	2	12	5
Injury caused by loss of sensation	70	11	7	4
Muscle spasms (spasticity)	20	24	26	22
Contractures	63	10	8	11
Heterotopic bone ossification	88	2	1	1
Diabetes mellitus	75	7	7	3
Bladder dysfunction	31	22	14	25
Bowel dysfunction	26	24	25	17
Urinary tract infections	41	20	21	10
Sexual dysfunction	62	10	12	8
Autonomic dysreflexia	74	8	6	4
Postural hypotension	64	12	13	3
Circulatory problems	56	15	17	4
Respiratory problems	76	8	5	3
Chronic pain	23	16	34	19
Joint and muscle pain	25	25	25	17

SCI-SCS: Spinal Cord Injury Secondary Conditions Scale; n: Number of participants.

**TABLE 3**  
Test-retest analysis of the SCI-SCS (n=57)

	Test		Retest		ICC	95% CI	p
	Median	Min-Max	Median	Min-Max			
Pressure sore(s)	0	0-3	0	0-3	0.711	0.553-0.820	0.001*
Injury caused by loss of sensation	0	0-3	0	0-3	0.402	0.155-0.602	0.001*
Muscle spasms (spasticity)	2	0-3	2	0-3	0.772	0.640-0.860	0.001*
Contractures	0	0-3	0	0-3	0.928	0.880-0.957	0.001*
Heterotopic bone ossification	0	0-3	0	0-1	0.158	-0.107-0.402	0.120
Diabetes mellitus	0	0-3	0	0-3	0.808	0.694-0.883	0.001*
Bladder dysfunction	1	0-3	2	0-3	0.689	0.522-0.805	0.001*
Bowel dysfunction	1	0-3	2	0-3	0.715	0.558-0.822	0.001*
Urinary tract infections	1	0-3	1	0-3	0.516	0.295-0.685	0.001*
Sexual dysfunction	0	0-3	1	0-3	0.529	0.311-0.694	0.001*
Autonomic dysreflexia	0	0-3	0	0-3	0.657	0.478-0.784	0.001*
Postural hypotension	0	0-3	0	0-3	0.582	0.379-0.732	0.001*
Circulatory problems	0	0-3	1	0-3	0.670	0.496-0.793	0.001*
Respiratory problems	0	0-3	0	0-3	0.718	0.563-0.825	0.001*
Chronic pain	2	0-3	2	0-3	0.659	0.481-0.785	0.001*
Joint and muscle pain	1	0-3	2	0-3	0.473	0.242-0.653	0.001*

SCI-SCS: Spinal Cord Injury Secondary Conditions Scale; ICC: Intraclass correlation coefficient; CI: Confidence interval; \* p<0.01.

**TABLE 4**  
Item-total correlation values

SCI-SCS	r	p
Pressure sore(s)	0.274	0.008
Injury caused by loss of sensation	0.495	0.000
Muscle spasms (spasticity)	0.651	0.000
Contractures	0.510	0.000
Heterotopic bone ossification	0.121	0.264
Diabetes mellitus	0.392	0.001
Bladder dysfunction	0.444	0.000
Bowel dysfunction	0.620	0.000
Urinary tract infections	0.371	0.001
Sexual dysfunction	0.541	0.000
Autonomic dysreflexia	0.402	0.000
Postural hypotension	0.450	0.000
Circulatory problems	0.310	0.001
Respiratory problems	0.405	0.000
Chronic pain	0.543	0.000
Joint and muscle pain	0.595	0.000

SCI-SCS: Spinal Cord Injury Secondary Conditions Scale; Significant at p<0.05.

three-factor model had very satisfactory reliability coefficients, ranging from 0.57 to 0.74. The standardized coefficients ranged from 0.324 to 0.831

(Table 5). The fit indices of the three-factor model were as follows:  $\chi^2/df=1.12$ , CFI=0.981, Tucker-Lewis index (TLI)=0.977, RMSEA=0.037, and SRMR=0.120. Substantial floor effects were evident in the domains of diabetes mellitus (24.7%), pressure sores (14.6%), and circulatory problems (14.16%).<sup>[28]</sup>

### Convergent validity

There were statistically significant positive correlations between the total SCI-SCS and PSFS, BDI, BAI, and PDQ. There were statistically significant negative correlations between the total SCI-SCS and SCI-SET, physical function, vitality, and bodily pain domains of SF-36, and the respiratory and sphincter management subscale of SCIM-III. However, no significant correlations were found with physical, emotional, social function, and general health domains of SF-36 or the self-care, total, and mobility subscales of SCIM-III. Furthermore, statistically significant negative correlations were observed between the respiratory and sphincter management, total, and mobility subscales of SCIM-III and the “skin, breathing, and metabolism” and “circulatory and autonomic” (Factor 2) items of SCI-SCS, as well as the “genitourinary and bowel” (Factor 3) items of SCI-SCS, as shown in Table 6. The highest significant correlation was found with the PSFS and SCI-SET.

**TABLE 5**  
Results of the CFA, including standardized factor loadings for the 14 items of the SCI-SCS

		Factor loading estimate*	SE	p	Cronbach's alpha ordinal	Skewness; Kurtosis
Factor 1 Muscle structures and pain	Chronic pain	0.627	0.063	<0.001	0.743	-0.18; -1.27
	Joint and muscle pain	0.744	0.069	<0.001		0.15; -1.24
	Muscle spasms (spasticity)	0.717	0.081	<0.001		-0.05; -1.25
	Contractures	0.717	0.087	<0.001		1.40; 0.40
Factor 2 Skin, breathing, and metabolism & Circulatory and autonomic	Respiratory problems	0.414	0.083	<0.001	0.657	2.51; 5.61
	Injury caused by loss of sensation	0.510	0.087	<0.001		2.01; 3.03
	Diabetes mellitus	0.337	0.090	<0.001		2.26; 4.13
	Pressure sore(s)	0.324	0.085	<0.001		1.92; 2.19
	Autonomic dysreflexia	0.831	0.096	<0.001		2.29; 4.20
	Postural hypotension	0.587	0.084	<0.001		1.53; 1.10
	Circulatory problems	0.367	0.083	<0.001		1.04; -0.27
Factor 3 Genitourinary and bowel	Bowel dysfunction	0.548	0.087	<0.001	0.574	0.15; -1.27
	Bladder dysfunction	0.350	0.073	<0.001		0.21; -1.54
	Sexual dysfunction	0.756	0.115	<0.001		1.29; 0.19

CFA: Confirmatory factor analysis; SCI-SCS: Spinal Cord Injury Secondary Conditions Scale; SE: Standard deviation; \* Standardized Coefficients estimated by diagonally weighted least squares method.

**TABLE 6**  
Correlations between sum scores and single items on SCI-SCS and other administered questionnaires

		Factor 1 Muscle structures and pain	Factor 2 Skin, breathing, and metabolism & circulatory and autonomic	Factor 3 Genitourinary and bowel	Total
<b>SCIM-III</b>					
Self-care	r	0.052	-0.224*	-0.062	-0.080
	p	0.631	0.035	0.564	0.455
Respiratory and sphincter management	r	-0.091	-0.288**	-0.265*	-0.260*
	p	0.397	0.006	0.012	0.014
Mobility	r	-0.028	-0.248*	-0.240*	-0.192
	p	0.792	0.019	0.024	0.072
Total	r	-0.029	-0.273**	-0.214*	-0.196
	p	0.788	0.010	0.044	0.065
Penn Spasm Scale	r	0.492***	0.183	0.295**	0.464***
	p	<0.001	0.087	0.005	<0.001
SCI-SET	r	-0.426***	-0.227*	-0.295**	-0.450***
	p	<0.001	0.032	0.005	<0.001
Beck depression inventory	r	0.435***	0.206	0.227*	0.392***
	p	<0.001	0.053	0.032	<0.001
Beck anxiety inventory	r	0.479***	0.333**	0.336**	0.502***
	p	<0.001	0.001	0.001	<0.001
PDQ	r	0.523***	0.162	0.160	0.390***
	p	<0.001	0.130	0.134	<0.001
<b>SF-36</b>					
Physical function	r	-0.086	-0.260*	-0.199	-0.215*
	p	0.424	0.014	0.063	0.044
Role physical	r	-0.210*	-0.048	-0.110	-0.173
	p	0.050	0.654	0.306	0.107
Vitality	r	-0.361***	0.040	-0.141	-0.223*
	p	<0.001	0.714	0.189	0.037
Role emotional	r	-0.179	-0.075	-0.159	-0.186
	p	0.095	0.490	0.140	0.083
Social function	r	-0.244*	0.009	-0.188	-0.169
	p	0.022	0.931	0.079	0.116
Bodily pain	r	-0.362***	-0.017	-0.098	-0.234*
	p	<0.001	0.873	0.366	0.029
Emotional well-being	r	-0.268*	-0.060	-0.142	-0.205
	p	0.012	0.581	0.188	0.055
General health	r	-0.117	0.074	-0.121	-0.087
	p	0.277	0.492	0.263	0.421

SCI-SCS: Spinal Cord Injury Secondary Conditions Scale; SCIM-III: Spinal Cord Independence Measure III; SCI-SET: Spinal Cord Injury Spasticity Evaluation Tool; PDQ: Pain-DETECT questionnaire; SF-36: 36-Item Short Form Survey; r: Spearman rho correlation coefficient; \* Significant at p<0.05; \*\* Significant at p<0.01; \*\*\* p<0.001.

## DISCUSSION

The SCI-SCS was cross-culturally adapted to the Turkish language in accordance with the guidelines for translating self-reported health

questionnaires.<sup>[24]</sup> The findings demonstrated excellent test-retest reliability and good internal consistency. The three-factor CFA model demonstrated a good fit to the data with the exception of the items

urinary tract infections and heterotopic ossification. Additionally, statistically significant correlations were found between the total SCI-SCS and SCI-SET, SCIM-III, PSFS, SF-36, BDI, BAI, and PDQ, except for the physical, emotional, social function, and general health domains of SF-36, as well as the self-care, mobility, and total subscales of SCIM-III.

The effective use of outcome measures is important for clinical care. The SCI-SCS is a quick and simple questionnaire that specifically measures secondary conditions that directly and indirectly impact health and physical functioning of patients with SCI.<sup>[9]</sup> Patients' perceptions about their conditions could influence their treatment plans. This self-reported questionnaire will be very valuable in clinical settings to identify secondary conditions and enable more profound understanding of the repercussions of secondary conditions on the daily lives of patients with SCI. Ensuring confidence in the utilization of the instrument across diverse cultures requires cross-cultural adaptation. This underscores the significance of our study.

In the present study, the mean sum score of SCI-SCS ( $12.42 \pm 6.90$ ) was higher than the mean sum score reported by Jørgensen et al.<sup>[11]</sup> ( $10.1 \pm 5.8$ ); however, it was lower than the mean sum score of  $17.1 \pm 7.6$  reported by Conti et al.<sup>[12]</sup> Although our participants were recruited from both the inpatient and outpatient rehabilitation units, 31.1% of patients were tetraplegic, which is lower than the rates in the studies of Conti et al.<sup>[12]</sup> and Jørgensen et al.<sup>[11]</sup> It was shown that tetraplegia significantly influences the total SCI-SCS score.<sup>[3]</sup>

Excellent test-retest reliability was found in our study, as in the study of Conti et al.<sup>[12]</sup> and Arora et al.<sup>[13]</sup> Telephone-based version of the SCI-SCS is also proposed to screen for secondary health conditions in low- and middle-income countries, where routine face-to-face follow-ups may not always be feasible and literacy poses a challenge.<sup>[13]</sup>

There exists no definitive consensus regarding the definition of the construct termed "secondary conditions." Craven et al.<sup>[8]</sup> expanded upon the SCI-SCS by incorporating six additional items, namely cardiac problems, high blood pressure, neurological deterioration, fracture, psychological distress, and depression. In our study, we removed heterotopic ossification as it did not show a significant correlation with the total score and also diagnosis requires radiologic examination. We performed CFA based on the factor structure described by Conti et al.,<sup>[12]</sup> and

they also omitted the item heterotopic ossification due to its low factor loading across all factors. Additionally, we omitted the item related to urinary tract infections due to its notably low loading factor. Furthermore, we merged two highly correlated latent variables, "skin, breathing, and metabolism" and "circulatory and autonomic," into a single latent variable. Urinary tract infections may not always be apparent to patients with SCI, or they may not be able to distinguish this condition from asymptomatic bacteriuria. Verifying these issues through a clinical assessment and educating patients about secondary conditions was recommended to prevent more severe complications. Factor analysis was utilized to reduce the number of items with similar impacts and identify groups of interrelated components that contributed to enhancing the construct validity of the SCI-SCS. While the SCI-SCS requires further consideration regarding the construct of secondary conditions following SCI, it enables individuals with SCI to effectively communicate their experiences with secondary conditions to medical professionals. Consequently, healthcare providers can make informed decisions and prioritize interventions based on the reported scores. Furthermore, enhancing the clarity of the construct of secondary conditions within the instrument could further optimize its utility.

Patients with SCI needed to be more informed about the secondary conditions. Korkmaz et al.<sup>[29]</sup> measured the patients' knowledge level about secondary complications at admission and discharge, and the knowledge level of the patients about secondary complications increased at discharge. To be able to prevent secondary consequences, patients with SCI have to learn and know secondary conditions. Moreover, the use of SCI-SCS is of great importance for patients in evaluating their secondary conditions.

The validity of the SCI-SCS was supported by statistically significant correlations between the SCI-SCS and all other administered questionnaires (Table 6). Higher scores on the SCI-SCS correlated with lower scores on health-related quality of life, similar to previous studies.<sup>[11,12,30]</sup> No correlation was found between the emotional, social function, and general health domains of the SF-36, as the SCI-SCS specifically targets physiological secondary conditions associated with SCI. As anticipated, correlations between the bodily pain domain of SF-36 and PDQ scores with SCI-SCS were statistically significant, consistent with previous



studies.<sup>[11,12]</sup> Beck depression and anxiety scores were also correlated with the SCI-SCS scores, as physiological secondary conditions have the potential to influence psychological aspects. The correlations between the subscales of SCIM-III were consistent with the factor items of SCI-SCS, as expected. Notably, the highest significant correlation was identified with the SCI-SET and PSFS. The SCI-SET measures the impact of spasticity on daily life in patients with SCI. The PSFS measures the patient's perception of spasm frequency. Patients' perceptions about their spasticity will often drive their treatment.<sup>[31]</sup> The SCI-SCS is able to record the subjective experience of problems related to SCI, and by combining with clinical assessment, convenient treatment plans can be formulated.

The lower percentage of tetraplegia in our study population is a limitation of our study since tetraplegia influences the SCI-SCS scores.<sup>[3]</sup> Furthermore, floor effects identified in the items diabetes mellitus, pressure sores, and circulatory problems could be attributed to the substantial number of participants who emphasized the absence of these conditions. This observation aligns with previous findings, underscoring the low prevalence of these complications in patients with SCI.<sup>[3,9,12]</sup> Another limitation could be the lower educational level of our patient population. The graduation rate from high school for our patients was 23.7%, in contrast to the findings of Conti et al.,<sup>[12]</sup> who reported a rate of 46.8%, and Jørgensen et al.,<sup>[11]</sup> who reported a rate of 30%.

In conclusion, the modified 14-item SCI-SCS represents a valuable self-rating tool for assessing secondary health conditions in patients with SCI in the Turkish population. It is recommended to educate patients with SCI about the secondary conditions and combine the self-reported measures with clinical assessment in Turkish population.

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**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Author Contributions:** Idea/concept, critical review, analysis and/or interpretation, writing the article: P.A., I.A.; Design: P.A., F.U.O., I.A.; Control/supervision: P.A.; Data collection and/or processing: P.A., A.A., F.U.O., Z.D.; Literature review: P.A., A.A.

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## APPENDIX 1

Hasta adı:

Tarih:

**Spinal Kord Yaralanmasına Bağlı İkincil Durumlar Skalası**

Aşağıdaki 14 sağlık problemi için lütfen son 3 ayda her birinin faaliyetlerinizi ve bağımsızlığınızı ne kadar etkilediğini değerlendirin. Son 3 ayda böyle bir durum yaşamadıysanız veya sizin için önemsiz bir sorunsuzsa lütfen "0"ı daire içine alınız. Durumların her birini derecelendirmek için aşağıdaki ölçeği kullanın.

- 0 Son 3 ayda yaşanmamış veya önemsiz bir problemdir.  
 1 Hafif veya nadir bir problemdir.  
 2 Orta derecede veya ara sıra olan bir problem.  
 3 Önemli veya kronik, devamlı olan bir problem.

Sağlık sorunu	Tanım	Derece
<b>Bası yarası (yaraları)</b>	Ciltte döküntü ya da kızarıklık şeklinde ortaya çıkar ve iltihaplı yaraya dönüşür. Deri ülseri, yatak yarası, dekübit ülseri olarak da adlandırılır.	0 1 2 3
<b>Duyu kaybı nedeniyle gelişen hasar</b>	Duyu kaybı nedeniyle yaralanma gelişebilir, kucakta sıcak sıvıların taşınması ya da ısıtıcı ve ateşin çok yakınında oturulması gibi.	0 1 2 3
<b>Kas spazmları (spastisite)</b>	Spastisite kontrol edilemeyen kas kasılması veya spazmları şeklinde kontrolsüz kas hareketlerini ifade eder. Sıklıkla enfeksiyon veya dar ayakkabı veya sıkı kemer kullanımı gibi durumlarda artar.	0 1 2 3
<b>Kontraktürler</b>	Kontraktür dirsek ve kalça eklemi gibi bir eklem, çevresindeki yumuşak dokuların kısılması nedeniyle gelişen eklem hareketindeki kısıtlanmadır. Bu durum, bir eklem, hareket açıklığı boyunca yeterli sıklıkta hareket edemediğinde ortaya çıkar. Ağrı genellikle bu soruna eşlik eder.	0 1 2 3
<b>Diyabet</b>	Diyabet kan şekeri seviyesindeki düzensizliklerden kaynaklanan bir sorundur. Belirtiler sık idrara çıkma ve aşırı susamadır. Bu durum bir hekim tarafından teşhis edilmelidir.	0 1 2 3
<b>Mesane disfonksiyonu</b>	İdrar kaçırma, mesane ya da böbrek taşları, böbrek problemleri, idrar kaçağı ve geri akımının hepsi mesane işlev bozukluğunun belirtileridir. NOT: İdrar yolu enfeksiyonları için ayrı bir madde bulunmaktadır.	0 1 2 3
<b>Bağırsak disfonksiyonu</b>	İshal, kabızlık, "kaçırmalar" ve bunlarla ilişkili sorunlar bağırsak işlev bozukluğunun belirtileridir.	0 1 2 3
<b>Cinsel disfonksiyon</b>	Seksüel fonksiyonlarda memnuniyetsizliği içerir. Memnuniyetsizliğin nedenleri hissin azalması, vücut algısındaki değişiklikler, hareketlerde zorluk ve bağırsak veya mesanede enfeksiyon gibi problemler olabilir.	0 1 2 3
<b>Otonom disrefleksi</b>	Bazen hiperrefleksi olarak adlandırılan otonom disrefleksi, vücudun ısı düzenleme sistemindeki bozuluktan kaynaklanır. Disrefleksinin belirtileri kan basıncında ani artışlar ve terleme, ciltte kızarıklıklar, tüylerin diken diken olması, göz bebeğinde büyüme ve baş ağrısıdır. Duyu kaybı olan bir kişide vücudun ağrıya yanıtı olarak da ortaya çıkabilir.	0 1 2 3
<b>Postural hipotansiyon</b>	Vücut pozisyonundaki değişikliklerle ortaya çıkan şiddetli baş dönmesi hissidir. Kan basıncındaki ani düşüş nedeniyle oluşur.	0 1 2 3
<b>Dolaşım problemleri</b>	Damarların, ayakların şişmesi veya kan pıhtısı oluşumunu içeren dolaşım problemleri.	0 1 2 3
<b>Solunum problemleri</b>	Solunum yolu enfeksiyonlarının ya da problemlerinin belirtileri nefes almada güçlük ve balgam artışıdır.	0 1 2 3
<b>Kronik ağrı</b>	Genellikle kronik karıncalanma, yanma ya da künt ağrı olarak hissedilir. Duyusu az veya olmayan alanlarda da görülebilir.	0 1 2 3
<b>Eklem ve kas ağrısı</b>	Belirli kas gruplarında veya eklemlerdeki ağrıyı içerir. Omuz kasları gibi belirli bir kas grubunu aşırı kullanması gereken veya eklemlerine çok fazla yük bindiren kişilerde ağrı gelişme riski vardır.	0 1 2 3