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Original Article

Psychometric validation of the Turkish version of the Neuropathic Pain Symptom Inventory

Serpil Savaş[1], Ayşegül Garip Honamlıoğlu[1], Adnan Karaibrahimoğlu[2], Serpil Demirci[3]

[1]Department of Physical Medicine and Rehabilitation, Süleyman Demirel University Faculty of Medicine, Isparta, Türkiye
[2]Department of Biostatistics and Medical Informatics, Süleyman Demirel University Faculty of Medicine, Isparta, Türkiye
[3]Department of Neurology, Süleyman Demirel University Faculty of Medicine, Isparta, Türkiye

ABSTRACT

Objectives: Certain symptoms of neuropathic pain and their combinations respond differently to various treatments. The Neuropathic Pain Symptom Inventory (NPSI) performs sensory phenotyping, providing a detailed assessment of neuropathic pain qualities, demonstrating responsiveness to changes in pain, and classifying patients for clinical trials in both central and peripheral conditions. This study aimed to perform a psychometric validation of the Turkish version of the NPSI (NPSI-T).

Patients and Methods: In this cross-sectional study, the NPSI-T, Douleur Neuropathique 4, and Numeric Rating Scale were administered twice to 275 patients with central and peripheral neuropathic pain (PNP) at 1-week intervals. All reliability and validity analyses, including factor analyses, Cronbach's alpha, Hotelling's T2, Tukey's test of nonadditivity, and item analysis, were performed using SPSS 27.0 (IBM Corp., Armonk, NY, USA). Software to compute descriptive statistics.

Results: The NPSI-T showed high reliability with a Cronbach's alpha of 0.89, an internal consistency Spearman-Brown coefficient of 0.779, and a significant 27% difference between upper and lower groups. The total explained variance was 61.58%, and five subdimensions were identified through exploratory factor analysis. Confirmatory factor analysis confirmed that the structure, consisting of four subdimensions with 9 items, is valid, as indicated by excellent goodness-of-fit indices.

Conclusion: The results of this study indicate that the NPSI-T is a reliable and valid instrument for assessing Turkish patients with central and PNP syndromes.

Keywords: Neuropathic pain, Neuropathic Pain Symptom Inventory, Turkish people, psychometrics.

Neuropathic pain results from a lesion or disease in the somatosensory nervous system.[1] This type of pain is often associated with chronic pain conditions and generally decreases the quality of life.[2] Patients with neuropathic pain have a wide range of causes and mechanisms, and display various sensory symptoms and signs related to pain. These include spontaneous pain (burning or pressing), paroxysmal pain (electric shock-like sensations), and/or allodynia (pain caused by brushing or pressure).[3] Symptoms related to peripheral and central lesions are similar regardless of the underlying cause.[4,5]

Due to the limited understanding of the underlying mechanisms, neuropathic pain treatment is not optimal. The response rate to pharmacotherapy for neuropathic pain is only 30-40%, which is even lower than that of a placebo.[6] This unsatisfactory therapeutic outcome is likely related to the diversity of sensory profiles, suggesting that different neurobiological mechanisms may respond differently to treatment.[7,8] Subgrouping patients with various causes of neuropathic pain primarily based on specific symptom combinations (i.e., pain descriptors) may lead to a more personalized treatment approach than the current one.[9-11]

Besides validated screening questionnaires like Douleur Neuropathique 4 (DN4), PainDETECT, and LANSS, several assessment questionnaires have also been developed to measure neuropathic symptoms, including

Corresponding author: Prof. Serpil Savaş, MD. Department of Physical Medicine and Rehabilitation, Süleyman Demirel University Faculty of Medicine, Isparta, Türkiye.
E-mail: serpilsavas@yahoo.com
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the Neuropathic Pain Scale (NPS) and the Neuropathic Pain Symptom Inventory (NPSI).[12] In clinical practice, assessment questionnaires can be used to characterize the nature of symptoms and monitor treatment responses.[6,13]

The NPSI is a simple, valid, and reliable tool that assesses various neuropathic pain symptoms, offering a quantitative measure of the type and intensity of different pain sensations.[13] Treatment-sensitive descriptors (plus two temporal items) facilitate the differentiation and measurement of five clinically important dimensions of central and peripheral neuropathic pain (PNP) syndromes. The NPSI conducts sensory phenotyping, providing a comprehensive assessment of neuropathic pain qualities, demonstrating sensitivity to changes in pain, and classifying patients for clinical trials.[9] The NPSI may also be used in future pharmacological studies to identify subgroups of patients who might respond differently to treatment.[9,10]

The NPSI has been translated and validated in several languages.[14-21] The Turkish version of the NPSI (NPSI-T) has been linguistically validated by the MAPI Research Trust; however, it has not yet undergone psychometric validation.[22]

This cross-sectional study aimed to conduct a psychometric validation of the NPSI-T.

PATIENTS AND METHODS

Before conducting the psychometric validation of the NPSI-T, approval was obtained from Dr. Didier Bouhassira, the original creator of the inventory. Additionally, permission to use the NPSI-T was secured from the MAPI Research Trust (Special Terms No. 120579). [(Turkish form of NPSI) contact information and permission to use: MAPI Research Trust, Lyon, France, https://eprovide.mapi-trust.org"].

Patients

This cross-sectional study included 275 patients with chronic neuropathic pain lasting more than three months, recruited from the physical medicine and rehabilitation and neurology clinics at a university hospital between January 2025 and September 2025. The diagnosis of neuropathic pain was established through clinical evaluation, including history and physical examination, and was confirmed when the total score on the Turkish DN4 Questionnaire was four or higher.[23]

Individuals excluded from the study included those under 18 years old, those experiencing pain not related to peripheral nerve diseases (such as bone metastasis or arthritis), individuals with a history of alcohol abuse or exposure to neurotoxic drugs (such as chemotherapy), individuals with psychiatric disorders (such as major depression), those currently experiencing depression, participants with cognitive impairment, as determined by clinical evaluation and medical history, and patients with additional neurological conditions that could significantly interfere with pain perception (e.g., severe or acute cerebrovascular disorders), illiterate individuals or those who lack primary school education, patients with non-neuropathic pain (such as myofascial pain syndrome), cases where a somatosensory system lesion could not be identified [such as complex regional pain syndrome (CRPS)], individuals with distinctly mixed pain syndromes (such as failed back surgery syndrome or tumor-related pain), and non-native Turkish speakers. The use of pain medication was not considered an exclusion criterion.

The sample size was calculated to be at least 60, with a minimum of 5-10 participants per item in the NPSI.[24]

All patients provided written informed consent, and the study was approved by the Süleyman Demirel University Ethics Committee on November 21, 2024 (document number: 85/3).

Procedure

The patients were evaluated during two consecutive visits, one week apart. During the first visit, demographic information, including age, gender, and education level (illiterate/primary school/middle school/high school/college, or university), was recorded. Participants completed four assessment tools: (1) the Turkish version of the DN4,[23] (2) the Turkish version of the Patient Health Questionnaire-9 (PHQ-9),[25] (3) the Numeric Rating Scale (NRS), where 0 means no pain and 10 indicates the worst possible pain,[26] and (4) the NPSI-T (Appendix 1). The PHQ-9 was used to diagnose depression, and individuals with scores of 20 or higher were excluded from the study.

Participants were recalled after one week and reassessed by the same interviewer to ensure test-retest reliability, thereby maintaining consistency across interviews. They were asked to complete the NRS, DN4, and NPSI-T. After one week, patients received medical treatment if needed.

Tools

The NRS, developed by Jensen et al.,[26] is a modified version of the visual analog scale scoring system. It is easy to use and assesses pain severity on a scale of 0 to 10. The patient was asked to rate their pain on a scale of 0-10, using 11 numerical values.

The French Neuropathic Pain group initially developed the DN4 scale.[27] This scale is widely used because of its convenience and ease of use. The DN4 is a questionnaire completed by clinicians, consisting of

ten items, seven of which relate to pain quality and are collected through patient interviews. The remaining three items are based on clinical examinations and assess the presence or absence of touch hypoesthesia, pinprick hypoesthesia, and tactile allodynia. Each positive item earns 1 point; each negative item earns 0 points. A score of 4 or higher out of 10 suggests neuropathic pain. The DN4 questionnaire was given to patients with suspected neuropathic pain, and those with a score of 4 or more were included in the study. Unal-Cevik et al.[23] conducted the validity and reliability study of the Turkish version of the DN4.

Bouhassira et al.[13] developed the NPSI. The NPSI includes 12 items: ten symptom descriptions rated on a scale of 0-10 (1-burning, 2-squeezing, 3-pressure, 5-electric shocks, 6-stabbing, 7-touching, 8-pressing, 9-pricking, and 10-tingling), and two additional items (4 and 7) that assess the duration and frequency of spontaneous and paroxysmal pain (pain attack and spontaneous pain). The overall intensity score was calculated by summing the scores for the ten descriptors (total score = 100). Five subscores were obtained by averaging the scores of items within each of the five factors. Participants were also evaluated on their understanding of each NPSI-T question: patients who needed assistance with the questionnaires due to vision problems, difficulty understanding the questions, or trouble completing the survey received help. The linguistically validated NPSI-T is licensed by MAPI Research Trust and may be used with permission.[22]

The PHQ-9 is a self-rated tool that measures the severity of depressive symptoms with reasonable sensitivity and specificity.[28] Participants rated how often they had been bothered by certain symptoms over the past two weeks on a 4-point Likert scale (0 = not at all to 3 = nearly every day). Total scores of 1-4 indicate minimal depression, 5-9 mild, 10-14 moderate, 15-19 moderately severe, and 20-27 severe depression. A total score of ≥11 has a sensitivity of 95% and specificity of 88.3% for major depression in the MS population.[29] Sarı et al.[25] conducted the validity and reliability study of the Turkish version of the PHQ-9.

Statistical analysis

Statistical analyses were conducted using SPSS 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics for categorical data are reported as frequencies (percentages), while numerical data are presented as mean ± standard deviation (median; minimum-maximum when applicable). The normality of the scale scores was assessed using the Kolmogorov-Smirnov test. The Wilcoxon test was used to compare repeated-scale scores. Spearman correlation analysis was used to examine the relationships between the different scales. Exploratory factor analysis (EFA) was performed to evaluate the validity of the NPSI-T using oblimin rotation. Reliability was assessed using Cronbach's alpha, item-total correlations, and Cronbach's alpha after deleting items. The internal consistency of the scale was evaluated using the split-half method, as indicated by the Spearman-Brown coefficient. Differences between the lowest and highest 27% of item scores were compared using the Student's t-test. Hotelling's T^2 and Tukey's tests of additivity analyses were conducted to identify potential response bias in the scale. Confirmatory factor analysis (CFA) was performed using JASP 0.95.0.0 (University of Amsterdam, Netherlands) to determine the scale's underlying structure. Fit indices were calculated, necessary modifications were made, and correlations between items and factors were visualized in a path diagram. Statistical significance was set at $p< 0.05$.

RESULTS

A total of 275 patients with neuropathic pain were enrolled in the study. Of these, 19 were excluded due to illiteracy, 18 were unreachable during follow-up, 12 had major depression, 1 had alcohol-related PNP, 14 had myofascial pain syndrome, 2 had CRPS, 2 were under 18, 3 were receiving chemotherapy, and 4 had a NRS score of 0. Consequently, the study included 200 patients with neuropathic pain.

The mean age of the patients was 53.3±14.9 years, with an age range of 18 to 94 years. The cohort consisted of 51.5% males. Over half of the patients (55%) had an education level corresponding to primary school. Additionally, 63% of the patients needed help to complete the NPSI-T. Lumbar radiculopathy was identified as the predominant cause of neuropathic pain, accounting for 29.5% of cases. Table 1 shows patient characteristics and the causes of neuropathic pain.

Psychometric analyses

A candidate scale was used for the validity and reliability study after reaching half of the patients (n=100). The purpose of this application was to demonstrate that the NPSI-T scale, which we aimed to validate and establish as reliable, could be applied at regular intervals using the test-retest method ($r=0.734$; $p< 0.001$ and intraclass correlation coefficient = 0.854, indicating high agreement). Subdimensions were created, and high reliability was found.

The total sample was randomly split into two independent subsamples to perform exploratory and confirmatory analyses separately. EFA was conducted in one subsample (n=100), and CFA was performed in a separate subsample (n=200), with a larger allocation to CFA due to its higher power requirements.

TABLE 1
Characteristics of patients and the causes of neuropathic pain

Characteristics	n=200
Age, years (mean ± SD)	53.33 ± 14.9
Gender, n (%)	
Female	97 (48.5)
Male	103 (51.5)
Educational level, n (%)	
Primary school	110 (55.0)
Secondary school	23 (11.5)
High school	38 (19.0)
University	29 (14.5)
Need assistance with finishing the questionnaire, n (%)	
Yes	126 (63.0)
No	74 (37.0)
Causes of neuropathic pain, n (%)	
Lumbar radiculopathy	60 (30.0)
Peripheral nerve injury	53 (26.5)
Entrapment neuropathy	35 (17.5)
Spinal cord injury	18 (9.0)
Non-diabetic neuropathy	10 (5.0)
Brachial plexus injury	7 (3.5)
Diabetic polyneuropathy	6 (3.0)
Postherpetic neuralgia	5 (2.5)
Multiple sclerosis	4 (2)
Parkinson's disease	2 (1.0)

SD, standard deviation.

Validity analyses

Exploratory factor analysis

EFA is a multivariate statistical technique used primarily for data reduction and for identifying latent constructs within a dataset. Unlike CFA, which tests a pre-specified theoretical model, EFA is discovery-oriented and allows the data to reveal its underlying structure by grouping highly correlated variables into a smaller set of summary dimensions, or factors. In practice, researchers examine factor loadings to assess the strength of relationships between observed variables and the underlying factors, often using rotation methods such as varimax or direct oblimin to obtain a clearer, more interpretable solution. The decision of how many factors to retain is usually guided by metrics such as eigenvalues greater than 1 (Kaiser's criterion), with the ultimate goal of establishing construct validity by demonstrating that the items consistently map onto distinct theoretical concepts.

A sample group of 100 patients was selected to assess the construct validity of the scale. EFA was used to determine the structure. Since the Kaiser-Meyer-Olkin value was 0.892 and Bartlett's sphericity test results were significant, it was concluded that the scale items were appropriate for factor analysis. Since the subdimension structure without rotation was inadequate, the oblimin rotation method was applied. The duration information on the scale was removed from two questions, resulting in a structure with 10 questions. The original scale had five dimensions, with one dimension consisting of only a single question [item 1: burning (superficial) spontaneous pain]. Because the content of this item and the other dimensions differed, item 1 was removed from the factor analysis, which was then conducted with the remaining nine items. First, the correlation values among all items were analyzed. It was decided that no item should be removed from the scale, as none had an extremely high correlation (above 0.90). The common factor variances of the items were examined, and it was decided that no item needed to be removed from the scale, as the smallest h^2 value was 0.404. Accordingly, four dimensions were identified using an eigenvalue threshold of 1. Since the total explained variance across these four dimensions was 61.58%, the four-factor structure was deemed appropriate. The factor loadings of the items within the dimensions were analyzed, revealing no overlapping factors, negative loadings, or loadings below 0.50. Therefore, it was concluded that no items needed to be removed from the scale. The first dimension was named "evoked pain," and it consisted of three items. The second dimension was called "paresthesia/dysesthesia" and consisted of two items. The third dimension was the "paroxysmal pain" dimension and included three items, while the last subdimension contained two items and was called "pressing deep spontaneous pain." Upon examining the items and their related dimensions, it was found that the same underlying structures as those of the original scale emerged (Table 2).

Confirmatory factor analysis

CFA is a hypothesis-driven statistical technique used to verify the factor structure of observed variables, specifically to test whether a researcher's theoretical understanding of a construct fits the data. Unlike EFA, which allows the data to dictate the structure, CFA requires the researcher to specify an a priori model, explicitly defining which variables are associated with which latent factors before the analysis begins. This method is widely used in the validation phase of scale development and is a fundamental component of structural equation modeling. By demonstrating that the items load onto their respective factors as hypothesized, CFA provides robust evidence for construct validity and allows researchers to test measurement invariance across different groups or time points.

A CFA was performed based on the structure derived from the initial analysis. The developed model was tested on the remaining sample (n=100), and responses from

TABLE 2
Results of NPSI-T factor analysis

	Factor loadings				
Items	Evoked pain	Paresthesia/ dysesthesia	Paroxysmal pain	Pressing deep spontaneous pain	Common factor variance (h^2)
Item 9 (evoked-pressure)	0.832				0.625
Item 8 (evoked-brushing)	0.792				0.688
Item 10 (contact-cold)	0.615				0.422
Item 12 (tingling)		0.801			0.698
Item 11 (pins and needles)		0.753			0.653
Item 5 (electric shocks)			0.580		0.404
Item 6 (stabbing)			0.553		0.541
Item 3 (pressure)				0.775	0.625
Item 2 (squeezing)				0.740	0.550
Item 1 (burning)					
Cumulative variance %	61.58				
KMO measure of sampling adequacy		0.892			
Bartlett's test of sphericity X^2	119.77	p< 0.001			
Cronbach's alpha	0.828	0.704	0.886	0.741	0.892
Half-split internal consistency	**Part 1**	0.779	**Part 2**	0.894	
Spearman-Brown coefficient	0.754				
Hotelling's T^2	159.78	F=16.31	p< 0.001		
Tukey's test of additivity		F=0.016	p= 0.900		

NPSI-T, Turkish version of the Neuropathic Pain Symptom Inventory.

the first sample were also included. Consequently, a path diagram was created based on the subdimensions to assess participants' reactions to the items (n=200). The X^2/df of the model was less than 1, indicating that the model was suitable for the factorial structure. When examining the fit indices, CFI = 1, Tucker-Lewis index = 1, incremental fit index = 1, and relative fit index = 1 indicate an excellent fit. Normed fit index = 0.920, which is acceptable, whereas parsimony normed fit index = 0.552 suggests that the model is relatively complex. Overall, the model fit the data well. The information criteria for the model were Akaike information criterion = 10,434.92, Bayesian information criterion = 10,560.26, and sample-size adjusted Bayesian information criterion = 10,439.87, indicating a balance between model complexity and goodness of fit. These values are preferable to those of the alternative models, indicating sufficient simplicity. Regarding absolute fit indices, root mean square error of approximation values less than 0.001 (90% confidence interval = 0.000-0.054, p= 0.928) and a standardized root mean square residual of 0.042 demonstrated an excellent fit. Additionally, goodness-of-fit index = 0.990 and McDonald fit index = 1.002 indicated a strong model fit. Sufficient levels of Hoelter's N suggest that the sample size was adequate for the model (Table 3).

When examining the standardized factor loadings of the model items, it was observed that the loads of all items range from 0.36 to 0.82. Notably, the high factor loads (relationship levels) of items such as question 11 (0.822), question 8 (0.790), and question 3 (0.785) suggest that these items strongly represent the relevant structures. Although the coefficient for question 10 was relatively low (0.365), it remained within acceptable limits. The p-values for all items were significant, indicating that the relationships in the model were statistically significant (Table 4).

When correlations among factors were analyzed, substantial and significant relationships emerged between paroxysmal pain and pressing spontaneous pain (β = 0.623, p< 0.001) and between paresthesia/ dysesthesia and pressing spontaneous pain (β = 0.530, p< 0.001). Pressing spontaneous pain was significantly and moderately related to evoked pain (β = 0.299, p= 0.002) and paresthesia/dysesthesia (β = 0.427, p< 0.001). Additionally, a significant correlation was observed between evoked pain and paresthesia/dysesthesia (β = 0.387, p< 0.001). The path diagram visualizing the relationships among the factors is shown in Figure 1.

TABLE 3
Results of the confirmatory factor analysis fit indices

Fit indices	Value	Acceptance
X^2/df	26.37/27=0.976	Excellent fit
Comparative fit index	1.000	Excellent fit
Tucker-Lewis index	1.000	Excellent fit
Bentler-Bonett non-normed fit index	1.000	Excellent fit
Bentler-Bonett normed fit index	0.920	Acceptable fit
Parsimony normed fit index	0.552	Acceptable fit
Bollen's relative fit index	0.866	Acceptable fit
Bollen's incremental fit index	1.000	Excellent fit
Relative noncentrality index	1.000	Excellent fit
Log-likelihood	-5179.62	
Number of free parameters	38.000	
Akaike	10434.924	
Bayesian	10560.260	
Sample-size adjusted Bayesian	10439.872	
Root mean square error of approximation	<0.001	Excellent fit
RMSEA 90% CI lower bound	<0.001	
RMSEA 90% CI upper bound	0.054	
RMSEA p-value	0.928	
Standardized root mean square residual	0.042	Excellent fit
Hoelter's critical N (α = 0.05)	305.218	
Hoelter's critical N (α = 0.01)	357.166	
Goodness of fit index	0.990	Excellent fit
McDonald's fit index	1.000	Excellent fit
Expected cross-validation index	0.512	Excellent fit

RMSEA, root mean square error of approximation; CI, confidence interval; df: degrees of freedom.

TABLE 4
NPSI-T item-factor relationship levels

Factor	Indicator	Standardized estimate	Z-value	p-value
Paroxysmal pain	Item 5 (electric shocks)	0.616	6.935	<0.001*
Pressing spontaneous pain	Item 6 (stabbing)	0.498	6.070	<0.001*
	Item 2 (squeezing)	0.585	7.674	<0.001*
	Item 3 (pressure)	0.785	9.187	<0.001*
Evoked pain	Item 8 (evoked-brushing)	0.790	7.859	<0.001*
	Item 9 (evoked-pressure)	0.645	7.465	<0.001*
	Item 10 (contact-cold)	0.365	3.616	0.001*
Paresthesia/dysesthesia	Item 11 (pins and needles)	0.822	8.580	<0.001*
	Item 12 (tingling)	0.538	6.814	<0.001*

*Significant at the 0.05 level based on CFA.
NPSI-T, Turkish version of the Neuropathic Pain Symptom Inventory; CFA, confirmatory factor analysis.

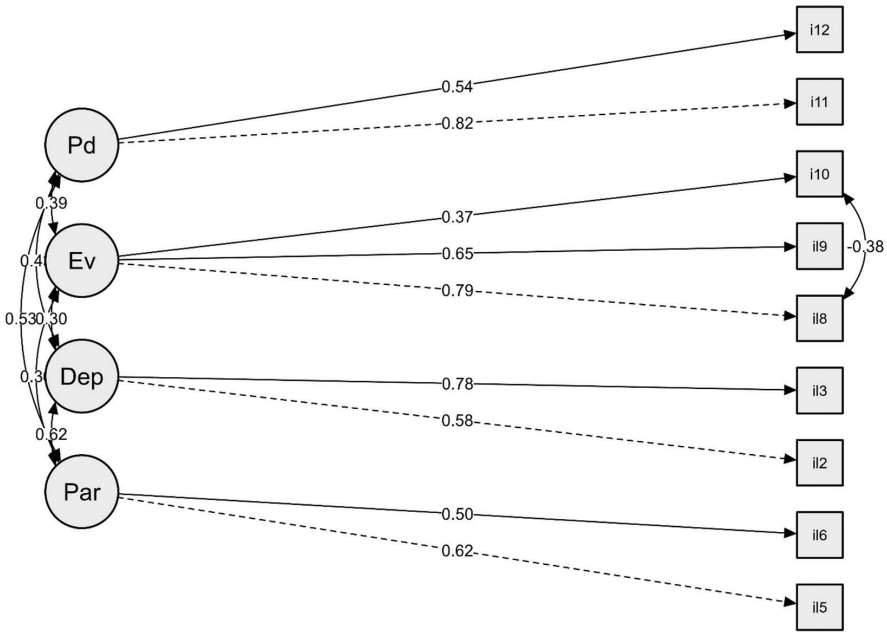

Figure 1. NPSI-T path diagram.

Pd, paresthesia/dysesthesia; Ev, evoked pain; Dep, pressing deep spontaneous pain; Par, paroxysmal pain; NPSI-T, Turkish version of the Neuropathic Pain Symptom Inventory.

Correlation

The total score of the scale and the correlation values between the subdimensions were examined. Strong and positive correlations were identified between the total NPSI score and all its subdimensions ($p< 0.001$). The highest correlation was observed between the evoked pain subdimension and total NPSI score ($r=0.724$). At the same time, the lowest score was found between the paresthesia/dysesthesia subdimension and the total NPSI score ($r=0.538$). Low correlations were observed between evoked pain and spontaneous pain, as well as between the paresthesia/dysesthesia subdimension and the other dimensions. No significant correlation was observed between the paresthesia/dysesthesia, paroxysmal pain, and pressing spontaneous pain subdimensions ($p> 0.05$).

Comparison of Neuropathic Pain Symptom Inventory with other neuropathic scales

The correlation coefficients between the NRS, DN4, and NPSI-T scores were analyzed for patient data collected both before and at one week. Correlations within each scale for measurements were positive and highly significant ($p< 0.001$). Moderate yet positive correlations were observed between the NRS and NPSI-T scores ($r=0.362$; $p< 0.005$). However, no significant relationship was found between DN4 and NPSI scores ($r=0.116$; $p= 0.249$), and NRS and DN4 scores ($r=0.056$; $p= 0.582$).

Reliability analyses

The reliability analyses began with item analysis. The mean values of the scale items were calculated. The highest intensity score was from the question "do you feel tingling" (6.91±2.38). Conversely, the lowest score was obtained from the question "does your pain feel like something is pressing on the painful area?" (2.63±3.44). When examining the item-total correlation values, it was noted that the correlations for "does your pain feel like burning?" and "does your pain feel like stabbing?" were low at 0.170 and 0.098, respectively. Nonetheless, these items were retained due to their high factor loadings and substantial common factor variance; the overall reliability remained stable even after they were removed. The overall reliability of the ten items was assessed using Cronbach's alpha, which yielded a value of 0.892. The reliability values for the subdimensions were 0.828, 0.704, 0.886, and 0.741, respectively. These values were within acceptable limits.

For the internal consistency analysis of the scale, first, the differences between the lower 27% and the upper 27% for each item score were examined. The difference between the lower and upper 27% of all items was found to be quite significant according to Student's t-test. As an alternative method, the split-half method was used. The correlation between the scores on the first five questions and the last five was examined. The Spearman-Brown coefficient was calculated as 0.779 for the first half and 0.894 for the second half, with a correlation of 0.754. This indicated that the scale's reliability level and internal consistency were good. Moreover, the test-retest reliability was measured at $r=0.734$, as mentioned above, indicating that the candidate scale is reliable (Table 5).

TABLE 5
NPSI-T item analysis

Items	Mean ± SD	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted	Lower 27%	Upper 27 %	t
Item 1 (burning)	5.48±3.41	0.170	0.154	0.889	0.70±1.38	9.30±0.82	8.20*
Item 2 (squeezing)	3.28±3.76	0.206	0.110	0.882	0±0	8.41±1.08	7.16*
Item 3 (pressure)	2.63±3.44	0.390	0.254	0.836	0±0	7.52±1.67	6.95*
Item 5 (electric shocks)	4.38±3.36	0.328	0.156	0.852	0±0	8.41±0.93	7.19*
Item 6 (stabbing)	4.65±3.74	0.098	0.122	0.909	0±0	9.11±0.89	7.21*
Item 8 (evoked-brushing)	2.99±3.62	0.270	0.248	0.866	0±0	8.00±1.35	7.08*
Item 9 (evoked-pressure)	4.26±4.13	0.361	0.254	0.840	0±0	9.41±0.74	7.23*
Item 10 (contact-cold)	3.53±4.17	0.299	0.160	0.858	0±0	9.33±0.83	7.22*
Item 11 (pins and needles)	5.74±3.03	0.412	0.352	0.836	1.63±1.69	8.96±0.89	9.88*
Item 12 (tingling)	6.91±2.38	0.189	0.270	0.883	0.70±1.38	9.30±0.82	8.20*

*Indicates the significant t-values at the 0.05 level according to Student's t-test.
SD, standard deviation.

Hotelling's T^2 and Tukey's test of additivity analyses were performed to evaluate the scale's response bias. Both Hotelling's T^2 value and the F-statistic (F=16.31) were significant ($p< 0.001$). Additionally, the non-additivity value was not substantial according to the Tukey test of additivity (F=0.016; p= 0.900). Based on these findings, it was concluded that there was no response bias.

DISCUSSION

This study evaluated the validity and reliability of the NPSI-T. The NPSI is a validated and reliable tool that includes 10 treatment-sensitive descriptors and two temporal items, which help differentiate and measure five clinically important dimensions of central and PNP syndromes. The psychometric properties of the NPSI are used to identify patient subgroups with neuropathic pain and to determine whether they respond differently to various medications and other treatments.[6,9,10]

The NPSI-T demonstrated high reliability, with a Cronbach's alpha of 0.89 and a Spearman-Brown internal consistency coefficient of 0.779. Item discrimination analysis revealed a statistically significant 27% difference between the upper and lower groups, indicating good discriminative power. The findings demonstrate that the NPSI-T exhibits strong psychometric validity and reliability, comparable to the original version in terms of internal consistency and factor structure.[13] The Cronbach's alpha of 0.89 is comparable to values reported for Iran (0.90), Germany (0.91), China (0.90), and Japan (0.86).[15,17,19,20] Additionally, agreement with the original scale's 5-factor structure is a significant indication of structural validity.[13]

We observed a moderate positive correlation between the NPSI-T and the NRS, indicating that neuropathic pain symptoms are related to pain intensity while reflecting distinct constructs. This result may support the convergent validity of the NPSI-T and its multidimensional assessment of neuropathic pain.

While most of our patients understood and answered the questions, a few required clarification of the term "pressure" in question 9, although the term holds a similar meaning in both Turkish and English, its technical application in Turkish caused comprehension difficulties for some patients. For this reason, question 9 in the NPSI-T may require additional explanations.

The original NPSI was designed as a self-administered questionnaire. However, 63% of participants in our study required clinician assistance to complete it. This may reflect the educational background of the sample population. Many of these individuals were primary school graduates, which could have made it more challenging for them to complete the inventory, given their limited health literacy and unfamiliarity with surveys or forms. Although this did not affect the validity of the questionnaire, it could have impacted the independence of participants' responses.

In addition, while the NPSI is invaluable for measuring the patient's subjective experience as a self-report tool, it is susceptible to certain limitations. Patients may exaggerate their responses due to their current mental state or forget specific details about their pain, introducing potential bias and affecting the accuracy of the data collected.[19]

A key strength of our study is its inclusion of a wide range of neuropathic pain causes, rather than focusing on a single one. This variety improves the applicability of our results across different clinical cases.

In conclusion, this study has validated the psychometric properties of the NPSI-T, demonstrating that the instrument effectively assesses neuropathic symptoms and is suitable for both clinical and research applications in central and PNP syndromes. However, individuals with limited education may require assistance to complete the questionnaire. Additionally, the term "pressure" in the NPSI-T may need further explanation for Turkish patients to ensure accurate understanding.

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

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Appendix 1: https://d2v96fxpocvxx.cloudfront.net/2c83d69a-dc5a-476c-9385-2d943ca48693/content-images/6bdb0fe7-0a8f-4852-972b-4ff043daa9af.pdf

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