## Validity and responsiveness of the pain self-efficacy questionnaire in patients with neck pain disorders

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# Validity and Responsiveness of the Pain Self-Efficacy Questionnaire in Patients With Neck Pain Disorders



**STUDY DESIGN:** Longitudinal clinimetric study.

**BACKGROUND:** Pain self-efficacy predicts poor recovery and mediates the relationship between pain and disability in patients with neck pain disorders (NPDs). The Pain Self-Efficacy Questionnaire (PSEQ) is a frequently used instrument to measure pain self-efficacy; however, its measurement properties have never been evaluated in a group of patients with NPDs.

**OBJECTIVES:** This study aimed to assess validity and responsiveness of the PSEQ in patients with NPDs.

**METHODS:** Patients with NPDs (n = 161) were included. Confirmatory and exploratory factor analysis was used to assess structural validity. Twelve hypotheses on expected correlations with other instruments were formulated a priori to assess construct validity. Responsiveness was evaluated in 146 patients with NPDs who underwent multimodal rehabilitation by testing 12 hypotheses on expected effect sizes, area under the curve, and correlations with change in other instruments.

**RESULTS:** Factor analyses showed that the PSEQ is a unidimensional instrument with moderate construct validity and responsiveness (50% to 75% of hypotheses met). Validity was consistent when analyzed separately for patients with whiplash-associated disorders and idiopathic neck pain, and responsiveness was better in patients with idiopathic neck pain.

**CONCLUSION:** The PSEQ is a unidimensional measure of pain self-efficacy in patients with NPDs, as found by previous studies in other populations. Nevertheless, in contrast with previous studies, its construct validity and responsiveness were found to be suboptimal in NPDs, suggesting that the content validity of the PSEQ and of the comparator instruments used in this study should be better assessed. *J Orthop Sports Phys Ther 2018;48(3):204-216. Epub 19 Dec 2017. doi:10.2519/jospt.2018.7605*

**KEY WORDS:** *cervical spine, factor analysis, idiopathic, whiplash*

Neck pain disorders (NPDs) are a leading cause of disability worldwide[84] and a cost burden to health care systems and society.[4,59] The lifetime activity-limiting mean prevalence of neck pain is estimated to be 23%, and the point prevalence is approximately 14%.[35] Neck pain disorders include various diagnoses, such as idiopathic neck pain (INP), headache, and whiplash-associated disorders (WADs).[38] The clinical course of these disorders is not favorable for a substantial number of patients who experience persistent symptoms and disability over time.[73,85]

Several prospective cohort studies have identified the role that psychological factors play as predictors of poor recovery in patients with NPDs.[6,7,41,70,86] One of the psychological factors that has been extensively studied is pain self-efficacy.[57] Self-efficacy can be defined as confidence in one's own ability to accomplish a given task or activity.[3] In people with pain, the perceived ability to perform certain activities despite the presence of pain has been associated with the level of disability.[30,89] In patients with NPDs, pain self-efficacy has been found to be a predictor of poor recovery[23] and a mediator in the relationship between pain and disability.[43,44] Low self-efficacy is also common in patients with WAD[5] and a more relevant factor in this population than in other posttraumatic musculoskeletal conditions.[71] In chronic WAD, lower self-efficacy has also been associated with more widespread pain.[29] Importantly, clinical trials have reported improved self-efficacy following various interventions in people with NPDs, including neck-specific exercise combined with a behavioral approach[45]

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and interactive behavioral modification therapy.[78] Pain self-efficacy is an aspect worth exploring to improve the understanding and management of patients with NPDs.

It is recommended that clinicians assess psychosocial factors when managing patients with NPDs,[13] and to be able to do so, they need sound measurement instruments. Several patient-reported measurement instruments have been developed to assess pain self-efficacy.[49] The Pain Self-Efficacy Questionnaire (PSEQ) is the most frequently used in individuals with pain[8] and may also be the most appropriate, being a widely investigated, short self-reported instrument.[57] Its measurement properties have been shown to be satisfactory in various countries, languages, and patient populations.[1,11,12,27,31,47,57,58,61,68,79,83] However, the PSEQ has mostly been tested in samples of patients with chronic pain, including several pain disorders (eg, widespread pain, headache, leg pain),[1,31,57,58,61,68,79,83] or in samples of patients with chronic low back pain (LBP).[11,12,27,47,57] No studies have investigated its measurement properties in a sample of patients presenting with NPDs as their primary musculoskeletal complaint.

The measurement properties of an instrument are population specific and context specific, and they should be assessed before use in clinical research and practice in specific populations.[25] The validity of a questionnaire refers to "the degree to which a test measures what it claims, or purports, to be measuring,"[20] and there is consensus that this measurement property is dependent on the context of a given measurement application.[46] Responsiveness is defined as "the ability of a measurement instrument to detect change over time in the construct to be measured," a measurement property that is also population specific and context specific.[65] Previous research has identified the need to assess the PSEQ measurement properties in populations of patients with the same pain disorder.[11,58]

Therefore, the aim of the present study was to assess the validity and responsiveness of the PSEQ in patients with NPDs. Considering the important role of pain self-efficacy as a prognostic factor and mediator in NPDs,[23,43,44] this study can be valuable to clinicians and researchers who intend to measure the pain self-efficacy construct in this patient population.

# METHODS

## Study Participants and Procedure

Patients included in the present study were recruited between April 2012 and December 2015 from 2 clinical settings: an outpatient service of a rehabilitation hospital (Lissone, Italy) and a rehabilitation center (Torino, Italy). Patients were screened by a rehabilitation physician with more than 10 years of clinical experience, or by 2 physical therapists with more than 5 years of experience. Inclusion criteria were being more than 18 years of age, having neck pain with or without arm pain or headache as a primary complaint, and being able to fluently read and speak Italian. Patients with WAD were included only if classified as grade I or II, according to the Quebec Task Force.[72] Exclusion criteria were specific causes of neck pain (eg, fracture), central neurological signs, fibromyalgia, systemic illnesses such as rheumatoid arthritis, and severe psychiatric diseases.

After signing the informed-consent form, patients were asked to fill out a booklet to collect information on sociodemographic and clinical characteristics. The booklet included the PSEQ and a set of self-reported measurement instruments to assess validity and responsiveness. All participants received a combination of manual therapy and exercise, as chosen by the physical therapists in charge of the treatment. When prescribed, patients also received cognitive-behavioral education, massage, or shortwave diathermy. Four physical therapists with 6, 8, 10, and 11 years of clinical experience were involved in delivering the treatments. Patients receiving physical therapy combined with cognitive-behavioral education underwent 10 sessions over 5 weeks, while all other patients received 6 sessions over 3 weeks. The cognitive-behavioral component was included because there is evidence suggesting that a multimodal intervention is effective in patients with chronic INP.[52] All patients were readministered the PSEQ and the other self-reported measurement instruments after the last treatment session.

Ethical approval for this clinimetric study was obtained from the Institutional Review Board of the Scientific Institute of Lissone, Salvatore Maugeri Foundation Institute of Care and Research.

## Pain Self-Efficacy Questionnaire

The PSEQ consists of 10 items that represent different daily activities or general aspects of life and ask patients to rate how confident they feel performing these activities, despite the presence of pain.[57] Each item is rated on a scale ranging from 0 ("not at all confident") to 6 ("completely confident"), and the total score can range from 0 to 60, with higher scores indicating better self-efficacy. The Italian version of the PSEQ used in this study has been shown to be unidimensional and to have optimal internal consistency, test-retest reliability, construct validity, and responsiveness in patients with chronic LBP.[11,12]

## Comparator Instruments

A set of patient-reported measurement tools were included as comparator instruments. These instruments were chosen to measure constructs representing core domains in patients with spinal pain (disability and pain intensity)[9] and psychosocial constructs found in previous studies to correlate moderately with pain self-efficacy (pain catastrophizing and fear of movement).[11,12,17,58,89] To increase the comparability of our findings, we used the instruments that have been more thoroughly investigated[69] or most frequently used[8] to measure these constructs. A global perceived effect scale

was administered following treatment to allow a more thorough assessment of responsiveness.[26]

Two 11-point numeric rating scales (NRSs) ranging from 0 ("no pain") to 10 ("the worst imaginable pain") were used to measure pain intensity[37] by asking the patients to rate their average neck pain over the last 24 hours and the last 7 days. Two NRSs were adopted, because there is evidence suggesting that pain intensity ratings may be sensitive to different recall periods.[39] The NRS has been shown to be a valid, reliable, and responsive tool for use in patients with NPDs.[14]

The Neck Disability Index (NDI) was used to assess neck pain–related disability.[81] It includes 10 items that assess pain intensity, personal care, lifting heavy objects, reading, headache, concentration, working, driving, sleeping, and distraction. Each item ranges from 0 to 5, and the total score is converted into a percentage. The NDI is the most frequently investigated questionnaire for neck pain disability, being a reliable, valid, and responsive instrument.[69] The Italian version showed good measurement properties in patients with INP.[53,55]

To assess the extent of pain catastrophizing, the 13-item Pain Catastrophizing Scale (PCS) was used.[74] Each item assesses the frequency of catastrophic thoughts and feelings related to pain on a 5-point Likert scale ranging from 0 ("never") to 4 ("always"), and the total score ranges from 0 to 52, with higher scores indicating higher pain catastrophizing. There is previous evidence that the total score of the PCS can be used as an interval-level measure.[87] The Italian version of the PCS exhibited adequate reliability and structural and construct validity in patients with chronic pain.[54]

The Tampa Scale of Kinesiophobia (TSK) was adopted to evaluate patients' fear of movement.[82] This 13-item questionnaire asks participants how strongly they agree or disagree with statements regarding pain and movement. Each item is answered on a scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"), to provide a total score ranging from 13 to 52. The TSK has shown acceptable internal consistency and test-retest reliability in patients with NPDs,[15] and the Italian version has shown good validity, reliability, and responsiveness in patients with chronic LBP.[56]

A global perceived effect scale was administered to patients following treatment to assess the extent of their perceived improvement. This scale asks the patients, "Compared to how you were feeling at the beginning of treatment, how would you describe yourself now?" The response categories are (1) totally recovered, (2) much improved, (3) rather improved, (4) slightly improved, (5) unchanged, alike the beginning of treatment, (6) slightly worsened, (7) rather worsened, (8) much worsened, and (9) worse than ever. Patients were specifically asked to indicate only 1 response option. This transition scale was used because it has been shown to be valid and reliable in patients with musculoskeletal disorders.[40,88]

## Validity Assessment

Structural and construct validity are 2 different subdomains of validity. Structural validity assesses the extent to which scores on the instrument reflect the dimensionality of the construct to be measured, and construct validity assesses the extent to which the scores on an instrument are consistent with a priori formulated hypotheses.[51]

Structural validity was assessed by testing the hypothesis that the PSEQ is a unidimensional measure of pain self-efficacy in patients with NPDs, where unidimensionality means that all patients' responses to the items account for the same underlying theoretical construct and not multiple constructs.[28] Confirmatory factor analysis was performed to determine whether the data fit our hypothesized measurement model.[63] Because the cutoffs of standard confirmatory factor analysis for good fit are rarely met in health outcome assessment,[16] we also ran an exploratory factor analysis to further assess the unidimensionality hypothesis, as suggested and performed by psychometric experts.[16,18,19,63]

Construct validity was assessed by formulating a set of 12 a priori hypotheses regarding expected correlations between the PSEQ and the comparator instruments and differences in mean scores between relevant subgroups, as suggested by the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) initiative,[25,50,51] the Patient-Reported Outcomes Measurement Information System initiative,[34] and the International Society for Quality of Life Research.[64] These hypotheses are presented and explained in **TABLE 1**. Because no studies were available in patients with NPDs, the magnitude and direction of hypothesized correlations with comparator instruments were based on previous studies conducted in patients with chronic LBP and reporting cross-sectional correlations with measures of pain self-efficacy.[12,17,32,89]

## Responsiveness Assessment

As recommended by clinimetric experts,[25,34,50,51,60,64] a priori hypotheses were also formulated for the evaluation of responsiveness. These hypotheses concerned expected effect sizes, areas under the curve, and expected correlations between the change scores of the PSEQ and the change scores of other instruments (**TABLE 1**). Differences in effect sizes were expected between adjacent categories of the global perceived effect scale, as observed in a previous study of patients with chronic LBP.[11] Larger effect sizes were expected in patients receiving the cognitive-behavioral treatment, as there is already evidence suggesting this pattern in patients with NPDs.[45,78] For assessing the area under the curve, patients classified as "totally recovered," "much improved," and "rather improved" on the global perceived effect scale were considered improved, and those rating "slightly improved," "unchanged," and "slightly worsened" were considered unchanged.[24] Correlations between PSEQ change scores and change scores of other instruments were based on previous studies

**TABLE 1** Hypotheses Formulated A Priori to Assess Construct Validity and Responsiveness of the Pain Self-Efficacy Questionnaire in Patients With Neck Pain Disorders

| Construct Validity | Total Sample | WAD Sample | INP Sample |
|---|---|---|---|
| 1. The correlation between the PSEQ scores and the NDI scores is negative and >0.60 | – | – | – |
| 2. The correlation between the PSEQ scores and the NRS scores is negative and 0.30≤0.60 | – | – | + |
| 3. The correlation between the PSEQ scores and the PCS scores is negative and 0.30≤0.60 | + | + | + |
| 4. The correlation between the PSEQ scores and the TSK scores is negative and 0.30≤0.60 | + | + | – |
| 5. The correlation between the PSEQ scores and the NDI scores is ≥0.20 than the correlation between the PSEQ scores and the NRS-7 scores | – | – | – |
| 6. The correlation between the PSEQ scores and the NDI scores is ≥0.10 than the correlation between the PSEQ scores and the PCS scores | – | – | + |
| 7. The correlation between the PSEQ scores and the NDI scores is ≥0.10 than the correlation between the PSEQ scores and the TSK scores | – | – | + |
| 8. The correlation between the PSEQ scores and the PCS scores is ≥0.10 than the correlation between the PSEQ scores and the NRS-7 scores | + | + | – |
| 9. The correlation between the PSEQ scores and the TSK scores is ≥0.10 than the correlation between the PSEQ scores and the NRS-7 scores | + | + | – |
| 10. The correlation between the PSEQ scores and the NRS-24 scores is greater than the correlation between the PSEQ scores and the NRS-7 scores | – | – | + |
| 11. The mean PSEQ score is greater in patients who have neck pain only than in patients who also have headache or arm pain | + | + | + |
| 12. The mean PSEQ score is greater in patients who have no comorbidities than in patients who have 1 or more comorbidities | + | + | + |
| Total hypotheses met, n (%) | 6/12 (50%) | 6/12 (50%) | 7/12 (58%) |
| **Responsiveness** | | | |
| 1. Patients classifying themselves as "much improved" on the GPES display larger ESs than patients classifying themselves as "rather improved" | + | + | + |
| 2. Patients classifying themselves as "much improved" on the GPES display larger SRMs than patients classifying themselves as "rather improved" | + | + | + |
| 3. Patients classifying themselves as "rather improved" on the GPES display larger ESs than patients classifying themselves as "slightly improved" | – | – | + |
| 4. Patients classifying themselves as "rather improved" on the GPES display larger SRMs than patients classifying themselves as "slightly improved" | – | – | – |
| 5. Patients receiving cognitive-behavioral education as part of the intervention exhibit greater ESs than patients not receiving cognitive-behavioral education | + | + | / |
| 6. Patients receiving cognitive-behavioral education as part of the intervention exhibit greater SRMs than patients not receiving cognitive-behavioral education | + | – | / |
| 7. The area under the curve for the PSEQ (using the primary GPES) is above 0.70. Patients were dichotomized into "improved" and "unchanged" to calculate the area under the curve. | – | – | + |
| 8. The correlation between the PSEQ change scores and the NDI change scores is ≥0.10 than the correlation between the PSEQ change scores and the NRS-7 change scores | + | + | + |
| 9. The correlation between the PSEQ change scores and the NDI change scores is greater than the correlation between the PSEQ change scores and the PCS change scores | – | – | – |
| 10. The correlation between the PSEQ change scores and the NDI change scores is greater than the correlation between the PSEQ change scores and the TSK change scores | – | + | + |
| 11. The correlation between the PSEQ change scores and the PCS change scores is greater than the correlation between the PSEQ change scores and the NRS-7 change scores | + | + | + |
| 12. The correlation between the PSEQ change scores and the TSK change scores is greater than the correlation between the PSEQ change scores and the NRS-7 change scores | + | + | + |
| Total hypotheses met, n (%) | 7/12 (58%) | 7/12 (58%) | 8/10 (80%) |

*Abbreviations: –, unmet hypothesis; /, not applicable hypothesis; +, met hypothesis; ES, effect size; GPES, global perceived effect scale; INP, idiopathic neck pain; NDI, Neck Disability Index; NRS, numeric rating scale; NRS-7, numeric rating scale measuring pain intensity over the last 7 days; NRS-24, numeric rating scale measuring pain intensity over the last 24 hours; PCS, Pain Catastrophizing Scale; PSEQ, Pain Self-Efficacy Questionnaire; SRM, standardized response mean; TSK, Tampa Scale of Kinesiophobia; WAD, whiplash-associated disorder.*

reporting the same longitudinal correlations in patients with chronic LBP.[11,17]

### Statistical Analysis

Missing data on the PSEQ and all other assessment tools were checked, and frequencies of missing values were calculated. Missing data were explored to find any recurrent pattern to suggest that data were missing in a nonrandom fashion. Data missing at random were imputed with a 2-way imputation technique.[80] Descriptive statistics were used to describe sociodemographic and clinical characteristics at baseline, and clinical characteristics following treatment. Change scores of the PSEQ and comparator instruments were obtained by subtracting the posttreatment score from the pretreatment score.

After determining whether Bartlett's test of sphericity was significant ($P<.05$) and the Kaiser-Meyer-Olkin measure of sampling adequacy was greater than 0.80,[77] a diagonally weighted least-squares estimation procedure was used with confirmatory factor analysis. To determine whether the data displayed a good unidimensional fit, multiple fit indices were used: comparative fit index (CFI) greater than 0.95, Tucker-Lewis index (TLI) greater than 0.95, and root-mean-square error of approximation (RMSEA) less than 0.06.[25,63] Subsequently, an exploratory factor analysis with a maximum-likelihood extraction method was performed by checking whether the variance explained by the largest factor was at least 20%, the ratio of eigenvalue magnitude of the first and second factors was greater than 4, Cattell's scree test indicated a predominant factor pattern, and the factor loadings were all 0.50 or greater.[25,63] The Cronbach alpha was used to assess internal consistency and was considered to be adequate when between .70 and .95.[76]

When data were normally distributed (Shapiro-Wilk test $P>.05$), a Pearson product-moment correlation ($r$) was used to assess correlations between instruments at baseline and between their change scores. A Spearman rank correlation coefficient ($r_s$) was used when data were not normally distributed. Correlations of 0.60 or greater were considered strong, those from 0.30 to 0.60 moderate, and those less than 0.30 weak.[12] As suggested by clinimetric experts and previous studies,[21,22,33,60] construct validity was considered satisfactory when 75% or more of the hypotheses were met, moderate when 50% or more but fewer than 75% were in agreement, and low when fewer than 50% were met.

Effect sizes for responsiveness were estimated by dividing the mean change scores by the respective pretreatment standard deviations. Standardized response means (SRMs) were calculated by dividing mean change scores by the respective standard deviations of the change. Receiver operating characteristic curves were plotted, displaying sensitivity and 1-minus-specificity values on the axes of the curves. The area under the curve was calculated as the probability of correctly discriminating patients as improved or unchanged[24] and considered acceptable when greater than 0.70.[26] Responsiveness was considered satisfactory when at least 75% of the hypotheses were met, moderate when 50% to 75% were in agreement, and low when fewer than 50% were met.[33,42,60]

A sample size of at least 100 patients was the recruitment goal, which is considered to be excellent for factor analysis on a questionnaire with 10 items and for assessing construct validity and responsiveness.[50] A subgroup analysis was preplanned for all measurement properties in patients with WAD and patients with INP. Missing data imputation, descriptive statistics, exploratory factor analysis, correlations, effect sizes, and area under the curve were calculated with IBM SPSS Statistics Version 23 (IBM Corporation, Armonk, NY). Confirmatory factor analysis was performed using the R package lavaan[67] implemented in Rstudio (RStudio, Inc, Boston, MA).

## RESULTS

One hundred sixty-one patients with neck pain were included in this study, 85 (53%) with WAD and the remaining 76 with INP. At baseline, 25 patients (16%) had at least 1 missing item on 1 of the self-reported measures (ie, PSEQ, NDI, PCS, TSK); in total, responses to only 51 items (0.7% across the full sample) were missing. Regarding the PSEQ, 2 patients did not complete items 9 and 10 (1.2% of missing responses for each of these items in total), and 1 patient missed the response to item 6 (0.6%). No consistent pattern of missing data was observed, and the imputed data set was used in all subsequent analyses. Baseline characteristics of the included patients are presented in **TABLE 2**.

Fifteen patients with WAD (9% of the total sample) did not complete the intervention period, and their posttreatment data were not collected, leaving a sample of 146 for responsiveness assessment. One hundred patients (68%) received both physical therapy and cognitive-behavioral education, while the others only received physical therapy.

### Validity

Confirmatory factor analysis displayed the following fit indices: CFI, 0.997; TLI, 0.996; RMSEA, 0.104 (95% confidence interval [CI]: 0.079, 0.130). These indices indicated a unidimensional pattern; however, because the RMSEA cutoff value was not met, an exploratory analysis confirmed the unidimensionality of the PSEQ in NPDs. One factor with an eigenvalue larger than 1 was able to explain 74.4% of the variance, while the second largest factor explained 5.5%. The ratio between the eigenvalues of these 2 factors

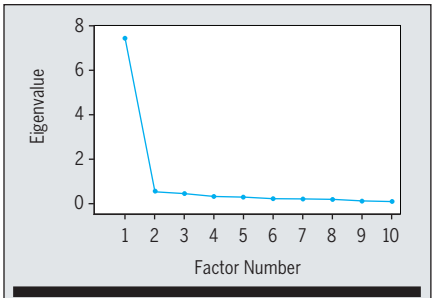


**FIGURE.** Scree test estimated with exploratory factor analysis of the Pain Self-Efficacy Questionnaire in 161 patients with neck pain disorders.

**TABLE 2** Baseline Sociodemographic and Clinical Characteristics of Patients With Neck Pain Disorders Included in This Study

| Variables | Total Sample (n = 161) | WAD (n = 85) | INP (n = 76) | Dropouts (n = 15) |
|---|---|---|---|---|
| Age, y* | 44.55 ± 13.81 | 38.85 ± 12.54 | 50.93 ± 12.36 | 37.13 ± 14.22 |
| Sex, n (%) | | | | |
| Male | 57 (35) | 37 (44) | 20 (26) | 10 (67) |
| Female | 104 (65) | 48 (56) | 56 (74) | 5 (33) |
| Civil state, n (%) | | | | |
| Married | 99 (61) | 41 (48) | 58 (76) | 4 (27) |
| Unmarried | 59 (37) | 41 (48) | 18 (24) | 9 (60) |
| Missing information | 3 (2) | 3 (4) | 0 (0) | 2 (13) |
| Highest educational level completed, n (%) | | | | |
| Primary school | 25 (15) | 1 (1) | 24 (32) | 0 (0) |
| Junior high school | 49 (30) | 25 (29) | 24 (32) | 5 (33) |
| Senior high school | 67 (42) | 43 (51) | 24 (32) | 8 (53) |
| University | 19 (12) | 15 (18) | 4 (5) | 1 (7) |
| Missing information | 1 (1) | 1 (1) | 0 (0) | 1 (7) |
| Pain duration, mo | | | | |
| Median (interquartile range) | 5.00 (2.00-24.00) | 2.00 (2.00-3.00) | 24.00 (12.00-48.00) | 2.00 (1.00-3.50) |
| Pain localization, n (%) | | | | |
| Neck only | 97 (60) | 55 (65) | 42 (55) | 10 (67) |
| Neck and arm | 46 (29) | 24 (28) | 22 (29) | 2 (13) |
| Neck and head | 4 (2) | 4 (5) | 0 (0) | 2 (13) |
| Only arm | 13 (8) | 1 (1) | 12 (16) | 0 (0) |
| Missing information | 1 (1) | 1 (1) | 0 (0) | 1 (7) |
| Comorbidities, n (%) | | | | |
| None | 97 (60) | 63 (74) | 34 (45) | 13 (87) |
| Hypertension | 25 (16) | 6 (7) | 19 (25) | 0 (0) |
| Diabetes | 15 (9) | 4 (5) | 11 (14) | 0 (0) |
| COPD | 12 (7) | 4 (5) | 8 (11) | 1 (7) |
| Gastritis | 3 (2) | 3 (3.5) | 0 (0) | 0 (0) |
| Anxiety/depression | 3 (2) | 3 (3.5) | 0 (0) | 0 (0) |
| Renal problems | 1 (1) | 1 (1) | 0 (0) | 0 (0) |
| Cardiovascular problems | 4 (2) | 0 (0) | 4 (5) | 0 (0) |
| Missing information | 1 (1) | 1 (1) | 0 (0) | 1 (7) |
| PSEQ (0-60)* | 27.34 ± 13.66 | 33.27 ± 15.02 | 20.71 ± 7.80 | 39.40 ± 11.94 |
| Disability, NDI (0-100)* | 26.77 ± 12.77 | 30.80 ± 13.44 | 22.26 ± 10.32 | 33.07 ± 14.85 |
| Pain intensity last day, NRS-24 (0-10)* | 4.44 ± 2.14 | 5.22 ± 2.01 | 3.57 ± 1.96 | 5.73 ± 2.22 |
| Pain intensity last week, NRS-7 (0-10)* | 4.73 ± 2.08 | 5.56 ± 2.07 | 3.80 ± 1.68 | 6.07 ± 2.02 |
| Pain catastrophizing, PCS (0-52)* | 23.65 ± 9.18 | 19.93 ± 9.90 | 27.82 ± 6.06 | 19.47 ± 11.50 |
| Kinesiophobia, TSK (13-52)* | 29.91 ± 7.62 | 27.98 ± 7.61 | 32.07 ± 7.08 | 22.87 ± 7.74 |

*Abbreviations: COPD, chronic obstructive pulmonary disease; INP, idiopathic neck pain; NDI, Neck Disability Index; NRS-7, numeric rating scale for pain intensity over the last 7 days; NRS-24, numeric rating scale for pain intensity over the last 24 hours; PCS, Pain Catastrophizing Scale; PSEQ, Pain Self-Efficacy Questionnaire; TSK, Tampa Scale of Kinesiophobia; WAD, whiplash-associated disorder.*
**Values are mean ± SD.*

was 13.5, and the scree plot indicated a predominant 1-factor pattern (**FIGURE**). The same results were found when the subgroups of patients with WAD (confirmatory: CFI, 0.997; TLI, 0.997; RMSEA, 0.104; 95% CI: 0.064, 0.143; exploratory: first-factor explained variance, 73.2%; eigenvalue ratio of the first 2 factors = 10.6) or INP (confirmatory: CFI, 0.995; TLI, 0.993; RMSEA, 0.100; 95% CI: 0.057, 0.141; exploratory: first-factor explained variance, 61.4%; eigenvalue ratio of the first 2 factors = 7.9) were examined separately. Descriptive statistics, communalities, and factor loadings of the

**TABLE 3** Descriptive Statistics, Communalities, and Factor Loadings for the 10 Items of the Pain Self-Efficacy Questionnaire in 161 Patients With Neck Pain Disorders

| Item | Mean ± SD | Skewness (SE) | Kurtosis (SE) | Item Total Correlations | Communalities | Factor Loadings |
|---|---|---|---|---|---|---|
| 1. I can enjoy things | 2.60 ± 1.59 | 0.52 (0.19) | −0.26 (0.38) | 0.84 | 0.72 | 0.85 |
| 2. I can do most of the household chores | 2.69 ± 1.59 | 0.63 (0.19) | −0.22 (0.38) | 0.80 | 0.65 | 0.81 |
| 3. I can socialize with my friends or family members as often as I used to do | 3.14 ± 1.78 | 0.49 (0.19) | −1.14 (0.38) | 0.84 | 0.73 | 0.85 |
| 4. I can cope with my pain in most situations | 2.80 ± 1.43 | 0.57 (0.19) | −0.45 (0.38) | 0.78 | 0.61 | 0.78 |
| 5. I can do some form of work | 2.63 ± 1.43 | 0.47 (0.19) | −0.62 (0.38) | 0.83 | 0.70 | 0.84 |
| 6. I can still do many of the things I enjoy doing | 2.45 ± 1.49 | 0.47 (0.19) | −0.34 (0.38) | 0.80 | 0.68 | 0.82 |
| 7. I can cope with my pain without medication | 2.60 ± 1.49 | 0.64 (0.19) | −0.07 (0.38) | 0.81 | 0.69 | 0.83 |
| 8. I can still accomplish most of my goals in life | 2.76 ± 1.64 | 0.65 (0.19) | −0.58 (0.38) | 0.88 | 0.81 | 0.90 |
| 9. I can live a normal lifestyle | 2.75 ± 1.75 | 0.61 (0.19) | −0.78 (0.38) | 0.90 | 0.86 | 0.93 |
| 10. I can gradually become more active | 2.89 ± 1.66 | 0.34 (0.19) | −0.84 (0.38) | 0.82 | 0.70 | 0.84 |

*Abbreviation: SE, standard error.*



10 PSEQ items are presented in **TABLE 3**.

The Cronbach alpha of the PSEQ was .96 for the total sample and in patients with WAD, and .93 in patients with INP. Internal consistency was not adequate for the total sample or for the patients with WAD, as some authors have suggested that a Cronbach alpha greater than .95 may indicate some item redundancy.[75]

Correlations between the PSEQ and the comparator instruments are presented in **TABLE 4**. Ninety-seven patients with neck pain displayed higher PSEQ values (mean, 28.50) than the 64 patients with neck pain and/or pain in other body regions (mean, 25.21). These results were consistent in patients with WAD (34.09 versus 31.17) and in patients with INP (21.19 versus 20.12). The 97 patients with no comorbidities also showed a higher PSEQ mean score than the remaining patients with 1 or more comorbidities (31.13 versus 21.16). This difference was consistent in the 2 subgroups of patients with WAD (35.73 versus 25.14) and patients with INP (22.62 versus 19.17). The construct validity of the PSEQ was moderate in both the total sample and in the WAD and INP subgroups (**TABLE 1**).

### Responsiveness

**TABLE 5** presents baseline, posttreatment, and change scores of the PSEQ, together with effect sizes and SRMs in the total sample and in the WAD and INP subgroups. These results were stratified for different response options on the global perceived effect scale, and depending on whether patients received cognitive-behavioral education. The area under the curve for the PSEQ, estimated with the global scale as the external anchor, was 0.69 (95% CI: 0.59, 0.79) in the total sample, 0.53 in the WAD group (95% CI: 0.38, 0.68), and 0.79 in the INP group (95% CI: 0.68, 0.90). Correlations between the change scores of the PSEQ and those of the other tools were also calculated (**TABLE 4**). The responsiveness of the PSEQ was satisfactory in patients with INP and moderate in the total sample and in patients with WAD (**TABLE 1**).

## DISCUSSION

To our knowledge, this is the first study to assess the measurement properties of the PSEQ in a sample of patients presenting with NPDs as their primary musculoskeletal complaint. The PSEQ was found to be a unidimensional measure of pain self-efficacy in this population, and its construct validity was moderate according to hypothesis testing. These results were consistent when analyzed separately in patients with either WAD or INP. Responsiveness was moderate according to hypothesis testing in both the total sample and patients with WAD, whereas it was satisfactory in those with INP.

This study provides valuable information to researchers and clinicians who intend to use the PSEQ in patients with NPDs. Previous studies in either mixed samples of patients with chronic pain or chronic LBP have shown that the PSEQ is a unidimensional tool,[12,27,31,68,79] in agreement with the findings of the current study. Therefore, summing the scores from the 10 items to obtain a 0-to-60 total score is appropriate in patients with NPDs. Nevertheless, because results for construct validity were suboptimal in this study, clinicians and researchers may need to use some caution in interpreting the PSEQ scores in relation to other instruments, particularly the NDI for disability and the NRS for pain intensity. More research in patients with NPDs is needed to better investigate the PSEQ's validity to ensure that, from a patient's perspective, it is capturing the pain self-efficacy construct. The responsiveness was adequate in patients with chronic INP, consistent with other studies on chronic LBP,[11,47,58] but was suboptimal in (sub)acute WAD. This is a novel result, considering that this is the first study to assess PSEQ measure-

**TABLE 4** Correlations (Spearman Rank Correlation Coefficient) Between the Pain Self-Efficacy Questionnaire and the Comparator Instruments in Patients With Neck Pain Disorders

| | GPES (0-9) | Disability, NDI (0-100) | Pain Intensity Last Day, NRS-24 (0-10) | Pain Intensity Last Week, NRS-7 (0-10) | Pain Catastrophizing, PCS (0-52) | Fear of Movement, TSK (13-52) |
|---|---|---|---|---|---|---|
| PSEQ (0-60) | | | | | | |
| Total sample baseline (n = 161) | / | −0.080 | 0.080 | 0.186* | −0.538* | −0.380* |
| WAD baseline (n = 85) | / | −0.128 | 0.063 | 0.142 | −0.517* | −0.362* |
| INP baseline (n = 76) | / | −0.569* | −0.390* | −0.382* | −0.415* | −0.193 |
| PSEQ (0-60) | | | | | | |
| Total sample change scores (n = 145) | 0.401* | −0.375* | −0.129 | −0.141 | −0.594* | −0.430* |
| WAD change scores (n = 70) | 0.338* | −0.301 | −0.157 | −0.125 | −0.404* | −0.185 |
| INP change scores (n = 75) | 0.599* | −0.595* | −0.210 | −0.249* | −0.715* | −0.589* |

*Abbreviations: /, correlation not applicable; GPES, global perceived effect scale; INP, idiopathic neck pain; NDI, Neck Disability Index; NRS-7, numeric rating scale for pain intensity over the last 7 days; NRS-24, numeric rating scale for pain intensity over the last 24 hours; PCS, Pain Catastrophizing Scale; PSEQ, Pain Self-Efficacy Questionnaire; TSK, Tampa Scale of Kinesiophobia; WAD, whiplash-associated disorder.*
**P<.05.*



ment performance in a sample of patients with acute symptoms. The inclusion of patients with acute pain may explain why the results are slightly divergent from previous studies in other samples. Overall, our findings need to be substantiated by other studies of patients with NPDs, especially those with a (sub)acute disorder. Currently, clinicians and researchers may use the PSEQ in patients with chronic INP with greater confidence than in patients with (sub)acute WAD.

The moderate construct validity found in this study is somewhat surprising. While the correlations with psychosocial measures such as the PCS and the TSK were consistent with those found in previous studies,[11,12,17,30,89] the most substantial difference concerned the correlations with disability and pain intensity instruments (**TABLE 4**). The baseline correlation with the NDI was substantially lower than correlations found in the previous 4 studies evaluating the association with disability in patients with chronic LBP.[12,17,32,89] One explanation for this large discrepancy may be the lack of association between pain self-efficacy and disability in patients with NPDs, in contrast with other pain groups. Another possible explanation may be that the disability construct measured by the NDI is different from that of other disability instruments used in patients with LBP (eg, Oswestry Disability Index, Roland-Morris Disability Questionnaire). In support of this explanation, a qualitative study showed that the content of the NDI does not appropriately cover what it purports to measure.[2] The correlation with the NRSs for pain in the last week (0.19) was also lower than the correlation between pain self-efficacy and pain intensity found in 3 previous studies (−0.39, −0.46, and −0.40).[12,17,89] To further explain these differences, it should be noted that the content validity of the NRS has been recently questioned[36,66] and the content validity of the PSEQ has never been investigated. Content validity is defined as "the degree to which the content of a patient-reported instrument is an adequate reflection of the construct to be measured,"[51] and its evaluation may help to explain the results obtained in this study. Another explanatory consideration for low PSEQ correlations with disability and pain intensity may be that approximately half of our sample (ie, the WAD subgroup) included patients in the (sub)acute phase of a musculoskeletal condition, and all the previous studies included only patients with chronic pain.

Item redundancy might be a challenge for the original 10-item version of the PSEQ, as the Cronbach alpha values reported in the current study and previous studies[12,27,31,68,79] were above or very close to the upper limit for acceptable internal consistency.[64,75,76] This issue could be further explored by using item response theory methods, as these allow item redundancy to be thoroughly investigated.[28] In addition, item response theory analysis would allow studying the measurement precision of a questionnaire (operationalized as information and measurement error) along various levels of "ability" of the measured construct.[62] Various short forms of the PSEQ have been developed and tested, showing very similar measurement properties to the original version.[11,48,58] Hence, to understand whether deleting some items from the original PSEQ would lead to a substantial loss in measurement precision would require a study directly comparing the original PSEQ and its short forms via item response theory.

The 2 subgroups of patients with WAD and with INP included in this study differed substantially in some characteristics; the INP group displayed older age, longer pain duration, more comorbidities, and more disability and pain intensity, resulting in lower pain self-efficacy (**TABLE 2**). Despite these differences, we found very similar results for structural validity, construct validity, and internal

**TABLE 5** Pretreatment Scores, Posttreatment Scores, Change Scores, Effect Sizes, and Standardized Response Means of the Pain Self-Efficacy Questionnaire in Patients With Neck Pain Disorders*

| Sample | Pretreatment Score* | Posttreatment Score* | Change Score* | Effect Size | Standardized Response Mean |
|---|---|---|---|---|---|
| Overall | | | | | |
| Total sample (n = 146) | 26.10 ± 13.24 | 35.82 ± 13.77 | 9.72 ± 8.46 | 0.73 | 1.15 |
| WAD (n = 70) | 31.96 ± 15.35 | 40.67 ± 14.17 | 8.71 ± 7.99 | 0.57 | 1.09 |
| INP (n = 76) | 20.71 ± 7.80 | 31.36 ± 11.83 | 10.64 ± 8.82 | 1.36 | 1.21 |
| Stratification according to the GPES† | | | | | |
| Totally recovered | | | | | |
| Total sample (n = 8) | 33.37 ± 19.12 | 45.50 ± 16.51 | 12.12 ± 7.04 | 0.63 | 1.72 |
| WAD (n = 8) | 33.37 ± 19.12 | 45.50 ± 16.51 | 12.12 ± 7.04 | 0.63 | 1.72 |
| INP (n = 0) | / | / | / | / | / |
| Much improved | | | | | |
| Total sample (n = 63) | 25.65 ± 12.75 | 38.51 ± 12.57 | 12.86 ± 8.52 | 1.01 | 1.51 |
| WAD (n = 36) | 28.83 ± 14.88 | 39.39 ± 14.00 | 10.56 ± 8.71 | 0.71 | 1.21 |
| INP (n = 27) | 21.41 ± 7.54 | 37.33 ± 10.51 | 15.93 ± 7.34 | 2.11 | 2.17 |
| Rather improved | | | | | |
| Total sample (n = 41) | 27.90 ± 13.29 | 35.61 ± 12.46 | 7.71 ± 7.80 | 0.58 | 0.99 |
| WAD (n = 20) | 34.10 ± 15.35 | 38.35 ± 14.44 | 4.25 ± 6.21 | 0.28 | 0.68 |
| INP (n = 21) | 22.00 ± 7.38 | 33.00 ± 9.88 | 11.00 ± 7.86 | 1.49 | 1.40 |
| Slightly improved | | | | | |
| Total sample (n = 17) | 24.06 ± 13.97 | 34.71 ± 12.15 | 10.65 ± 5.83 | 0.76 | 1.83 |
| WAD (n = 4) | 43.50 ± 7.68 | 51.25 ± 4.86 | 7.75 ± 4.11 | 1.01 | 1.88 |
| INP (n = 13) | 18.08 ± 8.99 | 29.62 ± 8.47 | 11.54 ± 6.12 | 1.28 | 1.89 |
| Unchanged | | | | | |
| Total sample (n = 16) | 20.62 ± 8.71 | 20.75 ± 11.20 | 0.12 ± 3.79 | 0.01 | 0.03 |
| WAD (n = 2) | 38.00 ± 15.56 | 46.50 ± 13.43 | 8.50 ± 2.12 | 0.55 | 4.01 |
| INP (n = 14) | 18.14 ± 3.98 | 17.07 ± 3.77 | −1.07 ± 1.98 | 0.27 | 0.54 |
| Stratification according to receiving cognitive-behavioral education | | | | | |
| Yes | | | | | |
| Total sample (n = 100) | 19.63 ± 6.72 | 29.84 ± 10.85 | 10.21 ± 8.76 | 1.52 | 1.17 |
| WAD (n = 25) | 17.36 ± 3.70 | 26.36 ± 7.85 | 9.00 ± 8.46 | 2.43 | 1.06 |
| INP (n = 75) | 20.39 ± 7.32 | 31.00 ± 11.50 | 10.61 ± 8.87 | 1.45 | 1.20 |
| No | | | | | |
| Total sample (n = 46) | 40.17 ± 13.06 | 48.83 ± 9.99 | 8.65 ± 7.76 | 0.66 | 1.11 |
| WAD (n = 45) | 39.90 ± 12.79 | 48.62 ± 10.00 | 8.72 ± 7.81 | 0.67 | 1.10 |
| INP (n = 1) | 45.00 | 58.00 | 13.00 | / | / |

*Abbreviations: /, not applicable; GPES, global perceived effect scale; INP, idiopathic neck pain; WAD, whiplash-associated disorder.*
**Values are mean ± SD unless otherwise indicated.*
*†Data were missing for 1 patient on the GPES; therefore, this analysis was performed in 145 patients.*

consistency, whereas responsiveness was found to be better in the chronic INP group. Thus, PSEQ responsiveness has been shown to be satisfactory in patients with a chronic pain complaint, but our findings indicate that more studies on the PSEQ in patients with (sub)acute pain are needed to evaluate whether all of its measurement properties are as good as they are in samples of patients with chronic pain.

This is the first study to find an area under the curve below 0.70 for the PSEQ, whereas previous studies met the threshold for acceptable validity.[11,47] The PSEQ not performing as expected could be explained by the generic global perceived effect scale that was used in this study and by the low correlation between the PSEQ and this external anchor, especially in the WAD sample (**TABLE 4**). In fact, a previous

study showed that it is not easy to define and identify an optimal global perceived effect scale when assessing psychosocial constructs such as pain self-efficacy[11]; therefore, the challenge remains when assessing responsiveness using the area under the curve. The potential weaknesses of the scale used in this study could also have had an influence on the effect sizes and SRMs (**TABLE 5**) that did not match all our a priori specified hypotheses on these indices, particularly in patients with WAD (**TABLE 1**). Just as for construct validity, the mismatch between expected and observed results for responsiveness highlights the importance of future research assessing the validity of the PSEQ, and specifically its content validity, as it is the only measurement property that has not been adequately assessed so far in any patient population. Also, it is fundamental to have other studies assessing the content validity of the NDI and NRS, used in this study, as there is some preliminary evidence[2,36,66] suggesting that this might also explain why expected correlations were not found.

Test-retest reliability and measurement error could not be assessed in this study, as only a small proportion of patients classified themselves as unchanged following the intervention (**TABLE 5**). However, while test-retest reliability of the PSEQ was found to be satisfactory in previous studies in other populations,[12,61,79] the smallest detectable change was found to be slightly above an acceptable margin.[12,79] Some authors have suggested that the smallest detectable change should not be larger than 20% of the scale range,[10] and other authors state that it should be smaller than the minimal important change, as this would imply that a change beyond the smallest change corresponds to a "true" change in the measured construct.[76] The minimal important change was not assessed in the current study because the correlation with the global scale was below 0.5, and this scale was not specific to the pain self-efficacy construct. No values of smallest detectable change and minimal important change are available for the PSEQ in patients with NPDs. However, the smallest change of 15.7 points found in a previous study[12] can be compared to the mean change scores presented in **TABLE 5**, highlighting that the change scores of this study are all smaller than the smallest change. This result is consistent with a previous PSEQ responsiveness study[11] that outlined the limited ability of the PSEQ to discriminate between measurement error and true change.

Other than the limitations listed above, another potential limitation of this study is that the subgroup analyses were performed in samples smaller than 100 patients; nevertheless, a sample between 50 and 100 patients is considered "good," according to the COSMIN checklist, to assess the methodological quality of validity and responsiveness studies.[50]

## CONCLUSION

This study explored the measurement properties of the PSEQ in patients with NPDs. Patients' self-confidence in dealing with their symptoms is very important in NPDs, and a sound measurement instrument is required. Our results are consistent with an existing body of literature regarding the unidimensionality of the PSEQ, which is satisfactory. In addition, we highlighted some challenges regarding the interpretation of the PSEQ scores in relation to other constructs in this patient population, in particular in patients with a (sub) acute WAD. This indicates that qualitative research on PSEQ content validity involving patients and clinicians is warranted to further investigate the construct measured by the PSEQ. ◉

### KEY POINTS

**FINDINGS:** This is the first study to assess the measurement performance of the Pain Self-Efficacy Questionnaire (PSEQ) in patients with neck pain disorders and to show that it is a unidimensional measure in this population. Construct validity and responsiveness of the PSEQ were found to be suboptimal in these patients, but responsiveness was satisfactory in patients with chronic idiopathic neck pain, consistent with previous studies in patients with chronic low back pain.

**IMPLICATIONS:** The PSEQ total score can be calculated with confidence in patients with neck pain disorders, and the questionnaire could be used in patients presenting with chronic idiopathic neck pain to monitor changes in pain self-efficacy over time.

**CAUTION:** The PSEQ's suboptimal results for construct validity and responsiveness may be due to the limited knowledge of the construct measured by the PSEQ and/or the comparator instruments for disability and pain intensity included in this study, or to the inclusion of patients with acute whiplash-associated disorder. Future research on the content validity of the instruments is required, as well as future clinimetric studies in acute pain samples.

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