SCIENTIFIC ARTICLE

A Comparison of Nerve-Specific, Condition-Specific, and Upper Extremity-Specific Patient-Reported Outcome Measures in Patients With Carpal and Cubital Tunnel Syndrome

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Purpose Arm-, region-, tissue-, and condition-specific patient-reported outcome measures (PROMs) are available to address idiopathic mononeuropathy. This study compared PROMs with varying specificities in patients with idiopathic neuropathy of the upper extremity with respect to correlations with each another, sources of variation in scores, and floor and ceiling effects.

Methods One hundred fifty patients (130 with carpal tunnel syndrome, 30 with cubital tunnel syndrome, and 10 with both conditions) completed a nerve-specific PROM (Impact of Hand Nerve Disorders), a condition-specific PROM (Boston Carpal Tunnel Syndrome Questionnaire and/or Patient-Rated Ulnar Nerve Evaluation), and an upper extremity—specific PROM (Patient-Reported Outcomes Measurement Information System Physical Function Upper Extremity 7). We also gathered demographic and condition-related data (side, electrodiagnostic studies present, muscle atrophy, static loss of sensibility), and patients completed questionnaires measuring self-efficacy, kinesiophobia, and symptoms of depression. Correlation of the PROMs with each another and factors accounting for their variation were assessed, as well as the number of items to complete, time to complete, and floor and ceiling effects.

Results Pearson correlations between PROMs were moderate to strong (0.56—0.90). Self-reported symptoms of depression were best able to account for the variations in symptom intensity and activity intolerance on all PROMs (adjusted R^2 between 0.09 and 0.31). The Impact of Hand Nerve Disorders is a long questionnaire and took the most time to complete. All instruments had comparable floor effects; Patient-Reported Outcomes Measurement Information System Physical Function Upper Extremity had a ceiling of effect of 16%.

Conclusions This study adds to the evidence that specific and general PROMs correlate with each another, perhaps in part through their correlation with mental health. Based on this line of evidence and pending testing of potentially greater responsiveness in specific settings, we prefer to use a single simple, brief, and general PROM to quantify symptom intensity and activity intolerance for both routine patient care and research. *(J Hand Surg Am. 2022;47(8):791.e1-e10. Copyright © 2022 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Prognostic II.

Key words Carpal tunnel syndrome, correlation, cubital tunnel syndrome, nerve compression, PROMs.

Online Exclusive

PATIENT-REPORTED OUTCOME MEASURES (PROMs) are used to quantify subjective aspects of health, such as symptom intensity and capability. Measures of the severity of pathology (disease activity) include electrodiagnostic studies, measures of sensibility, and assessments of strength of palmar abduction and atrophy of the thenar eminence. Musculoskeletal PROMs can be general (eg,

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Patient-Reported Outcomes Measurement Information System Physical Function [PROMIS PF][1]), extremity−specific (eg, PROMIS PF Upper Extremity [UE][2]), region-specific (eg, Michigan Hand Outcome Questionnaire[3]), or condition-specific (eg, Boston Carpal Tunnel Syndrome Questionnaire [BCTQ][4] and Patient-Rated Ulnar Nerve Evaluation [PRUNE][5]). The Impact of Hand Nerve Disorders [I-HaND] scale is a tissue (nerve)−specific and upper limb−specific PROM.[6] It is designed for use with any upper extremity nerve problem. The most common nerve diseases treated by hand specialists are carpal tunnel syndrome (CTS) and cubital tunnel syndrome (CubTS). There is an established line of evidence documenting that PROMs of varying specificity are correlated.[2,6−8] We designed an experiment to further this line of evidence by testing the relatively new I-HaND among patients with CTS and/or CubTS.

In this cross-sectional study, we compared the nerve-specific I-HaND to condition-specific PROMs for CTS and CubTS (the BCTQ and PRUNE, respectively) and an upper extremity−specific PROM (the PROMIS PF-UE-7). We tested the following hypotheses: (1) the I-HaND does not correlate with the BCTQ, PRUNE, or PROMIS PF-UE-7 in patients diagnosed with CTS and/or CubTS; and (2) there are no biopsychosocial factors (demographical, condition-related, and psychological factors) independently associated with I-HaND, BCTQ, PRUNE, or PROMIS PF-UE-7 scores. Finally, we assessed instrument properties such as items needed to complete, completion time, and floor and ceiling effects (ie, the percentage of patients scoring at the lowest or highest possible score, respectively).

MATERIALS AND METHODS

Study design

This study was performed at The Dell Medical School−The University of Texas. After approval by the Office of Research Support and Compliance, we prospectively invited people to complete questionnaires. The inclusion criteria were all new, established, or postoperative adult patients who spoke English, had a diagnosis of idiopathic CTS and/or CubTS, and presented to 1 of 3 participating orthopedic surgeons in an urban location in the United States. Patients were diagnosed based on the specialist's interpretation of symptoms and signs alone or with additional electrodiagnostic testing. We excluded patients with nonidiopathic CTS or CubTS (eg, following trauma). Research assistants not involved with patient care explained the study to patients in a private room. Completion of the survey implied informed consent.

This is partly a secondary use of the initial cross-sectional data. We created 3 different studies using 1 continuous enrollment cohort—2 cross-sectional and 1 longitudinal study—with a total of around 200 patients. For the first study, we used the initial 140 patients and looked at the I-HaND, upper extremity−specific PROMs, pain intensity, and quality of life in both compression neuropathy and traumatic nerve lesion patients. For this study, we included patient numbers 41 to 195, because there were no patients with CubTS in the initial 40 patients and the objective was to include at least 15% to 20% of patients having CubTS in a consecutively enrolled cohort.

Measures

The treating surgeon recorded the diagnosis, laterality, presence of electrodiagnostic study results, and signs of advanced neuropathy: the presence of atrophy (thenar atrophy for CTS and first dorsal interosseous atrophy for CubTS) or static numbness.[9] Next, patients were asked to complete a set of questionnaires on a tablet, starting with demographics asking about age, sex, partnered status, level of education, insurance, type of visit (new or established patient visit or postoperative visit), and perceived symptom duration. This was followed by short forms for psychological screening, including the Pain Self-Efficacy Questionnaire, Tampa Scale for Kinesiophobia, and Patient Health Questionnaire (PHQ-2). Activity intolerance was quantified using the BCTQ among the 150 people diagnosed with CTS and the PRUNE among the 30 people diagnosed with CubTS. All subjects completed the I-HaND and the PROMIS PF-UE-7.

A 7-point ordinal scale (scores 0−6) is used for both items of the Pain Self-Efficacy Questionnaire to quantify an individual's ability to achieve goals in spite of pain.[10] Greater self-efficacy is indicated by a higher summed score of both items combined (final scores 0−12).[10]

A 4-point Likert scale (scores 1−4) is used for the 4 items of the Tampa Scale for Kinesiophobia to quantify an individual's fear of painful movement: that is, kinesiophobia.[11] More fear of movement is indicated by a higher summed score of all items combined (final scores 4−16).[11]

A 4-point Likert scale (scores 0−3) is used for both items of the PHQ-2 to measure symptoms of depression in the past 2 weeks.[12] Having more symptoms of

depression is indicated by a higher summed score of both items combined (final scores 0−6).[12]

The I-HaND uses a 5-point Likert scale (scores 1−5) and a total of 32 items to quantify activity intolerance in patients with either traumatic or compressive upper extremity neuropathology.[6] More activity intolerance is indicated by a higher raw score of all items combined, which is then scaled into a final score of 0 to 100.[6]

The BCTQ uses a 5-point Likert scale (scores 1−5) and a total of 19 items to quantify symptom intensity and activity intolerance in patients with CTS.[4] The first 11 items quantify symptom intensity and the remaining 8 quantify the functional status.[4] Greater severity of CTS is indicated by a higher mean score of all (subscale) items combined (final scores 1−5).[4]

The PRUNE uses an 11-point ordinal scale (scores 0−10) and a total of 20 items to quantify the symptom intensity and activity intolerance in patients with CubTS.[5] The first 10 items quantify symptom intensity and the other 10 quantify difficulties in performing certain activities.[5] Greater severity of CubTS is indicated by a higher mean score of all (subscale) items combined (final scores 0−10).[5]

Because some collaborators did not have access to PROMIS computerized adaptive test (CAT) versions, we used the PROMIS PF-UE-7. This measure is comparable to its CAT version and uses a 5-point Likert scale (scores 1−5) for each of 7 items to quantify upper extremity−specific activity intolerance.[2] Less activity intolerance is indicated by a higher raw score of all items combined, which is then transformed into a final *T*-score between 16.3 and 58.2.[2,13] The final score is comparable to CAT-based PROMIS measures, with a *T*-score mean of 50 with an SD of 10 in a general population.[2]

Study sample

We prospectively invited 159 people to complete questionnaires, and 4 patients declined participation. After enrollment, 5 people (3.2%) were excluded from the analysis: 2 stopped completing the questionnaires at an early stage and 3 were incorrectly enrolled and did not have CTS or CubTS (2 had cervical radiculopathy and 1 had De Quervain tenosynovitis). Of the 150 patients, 130 had CTS, 30 had CubTS, and 10 had both (Table 1). The mean age was 55 ± 14 years and the majority of the patients ($n = 114$; 76%) had symptoms for 3 months or more when they filled out the questionnaires (Table 2).

TABLE 1. Clinical Characteristics*

Variables	N = 150†
Carpal tunnel syndrome	n = 130
Bilateral	81 (62)
Electrodiagnostic studies present	74 (57)
Cubital tunnel syndrome‡	n = 30
Bilateral	9 (31)
Electrodiagnostic studies present	14 (48)

*Discrete variables are shown as *n* (%).
†10 patients had both carpal and cubital tunnel syndromes.
‡Clinical characteristics were missing for 1 patient.

Statistical analysis

Histogram plots were used to assess the distributions of continuous variables. We presented continuous variables as means ± SDs or as medians (interquartile ranges), where appropriate, and presented discrete data as proportions. Pearson and Spearman tests were used to assess correlations between continuous variables (eg, between the I-HaND and BCTQ). For differences in mean scores among dichotomous variables, we used Student *t* tests (eg, I-HaND score difference between patients presenting at a first/preoperative or postoperative visit). For differences between mean scores among categorical variables, we used a 1-way analysis of variance (eg, I-HaND score differences among patients with different levels of education). Not all surveys were completely filled out, but all instruments started were completed in full. Six (4%) patients did not complete the psychological measures, 2 (1.3%) did not complete the PROMIS PF-UE-7, and 3 (2%) patients with CTS did not complete the BCTQ. We believe the missing data were completely at random and for multivariable statistics we opted to use a complete case analysis. Data were determined to be missing completely at random because there was no clear pattern (eg, there were no missing data based on the order of questionnaires) and there were no associations of the missing data with other variables. Correlation effects were interpreted as negligible for a correlation of 0.0 to 0.10, weak for 0.10 to 0.39, moderate for 0.40 to 0.69, strong for 0.70 to 0.89, and strong for 0.90 to 1.0.[14] Four multivariable linear regression models were created to identify independent predictors of the studied PROMs (the I-HaND, BCTQ, PRUNE, and PROMIS PF-UE-7). All variables available were tested in a bivariate analysis and those with a P value $< .10$

TABLE 2. Patient Characteristics*

Variables	N = 150
Age, years	55 ± 14 (24–81)
Men	55 (37)
Partnered status	
Married/unmarried couple	99 (66)
Other	51 (34)
Level of education	
High school or less	56 (37)
2-year college	32 (21)
4-year college	40 (27)
Postcollege graduate degree	22 (15)
Insurance	
Private	101 (67)
Other	49 (33)
Visit	
New or established patient visit	113 (75)
Postoperative visit	37 (25)
Symptom duration	
≤3 months	36 (24)
3 months to ≤1 year	48 (32)
>1 year	66 (44)
PSEQ-2, n = 6 missing	10 (7.5–12)
TSK-4, n = 6 missing	9 (6-11)
PHQ-2, n = 6 missing	0 (0-1)
I-HaND	36 ± 19 (0–94)
BCTQ, n = 3 missing	2.6 ± 0.86 (1–5)
BCTQ symptoms subscale	2.7 ± 0.92 (1–5)
BCTQ function subscale	2.3 ± 0.96 (1–5)
PRUNE	4.3 ± 2.2 (0.85–9.7)
PRUNE symptoms subscale	4.8 ± 2.2 (1.7–10)
PRUNE function subscale	3.8 ± 2.7 (0–9.3)
PROMIS PF-UE-7, n = 2 missing	41 ± 10 (16–58)

*Continuous variables are shown as means ± SDs (ranges) or as medians (interquartile ranges). Discrete variables are shown as n (%). PSEQ-2, Pain Self-Efficacy Questionnaire short form; TSK-4, Tampa Scale for Kinesiophobia short form.

(Appendix E1, available online on the *Journal*'s website at www.jhandsurg.org) were included in the multivariable models. We anticipated collinearity of the psychological measures. We chose to use the PHQ-2 in multivariable analyses because of the demonstrated importance of symptoms of depression to overall health.[15] The change in a PROM score by a 1-unit increase in the predictor variable is indicated by the regression coefficient (β). The amount of variability explained in the dependent variable is indicated by the adjusted R-squared (R^2), with the specific contribution of a predictor variable indicated by the semipartial R^2. We manually calculated the number of patients who rated every question using either the minimum score (floor effect) or the maximum score (ceiling effect) per instrument. The time taken to complete each instrument was automatically recorded electronically when completing the surveys and the mean completion time was assessed for each instrument separately. Significance was set at a P value $< .05$.

We powered on our multivariable analysis, and an *a priori* sample size estimate showed that we would need 136 patients. This was based on an alpha of 0.05, 80% power, and a linear regression model with 5 predictors that would explain 15% of the variability in activity intolerance, with 1 of the predictors explaining at least a third in that model. Since we included both patients with CTS and CubTS—and generally there are more patients presenting with CTS—we enrolled 10% more so we would have enough data for both the BCTQ and PRUNE.

Ethical committee approval

This study received approval from the Institutional Review Board of the University of Texas at Austin. This study was performed in accordance with the ethical standards in the 1964 Declaration of Helsinki and in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act.

RESULTS

Interquestionnaire correlations

The nerve, disease, and upper extremity PROMs were all strongly correlated, with Pearson correlations of 0.88 between the I-HaND and BCTQ, 0.87 between the I-HaND and PRUNE, and -0.76 between the I-HaND and PROMIS PF-UE-7 (all P values $< .05$; Table 3).

The symptom subscales of the BCTQ and PRUNE correlated the least with the I-HaND and PROMIS PF-UE-7. The lowest moderate correlation was found between the PRUNE symptom subscale and the PROMIS PF-UE-7 (r, -0.41; $P < .05$; Table 3).

Factors associated with the I-HaND, BCTQ, PRUNE, and PROMIS PF-UE-7

In a multivariable analysis, lower capability (PROM scores) was associated with greater symptoms of

TABLE 3. Interquestionnaire Correlations*

Variables	I-HaND	BCTQ	BCTQ Symptoms Subscale	BCTQ Function Subscale	PRUNE	PRUNE Symptoms Subscale	PRUNE Function Subscale	PROMIS PF-UE-7
I-HaND, *r*	-							
BCTQ, *r*	0.88; $P < .05$†	-						
BCTQ symptoms subscale, *r*	0.78; $P < .05$†	0.94; $P < .05$†	-					
BCTQ function subscale, *r*	0.87; $P < .05$†	0.90; $P < .05$†	0.70; $P < .05$†	-				
PRUNE, *r*	0.87; $P < .05$†	0.90; $P < .05$†	0.87; $P < .05$†	0.93; $P < .05$†	-			
PRUNE symptoms subscale, *r*	0.75; $P < .05$†	0.85; $P < .05$†	0.85; $P < .05$†	0.84; $P < .05$†	0.89; $P < .05$†	-		
PRUNE function subscale, *r*	0.83; $P < .05$†	0.90; $P < .05$†	0.85; $P < .05$†	0.95; $P < .05$†	0.93; $P < .05$†	0.66; $P < .05$†	-	
PROMIS PF-UE-7, *r*	−0.76; $P < .05$†	−0.72; $P < .05$†	−0.56; $P < .05$†	−0.80; $P < .05$†	−0.58; $P < .05$†	−0.41; $P < .05$†	−0.63; $P < .05$†	-

*Pearson correlations are indicated by *r*.
†$P < .05$ was considered to be significant.

TABLE 4. Multivariable Regression Analyses of Factors Associated With Patient-Reported Outcome Scores*

Dependent Variables	Retained Variables	β (95% CI)	Standard Error	*P* Value	Semipartial R^2	Adjusted R^2
I-HaND	Postoperative visit	−5.7 (−12 to 0.96)	3.4	.09		0.18
	PHQ-2	5.9 (3.7−8.2)	1.1	<.001†	0.16	
BCTQ	Postoperative visit	−0.43 (−0.76 to −0.10)	0.17	.01†	0.05	0.19
	PHQ-2	0.25 (0.14−0.36)	0.06	<.001†	0.13	
PRUNE	PHQ-2	0.82 (0.36−1.3)	0.22	.001†	0.31	0.31
PROMIS PF-UE-7	PHQ-2	−2.5 (−3.8 to −1.2)	0.66	<.001†	0.09	0.09

*Only the semipartial R^2 values of significant variables are displayed. All variance inflation factors are <10 (highest 1.02). β, regression coefficient; CI, confidence interval.
†$P < .05$ was considered to be significant.

depression (higher PHQ-2 scores) for all PROMs (adjusted R^2 between 0.09 and 0.31; Table 4).

Instrument properties

The number of items to complete (32 vs 7 items, respectively) and consequently the time needed to complete was highest for the I-HaND and lowest for the PROMIS PF-UE-7 (251 vs 50 seconds, respectively; Table 5). All instruments had comparable floor effects; the PROMIS PF-UE-7 had a ceiling of 16% (Table 5).

DISCUSSION

We compared nerve-, condition-, and upper extremity−specific PROMs in patients with idiopathic CTS or CubTS and found moderate to strong correlations between all measures. We also found that variation in symptoms of depression accounted for the variation in PROM scores better than other factors, like patient demographics or symptom duration.

We address some limitations: First, there were only 30 patients with CubTS. Correlation tests and multivariable analysis results might differ when a larger CubTS sample is studied. Second, in 41% of patients the diagnosis of CTS and/or CubTS was made based on symptoms and signs rather than electrodiagnostic testing, introducing some subjectivity. This study did not look at correlations between physical examinations or diagnostic tests and PROMs. We accepted the specialist's diagnosis as a reflection of daily practice, and we feel there are advantages to this approach since the symptoms and signs of CTS and CubTS are shown to have good diagnostic performance characteristics.[16,17] Constant numbness is a hallmark finding of advanced disease.[18,19] After reviewing the data, the authors found that some surgeons interpreted "constant numbness" as a symptom reported by the patient, while others thought of it as an objective sign (static loss of sensibility). Interestingly, neither indicator for advanced neuropathy—the presence of thenar atrophy or static loss of sensibility—correlated with PROMs in patients with CTS. For patients with CubTS, we did find associations of first dorsal interosseous atrophy with the PROMs tested, though with the limited number of patients, we did not test this in our multivariable model. Third, we used the short form of the PROMIS PF-UE instead of its CAT version because some collaborators did not have access to the CAT version. The upper extremity short form for PROMIS is comparable to its CAT version, although it is more prone to ceiling and floor effects.[2] Fourth, we used only 1 of the 3 psychological measures in our multivariable analyses. A combination of psychological factors may explain more variability in activity intolerance; however, this is more difficult to test due to collinearity between the measures. Fifth, it could be argued that CTS and CubTS should be evaluated separately; however, we believe including people with a typical mix of diagnoses at various points in care can be seen as a strength, especially since we tested a new PROM intended for use with nerve pathology in general, and we are extending a line of evidence establishing the relative interchangeability of PROMs of varied specificity. Sixth, we did not test responsiveness in this study, and it might prove better for more specific PROMs. Finally, for logistical reasons, we were not able to randomize

TABLE 5. Instrument Properties*

Questionnaire	Number of Items	Item Completion Rate, %	Mean Score	Score Range	Possible Range	Floor Effect	Ceiling Effect	Mean Time to Complete, Seconds
I-HaND	32	100	36 ± 19	0–94	0–100	1 (0.67)	0 (0)	251
BCTQ	19	100	2.6 ± 0.86	1–5	1–5	2 (1.6)	1 (0.80)	131
PRUNE	20	100	4.3 ± 2.2	0.85–9.7	0–10	1 (3.3)	1 (3.3)	128
PROMIS PF-UE-7	7	100	41 ± 10	16–58	16–58	2 (1.4)	24 (16)	50

*Continuous variables are shown as means ± SDs. Discrete variables are shown as *n* (%).

the order of the instruments. Some questions look alike and overlap with those in the next instrument; therefore, survey fatigue was possible. However, the mean time taken to complete all instruments was less than 10 minutes.

Similar to the developmental study of the I-HaND, where a strong Pearson correlation of 0.87 was found with the Quick Disabilities of the Arm, Shoulder, and Hand questionnaire,[6] we also found strong inter-questionnaire correlations using both condition- and upper extremity–specific PROMs. Of the 4 instruments tested, the BCTQ and PROMIS are the most studied. Our correlations are consistent with the evidence to date.[20,21] In a separate, as yet unpublished experiment, we also found similar strong correlations of the I-HaND with upper extremity–specific PROMs (the PROMIS PF-UE-7 and Quick Disabilities of the Arm, Shoulder, and Hand questionnaire) and pain intensity. This suggests the use of more specific PROMs may have few advantages over more general PROMs. Interestingly, we found the lowest—but still moderate—correlations between the PROMIS PF-UE-7 and the BCTQ and PRUNE symptom intensity subscales. One potential explanation is that the PROMIS PF-UE-7 had notable ceiling effects that would have been avoided if we were able to use the CAT version. These ceiling effects limit the spread in the scores, which might have reduced the correlations. Another explanation might be that 5 out of 11 questions for the BCTQ symptom intensity subscale and 6 out of 10 for the PRUNE symptom intensity subscale are related to pain and the remaining questions ask about other symptoms, like numbness, tingling, or weakness.[4,5] The numbness can be described or experienced as pain, but pain without concurrent numbness is not a symptom of either CTS or CubTS. Diagnostic scales for CTS, such as the CTS-6, do not include symptoms of pain.[16] Questions about weakness may measure pain more than they measure true weakness. It is our impression that people with muscle weakness usually describe issues with dexterity, not strength.

This study adds to the evidence that psychosocial factors have more influence on activity intolerance than pathophysiology, as symptoms of depression (as measured by the PHQ-2) were not only highly correlated with all PROMs, but depression was also the factor best able to account for the variability in the PROM scores. Factors such as symptoms of depression, anxiety, and catastrophic thinking are most consistently associated with activity intolerance.[22] For instance, studies of patients with CTS using the BCTQ identify mental health as a preoperative correlate of symptom intensity, and improvements in mental health are associated with improvements in

symptom intensity.[23–25] A longitudinal study of 60 patients with CTS undergoing carpal tunnel release found more improvement on the BCTQ symptom intensity subscale if their symptoms of depression and pain anxiety also improved.[23]

The finding that the shortest instrument tested (the PROMIS PF-UE-7) had a comparable floor effect to the other instruments but a greater ceiling effect is expected and might not have occurred if all sites could use the computer adaptive test. The length of a PROM tries to balance efficiency with limited floor and ceiling effects. One of the advantages of a CAT is that it can limit flooring and ceiling effects while remaining brief.[21,26,27]

This study confirmed that specific and general PROMs correlate strongly in patients with idiopathic CTS or CubTS. It also confirmed that mental health accounts for variation in PROMs and might be the reason that less specific and more specific PROMs correlate: they might be similarly influenced by factors other than pathology. Based on this line of evidence, pending testing of potentially greater responsiveness in specific settings, we prefer to use a single simple, brief, and general PROM to quantify symptom intensity and activity intolerance for both routine patient care and research.

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APPENDIX E1. Bivariate Analyses of Factors Associated With Patient-Reported Outcome Scores*

Variables, N = 150	I-HaND, n = 150	I-HaND *P* Value	BCTQ, n = 130	BCTQ *P* Value	PRUNE, n = 30	PRUNE *P* Value	PROMIS PF-UE-7, n = 148	PROMIS PF-UE-7 *P* Value
Age in years, *r*	−0.09	.25	−0.07	.42	−0.29	.12	−0.02	.84
Sex								
Women	36 ± 18	.66	2.6 ± 0.88	.87	5.0 ± 2.2	.14	40 ± 10	.17
Men	35 ± 20		2.5 ± 0.85		3.8 ± 2.2		43 ± 11	
Partnered status								
Married/unmarried couple	36 ± 19	.53	2.6 ± 0.84	.29	4.6 ± 2.2	.50	41 ± 10	.43
Other	34 ± 19		2.4 ± 0.91		4.0 ± 2.3		40 ± 11	
Level of education								
High school or less	37 ± 19	.19	2.7 ± 0.93	.13	3.7 ± 1.9	.76	39 ± 9.8	.43
2-year college	36 ± 17		2.5 ± 0.81		4.7 ± 1.8		41 ± 10	
4-year college	37 ± 21		2.6 ± 0.86		4.8 ± 3.6		41 ± 11	
Postcollege graduate degree	28 ± 17		2.1 ± 0.62		4.5 ± 2.5		44 ± 12	
Insurance								
Private	36 ± 18	.60	2.5 ± 0.79	.59	4.4 ± 2.1	.61	41 ± 9.4	.63
Other	34 ± 20		2.6 ± 1.0		4.0 ± 2.6		40 ± 12	
Visit								
New or established patient visit	37 ± 18	.06	2.7 ± 0.77	<.05†	4.5 ± 2.3	.46	41 ± 9.9	.50
Postoperative visit	30 ± 22		2.2 ± 1.0		3.8 ± 2.0		40 ± 12	
Symptom duration								
≤3 months	34 ± 22	.51	2.5 ± 1.0	.28	4.3 ± 2.3	.50	40 ± 11	.87
3 months to ≤1 year	34 ± 16		2.4 ± 0.74		3.2 ± 2.7		41 ± 9.1	
>1 year	38 ± 19		2.7 ± 0.87		4.7 ± 2.0		41 ± 11	
PSEQ-2, ρ	−0.40	<.05†	−0.37	<.05†	−0.39	<.05†	0.39	<.05†
TSK-4, ρ	0.44	<.05†	0.45	<.05†	0.53	<.05†	−0.30	<.05†
PHQ-2, ρ	0.37	<.05†	0.35	<.05†	0.54	<.05†	−0.32	<.05†
Diagnoses								
No carpal tunnel syndrome	35 ± 20	.82	-	-	4.0 ± 1.9	.31	42 ± 11	.56
Carpal tunnel syndrome	36 ± 19		-		4.9 ± 2.9		41 ± 10	
No cubital tunnel syndrome	35 ± 18	.81	2.6 ± 0.85	.81	-	-	41 ± 10	.71

(Continued)

APPENDIX E1. Bivariate Analyses of Factors Associated With Patient-Reported Outcome Scores* (Continued)

Variables, N = 150	I-HaND, n = 150	I-HaND *P* Value	BCTQ, n = 130	BCTQ *P* Value	PRUNE, n = 30	PRUNE *P* Value	PROMIS PF-UE-7, n = 148	PROMIS PF-UE-7 *P* Value
Cubital tunnel syndrome	36 ± 22		2.6 ± 1.1		-		40 ± 11	
Carpal tunnel syndrome, n = 130								
Unilateral	35 ± 21	.86	2.5 ± 0.98	.58	5.9 ± 3.2	.28	39 ± 11	.18
Bilateral	36 ± 17		2.6 ± 0.79		3.9 ± 2.4		42 ± 9.6	
Electrodiagnostic studies not present	34 ± 17	.33	2.6 ± 0.81	.75	2.8 ± 1.2	.13	43 ± 9.8	.06
Electrodiagnostic studies present	37 ± 20		2.5 ± 0.91		5.8 ± 2.9		39 ± 11	
Related atrophy not present	36 ± 18	.54	2.6 ± 0.83	.73	-	-	41 ± 10	.73
Related atrophy present	33 ± 24		2.5 ± 1.1		-		40 ± 13	
Related static numbness not present	34 ± 21	.48	2.5 ± 0.90	.79	-	-	43 ± 11	.14
Related static numbness present	36 ± 18		2.6 ± 0.85		-		40 ± 9.9	
Cubital tunnel syndrome, n = 30								
Unilateral	33 ± 22	.24	2.4 ± 1.1	.68	3.9 ± 2.1	.15	40 ± 10	.86
Bilateral	44 ± 22		2.8 ± 1.3		5.2 ± 2.5		41 ± 12	
Electrodiagnostic studies not present	34 ± 17	.51	2.1 ± 0.24	.34	3.9 ± 1.9	.28	44 ± 11	.06
Electrodiagnostic studies present	40 ± 26		3.0 ± 1.4		4.8 ± 2.6		37 ± 9.7	
Related atrophy not present	31 ± 18	<.05†	-	-	3.8 ± 1.9	<.05†	43 ± 10	.10
Related atrophy present	50 ± 25		-		5.6 ± 2.7		36 ± 10	
Related static numbness not present	26 ± 4.3	.38	-	-	2.9 ± 0.86	.26	49 ± 8.3	.17
Related static numbness present	38 ± 23		-		4.5 ± 2.3		40 ± 11	

*Pearson and Spearman correlations are indicated by r and ρ, respectively. Continuous variables are shown as means ± SDs, unless otherwise indicated. PSEQ-2, Pain Self-Efficacy Questionnaire short form; TSK-4, Tampa Scale for Kinesiophobia short form.

†$P < .05$ was considered to be significant.