HAND/PERIPHERAL NERVE

Outcomes Article

The Usefulness of Patient-Reported Measures for Clinical Practice

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Background: The authors assessed the diagnostic potential of commonly used patient-reported measures, namely, the Boston Carpal Tunnel Questionnaire (function and symptom severity), *Quick*DASH (a shortened version of the Disabilities of the Arm, Shoulder and Hand questionnaire), and the Short Form-8. **Methods:** Measure scores were extracted retrospectively from the records of 262 patients (397 hands) and compared using analysis of variance to determine statistical differences among diagnoses assigned by the same surgeon at the time of visit. Patients were grouped into one of two diagnostic groups: those with Dupuytren disease and those with carpal tunnel, osteoarthritis, and tenosynovitis conditions. Logistic regression analysis was performed, and a receiver operating characteristic curve was used in data analysis.

Results: Analysis of variance showed statistical differences among the five diagnoses for each patient-reported measure. Results showed that Dupuytren disease was significantly different from the other diagnoses. Carpal tunnel, osteoarthritis, and tenosynovitis conditions were statistically associated with higher Boston Carpal Tunnel Questionnaire function and symptom severity and *Quick*DASH scores compared with Dupuytren disease. Lower physical and mental summary Short Form-8 scores were associated with the carpal tunnel, osteoarthritis, and tenosynovitis conditions. *Quick*DASH scores of 25 or higher and Boston Carpal Tunnel Questionnaire symptom severity scores and function scores of 2.5 or higher and of 2 or higher, respectively, are the best patient-reported measure threshold values for distinguishing between the two diagnostic groups.



Conclusions: The *Quick*DASH and Boston Carpal Tunnel Questionnaire patient-reported measures have diagnostic potential. Establishing threshold values for predicting a diagnostic group may prove to be a useful tool for referring providers. (*Plast. Reconstr. Surg.* 132: 105, 2013.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Diagnostic, IV.

The common complaint of "hand pain" and "loss of function" carries a large differential diagnosis. The hand surgeon and community providers are often called on to guide treatment to the millions of people who seek relief from these common complaints every year. To add to the complexity, studies that have evaluated the diagnostic accuracy of both basic physical examination findings and nerve conduction velocity modalities have produced contrasting results.¹⁻⁵ With the increased focus on cost-effective and cost-conscious care, identifying reliable and costefficient diagnostic tools is essential. The goal of this article is to unveil the diagnostic potential of

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patient-reported measures, which have become a vital part of assessments used in clinical trials and health services research.

Patient-reported measures have become an integrated step in the care of patients at our institution. At the time of initial consultation, patients are invited to complete two commonly used patient-reported measures, the *Quick*DASH [a shortened version of the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire], and the Short Form-8. The Boston Carpal Tunnel Questionnaire is then administered to patients who either achieve a certain score on the *Quick*DASH or to patients referred with a diagnosis of carpal

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tunnel syndrome. Before entering the examination room, the surgeon reviews the results of the patient-reported measures. A hand surgeon at our institution has observed certain patterns in scores from patient-reported measures among patients with similar diagnoses. In fact, she was recently consulting on a patient referred with the diagnosis of Dupuytren disease. However, on the basis of elevated patient-reported measures scores, the surgeon knew that this diagnosis was unlikely the main disorder before even examining or meeting the patient.

On the basis of anecdotal observations, we hypothesize that patients' scores on the Boston Carpal Tunnel Questionnaire functional and symptom severity measures and the QuickDASH will differ among various hand diagnoses. In addition, we predict no difference in Short Form-8 health survey scores between the various diagnoses given the generic nature of this survey. By identifying a statistical difference between Boston Carpal Tunnel Questionnaire and QuickDASH values for certain conditions, we hope to identify a threshold that will be predictive of a certain diagnostic group of common hand complaints. The ultimate goal is to define the patient-reported measures as a diagnostic tool that will add predictive power in identifying the correct diagnosis.

MATERIALS AND METHODS

The Boston Carpal Tunnel Questionnaire was reported in 1993 by Levine et al. and consists of two scales, a functional status scale and a symptom severity scale.⁶ The functional status scale has eight items, rated from 1 (no difficulty with activity) to 5 (cannot perform the activity at all). The symptom severity scale has 11 items rated on a scale of 1 through 5, with 1 being the mildest and 5 being the most severe. The final scores for the Boston Carpal Tunnel Questionnaire are reported as an average of the ratings. The questionnaire is highly reliable and reproducible, and has been validated for assessing patient-reported carpal tunnel outcomes.^{6–9} It has limited reported use for comparison of non–carpal tunnel ailments.

The DASH questionnaire is a self-administered, region-specific scale of 30 items to assess the physical and social components of health related to the upper extremity. The DASH score is reported from 1 (no disability) to 100.⁸ A large number of literature reports have proven the validity, reliability, and responsiveness of the questionnaire for proximal and distal arm disorders.^{8–16} In this study, we used the *Quick*DASH questionnaire,¹⁷ which has 11 items with the same scoring range. Although studies have shown that the full-length questionnaire provides more specific and accurate results,¹⁸ numerous reports also indicate that the *Quick*DASH instrument can be used instead of the DASH questionnaire, with similar precision in upper extremity disorders.^{16,19–21} Additional studies have shown the independent responsiveness, validity, and reliability of the *Quick*DASH^{22–26} for various upper extremity disorders.

The Short Form-8 is an eight-item, practical measurement of eight health domains that provides both physical and mental component summary scores. The scale is calibrated such that 50 is the norm-based average, with an SD of 10. The generic survey can be applied to patients across all ages, diseases, and treatment groups. It obtains information about the functional health and wellbeing from the patient's point of view.²⁷

Subjects

After approval by the institutional review board committee, a query was created to extract from Dartmouth-Hitchcock's data warehouse all patients (n = 262) who had visited the senior surgeon (C.L.K.) in the past 5 years with International Classification of Diseases, Ninth Revision codes of 354.0 (carpal tunnel), 715.14 (osteoarthritis), 727.03 (trigger finger), 727.05 (tenosynovitis of the hand), and 728.6 (Dupuytren contracture). The query was built to return the following information for each patient: age; medical record number; date of visit; Current Procedural Terminology codes in a given time frame; other recorded patient diagnoses; and results of the Boston Carpal Tunnel Questionnaire, QuickDASH, and Short Form-8. Patients were not included if scores for patient-reported measures were missing from the record. All electronic records were reviewed manually to ensure accuracy of the guery and to extract handedness, affected hand, and nerve conduction velocity motor latencies when applicable.

All recorded diagnoses were based on the surgeon's opinion after review of the history, physical examination, nerve conduction velocity distal motor latency (in the case of suspected carpal tunnel), and scores for patient-reported measures.

Statistical Analysis

Analysis of variance was used to compare scores for patient-reported measures between all diagnoses. A post hoc multiple-comparison test (Bonferroni) was used to determine which diagnoses had significantly different scores for patient-reported measures. This established two diagnostic groups: (1) Dupuytren disease and (2) carpal tunnel, osteoarthritis, and tenosynovitis/ trigger finger conditions. Logistic regression was used to determine whether the two diagnostic groups were associated with the patient-reported measures, in which carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger conditions were assigned 1 and Dupuytren disease was assigned 0. Both a crude model and a model adjusted for age and Short Form-8 physical summary score to eliminate potential confounding factors were performed, in which there were no major differences between models and the adjusted results were reported. A value of p < 0.05 was considered significant. To determine the ability of the Boston Carpal Tunnel Questionnaire function and symptom severity and the *Quick*DASH questionnaire to predict a diagnosis, various cutoff scores were analyzed using the receiver operating characteristic curve. The best cutoff score was chosen by which one maximized the area under the curve and by examining specificity, sensitivity, and accuracy values. The software used for statistical analysis was STATA 8.0 (StataCorp, College Station, Texas).

RESULTS

A total of 397 hands from 262 patients were included in the study. Of the 397 hands included in the study, 169 were found to have carpal tunnel syndrome, 118 had Dupuytren contracture, 10 had tenosynovitis, seven had osteoarthritis, and 93 had

Total Hands Surveyed: 397

multiple diagnoses, at least one of which was an inflammatory condition. The average age of the patients was 59.6 years (SD, 13.4 years), and 232 of the patients (89 percent) were right-handed. Fifty-seven percent of the hand complaints from patients were for the right hand. Not all patients completed the three different patient-reported measures. Figure 1 is a Venn diagram that depicts the number of scores for patient-reported measure available in the database in which some patients completed more than one patient-reported measure. Patients in our institution are given patientreported measures according to a branching logic. All patients are given the Short Form-8 and the QuickDASH questionnaire. The Boston Carpal Tunnel Questionnaire is given only for carpal tunnel referrals and if a certain score was achieved on the QuickDASH patient-reported measure.

Average scores for patient-reported measures for the five different diagnostic groups extracted originally from the Dartmouth-Hitchcock patient database are listed in Table 1. The results of the analysis of variance for each of the patientreported measures showed that there were significant differences between the groups (p < 0.001 for all). Table 2 lists the p values for the Bonferroni post hoc analysis of the scores for patient-reported measure between all diagnoses, except for the multiple diagnoses group. Dupuytren disease was significantly different from the other diagnoses for the most scores for patient-reported measures. The multiple diagnoses group, not included in Table 2 because of its limited clinical applicability,



Fig. 1. The number of hands assessed by the indicated patient-reported measure. BCTQ, Boston Carpal Tunnel Questionnaire; SF-8, Short Form-8.

Diagnostic Group	BCTQ Function (SD)	BCTQ Symptom (SD)	QuickDASH (SD)	SF-8 Mental (SD)	SF-8 Physical (SD)
Carpal tunnel	2.3 (0.7)	2.9 (0.7)	40.2 (18.7)	53.1 (10.0)	42.8 (10.4)
Tenosynovitis/					
trigger finger	2.6(1.0)	2.9(0.5)	40.9(24.5)	59.8(5.6)	36.0(12.9)
Osteoarthritis	2.7(1.0)	2.6(1.1)	58.6(25.6)	53.9(9.2)	43.0 (10.3)
Dupuytren disease	1.6(0.5)	2.0(0.6)	11.3(10.0)	56.9(5.0)	50.0 (7.9)
Multiple diagnoses	2.3(1.0)	2.7(0.8)	37.4 (18.5)	53.3 (9.3)	43.0 (10.4)
p* 1 0	<0.0001	<0.0001	<0.0001	0.0007	< 0.0001

Table 1. Average Scores for Patient-Reported Measures for the Indicated Diagnostic Groups

BCTQ, Boston Carpal Tunnel Questionnaire; SF-8, Short Form-8.

*Analysis of variance.

was significantly different from the group with Dupuytren disease.

On the basis of the post hoc analysis (Table 2), patients were divided into two diagnosis groups: (1) carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger disorders and (2) Dupuytren disease. Table 3 shows the results of the logistic regression, in which higher Boston Carpal Tunnel Questionnaire function, Boston Carpal Tunnel Questionnaire symptom severity, and QuickDASH questionnaire scores were associated with carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger conditions compared with Dupuytren disease. Lower Short Form-8 mental and physical summary scores were also associated with carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger conditions. Figures 2 through 4 are histograms showing the distributions of three of the patient-reported measures for the two diagnosis groups.

Cutoff scores for the patient-reported measures were chosen and assessed to determine the best score for predicting a carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger disorder. Table 4 lists sensitivity, specificity, and the area under the curve of a range of scores for the given patient-reported measure. Threshold values with the greatest area under the curve are highlighted. For example, a score greater than or equal to 2 for Boston Carpal Tunnel Questionnaire function was the best cutoff score to predict a carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger disorder.

DISCUSSION

Patient-reported measures have widespread applicability in research and in determining effectiveness and satisfaction in individual health care. These measures, according to the data in this study, may have additional diagnostic potential. Although some studies have shown gross distinctions between patient-reported measure scores for various diagnoses,^{16,28} no studies to our knowledge have focused on this important observation as the focus of the study.

Other authors, however, have suggested using patient-reported measures for more than

Table 2. Post Hoc Analysis Comparing Scores for Patient-Reported Measures for Each Diagnosis to Another*

	Tenosynovitis	Osteoarthritis	Dupuytren Disease
Osteoarthritis	BCTQ Function = 1.00		
	BCTQ Symptom = 1.00		
	Quick DASH = 0.789		
	SF-8 Mental = 1.00		
	SF-8 Physical $= 1.00$		
Dupuytren disease	BCTQ Function = 0.014 †	BCTQ Function = 0.014 †	
1 /	BCTQ Symptom = 0.019 †	BCTQ Symptom $= 0.581$	
	QuickDASH < 0.001†	QuickDASH <0.001†	
	SF-8 Mental = 1.00	$\widetilde{SF-8}$ Mental = 1.00	
	SF-8 Physical = <0.001 †	SF-8 Physical = 0.624	
Carpal tunnel	BCTQ Function = 1.00	BCTO $Éunction = 1.00$	BCTO Function <0.001 ⁺
1	BCTO Symptom = 1.00	BCTO Symptom = 1.00	BCTO Symptom <0.001 ⁺
	QuickDASH = 1.00	QuickDASH = 1.00	QuickDASH < 0.001†
	SF-8 Mental = 0.219	SF-8 Mental = 0.219	SF-8 Mental = 0.002 †
	SF-8 Physical = 0.434	SF-8 Physical = 0.434	SF-8 Physical <0.001 ⁺

BCTQ, Boston Carpal Tunnel Questionnaire; SF-8, Short Form-8.

*Patients with multiple diagnoses were eliminated from this analysis. Numbers indicate p values for comparison of the indicated patient-reported measures.

†Statistically significant values.

	Odds Ratio	95% CI	þ	No. of Hands with Inflammatory Conditions	No. of Hands with Dupuytren Disease
BCTO Function	5.04	2.42-10.51	< 0.001	185	42
BCTO Symptom	7.48	2.98 - 18.78	< 0.001	166	23
QuickDASH	1.18	1.10 - 1.25	< 0.001	177	39
SF-8 Mental	0.94	0.90 - 0.98	0.008	175	117
SF-8 Physical	0.90	0.87 - 0.93	< 0.001	175	117

 Table 3. Logistic Regression Analysis Comparing Scores for Patient-Reported Measures between Dupuytren

 Disease and Inflammatory Conditions*

BCTQ, Boston Carpal Tunnel Questionnaire; SF-8, Short-Form-8.

*Odds ratio, 95% confidence interval, and *p* values for indicated patient-reported measure score comparisons between the Dupuytren disease and inflammatory cohorts. Also listed are the numbers of hands in each cohort for each patient-reported measure comparison.

measuring patient-centered outcomes. Jester et al. report that the DASH questionnaire has potential in the development of patient-centered treatment programs that are tailored to the individual patient's requirements. The authors retrospectively grouped surgically treated patients and compared DASH questionnaire scores between them. The treatment groups included over 10 surgical modalities, including burn operations, ray amputations, fusions, nerve releases, and arthroplasties. The DASH questionnaire scores differentiated well among the groups, adding further evidence that patients with different upper extremity ailments score differently on this patient-reported measure. The authors did not, however, report predictive value, sensitivity, or specificity of a threshold number on the patient-reported measure, which could be used to guide a clinical diagnosis.²⁸

This study suggests potential diagnostic ability of the Boston Carpal Tunnel Questionnaire and the *Quick*DASH questionnaire. It is the first report using patient-reported measures as a diagnostic tool with reported sensitivities and specificities. Patient-reported measures are a potential costeffective means of guiding referrals for primary care physicians. The ultimate goal is to define the patient-reported measure as another tool to add further evidence to a presumed diagnosis. If a provider encounters a *Quick*DASH questionnaire score below 25 and Boston Carpal Tunnel Questionnaire scores below 2, he or she could



Fig. 2. Histogram showing distribution of *Quick*DASH questionnaire scores (binned in increments of 5 on the *x* axis) for the two diagnostic groups. The percentage of patients is displayed on the *y* axis. *COT*, carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger.



Fig. 3. Histogram showing distribution of Boston Carpal Tunnel Questionnaire (*BCTQ*) symptom severity scores (binned in increments of 0.5 on the *x* axis) for the two diagnosis groups. The percentage of patients is displayed on the *y* axis. *COT*, carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger.

begin to develop a differential diagnosis before the initial patient visit. With the referral patient mentioned in the Introduction, knowledge of the patient-reported measure guided the hand surgeon toward a different diagnosis than the initial referral diagnosis. The patient's scores for patient-reported measures available before the consultation visit were as follows: Boston Carpal



Fig. 4. Histogram showing distribution of Boston Carpal Tunnel Questionnaire (*BCTQ*) function scores (binned in increments of 0.5 on the *x* axis) for the two diagnosis groups. The percentage of patients is displayed on the *y* axis. *COT*, carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger.

	Sensitivity (%)*	Specificity (%)*	Area under the Curve
BCTQ function PRM score			
≥1.75	77.8	61.9	0.699
≥2.00†	67.6	78.6	0.731
≥2.25	42.2	90.5	0.663
BCTO symptom PRM score			
≥2.00	89.2	52.2	0.707
≥2.25	81.3	73.9	0.776
≥2.50†	69.9	91.3	0.806
DASH PRM score			
≥20	86.4	84.6	0.855
≥25†	82.5	92.3	0.874

Table 4. Sensitivity, Specificity, and Area under the Curve Ranges for Given Patient-Reported Measure Score Range

BCTQ. Boston Carpal Tunnel Questionnaire; PRM, patient-reported measure; DASH, Disabilities of the Arm, Shoulder and Hand questionnaire. *Percentages represent sensitivity or specificity for predicting an inflammatory condition.

[†]Patient-reported measure score with greatest area under the curve.

Tunnel Questionnaire function, 2.88; Boston Carpal Tunnel Questionnaire symptom severity, 3.27; and *Quick*DASH questionnaire, 54.5. On the basis of the outcomes of this study, the senior author (C.L.K.) would have known, without an examination, that Dupuytren disease, the referring diagnosis, was low on the list of differential diagnoses as the sole cause of the patient's symptoms. In fact, the patient was experiencing carpal tunnel syndrome (in addition to mild Dupuytren disease), and his symptoms were relieved following carpal tunnel release.

A limitation of the study is that the carpal tunnel, osteoarthritis, and tenosynovitis/trigger finger conditions were grouped and compared with Dupuytren disease with ordinal data sets, thus increasing the likelihood of a type I error. However, we are confident that because the *p* value is so low, the possibility of differences or associations is most likely remote. In addition, although the data were collected prospectively, the study design and analysis were performed retrospectively. The data were recorded by the patients at the time of their visit, thus eliminating any potential recall bias and increasing the reliability of the study. Another limitation is that the patient-reported measures were used to make the original diagnosis, biasing the results toward each different diagnosis. In addition, the senior author has significant experience with using patient-reported measures to aid in diagnosis. This limits the generalizability to other practices.

Although the use of patient-reported measures as a diagnostic tool is an exciting concept, future work is necessary before the measures can alone predict a specific diagnosis. Although a specific score for a patient-reported measure was not correlated with each studied diagnosis, we were able to show trends in scores for certain ailments. These trends can be used by the provider to narrow the differential diagnosis and to generate a discussion with the patient about where they fall in relation to other patients who complete the same patient-reported measure. The diagnostic potential of patient-reported measures may become more evident if each component of the patient-reported measure (i.e., pain) is studied among the groups. In the future, it would be helpful for multiple surgeons with various degrees of experience to prospectively look at differences in each component of the patient-reported measures and assign a diagnosis on the basis of each component. It will also be imperative to avoid using the patient-reported measure under investigation to aid in the final diagnosis. Doing so may show the ability of patient-reported measures to help with treatments and diagnoses.

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