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CLINICAL RESEARCH

To What Degree do Shoulder Outcome Instruments Reflect Patients' Psychologic Distress?

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Abstract

Background Psychologic distress contributes to symptom severity in patients with several musculoskeletal disorders. While numerous shoulder outcome instruments are used it is unclear whether and to what degree psychologic distress contributes to the scores.

Questions/purposes We asked (1) to what degree shoulder outcome instruments reflect patients' psychologic distress, and (2) whether patients who are strongly affected by psychologic distress can be identified.

Methods We prospectively evaluated 119 patients with chronic shoulder pain caused by degenerative or inflammatory disorders using the Constant-Murley scale, Simple Shoulder Test (SST), and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire. To evaluate psychologic distress, we measured depression using the Center for Epidemiologic Studies-Depression (CES-D) scale and pain anxiety using the Pain Anxiety Symptom Scale (PASS). Demographic and clinical parameters, such as pain scores, ROM, and abduction strength, also were measured. We then assessed the relative contributions made by psychologic distress and other clinical parameters to the quantitative ratings of the three shoulder outcome instruments.

Results Quantitative ratings of shoulder outcome instruments correlated differently with psychologic distress. Constant-Murley scores did not correlate with psychologic measures, whereas SST scores correlated with PASS ($r = 0.32$) and DASH scores correlated with PASS and CES-D ($r = 0.36$ and $r = 0.32$). Psychologic distress contributed to worsening SST and DASH scores but not to Constant-Murley scores. DASH scores were more strongly influenced by pain anxiety and depression than the other two outcome instruments.

Conclusions Shoulder outcome measures reflected different psychologic aspects of illness behavior, and the contributions made by psychologic distress to different shoulder outcome instruments apparently differed. Physicians should select and interpret the findings of shoulder outcome instruments properly by considering their psychologic implications.

Level of Evidence Level II, prognostic study. See Instructions for Authors for a complete description of levels of evidence.

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Introduction

Chronic shoulder pain is a common problem, especially in patients with degenerative or inflammatory disorders, and has a prevalence of 7% to 34% in the general population [3, 5]. This type of pain restricts daily activities owing to ROM limitations and reduced muscle power and because it is accompanied by different types and degrees of psychologic distress [37]. Patient-perceived disability correlates as much or more with psychologic distress than with objective impairment [32], and thus there is growing interest in measuring psychologic distress and function or disability, which predicts surgical outcome and plays a substantial role in a patient's recovery, even accounting for clinical factors [30]. Psychologic distress, such as pain anxiety or depression, is increasingly being recognized as contributing to pain and disability perception in several musculoskeletal disorders [16]. Accordingly, the provision of care to patients with musculoskeletal disabilities no longer is limited to reducing signs and symptoms and improving a patient's ability to function but also embraces general well-being and quality of life, which include the mental and physical aspects of health [8].

An increasing number of questionnaires have been introduced to evaluate general shoulder function and disability [24, 29]. These questionnaires range from objective measures, such as ROM [6] or muscle strength [6], to more subjective measures, such as patient satisfaction [23] or quality of life [11, 35]. The commonly used shoulder outcome instruments reportedly yield varying scores even when used to evaluate similar disorders [2, 29]. Such variations could result from the degree to which the scores are influenced by psychologic distress. Although clinicians should be aware of the contributions made by psychologic distress to selected outcome instruments when making decisions regarding treatment priorities or interpreting treatment outcomes, it is unclear whether and to what degree psychologic distress influences the scores.

We therefore asked (1) what degree three commonly used shoulder outcome instruments, the Constant-Murley score, Simple Shoulder Test (SST), and Disabilities of the Arm, Shoulder, and Hand (DASH), reflect patients' psychologic distress, such as depression (measured using the Center for Epidemiologic Studies-Depression [CES-D] scale) and pain anxiety (measured using the Pain Anxiety Symptom Scale [PASS]), and (2) whether there are key questions or domain on the Distress Test which strongly indicates negative outcome scores in patients with chronic shoulder pain.

Patients and Methods

Between May 2011 and November 2011 we evaluated a total of 132 patients with shoulder pain. Of these we recruited 119 patients meeting the following criteria: disorders caused by degenerative or inflammatory changes in the shoulder region (adhesive capsulitis, arthritis, cuff disorder, or tendinitis calcarea), symptom duration greater than 3 months, age 30 years or older, and ability to complete the questionnaires. We excluded 13 patients with shoulder instability and those with shoulder pain originating from cardiovascular or neurologic problems. All patients provided informed consent, and the study protocol was approved by the institutional ethics committee.

A power analysis indicated a minimum sample size of 110 patients would provide 90% statistical power ($\beta = 0.1$, $\alpha = 0.05$) to detect a moderate correlation ($\rho \geq 0.30$) between CES-D and DASH scores, which means that association with a correlation coefficient greater than 0.3 can be detected with a power of 90%, given the actual sample size.

Demographic and clinical data were collected by a physician at first visits (Table 1). Clinical investigations included BMI, disease duration, pain score during activity (measured using a 0- to 10-cm VAS), ROM (measured using a goniometer), and muscle force (measured using a tensiometer).

We asked all individuals to complete three commonly used shoulder outcome instruments (Constant-Murley scale [6], SST [16], and DASH [11]) based on their shoulder condition during the past 4 weeks. The questionnaires were distributed by one orthopaedic surgeon (YHR) in the clinic after physical examination. All returned questionnaires

Table 1. Patient demographic and clinical characteristics

Variable	Value
Sex	
Male	67
Female	52
Age (years)*	49.1 (32–75)
BMI (kg/m^2)*	23.7 (19.7–29.1)
Disease duration (months)*	6.7 (4–19)
Affected shoulder	
Dominant side	68
Nondominant side	51
Diagnosis	
Adhesive capsulitis	46
Impingement syndrome without rotator cuff tear	31
Rotator cuff tear with/without impingement syndrome	22
Acromioclavicular joint arthritis	12
Calcific tendinitis	8

* Values are expressed as mean, with range in parentheses; the remaining values are expressed as number of patients.

were checked for completion by trained nurses, and participants were assisted in completing missing items. The Constant-Murley questionnaire is a reliable and valid shoulder outcome instrument [9], and is the most widely used questionnaire in Europe [17]. It combines physical examination tests (ROM and strength) and subjective evaluations (pain and function). The SST was developed by the shoulder service at the University of Washington (Seattle, WA, USA) [19]. It is a quick, subjective questionnaire composed of 12 questions with yes or no response options, and has been reported to be reliable, valid, and responsive [10]. For each question, the patient indicates whether he or she is able to perform the activity. Scores are summarized, and total scores range from 0 (worst) to 12 (best) for shoulder function. The DASH is a self-administered, upper extremity-specific questionnaire that consists of 30 questions [13]. It includes physical functions, symptoms, and social-role function, work, sleep, and confidence items. Five responses are provided per question and are scored from 1 (without difficulty or no symptoms) to 5 (unable to engage in activities or very severe symptoms). Thus, the DASH provides a best possible score of 0 and a worst possible score of 100. The DASH evaluation is user-friendly, reliable, and valid for a range of upper extremity disorders [12, 33]. The average ± SD DASH score in the general population has been reported as 10 ± 15 [14].

In addition, we measured depression using the CES-D [27] and pain anxiety using the PASS [25]. The CES-D [27] is used to assess depressive symptoms, screen for symptoms related to depression or psychologic distress, and provide a means of identifying those at risk of depression. The CES-D is composed of 20 items, which are rated from 0 to 3. Thus, total scores range from 0 to 60, and the average score for the general population is 9.1 ± 8.6 [4]. The PASS is a 40-question inventory designed to measure pain-related anxiety [25]. The PASS contains four subscales that measure the levels of different anxiety types: (1) cognitive anxiety, (2) fear of pain, (3) escape and avoidance, and (4) physiologic anxiety. The PASS rates responses using 6-point ordinal scales and assigns 50 points to each of the four subscales (a maximum possible pain anxiety score of 200) [22].

We used descriptive statistics to describe the demographics and clinical characteristics of the study subjects. To evaluate what degree shoulder outcome instruments reflect patients' psychologic distress, we ran multiple linear regression analysis after univariate correlation analysis. We evaluated associations between continuous explanatory variables (gender, ROM, pain VAS, strength, CES-D, and PASS scores) and response variables (Constant-Murley scale, SST, and DASH scores) using Pearson's correlation coefficients after normality testing. Independent variables with $p < 0.1$ were entered into a multivariate regression model with stepwise variable selection to identify independent predictors of the three shoulder outcome scores, adjust for potential confounding variables, and estimate the relative contributions made by pain anxiety (measured using the PASS) and depressive symptoms (measured using the CES-D) to the results of the three shoulder outcome instruments. We ran two multiple analysis models to evaluate what degree CES-D and PASS together influence shoulder outcome scores (psychologic model including only the PASS and CES-D as explanatory variables), and what degree CES-D and PASS each influence shoulder outcome scores accounting for other clinical variables (best-fit model using backward stepwise multiple regression analysis, which included all entered explanatory variables initially, and subsequently, iterations were used to remove variables). Multiple linear regression analysis assesses the ability of explanatory variables to cause variations in response variables and accounts for confounding effects between explanatory variables. This analysis produces a statistic called adjusted R^2, which reflects the percentage of overall variability in the dependant variable that can be explained or accounted for by the explanatory variables included in a multiple linear regression model. We also evaluated Pearson's correlation coefficient of each question or domain on CES-D or PASS with DASH scores to determine whether there are key questions on the Distress Test which strongly indicate negative outcome scores in patients with chronic shoulder pain. All statistical analyses were performed with SPSS version 17.0 (SPSS Inc, Chicago, IL, USA).

Results

Psychologic distress measures correlated quite differently with three shoulder outcome instruments examined, and contributed to worsening SST and DASH scores but not to Constant-Murley scores. Scores for the clinical, shoulder outcome, and psychologic measures are shown (Table 2). The Constant-Murley score did not correlate with the CES-D and PASS, whereas SST scores correlated with the PASS ($r = 0.32$, $p = 0.025$), and DASH scores correlated with the PASS and CES-D ($r = 0.36$, $p = 0.011$; and $r = 0.32$, $p = 0.022$, respectively) (Table 3). However, each of the three shoulder outcome instruments correlated with the other two instruments. Specifically, the DASH correlated with the SST and Constant-Murley scores with correlation coefficients of 0.72 ($p < 0.001$) and 0.41 ($p < 0.001$), while the SST scores correlated with Constant-Murley scores with a correlation coefficient of 0.58 ($p < 0.001$). In multivariate regression analysis, a psychologic model containing only psychologic variables explained 13% and 17 % of the variation in SST and DASH scores ($p = 0.032$

Table 2. Scores on clinical, shoulder outcome, and psychologic measures

Measure	Score
0- to 10-cm VAS for pain (cm)	5.4 ± 2.1 (2–10)
ROM total (points*)	19.8 ± 4.9 (8–28)
Muscle strength (points*)	23.6 ± 3.4 (5–25)
Constant-Murley (points)	65.2 ± 15.4 (21–82)
SST (points)	6.8 ± 2.7 (1–10)
DASH (points)	22.5 ± 13.3 (5.8–53.0)
CES-D (points)	12.7 ± 7.2 (0–37)
Adhesive capsulitis	12.4 ± 6.8
Impingement syndrome	12.1 ± 6.4
Rotator cuff tear	11.5 ± 4.5
Acromioclavicular arthritis	14.8 ± 10.5
Calcific tendinitis	14.5 ± 12.2
PASS (points)	58.0 ± 39.6 (4–120)
Adhesive capsulitis	58.1 ± 38.9
Impingement syndrome	55.3 ± 37.2
Rotator cuff tear	52.1 ± 29.4
Acromioclavicular arthritis	63.1 ± 38.1
Calcific tendinitis	61.0 ± 41.2
Cognitive	17.2 ± 16.2 (0–50)
Escape/avoidance	15.4 ± 9.0 (0–34)
Fear	15.1 ± 11.8 (0–30)
Psychological anxiety	10.3 ± 8.1 (0–26)

Values are expressed as mean ± SD, with range in parentheses; * ROM and muscle strength were converted to Constant-Murley subscale scores to facilitate statistical analysis; SST = Simple Shoulder Test; DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire; CES-D = Center for Epidemiologic Studies-Depression; PASS = Pain Anxiety Symptom Scale.

Table 3. Correlations between the three shoulder outcome instruments and the two measures of psychologic distress

Measure	Pearson correlation coefficient				
	Constant-Murley	SST	DASH	PASS	CES-D
Constant-Murley	1				
SST	0.580*	1			
DASH	0.411*	0.715*	1		
PASS	0.080	0.322†	0.359†	1	
CES-D	0.120	0.219	0.323†	0.447*	1

* $p < 0.001$; † $p < 0.05$; SST = Simple Shoulder Test; DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire; PASS = Pain Anxiety Symptom Scale; CES-D = Center for Epidemiologic Studies-Depression.

and 0.020, respectively), but it did not explain the variation in Constant-Murley scores ($p = 0.350$) (Table 4). The best multivariable model accounted for 81%, 43%, and 38% of the variation in Constant scores, SST, and DASH scores ($p < 0.001$, $p = 0.001$, and $p = 0.020$, respectively).

Nineteen percent of patients (23/119) with chronic shoulder pain had high CES-D scores greater than 16 (Table 5), and 8% of patients (10/119) had severe pain anxiety symptom scores greater than 122 (Table 6). Patients with higher CES-D or PASS scores had worsened DASH scores and higher VAS pain scores, but there were no differences in Constant-Murley scores, strength, and ROM. Three questions in the CES-D questionnaire, "I was bothered by things that usually don't bother me.", "I felt that everything I did was an effort." and "I was unhappy.", showed relatively strong correlations ($r = 0.47$, $p = 0.001$; $r = 0.41$, $p = 0.007$; and $r = 0.38$, $p = 0.009$) with worsened DASH scores, but the other questions did not correlate with worsened DASH scores. In terms of PASS score, every domain of the PASS score, cognitive anxiety, avoidance, fear of pain, and pain anxiety, correlated with worsened DASH scores with correlation coefficients of 0.38, 0.33, 0.41, and 0.39, respectively ($p = 0.003$, 0.006, 0.005, and 0.001, respectively).

Discussion

A range of shoulder instruments have been introduced to assess shoulder disability and health-related quality of life. In addition to objective measures, such as ROM and muscle strength, subjective patient-based measures have become increasingly important for comprehensive assessments of intervention outcomes. Furthermore, patient-perceived disability better correlates with psychologic distress than objective impairment, and thus, there is growing interest in measuring psychologic distress. We determined what degree shoulder outcome instruments reflect patients' psychologic distress and whether there are key questions on the Distress Test which strongly indicate negative outcome scores in patients with chronic shoulder pain.

Our study has several limitations. First, it was based on a cross-sectional cohort, which prevented definite conclusions regarding the directions of relations between psychologic distress and patient-perceived disability, and thus, uncertainty remains about the direction of this relationship. A prospective longitudinal study is warranted to determine the nature of the causal relationship between psychologic distress and perceived disability. Second, only three outcome instruments were included in the study, and these instruments may not adequately capture patient-perceived disability. However, the use of too many instruments would have increased the burden placed on patients, and the selection of outcome measurements depends on their applicability, patient compliance, and author preference. Third, psychologic distress was evaluated only using a self-administered questionnaire and not using a structured psychiatric interview, which could have

Table 4. Multivariate analysis

Model	Constant-Murley score				SST				DASH			
	Included variable	β	R^2	p value	Included variable	β	R^2	p value	Included variable	β	R^2	p value
Best-fit model	Sex	0.14	81.2	< 0.001	Sex	0.32	42.7	0.001	Sex	0.31	38.0	0.020
	ROM	0.64			ROM	0.28			ROM	0.21		
	Pain	0.19			Pain	0.20			Pain	0.16		
	Strength	0.46			Strength	0.20			CES-D	0.16		
					PASS	0.22			PASS	0.17		
Psychologic model	CES-D		4.4	0.350*	CES-D		13.2	0.032	CES-D		17.2	0.048
	PASS				PASS				PASS			

* Psychologic model did not explain the variation in Constant-Murley scores; SST = Simple Shoulder Test; DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire; CES-D = Center for Epidemiologic Studies-Depression; PASS = Pain Anxiety Symptom Scale.

Table 5. Comparison of shoulder outcome scores and clinical findings by CES-D score

Variables	CES-D score		p value
	Low CES-D group (CES-D ≤ 16; n = 96)	High CES-D group (CES-D > 16; n = 23)	
DASH	20.8 ± 12.7	27.3 ± 13.3	0.03
SST	6.9 ± 2.6	6.1 ± 2.8	NS
Constant-Murley	66.7 ± 13.7	64.9 ± 18.9	NS
Pain VAS	5.2 ± 1.7	6.2 ± 2.0	0.03
ROM	19.6 ± 4.9	20.0 ± 4.9	NS
Strength	23.5 ± 3.5	24.0 ± 3.4	NS

DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire; SST = Simple Shoulder Test; CES-D = Center for Epidemiologic Studies-Depression; NS = not significant.

Table 6. Comparison of shoulder outcome scores and clinical findings by PASS score

Variable	PASS score			p value
	Mild anxiety (PASS < 67; n = 87)	Moderate anxiety (67 ≤ PASS < 123; n = 22)	Severe anxiety (PASS ≥ 123; n = 10)	
DASH	18.8 ± 1.5	29.4 ± 1.43	32.9 ± 1.48	0.01
SST	7.2 ± 2.5	6.0 ± 2.3	4.1 ± 2.9	0.02
Constant-Murley	67.9 ± 13.9	62.9 ± 17.1	60.5 ± 12.2	NS
Pain VAS	5.1 ± 1.7	5.5 ± 1.6	7.0 ± 2.3	0.04
ROM	27.0 ± 6.6	24.2 ± 8.5	19.2 ± 7.4	NS
Strength	24.2 ± 3.2	24.0 ± 2.2	23.5 ± 3.4	NS

DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire; SST = Simple Shoulder Test; PASS = Pain Anxiety Symptom Scale; NS = not significant.

led to potential confounding owing to the misdiagnoses of depression and anxiety symptoms. However, the structured psychiatric interviews are too time-consuming to be considered efficient for routine outpatient visits. Fourth, a considerable amount of variance in shoulder outcome measures remained unexplained. In terms of SST and DASH scores, only 38% to 43% of total variance was accounted for by our multivariate analysis model. Thus, other potential contributors to shoulder function and disability, such as level of physical activity, education, and

Table 7. Literature review of associations between psychologic distress and perceived disability

Study	Study subjects (patient number)	Methods	Explanatory variables	Response variables	Results (conclusion)
Macfarlane et al. (1998) [20]	Community-based participant with chronic shoulder pain (92)	Physical examination (ROM check) Questionnaire survey	Demographic factor: age, sex Psychologic distress: General Health Questionnaire (GHQ). Pain, Physical impairment, ROM	Continuing shoulder pain	(−) No significant association High score of GHQ increased odds of symptoms but not statistically significant
van der Windt et al. (2007) [36]	Patients with shoulder pain consulted with 103 general practitioners (587)	Questionnaire survey	Demographic factor: age, sex Psychologic distress: pain catastrophizing, distress, somatization, fear-avoidance	Shoulder Disability Questionnaire (SDQ)	(−) Weak and not significant Most associations of psychologic factors with shoulder outcome were weak and not significant
Masters et al. (2007) [21]	Patients with acute shoulder pain from 21 general practices (100)	Chart review	Demographic factor: age, gender, smoking Psychologic distress: depression (screened by two verbally asked questions)	Shoulder Pain and Disability Index (SPADI)	(+) Significant association Depressed mood was higher in those with high disability score
Ryall et al. (2007) [31]	Patients who attended primary care of 8 general practices (222)	Questionnaire survey	Demographic factor: sex, age Psychologic distress: Hospital Anxiety Depression scale (HADS), Whiteley Index (anxiety), brief symptom inventory (somatic symptoms) Pain	Continuing shoulder pain	The risk of continuing pain is significantly elevated in patients with a high hypochondriasis score, but not significantly elevated in those with high anxiety and depression scores (−) Somatization—not significant (no clear trend) (−) Anxiety and depression—not significant (+) Hypochondriasis—significant
Current study (2012)	Patients with chronic shoulder pain consulted to one orthopaedic specialist (119)	Physical examination (ROM, strength) Questionnaire survey	Demographic factor: age, gender, BMI Psychologic distress: CES-D PASS ROM, Muscle strength	Constant-Murley score SST DASH	Psychologic distress contributed to worsening SST and DASH scores but not to Constant-Murley scores

CES-D = Center for Epidemiologic Studies-Depression; PASS = Pain Anxiety Symptom Scale; SST = Simple Shoulder Test; DASH = DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire.

other aspects of psychologic morbidity, which were not measured in our study, might have contributed to variance. Exploring the causal relationship would require considering complex biologic and psychologic factors, and it is almost impossible to explore every causal relation. Finally, we did not prescreen the patients regarding psychologic morbidity which might have allowed a wider spectrum of patients with psychologic disorders to be included, although we believe that the effects may be limited.

Despite reports on the roles of psychologic factors, such as anxiety and depression, in patients with upper limb conditions [20, 21, 31, 36], the relationship between outcome measures and psychologic distress has not been properly addressed. Inconsistencies of relationships between psychologic factors and performance-based and self-reported disabilities might be attributable to the different measurement properties of outcome instruments and of measured psychologic variables (Table 7). We found correlations between the psychologic measures and shoulder outcome instruments were quite different for the three outcome instruments examined, and the influences of psychologic distress on perceived disability in patients with chronic shoulder pain differ according to the outcome instruments used. Constant-Murley scores showed little correlation with psychologic factors. For these scores, patient-based assessments accounted for only 35% of the score (the remaining 65% was allocated to objective assessments of ROM and strength), and this might have caused the poor correlations with psychologic factors. However, SST and DASH scores are based wholly on patient-based or self-reported assessments, although only the DASH contains social and confidence items. Although the SST does not contain any items that directly assess psychologic distress, SST scores moderately correlated with PASS scores, and 13.2% of the variance in SST scores was explained by the psychologic model. This may have been because questions regarding function and symptoms in the SST involve physical impairment and psychologically related loss of function. However, psychologic factors are important determinants of DASH scores, and more of the variance in DASH scores was explained by the psychologic model than variances in SST or Constant-Murley scores. For DASH scores, anxiety and depression explained more variance than pain severity, which suggests psychologic distress rather than pain per se causes disability in patients with chronic shoulder pain. These findings concur with those of a previous study, in which a large variability in DASH scores in upper extremity disorders apparently arose from psychosocial rather than physical factors [28]. Furthermore, subjective factors, such as pain and depression, have been reported to have greater influences when disability is measured with respect to the entire arm, such as by using DASH scores, rather than with respect to a more specific regional site [18].

We also found that patients who have severely worsened patient-based outcome scores but not clinician-based questionnaire scores or performance (Constant-Murley score, ROM, and muscle strength) tend to have high degree of psychologic distress symptoms. Patient-based outcome measures (DASH or SST) assessed physical impairment and psychologic distress, and clinician-based outcome instruments did not reflect patients' psychologic distress. In addition, in the clinic, physicians may identify patients who are likely to be strongly affected by psychologic distress by asking three questions on the CES-D score ("I was bothered by things that usually don't bother me.", "I felt that everything I did was an effort." and "I was unhappy."). Patients with depression and anxiety may see themselves as being more disabled than might be expected based on objective findings and thus might not be capable of adapting to and managing painful upper extremity problems [1]. Depression and anxiety not only correlated with patient reports of disability but they also impair adherence to prescribed therapy, response to medical treatment, and recovery after surgery [15, 16, 34]. Several antidepressant medications have been reported to have substantial analgesic effects in patients with a musculoskeletal disorder [7, 26], and further studies are needed to investigate the efficacy of treating comorbid depression or anxiety in patients with chronic shoulder pain.

We showed shoulder outcome measures were affected by different psychologic aspects of illness behavior and the contributions made by psychologic distress to different shoulder outcome instruments apparently differed. Therefore, we suggest physicians should be aware of the relationship between physical outcome measures and psychologic distress and recommend efforts be made to select or interpret shoulder outcome instruments properly.

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References

1. Alizadehkhaiyat O, Fisher AC, Kemp GJ, Frostick SP. Pain, functional disability, and psychologic status in tennis elbow. *Clin J Pain.* 2007;23:482–489.
2. Beaton DE, Richards RR. Measuring function of the shoulder: a cross-sectional comparison of five questionnaires. *J Bone Joint Surg Am.* 1996;78:882–890.
3. Bjelle A. Epidemiology of shoulder problems. *Baillieres Clin Rheumatol.* 1989;3:437–451.
4. Boyd JH, Weissman MM, Thompson WD, Myers JK. Screening for depression in a community sample: understanding the discrepancies between depression symptom and diagnostic scales. *Arch Gen Psychiatry.* 1982;39:1195–1200.
5. Chard MD, Hazleman R, Hazleman BL, King RH, Reiss BB. Shoulder disorders in the elderly: a community survey. *Arthritis Rheum.* 1991;34:766–769.

6. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res.* 1987;214: 160–164.
7. Fishbain D. Evidence-based data on pain relief with antidepressants. *Ann Med.* 2000;32:305–316.
8. Furner SE, Hootman JM, Helmick CG, Bolen J, Zack MM. Health-related quality of life of US adults with arthritis: analysis of data from the behavioral risk factor surveillance system, 2003, 2005, and 2007. *Arthritis Care Res (Hoboken).* 2011;63:788–799.
9. Gilbart MK, Gerber C. Comparison of the subjective shoulder value and the Constant score. *J Shoulder Elbow Surg.* 2007;16: 717–721.
10. Godfrey J, Hamman R, Lowenstein S, Briggs K, Kocher M. Reliability, validity, and responsiveness of the simple shoulder test: psychometric properties by age and injury type. *J Shoulder Elbow Surg.* 2007;16:260–267.
11. Goldhahn J, Angst F, Simmen BR. What counts: outcome assessment after distal radius fractures in aged patients. *J Orthop Trauma.* 2008;22(8 suppl):S126–S130.
12. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. *BMC Musculoskelet Disord.* 2003;4:11.
13. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand)[corrected]. The Upper Extremity Collaborative Group (UECG). *Am J Ind Med.* 1996;29:602–608.
14. Hunsaker FG, Cioffi DA, Amadio PC, Wright JG, Caughlin B. The American Academy of Orthopaedic Surgeons outcomes instruments: normative values from the general population. *J Bone Joint Surg Am.* 2002;84:208–215.
15. Junge A, Frohlich M, Ahrens S, Hasenbring M, Sandler A, Grob D, Dvorak J. Predictors of bad and good outcome of lumbar spine surgery: a prospective clinical study with 2 years' follow up. *Spine (Phila Pa 1976).* 1996;21:1056–1064; discussion 1064–1065.
16. Kim KW, Han JW, Cho HJ, Chang CB, Park JH, Lee JJ, Lee SB, Seong SC, Kim TK. Association between comorbid depression and osteoarthritis symptom severity in patients with knee osteoarthritis. *J Bone Joint Surg Am.* 2011;93:556–563.
17. Kirkley A, Griffin S, Dainty K. Scoring systems for the functional assessment of the shoulder. *Arthroscopy.* 2003;19:1109–1120.
18. Lindenhovius AL, Buijze GA, Kloen P, Ring DC. Correspondence between perceived disability and objective physical impairment after elbow trauma. *J Bone Joint Surg Am.* 2008;90: 2090–2097.
19. Lippitt SB, Harryman DT, Matsen FA. A practical tool for evaluating function: the Simple Shoulder Test. In: Matsen 3rd FA, Fu FH, Hawkins RJ, eds. *The Shoulder: A Balance of Mobility and Stability*. Rosemont, IL: American Academy of Orthopaedic Surgeons; 1993:501–530
20. Macfarlane GJ, Hunt IM, Silman AJ. Predictors of chronic shoulder pain: a population based prospective study. *J Rheumatol.* 1998;25:1612–1615.
21. Masters S, O'Doherty L, Mitchell GK, Yelland M. Acute shoulder pain in primary care: an observational study. *Aust Fam Physician.* 2007;36:473–476.
22. McCracken LM, Zayfert C, Gross RT. The Pain Anxiety Symptoms Scale: development and validation of a scale to measure fear of pain. *Pain.* 1992;50:67–73.
23. Monnin D, Perneger TV. Scale to measure patient satisfaction with physical therapy. *Phys Ther.* 2002;82:682–691.
24. Oh JH, Jo KH, Kim WS, Gong HS, Han SG, Kim YH. Comparative evaluation of the measurement properties of various shoulder outcome instruments. *Am J Sports Med.* 2009;37:1161–1168.
25. Osman A, Barrios FX, Osman JR, Schneekloth R, Troutman JA. The Pain Anxiety Symptoms Scale: psychometric properties in a community sample. *J Behav Med.* 1994;17:511–522.
26. Perrot S, Maheu E, Javier RM, Eschalier A, Coutaux A, LeBars M, Bertin P, Bannwarth B, Treves R. Guidelines for the use of antidepressants in painful rheumatic conditions. *Eur J Pain.* 2006;10:185–192.
27. Radloff LS. The CES-D Scale: a self teport depression scale for research in the general population. *Appl Psychol Meas.* 1977;1: 385–401.
28. Ring D, Kadzielski J, Fabian L, Zurakowski D, Malhotra LR, Jupiter JB. Self-reported upper extremity health status correlates with depression. *J Bone Joint Surg Am.* 2006;88:1983–1988.
29. Romeo AA, Bach BR Jr, O'Halloran KL. Scoring systems for shoulder conditions. *Am J Sports Med.* 1996;24:472–476.
30. Rosenberger PH, Jokl P, Ickovics J. Psychosocial factors and surgical outcomes: an evidence-based literature review. *J Am Acad Orthop Surg.* 2006;14:397–405.
31. Ryall C, Coggon D, Peveler R, Poole J, Palmer KT. A prospective cohort study of arm pain in primary care and physiotherapy: prognostic determinants. *Rheumatology (Oxford).* 2007;46:508–515.
32. Schiphorst Preuper HR, Reneman MF, Boonstra AM, Dijkstra PU, Versteegen GJ, Geertzen JH, Brouwer S. Relationship between psychological factors and performance-based and self-reported disability in chronic low back pain. *Eur Spine J.* 2008;17:1448–1456.
33. Szabo RM. Outcomes assessment in hand surgery: when are they meaningful? *J Hand Surg Am.* 2001;26:993–1002.
34. Turk DC, Rudy TE. Neglected topics in the treatment of chronic pain patients–relapse, noncompliance, and adherence enhancement. *Pain.* 1991;44:5–28.
35. van de Ven-Stevens LA, Munneke M, Terwee CB, Spauwen PH, van der Linde H. Clinimetric properties of instruments to assess activities in patients with hand injury: a systematic review of the literature. *Arch Phys Med Rehabil.* 2009;90:151–169.
36. van der Windt DA, Kuijpers T, Jellema P, van der Heijden GJ, Bouter LM. Do psychological factors predict outcome in both low-back pain and shoulder pain? *Ann Rheum Dis.* 2007;66: 313–319.
37. Wolf JM, Green A. Influence of comorbidity on self-assessment instrument scores of patients with idiopathic adhesive capsulitis. *J Bone Joint Surg Am.* 2002;84:1167–1173.