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ORIGINAL ARTICLE

The Correlation of Cognitive Flexibility with Pain Intensity and Magnitude of Disability in Upper Extremity Illness

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Abstract Cognitive flexibility – the ability to restructure one's knowledge, incorporate new facts, widen perspective, and adapt to the demands of new and unexpected conditions - can help one adapt to illness. The aim of this study was to assess the relationship between cognitive flexibility and hand and upper extremity specific disability in patients presenting to a hand surgeon. Secondarily, we determined predictors of cognitive flexibility and pain. Eighty-nine consecutive outpatients completed the Cognitive flexibility questionnaire (CFS), Short Health Anxiety Inventory-5 (SHAI-5), Pain Self-Efficacy Questionnaire (PSEQ), Disabilities of Arm, Shoulder and Hand, short form (QuickDASH), and Patient Health Questionnaire for Depression-2 (PHQ-2) in a cross-sectional study. CFS did not correlate with disability or pain intensity. Disability correlated with PSEQ ($r=-0.66$, $p<0.01$), PHQ-2 ($r=0.38$, $p=<0.01$), and SHAI-5 ($r=0.33$, $p<0.01$). Pain intensity correlated with PSEQ ($r=-0.51$ $p<0.01$) and PHQ-2 ($r=0.41$ $p<0.01$). There was a small correlation between the CFS and PSEQ ($r=0.25$, $p=0.02$). The best multivariable models for QuickDASH and pain intensity included PSEQ and PHQ and explained 35 % and 28 % of the variability respectively. Upper extremity specific disability and pain intensity are limited more by self-efficacy than cognitive flexibility. Interventions to improve self-efficacy might help patients with upper extremity illness.

Keywords Cognitive flexibility scale · Pain intensity · Disability · Upper extremity · Self-efficacy

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Introduction

Symptoms of depression and coping strategies are known correlates of pain intensity, magnitude of disability, and patient satisfaction.[1–5] More adaptive patients report less pain and disability irrespective of the diagnosis or impairment.[1, 5–9] Recent developments from the field of positive psychology emphasize the importance of cognitive flexibility– the ability to restructure one's knowledge, incorporate new facts, widen perspective, and adapt to the demands of new and unexpected conditions–[10, 11] for problem solving and adaptation to life's demands. Martin and Rubin describe adaptation as a process of social cognition during which one becomes aware of options, becomes flexible, and experiences increased self-efficacy.[12–14] This implies that adaptation and resilience—key aspects of good health—require cognitive flexibility. As such, we reasoned that cognitive flexibility may be important in adapting to medical conditions including hand and upper extremity illness.

Previous work showed that cognitive flexibility correlates with some types of psychopathology.[15–17] For instance, low cognitive flexibility according to the Wisconsin Card Sorting Task correlated with severity of eating disorder.[16, 18] Studies of cognitive flexibility have been conducted with neuropsychological assessments and primarily in school-aged children.[19, 20] To our knowledge, no prior studies assessed the relationship between self-reported cognitive flexibility and medical illness.

Our interest in cognitive flexibility arose from our observation that patients who are cognitively inflexible and tend to hold strongly to their first impressions (intuitions, gut feelings, cognitive errors) in response to symptoms and impairment–in spite of expert advise to the contrary–have greater disability and pain intensity and can take longer to recover from upper extremity musculoskeletal illness. [5, 21–24] It appears that these patients are unable to negotiate and integrate the information presented to them. Rather, they seem prone to confirmatory bias, disregarding information that does not confirm their beliefs, and get stuck in a pattern of negative thinking. This is manifested in the strong relationship of catastrophic thinking and low self-efficacy to pain intensity and magnitude of disability in patients with arm illness.[5, 21–24].

Kahneman's simplification of these aspects of human thought into system 1 (human heuristics or the intuitive system) and system 2 (analytical calculation or reconsideration of first impressions) is useful.[25] System 1 searches for causality; it creates coherent interpretations quickly and unconsciously based on emotions, previous experiences/ information and memories. System 2 is much slower and has to be activated. It involves conscious judgment based on critical thinking and examination; it is rational and analytical. System 1 has a larger capacity and is generally more effective in day-to-day living. Employing system 2 in simple activities of daily living would be tiring.[25] However, in many situations that involve decisions with important consequences, system 2 is much better equipped to give the best solutions.

Kahneman's theory has many applications to illnesses and the decisions patients make with regard to their medical care. In patients with pain, it can be theorized that those who are cognitively inflexible are employing the intuitive system 1 rather than the analytical system 2 when faced with musculoskeletal conditions. In other words, they go with their first impressions and are not able to look at the evidence presented and analytically assess the information presented to them. Because system 1 is unable to process complex information, patients get stuck in the normal protective response to pain (where we tend to prepare for the worse) and are unable to adapt. In contrast, patients who are cognitively flexible may be more capable of adaptation and may employ the analytical system 2, "rethink" the normal protective response to pain, and regain trust in their body, which is the essence of good health.

The purpose of this study was to assess the relationship between cognitive flexibility and hand and upper extremity specific disability in patients presenting to an orthopedics hand and arm practice. We also studied psychosocial factors associated with cognitive flexibility and pain intensity that could potentially be used to eventually develop mind body interventions for hand surgery patients.

Material and Methods

After approval of our institutional review board, all non-pregnant, English speaking new and follow-up patients aged 18 years or greater were asked to participate in this cross-sectional study at a tertiary care institution. The patients were recruited from an office with three hand surgeons (the majority from just one of the surgeons—the one who more consistently allows his patients to participate in research) in a tertiary care urban hospital in the United States where most patients are referred directly from a primary care network. The enrollment was random and based on the availability of researchers working on this project and competition with other active projects. The doctor and study staff described the study details and informed consent was obtained.

Eighty-nine patients were enrolled, but 5 decided not to participate while completing questionnaires, due either to time constraints (4 patients) and or lack of interest (1 patient). [25] Patients completed a survey of demographics and the following questionnaires: Cognitive Flexibility Scale (CFS), Short Health Anxiety Inventory-5 (SHAI-5), Pain Self-Efficacy Questionnaire (PSEQ), Disabilities of Arm, Shoulder and Hand, short form (QuickDASH) and Patient Health Questionnaire for Depression-2 (PHQ-2).

Measurement Tools

The CFS is a validated tool to measure patients' ability to adapt to new situations, awareness of different alternatives, and readiness to adapt to different alternatives and be flexible. [26–28] The questionnaire consists of 12 questions answered on 6-point Likert scales ranging from strongly agree to strongly disagree. Scores range from 12 to 72, with a higher score implying higher cognitive flexibility.[14] In one case, individual mean imputation for a singular missing item was used to calculate that individual's CFS. We had one missing values on the CFS. We used mean imputation to complete this missing value.

The SHAI-5 questionnaire is a validated shortened 5-item version of the SHAI-18.[29, 2] Scores range from 0 to 15, with a higher score indicating greater health anxiety [29, 2].

The PSEQ is a 10-item patient-reported outcome inventory. The PSEQ assesses a patient's confidence and ability to accomplish their daily activities despite the pain.[28, 29] The questions are scored on a 7-point Likert scale ranging from 0 ("not at all confident") to 6 ("completely confident"). The

Table 1 Demographics

Parameter			n=84
	Mean	SD	Range
Age (y)	45	16	19–94
Education (y of School)	15	2.9	9–22
	Number	%	
Sex			
Male	41	49	
Female	43	51	
Marital status			
Single	27	32	
Living with partner	1	1.2	
Married	46	55	
Separated/Divorced	7	8.3	
Widowed	3	3.6	
Work status			
Working full time	51	61	
Working part time	8	10	
Homemaker	1	1.2	
Retired	10	12	
Unemployed, able to work	3	3.4	
Unemployed, unable to work	10	12	
Workers compensation	1	1.2	
Physician			
Surgeon 01	2	2.4	
Surgeon 02	5	5.9	
Surgeon 03	71	85	
Other	6	7.1	
Diagnosis Group			
Acute injuries	46	55	
Closed tendon injury	8	17	
Fractures	28	61	
Laceration	10	22	
Non-specific arm pain	1	1.2	
Trigger finger	4	4.8	
Carpal Tunnel Syndrome	10	12	
Ganglion	6	7.1	
Osteoarthritis	4	4.8	
Tendinitis	2	2.4	
Lateral epicondylosis	3	3.6	
Rotator cuff tendinosis	1	1.2	
Giant cell tumor	2	2.4	
Ligament deficiency	1	1.2	
Other	4	4.8	
Type of patient			
New patient	35	42	
Follow-up	33	39	
Post operative followup	16	19	

Table 1 (continued)

Parameter			n=84
	Mean	SD	Range
Sougth treatment for this condition before			
Yes	28	33	
No	56	67	

outcome score is calculated by adding up the items on a scale ranging from 0 to 70, with a higher score indicating greater self-efficacy. For missing values mean imputation was used.

The QuickDASH was used to measure upper extremity specific disability.[30] This questionnaire is the shortened version of the DASH.[30] The original DASH questionnaire is a thirty-item questionnaire.[31] The QuickDASH is comprised of 11 questions, which each are answered on a 5-point Likert scale. The score is scaled to a value between 0 (no disability) to 100 (most severe disability).[32] The QuickDASH is not valid if more than one question is missing.

The PHQ-2 was used to assess symptoms of depression.[33, 34] The PHQ-2 is a shortened 2-item questionnaire and is comprised of the first 2 questions of the PHQ-9. It has been validated in prior studies. It consists of two questions on a 4-point Likert scale between 0 "not at all" and 3 "nearly every day" assessing depression and anhedonia. The overall score ranges from 0 to 6 [35].

Patients rated their pain using the Numeric Rating Scale (an 11-point ordinal scale from 0, no pain to 10, the worst imaginable pain) [36].

Table 2 Health related parameters at enrollment

Parameter	Initial enrollment		n=84
	Mean	(±SD)	Range
CFS	63	6.3	45–72
Quick DASH	32	20	0–84
Pain	3.6	1.3	0–10
PSEQ	50	11	6–60
PHQ	0.7	1.2	0–4.0
SHAI-5	4.0	2.3	0–12

CFS, Cognitive Flexibility Scale; *SHAI-5*, Short Health Anxiety Inventory-5; *PSEQ*, Pain Self-Efficacy Questionnaire; *QuickDASH*, Disabilities of Arm, Shoulder and Hand, short form; *PHQ-2*, Patient Health Questionnaire for Depression-2

Statistical Analyses

A priori power analysis for our primary study question determined that 84 patients would provide 80 % power to detect a 0.30 (medium) correlation between the CFS and QuickDASH. The data was not normally distributed according to the Kolomogorov-Smirnov test and therefore non-parametric tests were used. The Spearman correlation was used to assess the relationship between continuous variables, the Mann–Whitney *U* test was performed to test the relationship between continuous and dichotomous variables, and the Kruskal-Wallis test was done to determine the relationship between categorical variables with more than two categories and continuous variables.

Variables with p-value<0.10, were inserted in a backward, stepwise, multivariable linear regression analysis to find predictors of the QuickDASH score. When categorical variables were inserted in multivariable analysis dummy codes were generated when there were more than two categories.

We accounted for potential confounders such as demographics, anxiety, self-efficacy, physical function and depression.

Results

The mean age of the 84 patients that completed the study was 45 years (SD=16, range 19–94 years) and 43 patients (51 %) were men. Forty-eight (57 %) patients had acute injuries, 10 (12 %) carpal tunnel syndrome, and 26 (31 %) other discrete diagnoses (Table 1).

Patients had moderate hand and upper extremity disability on average as measured by the QuickDASH (Table 2). QuickDASH correlated with PSEQ, PHQ, SHAI-5 and marital status, but not with cognitive flexibility. (Table 3) The best multivariable model included PSEQ alone and explained 35 % of the variability in QuickDASH (adjusted R-squared: 0.35, $p<0.01$).

Pain intensity correlated with PSEQ, PHQ-2 and SHAI-5, but not with CFS. (Table 3) The best multivariable model included PSEQ and PHQ and explained 29 % of the variability in pain intensity (adjusted R-squared: 0.27, $p<0.01$).

CFS correlated with PSEQ ($r=0.25$, $p=0.02$), but not PHQ-2 or SHAI-5. (Table 4).

Discussion

We found no correlation between cognitive flexibility and pain intensity or hand and upper extremity disability. Consistent with prior work, pain self-efficacy was strongly associated with hand and upper extremity disability and

Table 3 Bivariate analyses

	Quick DASH		Pain	
Parameters at enrollment	r	*p*-value	r	*p*-value
CFS	−0.053	0.63	−0.11	0.32
Age	0.078	0.48	0.13	0.24
Education	−0.083	0.45	−0.18	0.095
PSEQ	−0.66	<0.01	−0.52	<0.01
PHQ	0.38	<0.01	0.41	<0.01
SHAI-5	0.33	<0.01	0.19	0.09
Duration of injury	−0.022	0.84	0.05	0.63
Sex	Mean (SD)	*p*-value	Mean (SD)	*p*-value
Male	34 (±20)	0.45	3.7 (±2.5)	0.50
Female	31 (±21)		3.4 (±2.6)	
Marital status				
Single	32 (±20)	0.06	3.7 (±2.6)	0.017
Living with partner	11 (±0.0)		1.0 (0.0)	
Married	29 (±19)		3.0 (±2.3)	
Separated/ Divorced	46 (±26)		6.4 (±2.2)	
Widowed	54 (±8.0)		5.3 (±2.3)	
Work status				
Working full time	30 (±19)	0.25	3.1 (±2.4)	0.47
Working part time	46 (±23)		4.5 (±2.3)	
Homemaker	39 (±0.0)		2.0 (±0.0)	
Retired	36 (±25)		4.5 (±2.5)	
Unemployed, able to work	22 (±15)		4.3 (±2.5)	
Unemployed, unable to work	37 (±17)		4.2 (±3.1)	
Others	9.0 (±0.0)		2.0 (±0.0)	
Diagnosis				
Acute injuries	31 (±21)	0.86	3.0 (±2.5)	0.63
Closed tendon injury	29 (±18)		4.4 (±2.4)	
Fractures	34 (±22)		3.1 (±2.4)	
Laceration	25 (±24)		1.7 (±2.3)	
Non-specific arm pain	18 (±0.0)		3.0 (±0.0)	
Trigger finger	29 (±26)		4.3 (±3.1)	
Carpal Tunnel Syndrome	39 (±18)		4.2 (±3.4)	
Ganglion	30 (±18)		4.2 (±2.1)	
Osteoarthritis	26 (±28)		4.0 (±2.4)	
Tendinitis	41 (±13)		4.5 (±2.2)	
Epicondylitis lateralis	44 (±14)		5.7 (±2.1)	
Rotator cuff tendinosis	36 (±0.0)		5.0 (±0.0)	

Table 3 (continued)

Parameters at enrollment	Quick DASH r	Quick DASH p-value	Pain r	Pain p-value
Giant cell tumor	28 (±1.6)		3.0 (±2.8)	
Ligament deficiency	36 (±0.0)		1.0 (±(0.0)	
Other	39 (±25)		5.0 (±2.2)	
Doctor				
Surgeon 1	36 (±22)	0.40	2.0 (±2.8)	0.73
Surgeon 2	20 (±18)		3.0 (±3.0)	
Surgeon 3	33 (±18)		3.6 (±2.5)	
Other	38 (±18)		3.8 (±2.8)	
Type of patient				
New patient	33 (±22)	0.58	3.9 (±2.4)	0.14
Follow-up	30 (±20)		2.9 (±2.5)	
Post operative followup	37 (±16)		4.2 (±2.7)	
Sougth treatment for this condition before				
Yes	34 (±21)	0.58	3.5 (±2.7)	0.46
No	30 (±18)		3.8 (±2.1)	

CFS, Cognitive Flexibility Scale; *SHAI-5*, Short Health Anxiety Inventory-5; *PSEQ*, Pain Self-Efficacy Questionnaire; *QuickDASH*, Disabilities of Arm, Shoulder and Hand, short form; *PHQ-2*, Patient Health Questionnaire for Depression-2

pain intensity.[22, 24] Cognitive flexibility was significantly associated with pain self-efficacy, but not depression and health anxiety. These findings suggest that the specific coping tactic of interpreting nociception in the most optimistic and adaptive way (pain self-efficacy) might be the only part of the general construct of cognitive flexibility that has an impact on hand and upper extremity illness. For clinical care, this may mean that focusing on improving patients' sense of self-efficacy about their pain may be more effective in decreasing hand specific disability than encouraging open mindedness. It is not uncommon for surgeons in clinical practice to find themselves in the position of attempting to convince patients that it is safe to engage in activities that cause pain. Perhaps a better strategy for surgeons is to focus on providing encouragement, communicating confidence in patients ability to be successful in managing their pain condition (as they undoubtedly have successfully managed other difficult times in their lives), and foster an environment of hope and positivity. In addition, cognitive behavioral therapy may be of addition value, coaching patients with ineffective coping skills to better physical outcomes.

Table 4 Bivariate relationships between CFS and main study variables

Parameters	CFS r	CFS p-value
QDASH	−0.05	NS
PSEQ	0.25	0.02
PHQ	−0.12	NS
SHAI-5	−0.19	0.08
Pain	−0.11	NS

CFS, Cognitive Flexibility Scale; *SHAI-5*, Short Health Anxiety Inventory-5, *PSEQ*, Pain Self-Efficacy Questionnaire; *QuickDASH*, Disabilities of Arm, Shoulder and Hand, short form; *PHQ-2*, Patient Health Questionnaire for Depression-2

A prospective study might identify an association between cognitive flexibility and greater reduction in disability after reassurance or treatment that could not be demonstrated in this cross-sectional study. On the other hand, cognitive flexibility may have limited correlation with disability due to cognitive errors at both ends of the spectrum: either failing to incorporate new ideas that are more adaptive, or being too receptive resulting in a tendency to be influenced by maladaptive concepts.

This study should be considered in light of its shortcomings. We might find different results in subsets of patients with more uniform demographics and disease. Most of the patients were from the practice of one surgeon and different surgeon styles might alter the results. Stepwise regressions may be prone to spurious results. Finally, the reliability and validity of the CFS among elderly population with cognitive impairment is debated.

The results of this study suggest that the best strategy is to help patients limit pain and disability to improve their mood and self-efficacy. It may be that before a patient can shift their thinking and engage in cognitive flexibility and other helpful coping strategies, he or she needs to be confident that they are able to make changes. Patients that have difficulty gaining confidence that they can accomplish their goals in spite of pain might benefit from psychosocial interventions such as Cognitive Behavioral Therapy.

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Conflict of Interest None of the authors has a conflict of interest related directly to the subject matter.

Ethical Statement This research was approved by our human research committee and was performed in accordance with the Helsinki Declaration. Informed consent was obtained from each subject.

Disclosures No benefits in any form have been received or will be received related directly or indirectly to the subject of this article. The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

References

1. Ring D, Kadzielski J, Malhotra L, Lee SG, Jupiter JB (2005) Psychological factors associated with idiopathic arm pain. J Bone Joint Surg Am 87(2):374–380. doi:10.2106/JBJS.D.01907
2. Salkovskis PM, Rimes KA, Warwick HM, Clark DM (2002) The health anxiety inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. Psychol Med 32(5):843–853
3. Souer JS, Buijze G, Ring D (2011) A prospective randomized controlled trial comparing occupational therapy with independent exercises after volar plate fixation of a fracture of the distal part of the radius. J Bone Joint Surg Am 93(19):1761–1766. doi:10.2106/JBJS.J.01452
4. Turner JA, Jensen MP, Warms CA, Cardenas DD (2002) Catastrophizing is associated with pain intensity, psychological distress, and pain-related disability among individuals with chronic pain after spinal cord injury. Pain 98(1–2):127–134
5. Vranceanu AM, Barsky A, Ring D (2009) Psychosocial aspects of disabling musculoskeletal pain. J Bone Joint Surg Am 91(8):2014–2018. doi:10.2106/JBJS.H.01512
6. Doornberg JN, Ring D, Fabian LM, Malhotra L, Zurakowski D, Jupiter JB (2005) Pain dominates measurements of elbow function and health status. J Bone Joint Surg Am 87(8):1725–1731. doi:10.2106/JBJS.D.02745
7. Niekel MC, Lindenhovius AL, Watson JB, Vranceanu AM, Ring D (2009) Correlation of DASH and QuickDASH with measures of psychological distress. J Hand Surg 34(8):1499–1505. doi:10.1016/j.jhsa.2009.05.016
8. Vranceanu AM, Jupiter JB, Mudgal CS, Ring D (2010) Predictors of pain intensity and disability after minor hand surgery. J Hand Surg 35(6):956–960. doi:10.1016/j.jhsa.2010.02.001
9. Vranceanu AM, Safren S, Zhao M, Cowan J, Ring D (2008) Disability and psychologic distress in patients with nonspecific and specific arm pain. Clin Orthop Relat Res 466(11):2820–2826. doi:10.1007/s11999-008-0378-1
10. Canas J, Quesada JF, Antoli A, Fajardo I (2003) Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. Ergonomics 46(5):482–501. doi:10.1080/0014013031000061640
11. Spiro RJ, Jehng J (1990) Cognitive flexibility and hypertext: theory and technology for the non-linear and multidimensional traversal of complex subject matter. Cognition, education, and multimedia. Erlbaum, Hillsdale, NJ
12. Martin M, Anderson C (1998) Cognitive flexibility scale: three validity studies. Commun Rep 11(1):1–9
13. Martin M, Rubin R (1994) Development of a communication flexibility scale. South Commun J 1994(59):171–178
14. Martin M, Rubin R (1995) A new measure of cognitive flexibility; Matthew M. Martin and Rebecca B. Psychol Rep 76(623–626)
15. Tchanturia K, Davies H, Roberts M, Harrison A, Nakazato M, Schmidt U, Treasure J, Morris R (2012) Poor cognitive flexibility in eating disorders: examining the evidence using the Wisconsin Card Sorting Task. PloS one 7 (1). doi:10.1371/journal.pone.0028331
16. McAnarney E, Zarcone J, Singh P, Michels J, Welsh S, Litteer T, Wang H, Klein J (2011) Restrictive anorexia nervosa and set-shifting in adolescents: a biobehavioral interface. J Adolesc Health: Off Publ Soc Adolesc Med 49(1):99–101. doi:10.1016/j.jadohealth.2010.11.259
17. Schmidt U, Treasure J (2006) Anorexia nervosa: valued and visible. A cognitive-interpersonal maintenance model and its implications for research and practice. The British J Clin Psychol/The British Psychol Soc 45(Pt 3):343–366. doi:10.1348/014466505X53902
18. Greve K, Stickle T, Love J, Bianchini K, Stanford M (2005) Latent structure of the Wisconsin card sorting test: a confirmatory factor analytic study. Arch Clin Neuropsychol: Off J Natl Acad Neuropsychologists 20(3):355–364. doi:10.1016/j.acn.2004.09.004
19. Chelune GJ, Baer RA (1986) Developmental norms for the Wisconsin card sorting test. J Clin Exp Neuropsychol 8(3):219–228. doi:10.1080/01688638608401314
20. Diamond A, Barnett WS, Thomas J, Munro S (2007) Preschool program improves cognitive control. Science 318(5855):1387–1388. doi:10.1126/science.1151148
21. DeGood DE, Tait RC (2001) Assessment of pain beliefs and pain coping, 2nd edn, Handbook of pain assessment. Guilford Press, New York
22. Dolce JJ, Crocker MF, Moletteire C, Doleys DM (1986) Exercise quotas, anticipatory concern and self-efficacy expectancies in chronic pain: a preliminary report. Pain 24(3):365–372
23. Jensen MP, Turner JA, Romano JM, Karoly P (1991) Coping with chronic pain: a critical review of the literature. Pain 47(3):249–283
24. Lorig K, Chastain RL, Ung E, Shoor S, Holman HR (1989) Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. Arthritis Rheum 32(1):37–44
25. Kahneman D (25 October 2011) Thinking, Fast and Slow. Macmillan ISBN 978-1-4299-6935-2 (Retrieved 8 April 2012)
26. Bilgin M (2009) Developing a cognitive flexibility scale: validity and reliability studies. Soc Behav Personal Int J 37(3):343
27. Martin MM, Anderson CM (1998) The cognitive flexibility scale: three validity studies. Commun Rep 11(1):9. doi:10.1080/08934219809367680
28. Martin MM, Rubin RB (1995) A new measure of cognitive flexibility. Psychol Rep 76(2):623
29. Alberts NM, Hadjistavropoulos HD, Jones SL, Sharpe D (2013) The short health anxiety inventory: a systematic review and meta-analysis. J Anxiety Disord 27(1):68–78. doi:10.1016/j.janxdis.2012.10.009
30. Asghari A, Nicholas MK (2001) Pain self-efficacy beliefs and pain behaviour. A prospective study. Pain 94(1):85–100
31. Nicholas MK (2007) The pain self-efficacy questionnaire: taking pain into account. Eur J Pain 11(2):153–163. doi:10.1016/j.ejpain.2005.12.008
32. Beaton DE, Katz JN, Fossel AH, Wright JG, Tarasuk V, Bombardier C (2001) Measuring the whole or the parts? validity, reliability, and responsiveness of the disabilities of the Arm, shoulder and hand outcome measure in different regions of the upper extremity. J Hand Ther 14(2):128–146
33. Hudak PL, Amadio PC, Bombardier C (1996) 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 29(6):602–608. doi:10.1002/(SICI)1097-0274(199606)29:6<602::AID-AJIM4>3.0.CO;2-L
34. Gummesson C, Ward MM, Atroshi I (2006) The shortened disabilities of the arm, shoulder and hand questionnaire (QuickDASH): validity and reliability based on responses within the full-length DASH. BMC Musculoskelet Disord 7:44. doi:10.1186/1471-2474-7-44
35. Kroenke K, Spitzer RL, Williams JB (2001) The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 16(9):606–613
36. Kroenke K, Spitzer RL, Williams JB (2003) The patient health questionnaire-2: validity of a two-item depression screener. Med Care 41(11):1284–1292. doi:10.1097/01.MLR.0000093487.78664.3C