Update of the Quick DASH Questionnaire to Account for Modern Technology

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Abstract

Background: Almost 2 decades have passed since the development of the items contained in the Quick Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, and during this time, daily tasks have changed to adapt to changes in technology. **Methods:** A cohort of 108 patients completed demographic information, the Quick DASH (both standard and technologically updated versions), and 2 Patient-Reported Outcomes Measurement Information System (PROMIS)-based computerized adaptive testing questionnaires: PROMIS pain interference and upper-extremity function. To create a technologically updated Quick DASH, we substituted 3 items from the standard Quick DASH questionnaire with 3 other items related to the use of technology: (1) Text or dial with your cell phone, (2) Type on a keyboard, and (3) Use a computer mouse. **Results:** The technologically updated Quick DASH questionnaire had lower scores compared with the standard Quick DASH (37 vs. 33, respectively), but they had a large correlation and both had high internal consistency. The items “Text or dial with your cell phone” and “Use a computer mouse” in the updated Quick DASH questionnaire had the lowest scores. Except for affected side, the standard Quick DASH and updated Quick DASH were influenced by the same factors. PROMIS pain interference was the only independent variable affecting both questionnaire scores. **Conclusions:** A technologically updated Quick DASH had no advantage over the standard Quick DASH.

Keywords: Quick DASH, update, technology

Introduction

The Quick Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire is a validated and widely used 11-item questionnaire that measures upper-extremity specific symptoms and disability.³ This instrument, developed from the original 30-item DASH,¹⁰ has adequate psychometric properties and has been validated for a broad spectrum of upper-extremity disorders.^{9,14} One advantage of the Quick DASH is that it can be used to assess any region of the upper extremity.⁴ Given that the items contained in the Quick DASH questionnaire were created almost 2 decades ago, they may not be representative of modern daily activities of the upper extremity.

During the past 2 decades, the social and daily activities of people have changed notably, with substantial use of various electronic devices, most relying on good hand function. Using a cell phone is part of everyday life. Writing with a pen is less common nowadays, as it been substituted with typing on a keyboard—an activity that benefits from full pronation of the forearm. In 2008, Alexander and colleagues developed a questionnaire to assess patient-reported

hand function during modern daily activities,¹ but it is not widely used. In the present study, we aim to study whether a technologically updated Quick DASH questionnaire correlates with the standard Quick DASH questionnaire.

This study addresses the primary null hypothesis that there is no correlation between the Quick DASH Questionnaire and a technologically updated Quick DASH Questionnaire. In secondary analyses, we addressed the null hypotheses that there is no significant difference in mean scores, that the internal consistency for both questionnaires are comparable, that the correlation of the Patient-Reported Outcomes Measurement Information System (PROMIS) upper-extremity function

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Table 1. Three Questions Which Exchanged in Updated Quick DASH Questionnaire With Standard One According to Technology.

	Standard quick DASH	Updated quick DASH
Question 1	Open a tight or new jar	Text or dial with your cell phone
Question 3	Carry a shopping bag or briefcase	Type on a keyboard
Question 5	Use a knife to cut food	Use a computer mouse

Note. DASH, Disabilities of the Arm, Shoulder, and Hand.

and pain interference questionnaire with the Quick DASH Questionnaire and the technologically updated Quick DASH Questionnaire are comparable, and that the factors associated with higher Quick DASH scores and technologically updated Quick DASH scores are comparable.

Materials and Methods

Study Design

After approval of our institutional review board, in an observational cross-sectional study, 120 new or follow-up non-pregnant English-speaking patients aged 18 or greater presenting to a single hand surgeon were invited to participate in this prospective study between April 2014 and September 2014. Eleven patients declined and 1 had filled the questionnaires inappropriately, leaving 108 patients for analysis. All patients provided informed consent.

Description of Experiment

Demographics (including education in years, dominant hand, and affected hand) and questionnaires (Standard and updated Quick DASH questionnaire, PROMIS upper-extremity function, and PROMIS pain interference questionnaires) were completed at the time of enrollment. We used an online database Assessment Center (<http://www.assessmentcenter.net>) to gather our data.

Outcome Measures

The Quick DASH is an 11-item measure of the magnitude of disability and symptoms specific to the upper extremity. The first 6 items measure the degree of difficulty in performing various physical activities because of a shoulder, arm, and hand problem, and the other 5 items related to quality of sleeping, social activities, and daily activities, and the intensity of pain and numbness.

To create a technologically updated Quick DASH, we substituted 3 items from the standard Quick DASH questionnaire (items 1, 3, and 5) with 3 other items related to the use of technology: Text or dial with your cell phone, type on a keyboard, and use a computer mouse (Table 1). Similar to the conventional Quick DASH questionnaire, each question used a 5-point Likert scale (no difficulty, mild difficulty, moderate difficulty, severe difficulty, unable).

The PROMIS upper-extremity function and pain interference Computer Adaptive Tests (CAT) were used to measure upper-extremity disability and the degree to which pain is disabling, respectively. The latter is a construct similar to catastrophic thinking and self-efficacy. The total score of each PROMIS instrument ranges from 0 to 100 points. For PROMIS upper-extremity function, a score of 50 represents the mean score of the general population of the United States. Higher scores indicate lower levels of disability.

Statistical Analysis

This study was performed simultaneously with another study that enrolled 108 patients. Using Pearson correlation, we had 95% power for an effect size of 0.5 with 2-sided alpha of .05.

Construct validity was assessed by calculating the Pearson correlation coefficient between the average score per item of the standard and revised Quick DASH questionnaires.

Internal consistency was tested using Cronbach α (the internal correlations of all the items on the same scale). A Cronbach α of greater than .7 indicates good consistency. Greater than .9 is excellent consistency.

In bivariate analysis, Pearson's chi-square test was used to analyze categorical variables, and the paired *t* test was used for continuous variables. All variables that are either significant ($P < .05$) or near significant ($P < .10$) in bivariate analysis were inserted into a multivariable linear regression analysis of factors associated with Quick DASH and revised Quick DASH scores.

Patient Characteristics

There were 55 (51%) men and 53 women (49%) with a mean age of 51 years (range = 19 to 91 years). Most patients (86%) had no previous surgery for the presenting problem. Patients reported symptoms for an average of 11 months (range = 2 days to 18 years). The most common diagnoses were sprain/rupture/dislocation (19%), followed by wrist fracture (14%), and nerve entrapment (12%; Table 2)

Results

The Pearson correlation coefficient between the 2 questionnaires was 0.98 ($P < .001$), indicating a large correlation.

Table 2. Patients Demographic Characteristics (N = 108).

Sex, no (%)	
Male	55 (51)
Female	53 (49)
Age, mean (SD), (years)	51 (19)
Education, mean (SD), (years)	16 (3.1)
Marital status	
Married or with partner	60 (55)
Single	32 (30)
Separated	8 (7.4)
Widowed	8 (7.4)
Race	
White	94 (87)
Black	2 (1.9)
Asian	7 (6.5)
Others or unknown	5 (4.6)
Affected side	
Right	57 (53)
Left	47 (44)
Both	4.0 (3.7)
Dominant side	
Right	93 (86)
Left	15 (14)
Diagnosis	
Sprain, rupture, or dislocation	20 (19)
Wrist fracture	15 (14)
Carpal tunnel or cubital tunnel	13 (12)
Hand fracture	11 (10)
Tumor, lump and cyst, or nodule	10 (9.3)
Amputation, crush, or laceration	8 (7.4)
Trigger finger	7 (6.5)
Osteoarthritis	5 (4.6)
Nonspecific arm pain	3 (2.8)
All other diagnoses	16 (15)
Interval between injury and visit, mean (SD), (day)	320 (1,001)
Type of visit, no (%)	
New patient	63 (58)
Follow-up patient	45 (42)
Smoking, no (%)	
Yes	13 (12)
No	95 (88)
History of surgery, no (%)	
Yes	15 (13)
No	93 (86)
Standard Quick DASH score, mean (SD)	43 (28)
Updated Quick DASH score, mean (SD)	36 (27)
PROMIS pain interference score, mean (SD)	46 (8.5)
PROMIS upper-extremity function score, mean (SD)	36 (11)

Note. DASH, Disabilities of the Arm, Shoulder, and Hand; PROMIS, Patient-Reported Outcomes Information System.

There was a significant difference in the mean scores of the standard and updated DASH questionnaires (37 vs. 33, respectively; $P < .001$).

Cronbach α showed a high rate of internal consistency for both questionnaires (.93 for standard and .92 for updated quick DASH; Table 3). Two of the 3 technology-related items—item 1 (Text or dial with your cell phone) and item 5 (Use a computer mouse)—were the lowest scoring among the 11 items, suggesting patients are able to accomplish these tasks relatively easily in spite of arm illness.

There were strong and significant correlations between the standard Quick DASH and the updated Quick DASH with PROMIS upper-extremity function and PROMIS pain interference questionnaires (Table 4).

In bivariate analysis, sex, diagnosis, smoking, and PROMIS pain interference influenced the scores in both questionnaires, and affected side influenced the updated Quick DASH questionnaire (Table 5). In multivariable analysis, PROMIS pain interference was the only independent variable influencing the scores of both questionnaires (Table 5).

Discussion

Almost 2 decades have elapsed since the development of the items contained in the Quick DASH questionnaire. Current daily activities of the arm and the hand (eg, using a cell phone or computer mouse, typing on a keyboard) are not considered in the Quick DASH. In the present study, we found that the standard and the technologically updated Quick DASH were highly correlated, had high internal consistency, and demonstrated criterion validity. Inclusion of the modern activities in the updated Quick DASH did not show any advantage over the standard Quick DASH questionnaire.

Our study has some limitations. First, because this study was performed at a single urban academic site and all patients presented to only 1 hand surgeon, our findings may not be generalizable. Second, the 8 questions common to both questionnaires might account for the strong correlation of the questionnaires. This should be considered pilot work because we arbitrarily selected 3 items and replaced with a technology-related activity to study if modern activities have any impact on the disability in daily activities, and the item wording was not validated before administering to the patients.

There very strong correlation of the technologically updated and standard Quick DASH scores suggests that there is no advantage to updating the questionnaire to account for modern activities.

The updated Quick DASH questionnaire indicated significantly less disability compared with the standard Quick DASH, but a 4-point difference may not be clinically meaningful. However, perhaps patients experience less disability

Table 3. Comparison of Quick DASH and Updated Quick DASH.

	Mean	SD	Cronbach alpha	Pearson correlation	P value
Standard Quick DASH	37	24	.93	0.98	<.001
Updated Quick DASH	33	24	.92		

Note. DASH, Disabilities of the Arm, Shoulder, and Hand.

Table 4. Bivariate Analysis of Standard Quick DASH and Updated Quick DASH Questionnaires With Other Variables.

Variables	Standard quick DASH questionnaire		Updated quick DASH questionnaire	
	Mean (SD)	P value	Mean (SD)	P value
Sex				
Male	31 (23)	.003	29 (22)	.011
Female	44 (24)		39 (24)	
Marital status				
Married or with partner	37 (23)	.36	33 (22)	.22
Single	32 (24)		29 (24)	
Separated	50 (23)		44 (24)	
Widowed	48 (32)		44 (33)	
Race				
White	37 (24)	.12	33 (24)	.22
Black	43 (9.6)		32 (3.2)	
Asian	23 (24)		23 (28)	
Others or unknown	57 (16)		42 (14)	
Affected side				
Right	40 (25)	.13	37 (24)	.036
Left	32 (20)		28 (19)	
Both	51 (41)		51 (43)	
Dominant side				
Right	37 (24)	.69	34 (24)	.66
Left	35 (25)		31 (24)	
Diagnosis				
Sprain, rupture, or dislocation	35 (22)	.012	30 (21)	.013
Wrist fracture	59 (25)		44 (25)	
Carpal tunnel or cubital tunnel	48 (26)		46 (28)	
Hand fracture	42 (20)		38 (18)	
Tumor, lump and cyst, or nodule	13 (12)		11 (9.1)	
Amputation, crush, or laceration	39 (25)		36 (24)	
Trigger finger	48 (36)		32 (24)	
Osteoarthritis	17 (14)		14 (12)	
Nonspecific arm pain	35 (24)		29 (21)	
All other diagnoses	38 (25)		35 (24)	
Type of visit				
New patient	37 (25)	.99	34 (24)	.93
Follow-up patient	37 (24)		33 (24)	
Smoking				
Yes	50 (22)	.038	47 (23)	.028
No	35 (24)		31 (23)	
History of surgery				
Yes	38 (27)	.92	34 (26)	.88
No	37 (24)		33 (23)	

(continued)

Table 4. (continued)

	Pearson correlation	P value	Pearson correlation	P value
Age	0.12	.21	0.10	.32
Education	−0.068	.48	−0.043	.66
Interval between injury and visit	−0.038	.69	0.008	.93
PROMIS pain interference questionnaire	0.82	<.001	0.79	<.001
PROMIS upper-extremity function questionnaire	−0.81	<.001	−0.77	<.001

Note. DASH, Disabilities of the Arm, Shoulder, and Hand; PROMIS, Patient-Reported Outcomes Information System.

Table 5. Multivariable Analysis: Independent Factors Associated With Standard and Updated Quick DASH.

Model	R ²	Beta	SE	P value	Partial R ²	95% CI
Standard Quick DASH	.69					
PROMIS pain interference questionnaire		2.2	0.17	<.001	.63	(1.9-2.5)
Sex		4.7	2.8	.099	.029	(−0.89-10)
Diagnosis		0.062	0.46	.89	.0002	(−0.83-0.97)
Smoking		6.9	4.2	.10	.027	(−1.3-15.0)
Updated Quick DASH	.63					
PROMIS pain interference questionnaire		2.1	0.17	<.001	.59	(1.1-2.4)
Sex		2.9	2.9	.32	.01	(−2.9-8.8)
Diagnosis		0.035	0.47	.94	.0005	(−0.90-0.97)
Smoking		7.6	4.4	.086	.031	(−1.1-16)
Affected side		−0.79	2.1	.70	.0014	(−4.9-3.3)

Note. DASH, Disabilities of the Arm, Shoulder, and Hand; CI, confidence interval; PROMIS, Patient-Reported Outcomes Information System.

Figure 1. Three different ways of texting with cell phone.

during modern activities because less force is needed and more ways are available to accomplish tasks using modern technology. Among the items, using a computer mouse and

texting with cell phone were least affected. This may be due in part to the fact that there are many ways to text and type (Figure 1), and in part to the fact that many common

upper-extremity conditions do not affect finger motion, dexterity, or sensation. The limited disability in using the mouse may be due to the fact that it can be done with either hand.

Both the standard and the technologically updated Quick DASH questionnaires had excellent internal consistency.⁸ Across studies to date, the internal consistency of both the Quick DASH and the original DASH was high: between 0.84 to 0.94 for Quick DASH^{3,6,7,11,13} and more than 0.95 for DASH questionnaire.^{2,10,15-18}

We found a high correlation between the PROMIS pain interference score and both the standard and the updated Quick DASH scores. The high rate of correlation between PROMIS pain interference is consistent with other studies.⁵

The only factor influencing the updated Quick DASH questionnaire but not the standard Quick DASH was affected side, suggesting that either hand can be used for modern activities.¹² However, pain interference was the only factor independently associated with scores on both questionnaires in multivariable analysis. The observation of no correlation between age and the modern Quick DASH score suggests that younger subjects were not more affected by technology than older subjects as might be assumed.

The relative consistency and correlation of various measures of symptoms and disability along with the consistent finding of psychological and sociological factors explain most of the variation in symptoms and disability, which suggest that questionnaires such as the DASH are primarily measuring stress, distress, and coping strategies. Consequently, variations in the specificity of the actual questions have limited influence. This line of thinking merits additional study.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.⁴

Statement of Informed Consent

Informed consent was obtained from all patients for being included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

1. Alexander M, Franko OI, Makhni EC, Zurakowski D, Day CS. Validation of a modern activity hand survey with respect to reliability, construct and criterion validity. *J Hand Surg Eur Vol.* 2008;33(5):653-660.
2. Atroshi I, Gummesson C, Andersson B, Dahlgren E, Johansson A. The Disabilities of the Arm, Shoulder and Hand (DASH) outcome Questionnaire: reliability and validity of the Swedish version evaluated in 176 patients. *Acta Orthop Scand.* 2000;71(6):613-618.
3. Beaton DE, Wright JG, Katz JN. Development of the QuickDASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am.* 2005;87(5):1038-1046.
4. Davis AM, Beaton D, Hudak P, et al. Measuring disability of the upper extremity: a rationale supporting the use of a regional outcome measure. *J Hand Ther.* 1999;12(4):269-274.
5. Doring AC, Nota SP, Hageman MG, Ring DC. Measurement of upper extremity disability using the patient-reported outcomes measurement information system. *J Hand Surg Am.* 2014;39(6):1160-1165.
6. Ebrahimzadeh MH, Moradi A, Vahedi E, Kachooei AR, Birjandinejad A. Validity and reliability of the Persian version of shortened Disabilities of the Arm, Shoulder and Hand Questionnaire (Quick-DASH). *Int J Prev Med.* 2015;6:59.
7. Fayad F, Lefevre-Colau MM, Gautheron V, et al. Reliability, validity and responsiveness of the French version of the questionnaire Quick Disability of the Arm, Shoulder and Hand in shoulder disorders. *Man Ther.* 2009;14(2):206-212.
8. Feinstein AR. *Clinimetrics.* New Haven, Yale University Press, 1987.
9. Gay RE, Amadio PC, Johnson JC. Comparative responsiveness of the Disabilities of the Arm, Shoulder, and Hand, the Carpal Tunnel Questionnaire, and the SF-36 to clinical change after carpal tunnel release. *J Hand Surg Am.* 2003;28(2):250-254.
10. 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(6):602-608.
11. Imaeda T, Toh S, Wada T, et al. Validation of the Japanese society for surgery of the Hand version of the Quick Disability of the Arm, Shoulder, and Hand (QuickDASH-JSSH) Questionnaire. *J Orthop Sci.* 2006;11(3):248-253.
12. Kachooei AR, Moradi A, Janssen SJ, Ring D. The influence of dominant limb involvement on DASH and QuickDASH. *Hand.* 2015;10(3):512-515.
13. Koldas Dogan S, Ay S, Evcik D, Baser O. Adaptation of Turkish version of the questionnaire Quick Disability of the Arm, Shoulder, and Hand (Quick DASH) in patients with carpal tunnel syndrome. *Clin Rheumatol.* 2011;30(2):185-191.
14. Kotsis SV, Chung KC. Responsiveness of the Michigan Hand Outcomes Questionnaire and the Disabilities of the Arm, Shoulder and Hand Questionnaire in carpal tunnel surgery. *J Hand Surg Am.* 2005;30(1):81-86.
15. Offenbaecher M, Ewert T, Sangha O, Stucki G. Validation of a German version of the Disabilities of Arm, Shoulder,

- and Hand Questionnaire (DASH-G). *J Rheumatol*. 2002;29(2):401-402.
16. Padua R, Padua L, Ceccarelli E, et al. Italian version of the Disability of the Arm, Shoulder and Hand (DASH) Questionnaire. Cross-cultural adaptation and validation. *J Hand Surg Br*. 2003;28(2):179-186.
17. Rosales RS, Delgado EB, Diez de la Lastra-Bosch I. Evaluation of the Spanish version of the DASH and carpal tunnel syndrome health-related quality-of-life instruments: cross-cultural adaptation process and reliability. *J Hand Surg Am*. 2002;27(2):334-343.
18. Veehof MM, Slegers EJ, van Veldhoven NH, Schuurman AH, van Meeteren NL. Psychometric qualities of the Dutch language version of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH-DLV). *J Hand Ther*. 2002;15(4):347-354.