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Background: The QuickDASH, an abbreviated form of the Disabilities of the Arm, Shoulder and Hand Questionnaire, uses a graded-adjectives ordinal measurement response scale. In order to improve the sensitivity of the measure and to make it compatible with widely used measures of pain and disability, a visual analog scale version was developed. The present study investigated the reliability of the new version over time when used for the evaluation of patients undergoing treatment.

Methods: A test-retest model with a two-day interval was used to evaluate a sample of thirty-eight consecutive patients in an interdisciplinary tertiary rehabilitation setting who were identified as having an upper extremity disorder.

Results: The intraclass correlation coefficient indicating test-retest reliability was 0.90 for the eleven-item QuickDASH visual analog scale questionnaire (without the work component) and 0.94 for the fifteen-item questionnaire (with the work component), neither of which was significantly different from the results reported for the original questionnaire.

Conclusions: The QuickDASH visual analog scale questionnaire has acceptable reliability over time, and it can be used as an alternative to the original QuickDASH.

Assessment and accountability have been described as the "third revolution in medical care."[1] Evidence-based medicine requires that the efficacy of interventions be measured and confirmed[2]. To this end, the technology of outcome measurement has advanced rapidly in recent years[3,4]. One segment of outcome measurement that has developed with special vigor is the patient-report questionnaire[5-7].

The American Medical Association's *Guides to the Evaluation of Permanent Impairment*[8] is undergoing revision. The sixth edition will include a functional assessment measure (FAM) related to the body system that is the focus of each chapter. For the chapter on the upper extremity, the QuickDASH[9] has been selected. This instrument is a recently developed eleven-item version of the thirty-item Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire[10,11]. The instrument was designed with a 5-point Likert scale ranging from 1 to 5. Each of the five points on the scale is anchored by an adjective for the level of severity or function. Higher scores for the items correspond to reduced function and increased severity. The shorter version has been found to have excellent fidelity with respect to the original questionnaire and was selected for practical reasons as it requires less time for administration, scoring, and interpretation. In addition, a decision was made to include the four-item work module from the DASH because of the particular interest among users of the *Guides* in the functional consequences of impairment in terms of work activities.

A truism in the scientific study of measurement is that the higher the level (e.g., the closer to the ratio level), the greater the sensitivity of the measure and the easier it is to "crosswalk" to other related variables[12]. Such standardization, sensitivity, and universal application across domains were sought in the scaling of the functional assessment measures for the next edition of the American Medical Association's *Guides* through the use of visual analog scaling. For patient-reported measures, ratio-level scaling is available in the form of visual analog scales that have been adopted for widespread use to measure constructs such as pain[13-16]. The key benefits of a visual analog scale are the increased sensitivity to measured change as well as the decreased reliance on verbal skills for the understanding of response category alternatives[17]. In addition, a version of the visual analog scale has been used in several functional assessment measures, such as the Pain Disability Questionnaire[18] that has been adopted for the chapter on the spine in the next edition of the American Medical Association's *Guides*. Thus, consideration was given to modification of the QuickDASH with the application of a similar visual analog scale. Experts in test development modified the QuickDASH items with use of the original end point anchors and subjected the new version to scientific study of the measure's reliability, the results of which are presented in this report.

Materials and Methods

Subjects

The study group consisted of thirty-eight consecutive patients in an interdisciplinary tertiary rehabilitation setting

TABLE I Data on the Thirty-Eight Patients

Male gender *(%)*	44.7
Age* *(yr)*	47.95 ± 9.15
Time since injury* *(mo)*	28.02 ± 27.61
Body part involved *(%)*	
Upper extremity only	27.0
Upper extremity + spine	48.6
Upper extremity + lower extremity	10.8
Upper extremity + spine + lower extremity	13.5
Pre-rehabilitation surgery *(%)*	43.2

*The data are given as the mean and the standard deviation.

who were identified as having an upper extremity disorder. Table I summarizes the basic demographic information of the patient sample. The criteria for inclusion in the present study included a period of more than four months of partial or total disability following a work-related injury, the failure of nonoperative care to achieve functional recovery, the failure of operative treatment to produce resolution (or the lack of operative treatment as an option), and the ability to speak English or Spanish.

Procedure

All patients completed one of two versions of the QuickDASH visual analog scale. The version of the scale that was selected for each patient depended on his or her native language (either English or Spanish). The appropriate-language version of the QuickDASH visual analog scale was completed by the patient twice, with an average interval (and standard deviation) of 2 ± 1.9 days (range, one to eight days) between tests. This relatively short duration between tests is justified by the intensity of the three-week tertiary rehabilitation program as there is a possibility that meaningful clinical change may be reflected during the retest phase if the study is too long, thus potentially confounding the results of a test-retest reliability analysis.

Measures

The QuickDASH visual analog scale is a fifteen-item questionnaire utilizing the eleven items from the disability/symptom component and the four items from the optional work component of the QuickDASH. The visual analog scale was constructed on the basis of a 15-cm horizontal line. Every 1.5-cm increment corresponds to a 1-unit increment in the scale, resulting in a total of ten increments ranging from 0 to 10. The total score on the questionnaire was obtained by adding the scores for each of fifteen items, yielding a maximum total score of 150. The original QuickDASH as well as the QuickDASH visual analog scale are included in the Appendix.

Statistical Analysis

Prior to data collection, a power analysis was conducted to determine the sample size needed to detect a difference between the test-retest reliability coefficient of the QuickDASH visual analog scale and that of the original QuickDASH. To detect a medium-to-large effect size of 0.6 on the basis of Cohen's d[19], with a power of 0.80 at an alpha level of 0.05, it was determined that twenty-eight patients were required. Test-retest reliability was calculated with use of the Shrout and Fleiss intraclass correlation coefficient[20]. The intraclass correlation coefficient was calculated first for the QuickDASH visual analog scale with use of the original eleven items only and then with use of the four optional work component items, bringing the total number of items to fifteen. In addition, a formal hypothesis test was conducted with use of Fisher's r-to-z transformation to determine if both of the intraclass correlation coefficients that were obtained significantly differed from the intraclass correlation coefficient of the original QuickDASH. Finally, the mean difference between test and retest scores was computed and analyzed with use of a paired-sample t test. The mean difference scores, standard deviations, 95% confidence intervals, and p values are reported for both the eleven-item and fifteen-item QuickDASH visual analog scales.

Results

Quick-DASH Visual Analog Scale (Without Work Component)

The analysis of the QuickDASH visual analog scale (without the work component) utilized only the original eleven items from the QuickDASH. The mean score (and standard deviation) on the eleven-item QuickDASH visual analog scale was 64.6 ± 19.9 at the time of initial testing and 64.8 ± 21.3 at the time of subsequent testing. Reliability analysis indicated

TABLE II Comparison Between Test-Retest Reliability of QuickDASH and QuickDASH Visual Analog Scale

QuickDASH Visual Analog Scale Format	Intraclass Correlation Coefficient		P Value*
	QuickDASH Visual Analog Scale (N = 38)	QuickDASH (N = 200)	
With work component	0.94	0.94	NS
Without work component	0.90	0.94	NS

*P values were calculated with use of Fisher's r-to-z transformation on the intraclass correlation coefficient values. NS = not significant.

TABLE III Scale Distributions of the QuickDASH and QuickDASH Visual Analog Scale

Scale Distribution	Score *(points)*	
	Mean and Standard Deviation	Possible Range
QuickDASH (n = 200)	45.3 ± 23.2	0-100
QuickDASH visual analog scale* (n = 38)		
With work component	89.4 ± 27.0	0-150
Without work component	64.7 ± 20.1	0-110

*The mean values for the QuickDASH visual analog scale were obtained by averaging the two scores used in the test-retest reliability analysis.

good test-retest reliability of the eleven-item QuickDASH visual analog scale (intraclass correlation coefficient = 0.90, 95% confidence interval = 0.81 to 0.95). A formal hypothesis test, performed with use of Fisher's r-to-z transformation, showed that the intraclass correlation coefficient for this eleven-item QuickDASH visual analog scale did not differ significantly from the intraclass correlation coefficient of 0.94 reported for the original QuickDASH ($z = 1.51$, $p = 0.066$). Additionally, the mean difference between the test and retest scores (test score – retest score) was −0.24 ± 9.30 (95% confidence interval = −3.30 to 2.82). This mean difference was not significant ($p = 0.876$).

QuickDASH Visual Analog Scale (With Work Component)

The analysis of the QuickDASH visual analog scale (with the work component) utilized all fifteen items (the original eleven items and the four work component items). The mean score on the fifteen-item Quick-DASH visual analog scale was 89.7 ± 26.4 at the time of initial testing and 89.1 ± 28.5 at the time of subsequent testing. Reliability analysis indicated good test-retest reliability of the fifteen-item QuickDASH visual analog scale (intraclass correlation coefficient = 0.94, 95% confidence interval = 0.89 to 0.97). A formal hypothesis test, performed with use of Fisher's r-to-z transformation, showed that the intraclass correlation coefficient obtained for this fifteen-item QuickDASH visual analog scale did not differ significantly from the intraclass correlation coefficient of 0.94 reported for the original QuickDASH ($z = 0.08$, $p = 0.468$). Additionally, the mean difference between the test and retest scores (test score – retest score) was 0.63 ± 9.37 (95% confidence interval, −2.45 to 3.71). This mean difference was not significant ($p = 0.680$). Table II compares the test-retest reliability of the QuickDASH visual analog scale with that of the QuickDASH. Table III summarizes the scale distributions of the QuickDASH visual analog scale and the QuickDASH.

Discussion

The purpose of the present study was to investigate the test-retest reliability of a visual analog scale version of the QuickDASH self-reported measure when used for the evaluation of patients over time during active treatment. Reliability over time is crucial for a self-reported measure because it imposes a practical ceiling on the measure's validity and thereby its utility[21]. This is especially important for measures that are used for the evaluation of patients undergoing active treatment because the potential sensitivity of the measure, one index of its validity, is quickly degraded by problems with the reliability of the measure over time.

In the present study, a visual analog version of the original eleven-item QuickDASH and the four-item work component in a clinical setting was administered to thirty-eight patients with upper extremity disorders on a test-retest basis, with an average interval of two days between tests. Good test-retest reliability was found, with coefficients of correlation that were comparable with those of the original eleven-item and fifteen-item versions.

The potential limitations of a visual analog scale have been highlighted in previous research. Most notably, some investigators have found that elderly patients have less reliable responses on a visual analog scale and that such patients report a lower preference for the visual analog scale relative to Likert-type scales[22]. However, other studies have demonstrated that instruments utilizing a visual analog scale have better psychometric properties relative to other scales, especially in terms of the responsiveness to treatment[18], and are reliably predictive of treatment outcomes across age-groups[23-25].

The visual analog scale version of the QuickDASH has two important advantages over the original version. The visual analog scale version is scaled in a manner consistent with other measures to be used in the next edition of the American Medical Association's *Guides*, notably the Pain Disability Questionnaire and the visual analog pain scale. The visual analog scale version of the QuickDASH will facilitate research on the impact of pain on function and also will allow improved calibration of the contribution of pain to functional limitation. Given these benefits and the psychometric reliability over time demonstrated in the present study, the visual analog scale version of the QuickDASH can be recommended as an acceptable alternative to the original version.

Appendix

eA The QuickDASH and QuickDASH visual analog scale. (Reprinted with the permission of the Institute for Work and Health, Toronto, Ontario, Canada [dash.iwh.on.ca].) ■

THE QuickDASH
OUTCOME MEASURE

INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* of which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

QuickDASH

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Do heavy household chores (e.g., wash walls, floors).	1	2	3	4	5
3. Carry a shopping bag or briefcase.	1	2	3	4	5
4. Wash your back.	1	2	3	4	5
5. Use a knife to cut food.	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	1	2	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

QuickDASH DISABILITY/SYMPTOM SCORE = $\left(\left[\frac{\text{sum of n responses}}{n}\right] - 1\right) \times 25$, where n is equal to the number of completed responses.

A QuickDASH score may not be calculated if there is greater than 1 missing item.

QuickDASH

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including homemaking if that is your main work role).

Please indicate what your job/work is:_____

❒ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week.

Did you have any difficulty:	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you:_____

❒ I do not play a sport or an instrument. (You may skip this section.)

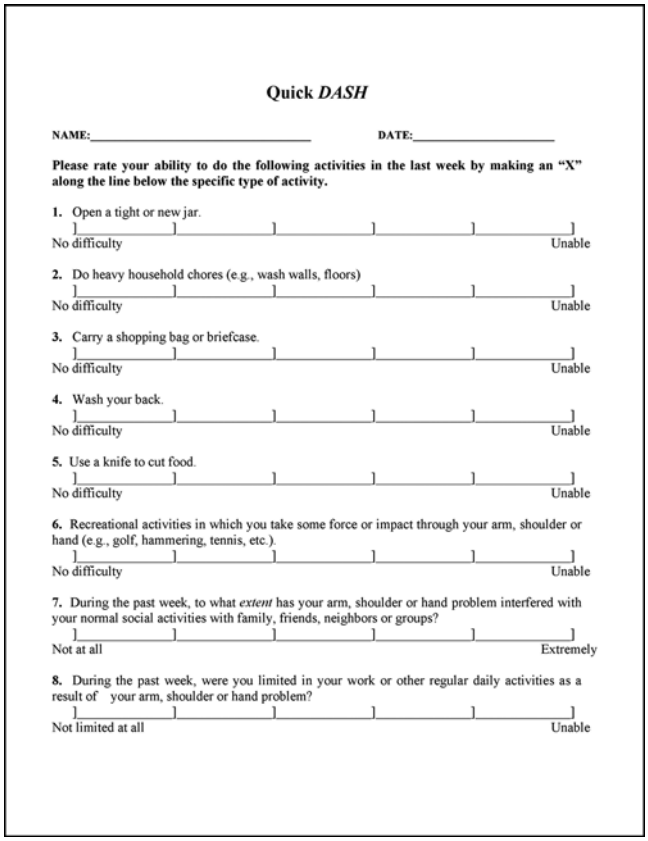
Please circle the number that best describes your physical ability in the past week.

Did you have any difficulty:	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	1	2	3	4	5
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3. playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4. spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

SCORING THE OPTIONAL MODULES: Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.
An optional module score may not be calculated if there are any missing items.

Appendix

A full version of this outcome measure is available at jbjs.org.



Quick *DASH*

NAME:_____ DATE:_____

Please rate your ability to do the following activities in the last week by making an "X" along the line below the specific type of activity.

1. Open a tight or new jar.
No difficulty — Unable

2. Do heavy household chores (e.g., wash walls, floors)
No difficulty — Unable

3. Carry a shopping bag or briefcase.
No difficulty — Unable

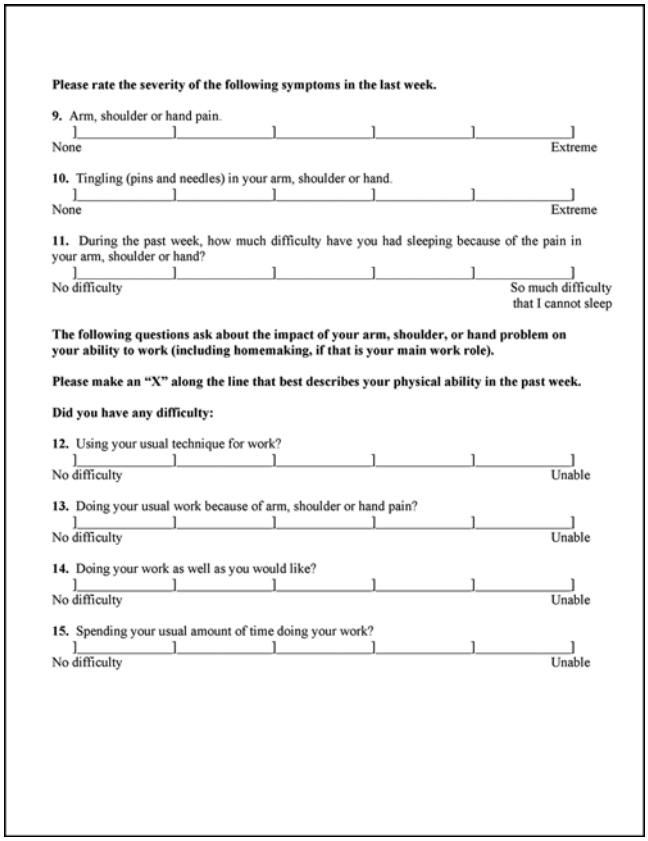
4. Wash your back.
No difficulty — Unable

5. Use a knife to cut food.
No difficulty — Unable

6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).
No difficulty — Unable

7. During the past week, to what *extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbors or groups?
Not at all — Extremely

8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?
Not limited at all — Unable



Please rate the severity of the following symptoms in the last week.

9. Arm, shoulder or hand pain.
None — Extreme

10. Tingling (pins and needles) in your arm, shoulder or hand.
None — Extreme

11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?
No difficulty — So much difficulty that I cannot sleep

The following questions ask about the impact of your arm, shoulder, or hand problem on your ability to work (including homemaking, if that is your main work role).

Please make an "X" along the line that best describes your physical ability in the past week.

Did you have any difficulty:

12. Using your usual technique for work?
No difficulty — Unable

13. Doing your usual work because of arm, shoulder or hand pain?
No difficulty — Unable

14. Doing your work as well as you would like?
No difficulty — Unable

15. Spending your usual amount of time doing your work?
No difficulty — Unable

Appendix

A full version of the QuickDASH visual analog scale is available at jbjs.org.

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