Construct Validity and Reliability of the Disability of Arm, Shoulder and Hand Questionnaire for Upper Extremity Complaints in Rheumatoid Arthritis

ERIC E.J. RAVEN, DANIËL HAVERKAMP, INGER N. SIEREVELT, DOUWE O. van MONTFOORT, RUUD G. PÖLL, LEENDERT BLANKEVOORT, and PAUL P. TAK

ABSTRACT. ***Objective.*** The Disability of Arm, Shoulder and Hand (DASH) questionnaire is a tool for measuring physical function and symptoms of the upper extremity. Although widely used, it is not validated for rheumatoid arthritis (RA). In this study the DASH was validated for this patient group.

Methods. In total, 102 patients participated in this study. For the validation, the questionnaires of the DASH, the Health Assessment Questionnaire (HAQ), the Medical Outcomes Study Short Form-36 (SF-36), and the Arthritis Impact Measurement Scale (AIMS2) were used. Patients were examined clinically before completing the questionnaires. Pain was scored by each patient using a visual analog scale (VAS). The Disease Activity Score (DAS28) was obtained and grip strength was measured. Reliability was tested by a second DASH questionnaire after 2 days. Validity was tested using a Pearson correlation analysis for the relevant domains of the questionnaires and for the clinical aspects.

Results. The reliability of the DASH was excellent (intraclass correlation coefficient 0.97). Internal consistency was strong (Cronbach's alpha 0.97). Validity was proven with excellent results for Pearson correlation with the relevant domains of the questionnaires: HAQ, r = 0.88; SF-36, r = 0.70; and AIMS2, r = 0.85. The clinical scores had a relatively low correlation with the DASH (DAS28, r = 0.42; and grip strength, r = 0.41–0.48), except for the VAS (r = 0.60–0.65).

Conclusion. The DASH is a reliable and valid questionnaire in patients with RA. It can be used as a measurement tool of physical disability of the upper extremity. (First Release Nov 1 2008; J Rheumatol 2008;35:2334–8; doi:10.3899/jrheum.080067)

Key Indexing Terms:
CONSTRUCT VALIDITY
RHEUMATOID ARTHRITIS
DISABILITY OF ARM, SHOULDER AND HAND
DASH

Orthopedic surgeons and rheumatologists are increasingly interested in determining the outcome of their interventions, whether surgical or nonsurgical. Several disease or site-specific subjective outcome measures are available. For patients with rheumatoid arthritis (RA) several questionnaires were developed to measure quality of life and physical disability. Those questionnaires are not specific to the site of the disease. Especially in patients with RA, disease activity in the upper extremity can be very invalidating. Hand and wrist symptoms are present in 43% and shoulder symptoms in 9% of these patients[1-3].

For independence, good functioning of the upper extremity during daily living is of utmost importance; therefore, a good standardized assessment is required. The Disability of Arm, Shoulder and Hand (DASH) is a questionnaire developed and validated in 1994 by the American Academy of Orthopedic Surgeons, the Council of Musculoskeletal Specialty Societies, and the Institute for Work and Health[4]. This questionnaire focuses on functional status and symptoms rather than one specific anatomic region or specific disease entity. The rationale for the development of the DASH was that the upper extremity is to be considered as one functional unit[5]. The DASH was developed to measure physical disability and symptoms of the upper limbs in a heterogeneous population, i.e., men and women, and individuals with mild, moderate, or severe disability and a wide variety of upper extremity disorders[6]. The purpose of the DASH questionnaire is to describe differences between

From the Orthopaedic Research Center Amsterdam, Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam; Department of Orthopaedic Surgery and Traumatology, Gelre Hospital, Apeldoorn; Department of Orthopaedic Surgery, Slotervaart Hospital, Amsterdam; and Division of Clinical Immunology and Rheumatology, Academic Medical Center/University of Amsterdam, Amsterdam, The Netherlands.

E.E.J. Raven, MD, Orthopaedic Research Center Amsterdam, Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam, Department of Orthopaedic Surgery and Traumatology, Gelre Hospital; D. Haverkamp, MD, PhD; I.N. Sierevelt, MSc; D.O. van Montfoort, MD, Orthopaedic Research Center Amsterdam, Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam; R.G. Pöll, MD, PhD, Department of Orthopaedic Surgery, Slotervaart Hospital; L. Blankevoort, PhD, Orthopaedic Research Center Amsterdam, Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam; P.P. Tak, MD, PhD, Division of Clinical Immunology and Rheumatology, Academic Medical Center/University of Amsterdam.

Address reprint requests to Dr. E.E.J. Raven, Department of Orthopaedics and Traumatology, Gelre Hospital, PO Box 9014, 7300 DS Apeldoorn, The Netherlands. E-mail: e.raven@gelre.nl

Accepted for publication July 10, 2008.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2008. All rights reserved.

Downloaded on April 10, 2024 from www.jrheum.org

groups of individuals in order to compare the effects of upper limb disorders and to compare outcomes in clinical studies.

Since 1996 the questionnaire has been translated and validated in many countries and languages and for different disorders of the upper extremity[7-9]. In addition, construct validity and responsiveness have been tested[10]. However, in these studies, the presence of RA was an exclusion criterion[7,9], or a subgroup analysis for RA patients was not possible[8,10].

Availability of the DASH for the population of RA patients with upper extremity disorders would be an excellent expansion of the subjective outcome measurements for this group, since no upper extremity-specific subjective score is available yet. However, construct validity and reliability of the DASH cannot be assumed for the RA patient group, since it includes patients with pathology that is often diverse and multifocal, who are not comparable to otherwise healthy patients with isolated upper extremity disorders. Before using the questionnaire for this specific population, a proper validation should be performed to test whether the outcome measurement is valid for this population. We evaluated whether the DASH is a valid outcome instrument for upper extremity disability in patients with RA.

MATERIALS AND METHODS

Patients and assessment of health status. We investigated construct validity and reliability of the Dutch DASH in RA patients who were rheumatoid factor-positive. For this purpose a consecutive group of patients visiting the outpatient clinic of the Academic Medical Center, the Slotervaart Hospital (a large non-academic hospital with special interest in RA), or the Jan van Breemen Institute (an outpatient clinic focused on RA and rehabilitation medicine) with rheumatoid factor-positive RA and pain of the upper extremity were asked to participate in the study. A total of 122 patients agreed to participate, of whom 102 (84%) completed and returned the questionnaires. The average age of respondents was 57.5 years (range 22.6–86.4) and 63.9% of respondents were female.

Besides the DASH, the questionnaire used was constructed from the 36-item Short Form health survey (SF-36), the Health Assessment Questionnaire (HAQ)[11], the Arthritis Impact Measurement Scales (AIMS2)[12], and a 100 mm visual analog scale (VAS) for pain. Additionally, all patients were clinically examined according to the Disease Activity Score (DAS28)[13] and grip strength was measured.

The DASH is a self-administered site-specific questionnaire consisting of 30 questions to be answered by the patient concerning general functioning, and it is focused on the upper extremity and is entirely subjective. It includes 21 physical function items, 6 symptom items, and 3 social role/function items. Each question consists of a 5-point Likert scale, leading to a total score from the best functional score of 30 to the worst functional outcome of 150. In order to simplify the results, the score is divided by the number of responses, subtracted with 1, and then multiplied by 25. This gives a best possible score of 0 and a worst possible score of 100.

The 28-joint Disease Activity Score, DAS28, is based on counts of the number of tender (TJC) and number of swollen (SJC) joints (of 26 upper extremity and knee joints) found on examination by the physician, the C-reactive protein (CRP value), and the patient's global assessment using a visual analog scale (VASDAS)[14].

The SF-36 is a general health questionnaire consisting of 36 Likert box questions[15-18]. The questionnaire contains 8 health concepts: physical functioning (PF), role limitation due to physical problems (RP), bodily pain (BP), perception of general health (GH), energy and vitality (VT), social functioning (SF), role limitation due to emotional problems (RE), and mental health (MH). The results of the SF-36 range from the worst outcome, 0, to the best outcome, 100[15,17].

The Stanford HAQ[11] measures difficulty in performing activities of daily living. It consists of 20 questions on daily functioning during the past week. There are 8 component areas: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and outdoor activity. Each response is scored on a 4-point scale of ability, range 0 to 3[19].

The AIMS2[12,20-23] was designed to measure the health status component of outcome in a multidimensional fashion using specific scales, summary components, and overall impact measures. The AIMS2 has been validated for the Dutch language[21]. The current AIMS2 instrument is a 78-item questionnaire; the first 57 items are divided into 12 scales: mobility level, walking and bending, hand and finger function, arm function, self-care tasks, household tasks, social activity, support from family and friends, arthritis pain, work, level of tension, and mood. It is also possible to recode the results in 3 scales: physical (mobility level, walking and bending, hand and finger function, arm function, self-care, household tasks), affect (level of tension, mood), and symptom (arthritis pain). For validation of the DASH, only the first 3 scales were used.

To determine the seriousness of the pain in the right and left upper extremity, a 100 mm VAS was used[24].

Grip strength was measured using a Jamar meter (Asimow Engineering, Los Angeles, CA, USA). All patients had to squeeze 3 times with each hand; the mean peak measure of these efforts was considered the grip strength.

The time and effort required to complete the questionnaire was recorded by the patient in order to determine the burden to the patient. A lengthy time required to complete the questionnaire implied a high burden.

For an indication of health status, we calculated the mean, standard deviation, and minimum and maximum of the DASH, DAS28, CRP, HAQ, AIMS-PF, AIMS-Affect, AIMS-Symptoms, SF-36-PF, SF-36-BP, SF-36-SF, and SF-36-RP.

Validation of DASH in RA patients. Reliability is defined as the ability of a test to yield the same results on repeated trials under the same conditions[25]. To determine retest reliability, the patients completed the DASH twice; 2 days after the first completion, patients had to fill out the questionnaire again. This 2-day period was chosen because the status of RA patients may vary over a longer period and reliability needs to be tested under the same conditions. The test-retest reliability was expressed as the intraclass correlation coefficient (ICC)[26] and the Bland-Altman coefficient of reliability[27]. T-tests were performed to determine the systematic difference between the first and the second test.

Internal consistency was assessed to determine whether all the questions cover the same construct. Internal consistency was assessed by Cronbach's alpha[28], which confirmed the homogeneity of the questions included in the questionnaire and is complementary to the ICC as a measure of reliability. An alpha finding of 0.7 is considered to represent a fair degree of internal consistency, 0.8 is considered good, and 0.9 would represent excellent internal consistency[29].

Construct validity addresses the ability of a questionnaire to measure the outcome parameter of interest. It was tested by comparing the DASH to the DAS28, SF-36, HAQ, AIMS2, a 100 mm VAS for pain, and the mean grip strength. The 8 domains of the SF-36 were used to assess convergent and divergent validity of the DASH. We evaluated this by hypothesizing that correlation coefficients between the study questionnaire and the SF-36 domains bodily pain (BP), role of physical limitations (RP), and physical functioning (PF) were higher than correlations with other domains. This was also done with the 3 main scales of the AIMS2. We hypothesized that the DASH would correlate better with AIMS2 scales of physical functioning than the AIMS2 scales of affect and symptom.

Content validity addresses whether a questionnaire has enough items and adequately covers the domain of interest. Content validity was evaluated by assessing the distribution and floor and ceiling effects of the DASH.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2008. All rights reserved.

Downloaded on April 10, 2024 from www.jrheum.org

A floor effect occurs when the patient scores the lowest possible score (0), and therefore the patient appears to have no upper extremity disability. The ceiling effect is the highest possible score (100), and is thus the opposite of the floor effect[29].

Statistics. Statistical analysis was performed by using SPSS (version 12.01; SPSS Inc., Chicago, IL, USA). A p value < 0.05 was considered statistically significant.

RESULTS

The mean, standard deviation, minimum and maximum of the DASH, DASH retest, DAS28, grip strength, CRP, HAQ, AIMS-PF, AIMS-Affect, AIMS-Symptom, SF-36-PF, SF-36-BP, SF-36-SF, and SF-36-RP were all normally distributed (Table 1).

Reliability. The ICC of the questionnaire was very high at 0.97 (95% CI 0.96–0.98). No statistically significant difference was found between the 2 assessments (p = 0.6). The Bland-Altman coefficient of reliability was 0.58 (95% CI –1.03 to 2.20). Cronbach's alpha showed that the questionnaire had strong internal consistency, with a value of 0.97 (95% CI 0.96–0.98).

Construct validity. The correlation of the DASH with the DAS28 was r = 0.42 (p < 0.01; Table 2). Two of the 4 components of the DAS28 correlated positively with the DASH, i.e., the number of tender joints and the VASDAS (Table 3).

The physical components of the SF-36 (PCS) correlated strongly with the DASH score (r = –0.70, p < 0.01). Three out of 4 parts of the physical component correlated well with the DASH (physical functioning, r = –0.67; bodily pain, r = –0.68; social functioning, r = –0.63; p < 0.01). Only role limitation (RP) had a moderate correlation (r = –0.44, p < 0.01). The correlation between the DASH and the mental correlation score was r = –0.27 (p < 0.01), whereas the general health score showed a moderate correlation (r = –0.53, p < 0.01).

Table 1. Health status.

Score	Mean	SD	Minimum	Maximum
DASH baseline	39.0	22.2	0.0	92.50
DASH retest	37.5	23.7	0.0	94.5
DAS28	3.1	1.23	0.41	6.68
Grip strength left	14.4	10.6	0	40.7
Grip strength right	15.1	10.7	0	40.7
CRP	14.5	20.4	1.0	118.0
HAQ	1.2	0.73	0.0	2.9
AIMS-PF	3.7	2.1	0.0	9.2
AIMS-Affect	3.2	1.8	0.0	8.8
AIMS-Symptoms	5.3	2.6	0.0	10.0
SF-36-PF	46.5	28.3	0.0	100.0
SF-36-BP	46.1	24.4	0.0	100.0
SF-36-SF	65.5	26.2	0.0	100.0
SF-36-RP	31.9	39.9	0.0	100.0

DASH: Disability of Arm, Shoulder and Hand; CRP: C-reactive protein; HAQ: Health Assessment Questionnaire; AIMS: Arthritis Impact Measurement Scale; PF: physical functioning; SF-36: Medical Outcome Study Short Form 36.

The HAQ had the strongest Pearson correlation with the DASH (r = 0.88, p < 0.01). Consistent with the relationship between DASH and SF-36, the physical part of the AIMS2 had a high correlation with the DASH (r = 0.85, p < 0.01). The symptom component had a marked correlation (r = 0.67). The affect part had a rather low correlation (r = 0.55).

The dominant arm VAS for pain correlated well with the DASH score (r = 0.61). The left and right arm correlations were similar (r = 0.60, r = 0.65, respectively).

The grip strength correlation with the DASH was low (right, r = 0.41; left, r = 0.49; Table 2).

Content validity. The scores of the DASH questionnaire were normally distributed. Ceiling and floor effects were not observed. Scores ranged from 0 to 92, where 2 of the 102 patients had a score of 0. The mean DASH score was 39.0 (SD 21.4).

Burden. Median time to complete the DASH was 6 minutes. In our patient group, 12% had some difficulty or needed assistance with completing the questionnaire. The Pearson correlation of the DASH with the time required to complete the questionnaire was moderate (r = 0.47), indicating that the burden was partly caused by disease activity.

DISCUSSION

The aim of this study was to validate the DASH questionnaire for upper extremity complaints in patients with RA. The questionnaire was previously translated and validated in Dutch and several other languages, but not evaluated in patients with RA. Reliability and construct validity were tested in a group of 102 consecutive patients in 3 clinics. The reliability and validity of the Dutch DASH for RA patients were found to be excellent.

It is well known that RA patients may have fluctuation in the severity of their complaints. Therefore, a short period of 2 days was chosen between the 2 testing times, instead of a longer period. The possible consequence may be that the reliability is somewhat overestimated. However, the internal consistency was similar to that of the original American version[5], and to that reported in other validation studies[7,10].

The construct validity of the DASH was tested by correlating its outcome to the relevant dimensions of the SF-36, the HAQ, and the AIMS2 questionnaires. The correlation with the physical function aspect of the SF-36 was comparable with the construct validity reported by other investigators in different patient groups and for other languages[7,30]. However, the physical component score and bodily pain showed different correlations with the DASH in several studies[7,30] (Table 4).

The correlation between the DASH and the HAQ was comparable with the results of a study in which the German-language version of DASH was validated[7](Table 4). The HAQ showed a better correlation with the DASH than the physical components of the SF-36. This may be because the SF-36 addresses general physical health rather than specific regional questions about the upper extremity like the HAQ.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2008. All rights reserved.

Downloaded on April 10, 2024 from www.jrheum.org

Table 2. Pearson correlation coefficients between the DASH score, SF-36, HAQ, AIMS2, DAS28, VAS, and grip strength.

	DASH	HAQ	AIMS-PF	AIMS-Affect	AIMS-Symptom	DAS28
SF-36						
Physical component score	–0.70	-0.73	–0.67	–0.41	–0.62	–0.46
Physical functioning	–0.67	–0.75	–0.64	–0.33	–0.46	–0.36
Role limitation due to physical problems	–0.44	-0.44	–0.47	–0.36	–0.46	–0.32
Bodily pain	–0.68	–0.61	–0.60	-0.58	–0.82	–0.47
Social functioning	–0.63	–0.57	–0.59	–0.69	–0.67	–0.39
Mental component score	–0.27	–0.17	–0.22	–0.63	–0.35	–0.13
Mental health	–0.37	–0.29	–0.33	–0.67	–0.36	–0.13
Role limitation due to emotional problems	–0.35	–0.28	–0.28	–0.48	–0.45	–0.26
Energy and vitality	–0.47	–0.41	–0.44	–0.63	–0.39	–0.26
General health	–0.53	–0.49	–0.49	–0.61	–0.54	–0.37
HAQ	0.88	—	0.84	0.48	0.61	0.46
AIMS2						
Physical functioning	0.85	0.84	—	—	—	0.36
Affect	0.55	0.48	—	—	—	0.32
Symptom	0.67	0.61	—	—	—	0.57
DAS28	0.42	0.46	0.36	0.32	0.57	—
VAS dominant side	0.61	0.49	0.52	0.54	0.65	0.46
VAS left	0.65	0.50	0.52	0.52	0.63	0.36
VAS right	0.60	0.52	0.51	0.48	0.67	0.50
Grip strength left	–0.49	–0.53	–0.36	–0.22	–0.36	–0.50
Grip strength right	–0.41	–0.43	–0.30	–0.08	–0.30	–0.37

For all correlation coefficients $p < 0.01$.

Table 3. Correlation of components of the DAS28 with the DASH.

Component	r
Number of tender joints, upper extremity	0.38*
CRP	0.08†
Number of swollen joints, upper extremity	0.07†
VASDAS	0.48*

* $p < 0.01$; † Not significant.

The good correlation of the DASH with the physical parts of the AIMS2, an arthritis-specific instrument, supports the DASH as suitable to use in patients with RA.

Although the SF-36 PCS showed construct validity equal to both AIMS physical functioning/symptom and HAQ compared to the DASH, the correlation with the VAS scores for pain in the upper extremity was superior to the DASH compared to the HAQ. The 3 domains of the AIMS showed a construct validity completely comparable to the DASH, but the burden of answering the AIMS can be considered higher, because it contains more questions. Therefore, if one is interested only in upper extremity complaints, the DASH could be more suitable than the HAQ or AIMS.

Low correlations were found between the DASH and the DAS28 and the grip strength measure. This is comparable with others' results[7,31], suggesting a weak correlation between the DASH and clinical outcome measures. An explanation for this would be that disability is dependent not only on disease activity, but is also related to joint destruction, especially in more advanced disease.

Table 4. Comparisons of DASH to SF-36 and DASH to HAQ correlations with other studies.

	This Study	SooHoo[30]	Offenbacher[7]
SF-36			
Physical component score	–0.70	–0.50	
Physical functioning	–0.67	–0.59	–0.58
Role limitation due to physical problems (RP)	–0.44	–0.61	–0.58
Bodily pain	–0.68	–0.43	–0.79
Social functioning	–0.63	–0.57	–0.26
Mental component score	–0.27	–0.59	
Mental health	–0.37	–0.55	–0.19
Role limitation due to emotional problems (RE)	–0.35	–0.62	–0.21
Energy and vitality	–0.47	–0.48	–0.46
General health	–0.53	–0.36	–0.35
HAQ	0.88		0.88

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2008. All rights reserved.

Downloaded on April 10, 2024 from www.jrheum.org

The responsiveness of the DASH to treatment was not formally tested in our study. However, the small 95% CI of the Bland-Altman coefficient of reliability suggests that responsiveness is likely to be good. Other studies[10] have indeed shown that the DASH can detect and differentiate changes in disability over time after surgery in patients with upper extremity musculoskeletal disorders. A 10-point difference in mean DASH score might be considered as a minimal important change[10]. However, these are outcomes in unilateral upper extremity disorders, and as noted, RA patients experience more bilateral upper extremity problems.

A limitation of our study is that we did not ask the patient at the time of the retest whether the signs and symptoms of the disease had changed. However, we did not expect marked changes because the DASH considers the complaints of the past week.

Our data indicate that the DASH is a valid instrument for assessing upper extremity complaints in patients with RA.

REFERENCES

1. Brook A, Corbett M. Radiographic changes in early rheumatoid disease. Ann Rheum Dis 1977;36:71-3.
2. Renner WR, Weinstein AS. Early changes of rheumatoid arthritis in the hand and wrist. Radiol Clin North Am 1988;26:1185-93.
3. Hulsmans HM, Jacobs JW, van der Heijde DM, Albada-Kuipers GA, Schenk Y, Bijlsma JW. The course of radiologic damage during the first six years of rheumatoid arthritis. Arthritis Rheum 2000;43:1927-40.
4. 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;29:602-8.
5. Davis AM, Beaton DE, Hudak P, et al. Measuring disability of the upper extremity: a rationale supporting the use of a regional outcome measure. J Hand Ther 1999;12:269-74.
6. McDowell I, Newell C. A guide to rating scales and questionnaires. Measuring health. 2nd ed. Oxford: Oxford University Press; 1996:106-15.
7. Offenbacher M, Ewert T, Sangha O, Stucki G. Validation of a German version of the Disabilities of Arm, Shoulder and Hand questionnaire (DASH-G). Z Rheumatol 2003;62:168-77.
8. 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;28:179-86.
9. Veehof MM, Sleegers 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;15:347-54.
10. 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.
11. Fries JF, Spitz PW, Young DY. The dimensions of health outcomes: the Health Assessment Questionnaire, disability and pain scales. J Rheumatol 1982;9:789-93.
12. Meenan RF, Mason JH, Anderson JJ, Guccione AA, Kazis LE. AIMS2. The content and properties of a revised and expanded Arthritis Impact Measurement Scales health status questionnaire. Arthritis Rheum 1992;35:1-10.
13. van der Heijde DM, van 't Hof MA, Van Riel PL, van de Putte L. Disease Activity Score. Ann Rheum Dis 1992;51:140.
14. Prevoo ML, van 't Hof MA, Kuper HH, et al. Modified disease activity scores that include twenty-eight-joint counts. Development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. Arthritis Rheum 1995;38:44-8.
15. Brazier JE, Harper R, Jones NM, et al. Validating the SF-36 health survey questionnaire: New outcome measure for primary care. BMJ 1992;305:160-4.
16. Ware JE Jr, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36). I. Conceptual framework and item selection. Med Care 1992;30:473-83.
17. Sullivan M, Karlsson J, Ware JE Jr. The Swedish SF-36 Health Survey. I. Evaluation of data quality, scaling assumptions, reliability and construct validity across general populations in Sweden. Soc Sci Med 1995;41:1349-58.
18. Aaronson NK, Muller M, Cohen PD, et al. Translation, validation, and norming of the Dutch language version of the SF-36 Health Survey in community and chronic disease populations. J Clin Epidemiol 1998;51:1055-68.
19. Siegert CE, Vleming LJ, Vandenbroucke JP, Cats A. Measurement of disability in Dutch rheumatoid arthritis patients. Clin Rheumatol 1984;3:305-9.
20. Mason JH, Meenan RF, Anderson JJ. Do self-reported arthritis symptom (RADAR) and health status (AIMS2) data provide duplicative or complementary information? Arthritis Care Res 1992;5:163-72.
21. Riemsma RP, Taal E, Rasker JJ, Houtman PM, Van Paassen HC, Wiegman O. Evaluation of a Dutch version of the AIMS2 for patients with rheumatoid arthritis. Br J Rheumatol 1996;35:755-60.
22. Taal E, Jacobs JW, Seydel ER, Wiegman O, Rasker JJ. Evaluation of the Dutch Arthritis Impact Measurement Scales (Dutch-AIMS) in patients with rheumatoid arthritis. Br J Rheumatol 1989;28:487-91.
23. Evers AW, Taal E, Kraaimaat FW, et al. A comparison of two recently developed health status instruments for patients with arthritis: Dutch-AIMS2 and IRGL. Arthritis Impact Measurement Scales. Impact of Rheumatic Diseases on General Health and Lifestyle. Br J Rheumatol 1998;37:157-64.
24. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain 1983;17:45-56.
25. Liow RY, Walker K, Wajid MA, Bedi G, Lennox CM. The reliability of the American Knee Society Score. Acta Orthop Scand 2000;71:603-8.
26. Bland JM, Altman DG. Measurement error and correlation coefficients. BMJ 1996;313:41-2.
27. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet 1986;1:307-10.
28. Cronbach LJ, Meehl PE. Construct validity in psychological tests. Psychol Bull 1955;52:281-302.
29. Dunbar MJ, Robertsson O, Ryd L, Lidgren L. Translation and validation of the Oxford-12 item knee score for use in Sweden. Acta Orthop Scand 2000;71:268-74.
30. SooHoo NF, McDonald AP, Seiler JG III, McGillivary GR. Evaluation of the construct validity of the DASH questionnaire by correlation to the SF-36. J Hand Surg Am 2002;27:537-41.
31. Navsarikar A, Gladman DD, Husted JA, Cook RJ. Validity assessment of the Disabilities of Arm, Shoulder, and Hand questionnaire (DASH) for patients with psoriatic arthritis. J Rheumatol 1999;26:2191-4.

Personal non-commercial use only. The Journal of Rheumatology Copyright © 2008. All rights reserved.

Downloaded on April 10, 2024 from www.jrheum.org