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Validity and reliability of a revised Japanese version of the Arthritis Impact Measurement Scales version 2 (AIMS2)

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Abstract This study aims to evaluate the validity and reliability of a Japanese version of the Arthritis Impact Measurement Scales, version 2 (AIMS2) for patients with rheumatoid arthritis (RA). The Japanese version of the AIMS2 questionnaire was administered to 1643 patients with classical or definite RA at 11 hospitals nationwide in Japan. Reliability was assessed by a test–retest procedure, 4 weeks apart, using 75 randomly selected patients. Internal consistency was measured by Cronbach's α, and factor analysis was used to obtain the proportion of variance explained by the first factor in principal component analysis. The validity of the AIMS2 scales was assessed by internal standards. Internal consistency (α coefficients, 0.84–0.94), test–retest reliability (intraclass correlation coefficients, 0.75–0.93), and factor analysis (0.62–0.85) of the AIMS2 health status scales proved that they are highly reliable in the Japanese version. Validity, as measured by the relationships among the scores on the questionnaire items, was also sufficiently secured. The validity and reliability of the Japanese version of the AIMS2 are sufficient for all practical purposes when compared with the original and with other translated versions of the questionnaire.

Key words Arthritis Impact Measurement Scales (AIMS) · Rheumatoid arthritis · Validity · Reliability · Japan

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Introduction

The Arthritis Impact Measurement Scales questionnaire (AIMS) was first developed in 1980 to assess the impact of arthritis on health.[1] The original AIMS was a self-administered questionnaire consisting of nine scales (mobility, physical activity, manual dexterity, household activities, social activities, activities of daily living, pain, depression, and anxiety), and its reliability and validity were extensively tested.[2–8] A decade later, the AIMS was revised and renamed the Arthritis Impact Measurement Scales version 2 (AIMS2). Three new scales were added to assess arm function, work, and social support, and sections to evaluate satisfaction with health status, attribution of problems to arthritis, and priority areas for improvement were also incorporated.[9] The revised AIMS is considered to capture most aspects of the lives of arthritis patients, both

objective and subjective, and is expected to help provide indispensable information to improve patients' quality of life. The AIMS2 was translated into many languages, and has been extensively evaluated and widely used to assess the health status of arthritis patients.[10,11]

The first Japanese version of the AIMS2 (original Japanese AIMS2) was developed in 1993,[12] and was a translation of the version published by Meenan et al. After an initial assessment, the wording of the questions and the arrangement of the answer sheets of the original Japanese AIMS2 was substantially refined to attain a reliability and validity which was comparable to that of AIMS2 in other languages. This article presents an assessment of the reliability and validity of this revised Japanese version of the AIMS2 (Japanese AIMS2), based on its large-scale administration to patients with rheumatoid arthritis (RA).[13,14] Assuming that it is sufficiently reliable, the AIMS2 can serve as a basis for official reports on arthritis impact and care.

Materials and methods

Questionnaire

The AIMS2 is a self-administered questionnaire that measures health status over a broad spectrum. It has 12 health scales (AIMS2 scales), comprising mobility level, walking and bending, hand and finger function, arm function, self-care tasks, household tasks, social activities, support from family and friends, arthritis pain, work, level of tension, and mood, each of which consists of four or five items. The potential range of status scores is from 0 (good health) to 10 (poor health). The AIMS2 also has sections on the patient's level of satisfaction with each health aspect (from 1, very satisfactory, to 5, entirely unsatisfactory), the patient's attribution of the cause of each health problem (0, no health problem; 1, due entirely to other causes; 5, due entirely to my arthritis), and a section on priorities which asks the subject to choose three out of 12 areas for health status improvement. The attribution scale is used either as a dichotomous scale to assess whether a subject has a problem or not, or as an ordinal scale to measure the subject's attribution of a problem, when present, to arthritis.

In addition to the questions about each health area, the questionnaire includes single-item overall assessments of arthritis impact (health status compared with that of others of the same age: from 1, excellent, to 5, very poor), satisfaction with health status (from 1 to 5, as for health aspects), and the attribution of the impairment to arthritis (from 0 to 5, as for health problems).[9]

The Japanese AIMS2 was developed after the original Japanese AIMS2. The original Japanese AIMS2 was throughly evaluated in terms of its response rate, validity, and reliability.[14] Based on the results, the wording of questions with poor response rates was changed to improve their clarity. For example, "block" in the questions on walking and bending was replaced with "40–50 meters," since the former term is not usually used as an expression of distance in Japan. The overall correspondence between the English and Japanese versions was then confirmed by back-translation by a native speaker. In addition, the arrangement of questions and answers was changed: the set of possible responses to be chosen by the subject was repeated under each question. In the old version, the subject needed to find the places to check by following rows of questions and columns of possible answers. This structure was considered to be cumbersome and difficult for older subjects to understand. Furthermore, a note was added to the cover sheet of the questionnaire stating that the subject should choose "possible" when (s)he was able to perform the activities in question even if (s)he had not actually done so in the past month.[13]

The revised Japanese version of the AIMS2 questionnaire can be obtained from the authors on request.

Data collection

During routine medical visits to rheumatology clinics at 11 hospitals across the country, 100–150 subjects were chosen at random. They were requested to take the questionnaire sheets home with them, and to answer all the questions according to their status on that day and in the preceding month. For those with vision impairment or difficulty in writing, as well as those who found the questions difficult to understand, we recommended that they seek help from family members or nurses. At the same time, information on the American Rheumatism Association (ARA) criteria/gradings and Steinbrocker's functional classification of the RA patients[15] was collected from the subjects' physicians. These traditional diagnostic criteria/gradings were adopted in the study since they were considered to be more widely used by the participating researchers at the time of the survey. To examine test–retest reliability, 10–15 subjects were chosen at random at each hospital and asked to answer the questionnaire again 4 weeks after their initial responses.

Out of 1884 patients, 1774 (94.2%) returned their responses. All but 76 patients (1698 cases) were diagnosed as having RA (possible, probable, classical, or definite RA by the above criteria), of whom 1643 patients were either classical or definite RA. Possible and probable RA cases were then dropped from the analysis, since their diagnoses were regarded as not always being reliable, and some might have problems other than RA. Assessment of the Japanese AIMS2 was based on the responses of these 1643 patients. The demographic and clinical characteristics of the subjects are shown in Table 1. As regards educational status, 4.4% were elementary school graduates, 21.4% were junior high school graduates, 48.5% were senior high school graduates, and 25.7% were college or university graduates. All of the subjects chosen for retest had either classical or definite RA, and all returned their responses.

Table 1. Demographic and clinical characteristics of the subjects

	Ranges	Means ± SDs or numbers (%)
Age (years)	17–87	56.9 ± 12.1
Sex	Male/female	220/1423 (13.4/86.6)
Marital status[a]	Married/not married	1273/370 (77.5/22.5)
Disease duration (years)	0.17–59.5	12.04 ± 8.92
Job status[b]	With/without job	1145/498 (69.7/30.3)
ARA grading	Classical RA	1048 (69.9)
	Definite RA	495 (30.1)
Functional classification	Class 1	286 (17.4)
	Class 2	907 (55.2)
	Class 3	417 (25.4)
	Class 4	33 (2.0)

[a] Marital status: married (married, married but not living together); not married (divorced, widowed, unmarried)
[b] Job status: with job (employed, house makers, students); without job (jobless, disabled, retired)

Table 2. Scores and reliability of the AIMS2 health status scales

AIMS2 scales	Scores		Reliability		
	Actual score ranges	Means ± SDs[a]	Internal consistency[b]	Test–retest reliability[c]	Factor analysis[d]
Mobility level	0–10	2.64 ± 3.05	0.91	0.93	0.74
Walking and bending	0–10	4.04 ± 3.40	0.89	0.93	0.7
Hand and finger function	0–10	3.47 ± 3.26	0.91	0.87	0.75
Arm function	0–10	3.06 ± 3.25	0.92	0.89	0.76
Self-care	0–10	1.66 ± 2.57	0.87	0.9	0.74
Household tasks	0–10	2.26 ± 3.03	0.94	0.9	0.85
Social activities	0–10	6.48 ± 2.17	0.84	0.75	0.62
Support from family and friends	0–10	1.73 ± 2.14	0.89	0.83	0.76
Arthritis pain	0–10	4.17 ± 2.63	0.86	0.89	0.66
Work	0–10	3.24 ± 3.38	0.92	0.83	0.82
Level of tension	0–10	3.52 ± 2.55	0.93	0.83	0.78
Mood	0–10	3.64 ± 2.44	0.87	0.85	0.67

[a] Mean scale score and standard deviation on the AIMS2 (from 0, best health status, to 10, worst health status). $n = 1643$ ($n = 1145$ for work)
[b] Estimated by Cronbach's coefficient α. $n = 1643$ ($n = 1145$ for work)
[c] Intraclass correlation coefficient between scores on two administrations of questionnaire (all were significant at $P < 0.001$). $n = 75$ ($n = 52$ for work)
[d] Percentage of variance explained by the first factor in principal component analysis. $n = 1643$ ($n = 1145$ for work)

Data analysis

For a reliability assessment of the 12 AIMS2 scales, internal consistency (Cronbach's α),[16] test–retest reliability (intraclass correlation coefficients between scores on two administrations of the questionnaires),[17,18] and factor analysis (proportion of variance explained by the first factor in principal component analysis) were calculated. The test–retest reliability of the scales for satisfaction, attribution, and improvement priority was examined either by intraclass correlation coefficients or by κ statistics.[19] For the ordinal aspects of the satisfaction and attribution scales, intraclass correlation coefficients were obtained. For the dichotomous aspects of the priority and attribution scales, κ statistics were calculated.

The validity of the AIMS2 scales was assessed by the methods used by Meenan et al.,[9] using internal standards. The relationships between the 12 AIMS2 scale scores and both the subjects' attribution as a health status problem area and the subjects' designation as an improvement priority area were examined by *t*-tests. Then, Spearman's correlations of the AIMS2 scale scores with both the scores on subjects' satisfaction with these health areas and the scores on subjects' attribution of their problems, if any, to arthritis were calculated.

As was done for the 12 scales, the reliability and validity of single-item measures were also assessed. The reliability of the scales on overall arthritis impact, overall satisfaction, and overall attribution was examined by intraclass correation between scores on two questionnaire administrations. The validity of these scales was then examined by calculating Spearman's correlations among them.

Statistical analyses were conducted using Stata version 6.0.[20] $P < 0.05$ was considered as statistically significant.

Results

Scores and scale reliability of the AIMS2 scales

The ranges and means of the AIMS2 scale scores are given in Table 2. Mean scores ranged from a good health status

score of 1.66 on self-care to a poor health status of 6.48 on social activities. Except for the social activities scale, the mean scores were less than 5.00, while the actual scores which subjects used ranged from 0 to 10. The mean ± SD of the single-item measure of arthritis impact was 3.73 ± 0.94, with a score range of 1–5.

The reliability results are also shown in Table 2. The reliability of the 12 AIMS2 scales, as measured by the internal consistency (Cronbach's α) of their component items, exceeded 0.80, i.e., larger than the threshold value of 0.70, and most coefficients were in the range 0.85–0.95. Test–retest reliability, as measured by the intraclass correlation coefficients of scores from two administrations of the questionnaire, exceeded 0.80 for all the scales except social activities, and equaled or exceeded 0.89 for six of the scales. Within-scale principal component factor analysis revealed that the items in each of the 12 scales loaded on a single major factor. The percentage of the scale score variance explained by the principal factor exceeded 60% in all cases. Test–retest reliability of the single-item measure of arthritis impact was 0.89.

The reliability of the AIMS2 scales was also examined in three major demographic subsets, i.e., those tabulated by sex, age (≤60 or >60), or education (less than or equal to high school graduate, or more than high school graduate), and two subsets of RA diagnosis (classical or definite). The results of the internal consistency and factor analysis in these subgroups were very similar to those found in the total group: all the α coefficients exceeded 0.80, while the factor loadings were over 60%. Test–retest reliability was over 0.80 for all the scales except for social activities, whose intraclass correlation coefficients ranged between 0.70 and 0.85.

Scores and scale reliability of satisfaction, attribution, and priority scales

The means and test–retest reliability coefficients of the satisfaction and attribution scores are shown in Table 3. Mean satisfaction scores ranged from a maximum satisfaction score of 2.23 on support from family and friends, to a minimum satisfaction score of 3.46 on arthritis pain. The test–retest reliability of the satisfaction and attribution scores were somewhat lower than those of the AIMS2 scales, ranging between 0.63 and 0.91. Reliability for all the scales, except the one for pain, was more than 0.75; seven scales attained over 0.80. The α reliability coefficient for the satisfaction items as a scale was 0.95. The 12 satisfaction items loaded on two major factors, with 64.1% of the variance being explained by the principal factor and 9.1% by the second one. The mean ± SD of the single-item overall satisfaction scale score was 3.42 ± 1.23 (range 1–5), and its test–retest reliability was 0.83.

Mean attribution scores ranged from a least attribution of 2.30 on support to a greatest attribution of 3.97 on arthritis pain. Test–retest reliability for all the attribution scales was equal to or more than 0.70, with five scales over 0.80. The α reliability coefficient for the attribution items as a scale was 0.96, and the 12 attribution items loaded on a single major factor, where 67.0% of that variance was explained by that factor. As a dichotomous scale, the proportion of subjects who indicated that they had a problem in a particular area ranged from 62.1% (support from family and friends) to 90.0% (pain). The κ statistic for each of these dichotomous scales was between 0.64 and 0.90. The mean ± SD of the single-item overall attribution

Table 3. Scale scores and reliability of the AIMS2 satisfaction, attribution, and improvement priority scales

AIMS2 scales	Health status satisfaction		RA attribution[a]		Improvement priority[b]	
	Scores[c]	Test–retest reliability[d]	Scores[e]	Test–retest reliability[d]	% listing[f]	Test–retest reliability[g]
Mobility level	2.94	0.79	3.10	0.87	27.8 (34.7)	0.62
Walking and bending	3.35	0.88	3.46	0.93	42.2 (41.0)	0.80
Hand and finger function	2.83	0.91	2.98	0.79	11.7 (9.8)	0.55
Arm function	2.78	0.87	2.88	0.79	10.7 (8.2)	0.71
Self-care	2.69	0.89	2.83	0.91	15.8 (9.8)	0.89
Household tasks	2.93	0.89	3.12	0.82	17.0 (16.4)	0.75
Social activities	3.10	0.87	2.98	0.89	17.5 (18.6)	0.56
Support from family and friends	2.23	0.76	2.30	0.73	7.8 (9.1)	0.51
Arthritis pain	3.46	0.63	3.97	0.75	46.4 (48.1)	0.76
Work	3.33	0.82	3.39	0.68	15.1 (18.0)	0.78
Level of tension	2.71	0.78	2.71	0.71	6.6 (7.5)	0.80
Mood	2.60	0.76	2.65	0.70	5.6 (5.6)	0.80

[a] Subject attributes health status problem to rheumatoid arthritis when present
[b] Subject designates as one of his/her three priority areas for health status improvement
[c] Mean satisfaction scale score (from 1, very satisfactory, to 5, entirely unsatisfied). $n = 1643$ ($n = 1145$ for work)
[d] Intraclass correlation coefficient between scores on two administrations of questionnaire (all were significant at $P < 0.001$). $n = 75$ ($n = 52$ for work)
[e] Mean attribution scale score (from 0, no health problem, to 1, due entirely to other causes, to 5, due entirely to arthritis). $n = 1643$ ($n = 1145$ for work)
[f] Proportion of subjects who designated as priority area for health status improvement among all the subjects ($n = 1643$) and among those with jobs ($n = 1145$) in parenthesis
[g] The κ statistic between scores on two administrations of questionnaire (all were significant at $P < 0.001$). $n = 75$ ($n = 52$ for work)

scale score was 3.79 ± 1.38 (range 0–5), and its test–retest reliability was 0.77.

The proportion of the subjects who chose a particular health aspect as one of their three priority areas for improvement, and the test–retest reliability (κ statistics) for subjects' priority designations, are presented in Table 3. For both subjects with jobs and those without, the most frequently chosen areas for improvement were arthritis pain, walking and bending, and mobility level, while the least chosen areas were mood, level of tension, support from family and friends, and arm function. The κ statistic measures of agreement in their priority designations between two administrations of the questionnaire ranged between 0.51 and 0.89.

Scale validity of the AIMS scales

The validity of the AIMS2 scale scores was tested using internal standards based on the subjects' responses to other items in the questionnaires. The results indicate that subjects who, on the related attribution question, answered that they had a problem in a certain health status area had consistently worse health status (Table 4). Furthermore, except for the scales on social activities and work, the AIMS2 scale scores were significantly worse for subjects who designated a particular scale as one of their three priority areas for improvement. These relationships were consistent across the groups tabulated by sex, age, or job status, although they differed for household tasks and support from family and friends. On the household scale, there was no significant difference in the AIMS score by priority designation in male subjects ($P = 0.097$), while on the support scale, there was a significant difference in priority designation in subjects without jobs ($P < 0.001$).

Scale validity of satisfaction and attribution scales

There were significant positive correlations between levels of satisfaction and health status for each of the 12 AIMS2 scales ($P < 0.001$): as subjects were less satisfied with a particular health aspect, their health status tended to be worse. The correlation coefficients were between 0.52 and 0.79 (Table 5). Furthermore, as discussed above, mean satisfaction scale scores for subjects who indicated a health status problem in a particular area were consistently worse than those for subjects who did not (*t*-test, $P < 0.001$). The single-item overall satisfaction scale score correlated with

Table 5. Correlations of the AIMS2 health status scales with satisfaction and attribution

AIMS2 scales	Correlation with satisfaction score[a]	Correlation with attribution score[b]
Mobility level	0.66*	0.58*
Walking and bending	0.77*	0.62*
Hand and finger function	0.77*	0.65*
Arm function	0.79*	0.66*
Self-care	0.65*	0.53*
Household tasks	0.70*	0.53*
Social activities	0.52*	0.35*
Support from family and friends	0.53*	0.21*
Arthritis pain	0.69*	0.41*
Work[c]	0.63*	0.47*
Level of tension	0.69*	0.60*
Mood	0.63*	0.62*

[a] Spearman's correlation coefficient between satisfaction score and the AIMS2 scale score (*significant at $P < 0.001$)
[b] Spearman's correlation coefficient between attribution score and the AIMS2 scale score (*significant at $P < 0.001$)
[c] $n = 1145$ ($n = 1643$ for the other scales)

Table 4. Validity of the AIMS2 health status scales

AIMS2 scales	Subject attributes as health status problem area[a]		Subject designates as improvement priority area[b]		
	Yes		No	Yes	No
	Proportion[c]	Scores[d]	Scores[d]	Scores[d]	Scores[d]
Mobility level	75.9	3.35*	0.41	3.85*	2.18
Walking and bending	80.2	4.89*	0.63	4.62*	3.62
Hand and finger function	68.5	4.68*	0.84	5.16*	3.24
Arm function	66.3	4.37*	0.50	5.88*	2.73
Self-care	65.3	2.45*	0.18	4.11*	1.20
Household tasks	72.5	3.00*	0.32	3.03*	2.10
Social activities	74.0	6.90*	5.29	6.33	6.51
Support from family and friends	62.1	2.14*	1.62	3.07*	1.62
Arthritis pain	90.0	4.49*	1.28	4.74*	3.68
Work[e]	80.3	3.86*	0.71	2.99	3.28
Level of tension	73.6	4.28*	1.40	4.21*	3.47
Mood	72.4	4.43*	1.57	4.51*	3.59

[a] Health status problem (Yes (1–5 on the RA attribution scale) or No (no problem)). Scale reliability is provided under RA attribution in Table 3
[b] Priority area for health status improvement (proportions are shown in Table 3)
[c] Proportion of subjects who indicated that they had a problem in each AIMS2 scale (%)
[d] Mean scale score on the AIMS2 (from 0, best health status, to 10, worst health status, tabulated by subject's priority for health status improvement. * Significant difference by *t*-test at $P < 0.001$)
[e] $n = 1145$ ($n = 1643$ for the other scales)

the single-item measure of arthritis impact at the level of 0.63 ($P < 0.001$).

Similarly, the correlations between attribution levels and health status scores were significant for all the scales ($P < 0.001$). As shown in Table 5, the correlation coefficients ranged between 0.21 and 0.66: four scales (support from family and friends, social activities, arthritis pain, and work) had coefficients smaller than 0.50. The single-item overall attribution scale score correlated with the single-item measure of arthritis impact at the level of 0.52 ($P < 0.001$).

Discussion

This study examined the reliability and validity of the Japanese AIMS2 health status scales, and in particular its sections on satisfaction, attribution, and improvement priority, using the methods employed by Meenan and colleagues. Both the AIMS2 scales measuring individual health status areas and those measuring subjects' aggregate health status as single-item scales were assessed. The results of this study revealed that the reliability and validity of the Japanese AIMS2 were satisfactory, and that it would be suitable for measuring multiple dimensions of arthritis consequences. The Japanese AIMS2 was found to be comparable to the original and to other translated versions of the AIMS2.

Reliability of the Japanese AIMS2 scales

The internal consistency of the Japanese AIMS2 scales was considered to be reasonably high, since their α coefficients exceeded 0.80. Alphas in Meenan's original AIMS2 (US AIMS2) were reported to be over 0.70, which was judged as being consistent.[9] The Dutch version of the AIMS2 (Dutch AIMS2)[10] and the Swedish version of the AIMS2 (Swedish AIMS2)[11] had somewhat lower αs for the scale on social activities, i.e., 0.66 and 0.68, respectively. The Japanese AIMS2 also showed high consistency on this scale ($\alpha = 0.84$). On the other hand, on the Japanese AIMS2, the test–retest reliability for social activities was relatively low (0.75), compared with the other scales. While the US AIMS2 showed low reliability for work (0.78)[9] and the Swedish AIMS2 for walking,[11] the Japanese AIMS2 did not. The French version reported low reproducibility for depression,[4] but the Japanese AIMS2 showed good test–retest reliability on this scale. With some variations in reliability across these different versions, they all attained satisfactory levels for practical use.

Within-scale principal component factor analysis revealed that each of the Japanese AIMS2 scales loaded on a single major factor, which explained more than 60% of the scale variance. This finding coincided with the result of the study by Meenan et al.,[9] indicating good scale reliability. Although the overall reliability of the AIMS2 scales was considered satisfactory, the proportion of the variance explained by the principal factor was smallest on the scale for social activities (62.0%) in our study. Results from the US AIMS2 indicated that the variance explained by the principal factor was small for social activities (50%) among RA patients. It was also reported that the variance explained by the principal factor was smaller for this scale among certain ethnic groups.[21] On the Dutch AIMS2, the scale for social activities consisted of two factors.[10] The social activities scale may need special attention when applying the AIMS2 to some populations.

Reliability of satisfaction, attribution, and priority sections

The reliability of the satisfaction scales of the Japanese AIMS2 is considered to be good based on the measures of the test–retest statistics, which were more than 0.75, except for the scale for satisfaction with pain (0.63). The α coefficient for the satisfaction items as a scale was 0.95, which is larger than that reported by Meenan et al.[9] The intraclass correlation for this single-scale measure on satisfaction was also comparable to that of the US AIMS2. It was found that the 12 satisfaction items loaded on two major factors. This indicates that patients' satisfaction with their health status can be determined by a combination of two different components. Further psychometric study is important to elucidate these components, since understanding the psychological structure of patients' satisfaction with their health status is important in improving patients' quality of life.[22]

The intraclass correlation coefficients of the six-scale attribution scales were more than 0.68, while the κs of the dichotomous problem designation were more than 0.64. Overall, the Japanese AIMS2 had correlation coefficients and κs for the attribution scales which were larger than those reported by Meenan et al.,[9] suggesting considerable reliability in these scales. Although the US AIMS2 reported relatively small intraclass correlation on support from family and friends (0.35) and a low κ on dexterity (0.57), the Japanese version did not have these properties. In contrast to the satisfaction scales, the 12 attribution items loaded on a single major factor.

The choice of priority areas for health status improvement was more or less similar to the results reported in the US AIMS2 and the Dutch AIMS2. Arthritis pain was the area most often designated for improvement in the US and Dutch studies, as well as in the Japanese AIMS2: 62% in the US AIMS2,[9] 74% in the Dutch AIMS2,[10] and 46% in the Japanese AIMS2. Walking and bending was the second area most often chosen in these three versions of AIMS2. On the other hand, while hand and finger function ranked third in both the US and the Dutch AIMS2, mobility level was designated third in the Japanese AIMS. Improvement in mobility was frequently chosen in the Dutch AIMS2, but not in the US AIMS. The difference in this scale across countries may reflect the difference in subjects' social environment, since mobility status can be affected by both subjects' physical capacity and the social resources available to the disabled.

The reproducibility of priority selection in the Japanese AIMS2 was also considerable, as all of the κs exceeded 0.50.

Kappa statistics ranged between 0.51 and 0.89: agreement on the two tests was considered moderate or substantial for all scales.[23]

Validity of the Japanese AIMS2 scales

The validity of the Japanese AIMS2 scale scores was assessed using internal standards: the relationship of the AIMS2 scale scores to the subject's responses to other items in the questionnaire was examined. The results of this study were comparable to those reported for the other versions of the AIMS2. Subjects who answered that they had a problem in a particular health area had a consistently worse health status in that area. Except for social activities and work, subjects who designated a particular health area as one of their three priority areas for improvement also had a consistently worse health status in that area. The absence of a significant difference in the AIMS2 scores on work between subjects who designated work as a priority area and those who did not was commonly seen in the US AIMS2,[9] the Dutch AIMS2,[10] and the Swedish AIMS2.[11] The same relationship (absence of difference) was also seen for social activities in the latter two versions. This indicates that subjects' prioritization of these health aspects could be determined more by factors other than their functional status, such as other physical conditions, psychological status, or social environments.

At the subgroup level, the relationship between the AIMS2 scores and the priority areas was not always consistent. On household tasks, there was no difference in the AIMS2 score by priority designation in males. Household tasks are commonly assigned to women in Japan, but not to men. The absence of an AIMS2 score difference by priority designation in males may be attributable to this sociocultural context: male priority for household tasks may be determined more by the subject's lifestyle and family resources than by the subject's physical abilities.[24]

On the other hand, the difference in the AIMS2 score on social activities by priority was seen only among subjects without jobs: subjects without any form of job were likely to score worse in social activities than those with jobs ($P < 0.001$). It can be inferred that the former may also have fewer opportunities for socialization through performing their job tasks than the latter. Therefore, the priority designation of social activities by the subjects without jobs may be more sensitive to their actual participation in social activities. Psychological demands for social activities among the subjects with jobs may be partly fulfilled by their job participation.[25] Although these results at the subgroup level do not necessarily erode the validity of the Japanese AIMS2 scores, one should be careful when applying the questionnaire to these groups.

Furthermore, the correlations of the AIMS2 scores with either the satisfaction scores or the attribution scores were examined to check whether there was any inconsistent or inexplicable relationship among them. The AIMS2 scores were positively correlated with the satisfaction scores for all the AIMS2 scales ($P < 0.001$). The correlation coefficients between them ranged between 0.52 and 0.79, which are comparable to those reported in the US AIMS2 (0.50–0.69)[9] and the Dutch AIMS2 (0.45–0.70).[10] They indicate that subjects who were less satisfied with a particular health area were likely to have a worse health status in that area. The correlation coefficient between the overall satisfaction scale score and the single-item measure of arthritis impact was 0.63, which is again comparable to those reported in the US AIMS2 (0.63) and the Dutch AIMS2 (0.55).

The AIMS2 scores were also positively correlated with the attribution scores for the 12 AIMS2 scales ($P < 0.001$). The smallest correlation coefficient, observed on support from family and friends, suggests that subjects' attribution of poor status in this area can be attributed to factors other than arthritis. Perception of support needs and of their fulfilment is closely associated with subjects' coping behaviors, and therefore can vary greatly among individuals.[26–28] The roles of family care and social support in the management of RA patients remain to be studied.[29]

In this study, the validity of the questionnaire was assessed by internal standards, based on the premise that if several questions measure the same or related things, then they should be highly correlated with one another.[30,31] Validation of the Japanese AIMS2 by external standards has also been in progress. Preliminary reports have indicated that many of the Japanese AIMS2 scale scores correlate well with other measures of physical functions, pain (e.g., visual analog scale, face scale),[32] mental status, general health status (e.g., mHAQ),[33] clinical status (e.g., grip strength), and laboratory tests (e.g., ESR, CRP, Hb, duration of morning stiffness, and Lansbury activity index).[34] The dimensional structure of the original Japanese AIMS was examined through a confirmatory factor analysis.[14]

Utilization of the AIMS2

The expanded and revised AIMS2 includes many new sections, such as those on satisfaction and attribution. Incorporating behaviormetric and psychometric sections in a comprehensive questionnaire opens up a variety of possibilities for arthritis research. Exploring the relationships among AIMS2 scores, subjects' satisfaction, and their own assessment of overall well-being could elucidate important factors which could affect (or be affected by) their coping behaviors and hence their quality of life.[35–37] The combination of the AIMS2 with other measurement scales could also advance our understanding of the multiple dimensions of health status in patients with arthritis.[38–41] Furthermore, the relationship of the various AIMS2 scale scores with therapeutic measures has also been under investigation, along with the sensitivity assessment of the AIMS2 using longitudinal data.[41–43] The revised AIMS2 is a comprehensive questionnaire which has a long list of questions and could take a long time to answer. The development of shorter versions is in progress in many countries for convenient clinical use.[44]

The findings of this study substantially resemble those reported by researchers in other countries. This similarity could be attributable to the properties of the AIMS2 themselves as well as to the common characteristics of RA patients across countries. International collaborative studies would be expected to shed light on the commonalities and differences in the health status of RA patients across countries, and advance our understanding of possible strategies to improve their quality of life.

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References

1. Meenan RF, Gertman PM, Mason JH. Measuring health in arthritis: the arthritis impact measurement scales. Arthritis Rheum 1980;23:146–52.
2. Meenan RF, Gertman PM, Mason JH, Funaif R. The arthritis impact measurement scales: further investigations of a health status measure. Arthritis Rheum 1982;25:1048–53.
3. 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.
4. Samplis JS, Pouchot J, Beaudet F, Carette S, Gutkowski A, Harth M, et al. Arthritis impact measurement scales: reliability of a French version and validity in adult Still's disease. J Rheumatol 1990;17:1657–61.
5. Bijsma J, Huiskes C, Kraaimaat FW, Vanderveen MJ, Huber-Bruning O. Relation between patients' own health assessment and clinical and laboratory findings in rheumatoid arthritis. J Rheumatol 1991;18:650–3.
6. Fitzpatric R. The measurement of health status and quality of life in rheumatoid arthritis. Bailliere's Clin Rheumatol 1993;7:297–317.
7. Abello-Banfi M, Cardiel MH, Ruiz-Mercado R, Alarcon-Segovia D. Quality of life in rheumatoid arthritis: validation of a Spanish version of the arthritis impact measurement scales (Spanish AIMS). J Rheumatol 1994;21:1250–5.
8. Archenholz B, Bjelle A. Evaluation of a Swedish version of the arthritis impact measurement scales (AIMS). Scand J Rheumatol 1995;24:64–8.
9. 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.
10. 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.
11. Archenholz B, Bjelle A. Reliability, validity, and sensitivity of a Swedish version of the revised and expanded arthritis impact measurement scales (AIMS2). J Rheumatol 1997;24:1370–7.
12. Hashimoto A, Sato H, Kondo H, Ishihara Y, Akizuki M, Kutsuna T, et al. Results of the QOL study in RA patients with the Japanese AIMS2 and the questionnaires developed by the QOL research group (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1992–1993. Tokyo: Ministry of Health and Welfare; 1993. pp. 235–42.
13. Hashimoto A, Sato H, Kondo H, Ishihara Y, Akizuki M, Kutsuna T, et al. Development and reliability of the revised Japanese AIMS2 (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1993–1994. Tokyo: Ministry of Health and Welfare; 1994. pp. 184–7.
14. Sato H, Araki S, Hashimoto A, Kondo H, Ishihara Y, Akizuki M, et al. The validity and reliability of a Japanese version of arthritis impact measurement scales in patients with rheumatoid arthritis (in Japanese). Ryumachi (J Jpn College Rheumatol) 1995;35:566–74.
15. Kelley WN, Harris ED, Ruddy S, Sledge CB. Textbook of rheumatology. 2nd ed. Vol 1. Philadelphia (PA): WB Saunders; 1985. pp. 914–48.
16. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrica 1951;16:297–334.
17. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. Psycho Bull 1979;86:420–8.
18. Donoghue JR, Collins LM. A note on the unbiased estimation of the intraclass correlation. Psychometrica 1990;55:159–64.
19. Rae G. The equivalence of multiple rater kappa statistics and intraclass correlation coefficients. Educ Psychol Measure 1988;48:367–74.
20. Stata Corporation. Stata Statistical Software: release 6.0. College Station (TX): Stata Corporation; 1999.
21. Coulton CJ, Hyduk CM, Chow JC. An assessment of the arthritis impact measurement scales in 3 ethnic groups. J Rheumatol 1989;16:1110–5.
22. Pollock SE, Christian BJ, Sands D. Responses to chronic illness: analysis of psychological and physiological adaptation. Nurs Res 1990;39:300–4.
23. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33:159–74.
24. Potts MK, Brandt KD. Evidence of the validity of the arthritis impact measurement scales. Arthritis Rheum 1987;30:93–6.
25. Fifield J, Reisine ST, Grady K. Work disability and the experience of pain and depression in rheumatoid arthritis. Soc Sci Med 1991;33:579–85.
26. Ravenson TA, Felton BJ. Disability and coping as predictors of psychological adjustment to rheumatoid arthritis. J Consult Clin Psychol 1989;57:344–8.
27. Clough DH. The effects of cognitive distortion and depression on disability in rheumatoid arthritis. Res Nurs Health 1991;14:439–46.
28. Ravenson TA, Schiaffino KM, Majerovitz SD, Gibofsky A. Social support as a double-edged sword. Soc Sci Med 1992;33:807–13.
29. Krol B, Sanderman R, Suurmeijer T. Social support, rheumatoid arthritis and quality of life: concepts, measurement and research. Patient Educ Couns 1993;20:101–20.
30. Walsh WB, Betz NE. Tests and assessment. Englewood Cliffs (NJ): Prentice Hall; 1985. pp. 46–73.
31. Fowler FJ. Improving survey questions: design and evaluation. Thousand Oaks (CA): Sage; 1995. pp. 138–55.
32. Ishihara Y, Konno T, Hiki K. Effects of rehabilitation in rheumatoid arthritis (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1993–1994. Tokyo: Ministry of Health and Welfare; 1994. pp. 198–200.
33. Kutsuna T. Study on the QOL among RA patients (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1992–1993. Tokyo: Ministry of Health and Welfare; 1993. pp. 252–4.
34. Sato H, Hashimoto A, Kondo H, Ishihara Y, Akizuki M, Kutsuna T, et al. Assessment of the Japanese AIMS2 with the relationships between the AIMS2 scores and various laboratory tests (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1993–1994. Tokyo: Ministry of Health and Welfare; 1994. pp. 179–83.
35. Blalock SJ, Vellis BM, Vellis RF, Sauter SH. Self-evaluation processes and adjustment to rheumatoid arthritis. Arthritis Rheum 1988;31:1245–51.
36. Lankveld W, Naring G, Staak C, Bosch PP, Putte L. Stress caused by rheumatoid arthritis: relation among subjective stressors of the disease, disease status and well-being. J Behav Med 1993;16:309–21.
37. Sato H, Araki S, Hashimoto A, Moroi Y, Kondo H, Ishihara Y, et al. Quality of life, subjective health status and health and life satisfaction in rheumatoid arthritis (in Japanese). Jpn J Pub Health 1995;42:743–54.
38. Anderson KO, Bradley LA, Young LD, McDaniel LK, Wise CM. Rheumatoid arthritis: review of psychological factors related to etiology, effects and treatment. Psychol Bull 1985;98:358–87.
39. Spiegel JS, Leake B, Spiegel TM, Paulus HE, Kane RL, Ward NB, et al. What are we measuring?: an examination of self-reported functional status measures. Arthritis Rheum 1988;31:721–8.
40. Young D. Psychological factors in rheumatoid arthritis. J Consult Clin Psychol 1992;60:619–27.

41. Fitzpatric R, Ziebland S, Jenkinson C, Mowat A, Mowat A. A comparison of the sensitivity to change of several health status instruments in rheumatoid arthritis. J Rheumatol 1993;20:429–36.
42. Bendtsen P, Hoernquist JO. Change and status in quality of life in patients with rheumatoid arthritis. Qual Life Res 1992;1:297–305.
43. Sato H, Hashimoto A, Kondo H, Ishihara Y, Akizuki M, Kutsuna T, et al. Changes in quality of life by therapeutic measures in patients with rheumatoid arthritis: a preliminary report (in Japanese). In: Ministry of Health and Welfare. Report of the grant study on chronic diseases, rheumatoid arthritis 1994–1995. Tokyo: Ministry of Health and Welfare; 1995. pp. 179–86.
44. Ren XS, Kazis L, Meenan RF. Short-form arthritis impact measurement scales 2: tests of reliability and validity among patients with osteoarthritis. Arthritis Care Res 1999;12:163–71.