

# Comparing the AUSCAN Osteoarthritis Hand Index, Michigan Hand Outcomes Questionnaire, and Sequential Occupational Dexterity Assessment for Patients with Rheumatoid Arthritis

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**ABSTRACT.** *Objective.* The Australian Canadian Osteoarthritis Hand Index (AUSCAN), Michigan Hand Outcomes Questionnaire (MHQ), and the Sequential Occupational Dexterity Assessment (SODA) are assessments of hand function. Investigation of psychometric properties, administration, acceptability, and content of an assessment add strength to the findings of research and treatment. We evaluated the validity and reliability of the AUSCAN, MHQ, and the SODA for assessing disability in patients with rheumatoid arthritis (RA).

*Methods.* Sixty-two patients with RA completed the AUSCAN (visual analog scale version), the MHQ, and the SODA. Seventeen patients repeated the assessments within one week.

*Results.* The assessments recorded high variability within the sample of 62 patients with RA. The AUSCAN and MHQ provided patient and context-specific information, while the SODA provided more impairment information that could be readily compared between patients. Seventeen patients were tested twice within 5 days, showing good reliability of all assessments. Unlike the MHQ, AUSCAN and SODA do not provide information about individual hands or hand dominance. The physical function scales of the AUSCAN and the SODA were related ( $r = 0.81$ ), and the AUSCAN and MHQ pain scales were related ( $r = 0.68$ ).

*Conclusion.* Clinicians and researchers should decide whether impairment, ability, or handicap outcome is the goal of assessment, and whether bilateral function or the function of one hand is of interest before choosing a hand assessment. The AUSCAN and MHQ are valid and reliable for assessment of hand disability in patients with RA, and they allow the patients to answer questions about their home environment. The SODA is also valid and reliable for assessing disability in a clinical situation that cannot be generalized to the home. (J Rheumatol 2004;31:1996–2001)

## Key Indexing Terms:

RHEUMATOID ARTHRITIS

HAND

QUESTIONNAIRES

Interventions for patients with rheumatoid arthritis (RA) aim to reduce the symptoms and the damage caused by the disease. Hand surgery and occupational therapy aim to reduce pain, increase function, and prevent deformity in the hands of people with RA<sup>1,2</sup>.

The International Classification of Function (ICF) describes function as discrete ability to perform tasks, as well as an individuals' participation in activities within their own

environment<sup>3</sup>. Hand assessments most often assess the ability to perform discrete tasks. This research investigates assessments of hand ability.

Two pilot studies led to this current research: First, to understand the experiences of patients with RA who have undergone metacarpophalangeal arthroplasty we conducted patient interviews about changes due to their surgery<sup>4</sup>. Patients stated they had less difficulty and less pain performing some tasks, but were rarely able to commence new activities despite increased hand function following surgery; second, we appraised hand assessments designed for patients with arthritis. The assessments were critically evaluated using the criteria of Bombardier and Tugwell<sup>5</sup> and Andresen<sup>6</sup>. The Australian Canadian Osteoarthritis Hand Index (AUSCAN), an instrument that had acceptable psychometric properties, allowed patients to describe pain and difficulty with activities of daily living (ADL) and was brief to complete and to score. Because no gold standard assessment for patients with RA has been identified, the AUSCAN index was compared with assessments of hand function that have been described in the literature for patients with RA.

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The AUSCAN<sup>4</sup> is a patient-rated questionnaire with 15 items in 3 scales, designed to measure the status of hand function. It is not a measure of body structures and functions described by the ICF, such as hand motion or strength.

One version of the AUSCAN contains a 10 cm visual analog scale; the other version contains Likert scales. Patients rate their pain at rest and during 4 activities (“no pain” to “extreme pain”), the severity of morning stiffness (“no stiffness” to “extreme stiffness”), and the level of difficulty in performing 9 activities of daily living over the last 48 h (“no difficulty” to “extreme difficulty”).

Items for the AUSCAN were identified from interviewing physiotherapists, rheumatologists, an orthopedic surgeon, and patients with osteoarthritis (OA). Items were then reduced by eliminating those with lowest prevalence, recurrence, and importance ratings<sup>7</sup>. AUSCAN scores were compared against scores from the Health Assessment Questionnaire (HAQ) physician and patient-rated functional indices, and measures of hand strength and morning stiffness. The results of the AUSCAN pain, function, and stiffness scales were in agreement with the pain, function, and stiffness scales of these assessments<sup>8,9</sup>.

We investigated whether there are benefits in using the AUSCAN over a similar assessment for patients with RA.

## MATERIALS AND METHODS

Ethical approval was obtained from the Repatriation General Research and Ethics Committee, the Royal Adelaide Hospital Research Ethics Committee, and the Flinders Medical Centre Clinical Research Ethics Committee. Rheumatologists in these hospitals introduced the study to their patients, and the interested patients contacted the researcher. For inclusion they had to have been adults diagnosed with RA in accordance with American Rheumatology Association criteria<sup>10</sup>, and had to be mentally able to consent and participate in the study. Consent was obtained from all patients according to the Declaration of Helsinki. Patients were excluded if they had a hand injury or condition other than RA.

**Content and construct validation.** In the absence of a gold standard assessment of hand function in RA, 2 other instruments that have undergone psychometric testing with RA patients were sought for comparison with the AUSCAN (convergent construct validity). These had to have been developed for patients with arthritis, explore more than one dimension of function, and be patient-rated like the AUSCAN. The assessments chosen were the Michigan Hand Outcomes Questionnaire (MHQ) and the Sequential Occupational Dexterity Assessment (SODA). The description, development, and scoring of these assessments are summarized in Table 1. The main differences between them are that the MHQ assesses aspects of the hand other than disability: patient satisfaction, hand esthetics, and the severity, duration and behavioral and emotional consequences of pain. The SODA includes standardized tasks that are performed and assessed while the clinician assesses the patient's dexterity. Steinbrocker classifications were also collected<sup>11</sup>.

**Reliability.** Seventeen volunteers repeated the assessments within 5 days. Changes in their status were recorded. The differences between test and retest were plotted<sup>12</sup> to identify any systematic biases.

**Statistical analysis.** All statistics were calculated using SPSS (11.5) and Microsoft Excel. Frequencies, ranges, and tests of normality<sup>13</sup> were calculated for each item, scale, and overall questionnaire.

Cronbach's alpha was calculated for the AUSCAN pain and physical function scales to determine their internal consistency. The smallest detectable difference ( $\delta$ ) was calculated using methods described by Lassere, *et al*<sup>14</sup> and by calculating the upper confidence limit of the differences

between tests 1 and 2. Intraclass correlation (ICC) measures were calculated for each scale and overall score.

Pearson correlations were performed to determine the convergent construct validity between AUSCAN, MHQ, and SODA scales of pain and of physical function.

## RESULTS

**Sample.** Eighty-eight patients from 3 hospitals were invited into the study via a letter from their rheumatologist, and 65 volunteered to participate. One woman with severe Dupuytren's contracture was excluded, one spoke only limited English, and one was deaf, leaving 62 volunteers. All volunteers attempted all assessments. There were 17 men and 45 women aged from 24 to 90 years (mean age 65). All were right-handed, with RA affecting both hands, and their Steinbrocker classifications were between II and III. One patient was class IV, having had a leg amputation secondary to diabetes. Seventeen patients repeated the assessments within 5 days.

**General utility.** All patients were able to complete the AUSCAN in less than 7 minutes. Scores ranged widely within each of the 3 AUSCAN scales (Table 2). None of the items, scales, or overall scores was normally distributed within the sample. Ceiling effects on individual physical function items appeared when 12 patients marked “extreme difficulty” for the tasks involving heavy lifting. This means that their scores could not get worse even if their function deteriorated.

**Convergent validity between the AUSCAN, MHQ, and SODA.** Scores from each scale of the AUSCAN and MHQ were compared, and significant ( $p < 0.05$ ) correlations are listed below. The AUSCAN and MHQ pain scales correlated ( $r = 0.68$ ,  $p < 0.001$ ). The AUSCAN ADL physical function scale correlated with the MHQ ADL physical function scale ( $r = 0.8$ ,  $p < 0.001$ ).

**Reliability.** Seventeen patients completed all assessments in less than one week, except 6 patients whose homes did not have the correct chairs and tables for administration of the SODA. Retest values were within 11% of the initial test value for all assessments. Intraclass correlation scores and upper confidence limits of the differences between tests 1 and 2 are presented in Table 2.

## DISCUSSION

We investigated the validity and reliability of the AUSCAN, MHQ, and SODA for patients with RA. The appropriateness of content was evaluated by investigating the manner in which these assessments identified, tested, and reduced individual items. All 3 assessments were developed through consultation, evaluation of importance, and trial with patients with RA. The aim of this research was to investigate assessments of physical function or ability. The MHQ is more than a disability assessment; it contains demographic and work history questions. Unlike the SODA and AUSCAN, which relate the effect of pain and function, the MHQ allows some description of emotional and behavioral effects of pain.

Table 1. Description, content, and development of the AUSCAN Osteoarthritis Hand Index, the Michigan Hand Outcomes Questionnaire, and the Sequential Occupational Dexterity Assessment.

	The AUSCAN Osteoarthritis Hand Index	The Michigan Hand Outcomes Questionnaire	Sequential Occupational Dexterity Assessment
Purpose	To evaluate dimensions of hand status for OA trials	To evaluate the patient's perception of one/both hands; function, appearance, pain, satisfaction. Scores for each hand may be calculated or the 2 scores can be averaged for a bilateral score	To evaluate patient's dexterity, and patient's perception of difficulty and pain with each task
Description & scoring	15 item patient-completed questionnaire. 3 scales: pain, morning stiffness, and difficulty with function. Lower scores indicate better status. The questions are about a patient's current pain or capacity to perform tasks. The 3 scales: 1. Hand pain 5 VAS 0–100 each = 0–500 2. Morning stiffness 1 VAS = 0–100 3. Physical function with washing, dressing and meal preparation; 9 VAS 0–100 each = 0–900 Available in 2 formats: 100 mm horizontal VAS or Likert scale (none, mild, moderate, severe, extreme). Lower scores indicate better status <sup>15</sup>	67 question patient-completed questionnaire. Items are specific to the right or left hand, except in the pain and work subscales where both hands are answered for in each question. 6 domains of overall hand function: 1. Overall hand function 2. Physical function with ADL tasks 3. Pain 4. Work performance 5. Esthetics 6. Satisfaction with their hand function The 6 scale scores are summed a possible 100. Each question has 5 Likert scale answer options. Higher scores indicate better status.	4 unilateral and 8 bilateral ADL tasks for completion by clinician and patient. 3 scales with ordinal answers: 1. Ability: clinician rates patient's performance; able/able in an alternative way/not able to complete the task. Range 0–72 2. Physical function: Patient rates level of difficulty with the task; not/somewhat/very difficult. Range 0–36 3. Pain: pain with the task/no pain Lower pain score, higher ability, and physical function scale score = better status. Range: 0–18
Timeframe	Preceding 48 h	Preceding week (work scale: preceding 4 wks)	Answered for the time of the assessment only
Identification of content	Items identified by patients with OA, rheumatologists, physiotherapists, and a hand surgeon <sup>7, 8</sup> . Items ranked by importance on a 5 point scale, those > 2 were retained	Items were identified from existing questionnaires and by patients with hand disorders (some of the patients had RA) <sup>18</sup>	Items identified from existing ADL questionnaires and tried by patients with RA. Tasks patients considered most important were chosen for the SODA <sup>19</sup>
Construct validity	AUSCAN scales show significant relationships (Pearson correlation) with similar scales of the Functional Index for Hand OA <sup>7</sup>	Pain questions from the MHQ were correlated ( $r = 0.79$ , $p < 0.05$ ) with pain questions from the SF-12 <sup>18</sup>	SODA scores correlated with the Sollerman Hand Function Test ( $r = 0.79$ ) in a sample of 25 patients with RA <sup>20</sup>
Responsiveness	The AUSCAN was responsive to changes in hand status of patients ( $n = 44$ ) with OA, undergoing medication changes. Both versions (VAS and Likert) of the AUSCAN were tested	92 patients with all types of hand disorders were tested 6 mo after the start of treatment, and asked if change occurred. 85–92% rated change in each scale, except esthetics (65%)	The short version of the SODA has 6 items, chosen by their responsiveness to change <sup>17</sup> . 53 out of 74 patients (RA) showed significant change 6 mo after surgery, using the SODA

VAS: visual analog scale, ADL: activities of daily living.

No assessments allowed the patient to describe the importance of the specified activities or to add activities important to them. This was apparent when one patient left the question regarding “difficulty of washing hair” (MHQ), and joked that he had no hair! If a task is not performed by the patient completing the AUSCAN, the user guide<sup>15</sup> suggests that the irrelevant task be supplemented with a similar task. Substitution of items could reduce interpatient comparability of the questionnaire.

The different forms of scoring between the 3 assessments (continuous, nominal, and ordinal) forced the use of nonparametric correlation methods, which may have reduced power of the correlation. However, it appears these patient-rated methods (using test equipment or a questionnaire) and clinician and patient-rated methods yield similar physical function results.

If standardized tasks yield results similar to physical func-

tion questions, what is the value of buying standardized equipment, learning to administer the assessments, and taking the time to administer them? There are arguments for both methods. The conditions of a standardized test are controlled and therefore better allow for between-patient comparisons. The standardized test ensures that patients perform each task and rate it immediately, which ensures completion of the task even if it is not relevant to the patient, also reducing recall bias. The questionnaire is easy to administer, no equipment is required, and it takes minimum time other than for scoring. The questionnaire allows patients to describe discrete timeframes, which fluctuate, reflecting the nature of RA; while the standardized assessment is scored for the time of the assessment only. The administration and timeframes of the assessments change the content of the assessments. Because the AUSCAN and MHQ are completed by the patient within the past week or past month (depending upon the scale), the con-

Table 2. Characteristics of the AUSCAN Osteoarthritis Hand Index, the Michigan Hand Outcomes Questionnaire, and the Sequential Occupational Dexterity Assessment in a sample of 62 patients with RA.

	The AUSCAN Osteoarthritis Hand Index	The Michigan Hand Outcomes Questionnaire	Sequential Occupational Dexterity Assessment
Construct Validity	AUSCAN, MHQ, or SODA scores were not related to patient's age/duration of RA. AUSCAN and SODA physical function scales related ( $r = 0.81$ ). AUSCAN and MHQ pain scales related ( $r = 0.68$ )		
Variability	1. Pain (0–500) range = 0–447 mean = 190 (SD) 120 2. Physical Function (0–900) range = 55–832 mean = 514 (SD) 226 3. Morning stiffness (0–100) range = 0–97 mean = 40 (SD) 30	1. Hand function (5–25), range = 5–24, mean = 13 (3.5) 2. Unilateral ADL (5–25) range = 5–24, mean = 13.5 (SD) 5.6 Bilateral ADL, (7–35) range = 9–26, mean = 18 (SD) 6.6 3. Work (5–25), range = 5–20, mean = 16 (SD) 4.9 4. Pain (0–24), range = 0–24, mean = 15 (SD) 5.3 5. Esthetics (4–20), range = 5–20, mean = 3.5 (SD) 3.9 6. Satisfaction (6–30) range = 6–27, mean = 17 (SD) 5.6	1. Ability (0–72) range = 9–72 mean = 53 (17) 2. Physical Function (9–72), range = 11–38 28 mean = 53 (6.4) 3. Pain (0–18) range = 0–14 mean = 2.7 (0.5)
Distribution	Floor and ceiling effects observed with 12 physical function items and some scales No item, scale, or overall score showed a perfectly normal distribution, reflected by distribution graphs and skewness values < 2 (toward the lower range of physical function) and kurtosis values < 1.5, indicating a wide spread of scores	Floor and ceiling effects observed with some items and all scales	Floor and ceiling effects observed in some items
Internal consistency	Alpha values for: Pain scale = 0.92 Physical Function scale = 0.93. The entire AUSCAN had an alpha of 0.94	Alpha values for: Hand function = 0.88 Unilateral ADL = 0.94 Bilateral ADL = 0.88 Work = 0.95 Pain = 0.75 Esthetics = 0.88 Satisfaction = 0.92	Alpha values for: Ability = 0.91 Physical function = 0.9 Pain = 0.8
Reliability, $n = 17$	ICC for scales = 0.92–0.93, overall ICC = 0.94. Upper confidence limit for the differences between test 1 and 2 = 79 points out of 1500	ICC for scales = 0.58–0.97, overall ICC = 0.95. Upper confidence limit for the differences between test 1 and 2 = 5 points out of 100	ICC for scales = 0.88–0.89, overall ICC = 0.89. Upper confidence limit for the differences between test 1 and 2 = 17 points out of 108
Utility	Completed in 4–7 min, scored in < 5 min. The VAS version takes longer as each VAS must be measured before scales are summed	Completed in 12–20 min. Scored in 15–20 min manually	Completed by patients and rater in 25 min, scored < 2 min. Instruction manual must be purchased, test items are commercially available
Acceptance by patients (no. of patients)	Questions didn't represent function over the time frame because of fluctuations (30) Wanted to answer one question for each hand (2) Some ADL physical function scale items were not relevant to patients (4) Unsure how to indicate "can't do" a task (12)	One hand hurt more than the other, had to average the pain in her hands (1) Questions didn't represent function over the time frame because of fluctuations (30) ADL physical function items not relevant (1) Esthetics questions were confusing (2) Answers did not fit esthetics questions (2) Misunderstandings on the esthetics scale (2)	Patient did not use that type of telephone (15) Patient did not use that type of coin (45) Patient did not use that type of jug (15) Jug problems from shoulder not hand (2) Patient never fills the jug so much (15) Patient did not use that type of tube (17) Patient did not use that/any type of toothpaste (27)
Information provided	In the patient's own environment: 1. Pain with uni/bilateral ADL tasks 2. Difficulty with uni/bilateral ADL tasks 3. Severity of morning stiffness	In the patient's own environment: 1. Function of left and right hands 2. Difficulty with left and right and bilateral ADL 3. Pain severity/duration/emotional/behavioral 4. Effect of hand function on occupation 5. Appearance of left and right hand 6. Satisfaction with left and right hand function 7. Hand dominance, which hand is worse	In the clinic environment: 1. Whether patients can perform a standardized task in a prescribed manner 2. Pain with standardized uni/bilateral ADL tasks 3. Patient's perception of difficulty with standardized uni/bilateral ADL tasks

VAS: visual analog scale, ADL: activities of daily living.

tent relates to their own life and their own environment. This is described by the ICF<sup>3</sup> as participation within the person's own situation, which takes into account personal and environmental characteristics. The SODA does not assess function within a patient's context; rather, it assesses the execution of

an activity and any impairment in dexterity. The results of the SODA may be compared between patients because the tasks are standardized. AUSCAN and MHQ results can only be compared between patients in the knowledge that each ADL task will be performed differently.



The equipment prescribed by the SODA was outdated, but standardized equipment was used in this study. For example the telephone style was no longer available, and the coins were no longer in circulation. The diameter and design of the water jug specified in the SODA was very hard to find, suggesting that it is not commonly used in Australia.

Of the 3 assessments, the MHQ is greatest for differentiating patient's ability, satisfaction, and the specific problems with their hands and between the hands. This may be of value when a unilateral intervention such as surgery is performed. The MHQ allows patients to describe functional changes in both hands separately and also in 7 bilateral tasks. The SODA also allows for separate evaluation of each hand during bilateral tasks, but does not specify the role each hand plays in the tasks. The AUSCAN allows for each task, whether unilateral or bilateral, to be evaluated in one VAS. The value of assessing each hand separately is uncertain, when many ADL tasks are bilateral. Further, people with RA often compensate for reduced strength and dexterity by using both hands for normally one-handed tasks such as turning knobs and lifting cups, as was written on 3 AUSCAN questionnaires. If the examiner wants to know why a task is difficult, or not possible, questions must be added to the SODA, MHQ, and AUSCAN. None of these indicate the cause of disability.

All of the alpha values were high for scales within these assessments, even though the variability in hand function in this sample was large (Table 2). This means that despite very high or very low scores, within-patient scores were consistent. The high alpha suggests that some AUSCAN, MHQ, and SODA items measure the same constructs, and could predict the outcome of other items. The overall alpha suggests that the 3 AUSCAN scales are not measuring discrete aspects of hand function. The AUSCAN items could be reduced and the scales merged without losing information.

Variability and reliability calculations from the assessments allowed the calculation of the smallest detectable difference. This does not mean that any change of greater magnitude is clinically important, only that it is likely to represent real change, not measurement error. Clinically important differences and responsiveness to change of the AUSCAN and MHQ are currently being calculated in a longitudinal study. The SODA is reported to be responsive to change in patients with RA<sup>16,17</sup>.

#### Recommendations for changes to the assessments

1. The SODA scoring system could be reformulated to:
  - (i) present more detailed options to grade the quality of the patient's performance;
  - (ii) define the hand that they used; and
  - (iii) state the reason for their inability to perform the task
2. The SODA requires standardization with Australian coins and current telephones, both touch-phone and hand-held units
3. The AUSCAN scoring of "unable to do" items requires clarification. A separate box for "unable to do" or marking 100 as "unable to do" are suggested

4. Comparable options for ADL tasks could be offered for AUSCAN and MHQ items for patients who do not perform the given tasks
5. The MHQ pain scale could include options for both hands in questions 1 and 2

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