
Appendix 1: ABILHAND (Manual Ability Measure)

Answers to the questions

0=Impossible

1=Difficult

2=Easy

N/A=Activities not attempted in last 3 months.

Questions: How difficult are the following activities?

1. Picking-up a can
2. Handling a stapler
3. Writing a sentence
4. Using a screwdriver
5. Screwing a nut on
6. Replacing a light bulb
7. Cutting meat
8. Peeling potatoes with a knife
9. Taking a coin out of the pocket
10. Sharpening a pencil
11. Filing one's nails
12. Handling a four-color ballpoint pen with one hand
13. Grasping a coin on a table
14. Wrapping up gifts
15. Turning a key in a keyhole
16. Peeling onions
17. Brushing one's hair
18. Tearing open a pack of chips
19. Turning off a tap
20. Fastening the zipper of a jacket
21. Opening a screw-topped jar
22. Hammering a nail
23. Fastening a snap (jacket, bag, ...)
24. Threading a needle
25. Taking the cap off a bottle
26. Cutting one's nails
27. Combing one's hair

ABILHAND was originally developed using the Rasch measurement model. It allows ordinal scores to be converted into linear measures located on a unidimensional scale. The raw ordinal data is converted to linear measures expressed in logits (log-odds probability units). The higher the logit number, the greater the patient's perceived ability. Activities not commonly performed in the previous 3 months were not scored and were encoded as missing. It was validated in rheumatoid arthritis, systemic sclerosis, and chronic stroke.

References

1. Penta M, Thonnard JL, Tesio L. ABILHAND: a Rasch-built measure of manual ability. *Arch Phys Med Rehabil.* 1998;79:1038-42.
2. Durez P, Fraselle V, Houssiau F, Thonnard JL, Nielens H, Penta M, et al. Validation of the ABILHAND questionnaire as a measure of manual ability in patients with rheumatoid arthritis. *Ann Rheum Dis.* 2007; 66: 1098-105.

Appendix 2: Boston Questionnaire (Brigham and Women's Carpal Tunnel Questionnaire/The Carpal Tunnel Syndrome Instrument)

Questionnaire for Assessment of Severity of Symptoms and Functional Status

Symptom Severity Scale

The following questions refer to your symptoms for a typical 24-h period during the past 2 weeks (circle one answer to each question).

How severe is the hand or wrist pain that you have at night?

1. I do not have hand or wrist pain at night
2. Mild pain
3. Moderate pain
4. Severe pain
5. Very severe pain

How often did hand or wrist pain wake you up during a typical night in the past 2 weeks?

1. Never
2. Once
3. Two or three times
4. Four or five times
5. More than five times

Do you typically have pain in your hand or wrist during the daytime?

1. I never have pain during the day
2. I have mild pain during the day

3. I have moderate pain during the day
4. I have severe pain during the day
5. I have very severe pain during the day

How often do you have hand or wrist pain during the daytime?

1. Never
2. Once or twice a day
3. Three to five times a day
4. More than five times
5. The pain is constant

How long, on average, does an episode of pain last during the daytime?

1. I never get pain during the day
2. Less than 10 min
3. 10–60 min
4. Greater than 60 min
5. The pain is constant throughout the day

Do you have numbness (loss of sensation) in your hand?

1. No
2. I have mild numbness
3. I have moderate numbness
4. I have severe numbness
5. I have very severe numbness

Do you have weakness in your hand or wrist?

1. No weakness
2. Mild weakness

- 3. Moderate weakness
- 4. Severe weakness
- 5. Very severe weakness

Do you have tingling sensations in your hand?

- 1. No tingling
- 2. Mild tingling
- 3. Moderate tingling
- 4. Severe tingling
- 5. Very severe tingling

How severe is numbness (loss of sensation) or tingling at night?

- 1. I have no numbness or tingling at night
- 2. Mild
- 3. Moderate
- 4. Severe
- 5. Very severe

How often did hand numbness or tingling wake you up during a typical night during the past 2 weeks?

- 1. Never
- 2. Once
- 3. Two or three times
- 4. Four or five times
- 5. More than five times

Do you have difficulty with the grasping and use of small objects such as keys or pens?

- 1. No difficulty
- 2. Mild difficulty
- 3. Moderate difficulty
- 4. Severe difficulty
- 5. Very severe difficulty

Functional Status Scale

On a typical day during the past 2 weeks have hand and wrist symptoms caused you to have any difficulty doing the activities listed below? Please circle one number that best describes your ability to do the activity.

The overall symptom-severity score is calculated as the mean of the scores for the 11 individual items and the overall score for function status is calculated as the mean of all eight items. The range of total scores is between 1 and 5. The high score indicates “most severe” or “bad function” for subscales (Symptom Severity Scale and Functional Status Scale). Item that is left unanswered or that is not applicable is not included in the calculation of the overall score.

Activity	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Cannot do at all due to hand or wrist symptoms
Writing	1	2	3	4	5
Buttoning of clothes	1	2	3	4	5
Holding a book while reading	1	2	3	4	5
Gripping of a telephone handle	1	2	3	4	5
Opening of jars	1	2	3	4	5
Household chores	1	2	3	4	5
Carrying of grocery bags	1	2	3	4	5
Bathing and dressing	1	2	3	4	5

Reference

1. Levine DW, Simmons BP, Koris MJ, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *J Bone Joint Surg Am.* 1993; 75:1585–92.

Appendix 3: Duruöz Hand Index (DHI)

Duruöz Hand Index (DHI)

Answers to the questions:

- 0= Yes, without difficulty,
- 1= Yes, with a little difficulty,
- 2= Yes, with some difficulty,
- 3= Yes, with much difficulty,
- 4= Nearly impossible to do,
- 5= Impossible.

Answer the following questions regarding your ability without the help of any assistive device.

C1—In the kitchen.

1. Can you hold a bowl?
2. Can you seize a full bottle and raise it?
3. Can you hold a plate full of food?
4. Can you pour liquid from a bottle into a glass?
5. Can you unscrew the lid from a jar opened before?
6. Can you cut meat with a knife?
7. Can you prick things well with a fork?
8. Can you peel fruit?

C2—Dressing.

9. Can you button your shirt?
10. Can you open and close a zipper?

C3—Hygiene.

11. Can you squeeze a new tube of toothpaste?
12. Can you hold a toothbrush efficiently?

C4—In The Office.

13. Can you write a short sentence with a pencil or ordinary pen?
14. Can you write a letter with a pencil or ordinary pen?

C5—Other.

15. Can you turn a round door knob?
16. Can you cut a piece of paper with scissors?
17. Can you pick up coins from a table top?
18. Can you turn a key in a lock?

The raw scores of questions are added to get the total score of the scale. The range of total score is between 0 and 90, and high score indicates bad function. Duruöz Hand Index (DHI) was validated to assess hand function in several diseases and hand arthropathies such as rheumatoid arthritis, osteoarthritis, systemic sclerosis, psoriatic arthritis, tetraplegia, stroke, diabetes mellitus, flexor tendon injuries of hands, carpal tunnel syndrome, patient under hemodialysis, juvenile idiopathic arthritis, and geriatric persons.

Reference

1. Duruöz MT, et al. Development and validation of a rheumatoid hand functional disability scale that assess functional handicap. *J Rheumatol.* 1996;23: 1167–72.

Appendix 4: Hand Mobility in Scleroderma (HAMIS) Test

Finger flexion

(All fingers must be tight to the object)

- 0-Can bend fingers 2–5 around a pencil (5 mm diam.)
- 1-Can bend fingers 2–5 around a piece of cutlery (15 mm diam.)
- 2-Can bend fingers 2–5 around handlebar (30 mm diam.)
- 3-Cannot manage the previous item

Finger extension

- 0-Can feel the table completely with digits 2–5
- 1-Can feel the pencil (5 mm diam.) with digits 2–5
- 2-Can feel the piece of cutlery (15 mm diam.) with digits 2–5
- 3-Cannot manage the previous item

Thumb abduction

- 0-Can grip around a coffee package (90 mm diam.)
- 1-Can grip around a milk parcel (70 mm diam.)
- 2-Can grip around a bottle (60 mm diam.)
- 3-Cannot manage the previous item

Pincer grip

- 0-Can form a round pincer grip
- 1-Can form a D-shaped pincer grip
- 2-Can form a long narrow pincer grip
- 3-Cannot manage the previous item

Finger abduction

- 0-Can spread the fingers and then fold the hands together to the bottom of the fingers
- 1-Can spread the fingers and then fold the hands

- together to the first phalanx
- 2-Can spread the fingers and then fold the hands together to the second phalanx
- 3-Cannot manage the previous item

Volar flexion

- (The person stands with the arms alongside the body. The object is given from behind)
- 0-Can grasp a spool of thread with a slight flexion of MCP and extended PIP and DIP joints
 - 1-Can grasp a spool of thread with a large flexion of MCP and extended PIP and DIP joints
 - 2-Can grasp a spool of thread with a large flexion of MCP and flexion of PIP
 - 3-Cannot manage the previous item

Dorsal extension

- 0-Can hold the palms together and put the wrists against the stomach
- 1-Can hold the palms together and put the thumbs against the throat
- 2-Can hold the palms together and put the thumbs up to the mouth
- 3-Cannot manage the previous item

Pronation

- 0-Can put the palms of the hands on the table (MCP 2–5 must touch the surface)
- 1-Can put the palms of the hands on the table (MCP 3–5 must touch the surface)
- 2-Can put the palms of the hands on the table (MCP 4–5 must touch the surface)
- 3-Cannot manage the previous item

Supination

- 0-Can put the backs of the hands on the table (MCP 2–5 must touch the surface)
- 1-Can put the backs of the hands on the table (MCP 3–5 must touch the surface)
- 2-Can put the backs of the hands on the table (MCP 4–5 must touch the surface)
- 3-Cannot manage the previous item (MCP 4–5 must touch the surface)

The test equipment consists of standardized cylinders for assessment of finger flexion, finger

extension, and thumb abduction. Each hand is assessed separately. The raw scores are added to get the total score of HAMIS. It ranges for each hand between 0 and 27 points. High score represents a high degree of dysfunction.

Reference

1. Sandqvist G, Eklund M. Hand mobility in scleroderma (HAMIS) test: the reliability of a novel hand function test. *Arthritis Care Res.* 2000;13:369–74.

Appendix 5: Hand Functional Index (HFI)

Test items	Grading		Criteria
	Right	Left	
1. Tip of thumb touches hypothenar of 5th finger	0	0	Test performed fully and with no delay
	1	1	Test performed fully but with effort or delay or both
	2	2	Tip of thumb touches Proximal phalanx 3 and 4
	3	3	Neither realized
2. Bending of 2nd finger	0	0	Clutched normally
	1	1	Cannot be bent fully: tip reaches palm
	2	2	Fingertip does not reach palm
3–5. Bending of 3rd, 4th, 5th fingers	0	0	<i>As 2nd question</i>
	1	1	
	2	2	
6. Forearm held horizontal palmar surfaces pressed together point upward	1	1	Test performed fully and no delay
	2	2	Test performed fully with effort or delay, or both
	3	3	Volar and dorsal flexion of wrist 45°
7. Forearm held horizontal dorsal surfaces pressed together point downward	1	1	Fully; no delay
	2	2	Fully; with effort or delay, or both
	3	3	Palmar and ventral flexion of wrist 45°
8. Both backs of hands simultaneously on the table; elbows held rectangularly: ulnar margin of hand lifted	0	0	Performed fully
	1	1	Backs of hands on table; margin cannot lift
	2	2	Backs of hands not fully on table
9. Radial margins of hands simultaneously placed on table: thumb points downward before table edge: planes of hands inclined inward: no lateral bending of trunk	0	0	Performed fully
	1	1	Planes of hands perpendicular: cannot be inclined inward
	2	2	Planes of hand not vertical

Hand Functional Index (HFI) is the first of the nine questions [1] of Keitel Function Test (KFT) [2]. Raw scores of both hands are added to get the total score of HFI. It ranges between 4 and 42 points. The high score indicates bad function [1].

References

1. Kalla AA, Kotze TJ, Meyers OL, Parkyn ND. Clinical assessment of disease activity in rheumatoid arthritis: evaluation of a functional test. *Ann Rheum Dis.* 1988;47(9):773-9.
2. Keitel W, Hoffmann H, Weber G, Krieger U. Evaluation of the percentage of functional decrease of the joints using a motor function test in rheumatology [in Dutch]. *Dtsch Gesundheitsw.* 1971;26:1901-3.

Appendix 6: Michigan Hand Outcomes Questionnaire (MHQ)

Instructions: This survey asks for your views about your hands and your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

Answer **EVERY** question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

I. The following questions refer to the function of your hand(s)/wrist(s) **during the past week**. (Please circle one answer for each question). Please answer **EVERY** question, even if you do not experience any problems with the hand and/or wrist.

A. The following questions refer to your **right** hand/wrist.

	Very good	Good	Fair	Poor	Very poor
1. Overall, how well did your right hand work?	1	2	3	4	5
2. How well did your right fingers move?	1	2	3	4	5
3. How well did your right wrist move?	1	2	3	4	5
4. How was the strength in your right hand?	1	2	3	4	5
5. How was the sensation (feeling) in your right hand?	1	2	3	4	5

B. The following questions refer to your **left** hand/wrist.

	Very good	Good	Fair	Poor	Very poor
1. Overall, how well did your left hand work?	1	2	3	4	5
2. How well did your left fingers move?	1	2	3	4	5
3. How well did your left wrist move?	1	2	3	4	5
4. How was the strength in your left hand?	1	2	3	4	5
5. How was the sensation (feeling) in your left hand?	1	2	3	4	5

II. The following questions refer to the ability of your hand(s) to do certain tasks *during the past week*. (Please circle one answer for each

question). If you do not do a certain task, please estimate the difficulty with which you would have in performing it.

A. How difficult was it for you to perform the following activities using your *right hand*?

	Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
1. Turn a door knob	1	2	3	4	5
2. Pick up a coin	1	2	3	4	5
3. Hold a glass of water	1	2	3	4	5
4. Turn a key in a lock	1	2	3	4	5
5. Hold a frying pan?	1	2	3	4	5

B. How difficult was it for you to perform the following activities using your *left hand*?

	Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
1. Turn a door knob	1	2	3	4	5
2. Pick up a coin	1	2	3	4	5
3. Hold a glass of water	1	2	3	4	5
4. Turn a key in a lock	1	2	3	4	5
5. Hold a frying pan?	1	2	3	4	5

C. How difficult was it for you to perform the following activities using *both of your hands*?

	Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
1. Open a jar	1	2	3	4	5
2. Button a shirt/blouse	1	2	3	4	5
3. Eat with a knife/fork	1	2	3	4	5
4. Carry a grocery bag	1	2	3	4	5
5. Wash dishes	1	2	3	4	5
6. Wash your hair	1	2	3	4	5
7. Tie shoe laces/knots	1	2	3	4	5

III. The following questions refer to how you did in your *normal work* (including both house-

work and school work) during the *past 4 weeks*. (Please circle one answer for each question).

	Always	Often	Sometimes	Rarely	Never
1. How often were you unable to do your work because of problems with your hand(s)/wrist(s)?	1	2	3	4	5
2. How often did you have to shorten your work day because of problems with your hand(s)/wrist(s)?	1	2	3	4	5
3. How often did you have to take it easy at your work because of problems with your hand(s)/wrist(s)?	1	2	3	4	5
4. How often did you accomplish less in your work because of problems with your hand(s)/wrist(s)?	1	2	3	4	5
5. How often did you take longer to do the tasks in your work because of problems with your hand(s)/wrist(s)?	1	2	3	4	5

IV. The following questions refer to how much **pain** you had in your hand(s)/wrist(s) **during the past week**. (Please circle one answer for each question).

A. The following questions refer to **pain** in your **right** hand/wrist.

1. How often did you have pain in your **right** hand(s)/wrist(s)?
 1. Always
 2. Often
 3. Sometimes
 4. Rarely
 5. Never

If you answered **never** to **question IV-A1** above, please skip the following questions and go to the next page.

2. Please describe the pain you had in your **right** hand(s)/wrist(s).
 1. Very mild
 2. Mild
 3. Moderate
 4. Severe
 5. Very severe

	Always	Often	Sometimes	Rarely	Never
3. How often did the pain in your right hand(s)/wrist(s) interfere with your sleep?	1	2	3	4	5
4. How often did the pain in your right hand(s)/wrist(s) interfere with your daily activities (such as eating or bathing)?	1	2	3	4	5
5. How often did the pain in your right hand(s)/wrist(s) make you unhappy?	1	2	3	4	5

B. The following questions refer to **pain** in your **left** hand/wrist.

1. How often did you have pain in your **left** hand(s)/wrist(s)?
 1. Always
 2. Often
 3. Sometimes
 4. Rarely
 5. Never

2. Please describe the pain you had in your **left** hand(s)/wrist(s).

1. Very mild
2. Mild
3. Moderate
4. Severe
5. Very severe

If you answered **never** to **question IV-B1** above, please skip the following questions and go to the next page.

	Always	Often	Sometimes	Rarely	Never
3. How often did the pain in your left hand(s)/wrist(s) interfere with your sleep?	1	2	3	4	5
4. How often did the pain in your left hand(s)/wrist(s) interfere with your daily activities (such as eating or bathing)?	1	2	3	4	5
5. How often did the pain in your left hand(s)/wrist(s) make you unhappy?	1	2	3	4	5

V. A. The following questions refer to the appearance (look) of your **right** hand **during the past week**. (Please circle one answer for each question).

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I am satisfied with the appearance (look) of my right hand	1	2	3	4	5
2. The appearance (look) of my right hand sometimes made me uncomfortable in public	1	2	3	4	5
3. The appearance (look) of my right hand made me depressed	1	2	3	4	5
4. The appearance (look) of my right hand interfered with my normal social activities	1	2	3	4	5

B. The following questions refer to the appearance (look) of your **left** hand **during the past week**. (Please circle one answer for each question).

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I am satisfied with the appearance (look) of my left hand	1	2	3	4	5
2. The appearance (look) of my left hand sometimes made me uncomfortable in public	1	2	3	4	5
3. The appearance (look) of my left hand made me depressed	1	2	3	4	5
4. The appearance (look) of my left hand interfered with my normal social activities	1	2	3	4	5

VI. A. The following questions refer to your satisfaction with your **right** hand/wrist **during the past week**. (Please circle one answer for each question).

	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied
1. Overall function of your right hand	1	2	3	4	5
2. Motion of the fingers in your right hand	1	2	3	4	5
3. Motion of your right wrist	1	2	3	4	5
4. Strength of your right hand	1	2	3	4	5
5. Pain level of your right hand	1	2	3	4	5
6. Sensation (feeling) of your right hand	1	2	3	4	5

B. The following questions refer to your satisfaction with your **left** hand/wrist **during the past week**. (Please circle one answer for each question).

	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied
1. Overall function of your left hand	1	2	3	4	5
2. Motion of the fingers in your left hand	1	2	3	4	5
3. Motion of your left wrist	1	2	3	4	5
4. Strength of your left hand	1	2	3	4	5
5. Pain level of your left hand	1	2	3	4	5
6. Sensation (feeling) of your left hand	1	2	3	4	5

Raw scores are converted to a scale from 0 to 100 according to a scoring algorithm [1]. Ranges for subscales are the following: hand function (5–25), unilateral ADL (5–25), bilateral ADL (7–35), work (5–25), pain (0–24), aesthetics (4–20), and satisfaction (6–30). Higher scores indicate better hand performance in all domains except pain. In the pain scale, high scores indicate more severe pain.

If 50 % or more of the items in a scale are missing, then that particular scale cannot be scored. An overall MHQ score can be obtained by summing the scores for all 6 scales and divide by 6. If scores for more than two scales are missing, an overall MHQ score cannot be computed.

MHQ Scoring Algorithm¹

Scale	Recode ^a	RawScoreRange ^b	Normalization ^c
Overall hand function	None	5–25	$[-(\text{rawscore} - 25)/20] \times 100$
Activities of daily living	None	5–25 1 handed	$[-(\text{rawscore} - 25)/20] \times 100$
		7–35 2 handed	$[-(\text{rawscore} - 35)/28] \times 100$
		Overall ADL	$=(1 \text{ handed} + 2 \text{ handed})/2$
Work	None	5–25	$[(\text{rawscore} - 5)/20] \times 100$
Pain	Question 2: (1 = 5) (2 = 4) (4 = 2) (5 = 1)	5–25	if question 1 = 5, then pain score = 0 if question 1 ≠ 5, then $[-(\text{rawscore} - 25)/20] \times 100$
Aesthetics	Question 1: (1 = 5) (2 = 4) (4 = 2) (5 = 1)	4–16	$[(\text{rawscore} - 4)/16] \times 100$
Satisfaction	None	6–30	$[-(\text{rawscore} - 30)/24] \times 100$

¹The scoring algorithm is available from the authors is SAS program.

^aThe response categories for some of the questions are reversed and are recoded

^bSum of the responses for each scale

^cFor the pain scale, higher scores indicate more pain. For the other 5 scales, higher scores indicate better hand performance. The scores are normalized to a range of 0–100

Reference

1. Chung KC, Pillsbury MS, Walters MR, et al. Reliability and validity testing of the Michigan hand outcomes questionnaire. *J Hand Surg Am.* 1998;23: 575–87.

Appendix 7: Quick-DASH (The Disabilities of the Arm, Shoulder and Hand)

INSTRUCTIONS. This questionnaire asks about your symptoms as well as your ability to perform certain activities. Please answer *every question*, based on your condition in the last week, by

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

Answers to the Questions

Questions 1–6, 11	Question 7	Question 8	Questions 9–10
1=No difficulty,	1=Not at all	1=Not limited at all	1=None
2=Mild difficulty,	2=Slightly	2=Slightly limited	2=Mild
3=Moderate difficulty,	3=Moderately	3=Moderately limited	3=Moderate
4=Severe difficulty	4=Quite a bit	4=Very limited	4=Severe
5=Unable. (Q=1–6)	5=Extremely	5=Unable	5=Extreme
... = So much difficulty that I can't sleep (Q=11)			

Please rate your ability to do the following activities in the last week.

1. Open a tight or new jar.
2. Do heavy household chores (e.g., wash walls, wash floors).
3. Carry a shopping bag or briefcase.
4. Wash your back.
5. Use a knife to cut food.
6. Recreational activities in which you take some force or impact through your arm, shoulder, or hand (e.g., golf, hammering, and tennis).
7. During the past week, *to what extent* has your arm, shoulder, or hand problem interfered with your normal social activities with family, friends, neighbours, or groups?
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder, or hand problem?

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

9. Arm, shoulder, or hand pain.
10. Tingling (pins and needles) in your arm, shoulder, or hand.
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder, or hand?

The sum of the responses produces a score, which then is transformed to obtain the Quick-DASH score. The final score ranges between 0 (no disability) and 100 (the greatest possible disability). Only one missing item can be tolerated, and, if two or more items are missing, the score cannot be calculated.

QuickDASH Disability / Symptom Score

$$= \left[\left(\frac{\text{Sum of } n \text{ responses}}{n} \right) - 1 \right] \times 25$$

where n is equal to the number of completed responses.

Reference

1. Beaton D, Wright J, Katz J, The Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three-item reduction approaches. *J Bone Joint Surg Am.* 2005;87:1038–46.

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