

# **Measuring physical function in psoriatic arthritis: a comparison of the Multi-dimensional Health Assessment Questionnaire to the Health Assessment Questionnaire Disability Index**

Weiyu Ye<sup>1</sup>, Simon Hackett<sup>2</sup>, Claire Vandeveld<sup>3</sup>, Sarah Twigg<sup>4</sup>, Philip S Helliwell<sup>5</sup>, Laura C Coates<sup>2</sup>

## **Affiliations:**

1. Oxford University Clinical Academic Graduate School, Room 3A31, The Cairns Library IT Corridor, Level 3, John Radcliffe Hospital, Oxford, OX3 9DU
2. Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Science, University of Oxford, The Botnar Research Centre, Old Road, Oxford, OX3 7LD
3. NIHR Leeds Biomedical Research Centre, Leeds Teaching Hospitals NHS Trust, and Leeds Institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, Leeds, LS7 4SA.
4. Bradford Teaching Hospitals NHS Foundation Trust, St Lukes Hospital, Little Horton Lane, Bradford, BD5 0NA
5. Leeds Institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, Chapel Allerton Hospital, Leeds LS7 4SA.

**Key Indexing Terms:** psoriatic arthritis, health assessment questionnaire, quality of life, activities of daily living, self-assessment

**Funding:** Weiyu Ye is an NIHR Academic Clinical Fellow. Laura C Coates is an NIHR Clinician Scientist and Senior Clinical Research Fellow funded by a National Institute for Health Research Clinician Scientist award. The research was supported by the National Institute for Health Research (NIHR) Oxford Biomedical Research Centre (BRC). The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health. We acknowledge the support of the National Institute for Health Research Clinical Research Network (NIHR CRN).

**Conflict of interest:** none.

## **Initials, surnames, appointments, and highest academic degrees of all authors (e.g., MD, PhD):**

- W Ye – NIHR Academic Clinical Fellow, MB BChir
- S Hackett – Academic Foundation Doctor, PhD

- C Vandeveld – Consultant Rheumatologist and Honorary Senior Lecturer, MD
- S Twigg – Consultant Rheumatologist, MD
- PS Helliwell – Professor of Clinical Rheumatology, PhD
- LC Coates – NIHR Clinician Scientist and Senior Clinical Research Fellow, PhD

**Corresponding author:**

Dr Weiyu Ye

Oxford University Clinical Academic Graduate School,

Room 3A31, The Cairns Library IT Corridor, Level 3,

John Radcliffe Hospital,

Oxford,

OX3 9DU

[christina.ye@conted.ox.ac.uk](mailto:christina.ye@conted.ox.ac.uk)

ORCID: 0000-0002-8983-0355

**Running head:** MDHAQ vs HAQDI

**Word count:** 1794

## **ABSTRACT**

### Objectives

To compare physical function scales of the Multi-Dimensional Health Assessment Questionnaire (MDHAQ) to the Health Assessment Questionnaire Disability Index (HAQDI) in patients with psoriatic arthritis (PsA), and examine whether either questionnaire is less prone to 'floor effects'.

### Methods

Data were collected prospectively from 2018-2019 across three UK hospitals. All patients completed physical function scales within the MDHAQ and HAQDI in a single clinic visit. Agreement was assessed using medians and the Bland-Altman method. Intraclass correlation coefficients (ICCs) were used to assess test-retest reliability.

### Results

210 patients completed the clinic visit; one withdrew consent thus 209 were analysed. 60.0% were male, with mean age of 51.7 years and median disease duration of 7 years. In clinic, median MDHAQ and HAQDI including/excluding aids scores were 0.30, 0.50 and 0.50 respectively. Although the median score for HAQDI is higher than MDHAQ, the difference between the two mostly lies within 1.96 standard deviations of the mean suggesting good agreement. The ICCs demonstrated excellent test-retest reliability for both HAQ questionnaires.

Similar numbers of patients scored '0' on the MDHAQ and HAQDI including/excluding aids (48, 47, and 49 respectively). Using a score of  $\leq 0.5$  as a cut-off for minor functional impairment, 23 patients had a MDHAQ  $\leq 0.5$  when their HAQDI including aids  $> 0.5$ . Conversely, 4 patients had a MDHAQ  $> 0.5$  when the HAQDI including aids  $\leq 0.5$ .

### Conclusion

Both HAQ questionnaires appear to be similar in detecting floor effects, however the HAQDI may be better at identifying minor functional impairment.

Word count: 248

## INTRODUCTION

Psoriatic arthritis (PsA) is a chronic inflammatory arthritis which can limit daily activities, with detrimental effects on patients' quality of life <sup>1,2</sup>. Assessment of function is important in both clinical practice and in trial settings to enable evaluation of disease activity and treatment effect. The Health Assessment Questionnaire Disability Index (HAQDI) is a well-validated patient self-report questionnaire to assess physical function in rheumatic diseases <sup>3</sup>. However, its clinical utility is limited by its length and complex scoring. Scores can also be artefactually elevated when aids are used, despite improving patient function, and the scoring method may lead to different activities being compared from visit to visit <sup>4</sup>.

To improve clinical utility of the HAQDI, simpler versions have been developed, including the Multi-Dimensional Health Assessment Questionnaire (MDHAQ) <sup>4,5,6,7</sup>. The MDHAQ has been compared against the HAQDI previously in other rheumatic diseases, however, has not been directly compared in PsA. <sup>4,5</sup>. Prior research have shown that it may be more sensitive to 'floor effects', whereby patients report normal scores of '0' despite experiencing functional impairment <sup>5</sup>. Detection of 'floor effects' is becoming more important, as treatment strategies increasingly shift towards achieving minimal disease activity <sup>8</sup>. Our study aimed to assess the agreement between the physical function scales of the MDHAQ and HAQDI in patients with PsA, and evaluate whether either questionnaire was more sensitive to 'floor effects'.

## METHODS

### Study design

We conducted a cross-sectional questionnaire study comparing the physical function scales of the MDHAQ to the HAQDI in patients aged  $\geq 18$  with definite PsA (according to the CIASsification of Psoriatic Arthritis (CASPAR) criteria <sup>9</sup> or previous diagnosis by a rheumatologist). Patients were recruited from three UK hospital trusts (Oxford University Hospitals, Leeds Teaching Hospitals, and Bradford Teaching Hospitals) from 20/12/2018 to 22/08/2019.

All patients completed the MDHAQ and HAQDI in a single visit within usual care. The HAQDI consists of 20 activities of daily living grouped into 8 categories, and the difficulty in carrying out each activity is ranked using a semi-quantitative 0 to 3 scale. The MDHAQ consists of 8 activities of daily living chosen from the HAQDI, one per category. It also contains two additional questions pertaining to more challenging activities, aimed at identifying more minor, but still relevant functional impairment, and is also scored from 0 to 3<sup>3,4</sup>. The order the HAQ questionnaires were completed was alternated to exclude the effects of participant fatigue. Both HAQ questionnaires were compared with the PsA Impact of Disease questionnaire (PsAID-12)<sup>10</sup>, which is scored from 0 to 10. This has a validated patient acceptable symptom state (PsAID-12 score  $\leq 4$ ) to stratify high-impact and low-impact disease. Data were also collected on patient demographics, PsA subtype, disease duration, concurrent fibromyalgia, self-reported disease activity and current therapy.

Patients were given an identical pack with a pre-paid self-addressed envelope with instruction to complete the questionnaires one week later. This ceased when returned questionnaires numbers was sufficient to evaluate test-retest reliability. The one-week timepoint was chosen as it was assumed that most patients' disease activity state will have not changed significantly. This was clarified via an additional question on disease activity at one-week.

#### Sample size calculation

Based on a prior pilot study of 51 patients with PsA, we calculated that for a powered study to detect non-inferiority between the physical function scales of the MDHAQ and HAQDI with a margin of 0.125 at a two-sided 0.025 significance level with >90% power, 210 participants are needed<sup>11</sup>, given that 30% of these cases had a HAQ score of 0.

#### Statistical analysis

Median scores and interquartile range (IQR) were calculated for all questionnaires. Agreement between the HAQ questionnaires were assessed using the Bland-Altman method<sup>12</sup>. The t-test was used to evaluate whether the order of HAQ questionnaire presentation impacted the scores. Spearman's rank was used to assess the

correlation between HAQ and PsAID-12 scores. Intraclass correlation coefficients (ICC, two-way mixed model absolute agreement) were used to assess test-retest reliability, with ICCs greater than 0.75 considered to demonstrate concordance<sup>13</sup>. The proportion of patients who scored '0' was calculated for the HAQ questionnaires, to allow assessment of floor effects. All analyses were performed using R (version 3.6.1).

### Ethical considerations

This study was approved by the London-Surrey Research Ethics Committee (reference 18/LO/2057). All patients gave written informed consent.

## **RESULTS**

### Patients and questionnaire scores

210 patients completed the initial clinic visit; one withdrew consent, thus data from 209 patients were analysed. 62 of 107 patients given an identical pack to complete at one week returned the questionnaires.

Table 1 details baseline characteristics of the cohort and median questionnaire scores, with score distributions in clinic shown in Figure 1. Although the median HAQDI score is consistently higher than the MDHAQ, the difference mostly lies within 1.96 standard deviations (S.D.) of the mean, suggesting good agreement (Figure 1). Patients with PsAID-12 scores  $\leq 4$  had HAQ scores clustered around the lower half of the 0 to 3 range, whereas those with PsAID-12 scores  $> 4$  had an even distribution of HAQ scores.

Using Spearman's rank, we found statistically significant correlations between clinic PsAID-12 scores and clinic MDHAQ, HAQDI including aids, and HAQDI excluding aids scores (Spearman's rho 0.75, 0.72, 0.71, respectively, all  $p < 0.001$ ).

The order in which HAQ questionnaires were completed did not affect the score (MDHAQ first vs second,  $p = 0.72$ ; HAQDI including/excluding aids first vs second,  $p = 0.86$  and  $p = 0.92$ ).

### Floor effects

When considering individual question scores (Table 2), questions i and j of the MDHAQ (walk 3 km and participate in sport) were most sensitive to floor effects, with the lowest proportion of patients who scored '0'. They also had an increased proportion of patients with higher scores, as with questions 5b (take a bath), 6a (reach and get down 5lb object from overhead), and 8c (household chores) of the HAQDI.

However, when considering total scores, similar numbers of patients scored '0' in MDHAQ and HAQDI including/excluding aids (48, 47, and 49 respectively), with no increased detection of floor effects seen with the MDHAQ. Moreover, similar numbers of patients scored '0' in the HAQ questionnaires when their PsAID-12 score was  $> 4$  (2, 3, 3, respectively). There was also no clear difference between the numbers of patients scoring '0' in the HAQ questionnaires when analysing by patient-reported remission (remission: 15, 13, 15 vs non-remission: 31, 32, 32, respectively) and presence/absence of fibromyalgia (yes: 1, 0, 0, vs no: 47, 37, 39, respectively).

Using  $\leq 0.5$  as a cut-off for minor functional impairment, 23 patients had a MDHAQ  $\leq 0.5$  when their HAQDI including aids  $> 0.5$ . This reduced to 17 when HAQDI excluding aids  $> 0.5$ . Conversely, 4 patients had a MDHAQ  $> 0.5$  when the HAQDI including aids  $\leq 0.5$ . This increased to 5 when HAQDI excluding aids  $\leq 0.5$ . For patients with PsAID-12 scores  $> 4$ , 24 patients had a MDHAQ  $\leq 0.5$ , compared to 20 and 16 when HAQDI excluding/including aids  $\leq 0.5$ , respectively.

### Test-retest reliability

Clinic and home questionnaire scores were similar although consistently slightly numerically higher, at home (Table 1). The ICCs for MDHAQ, HAQDI including/excluding aids and PsAID-12 were 0.97 (95% confidence interval 0.95-0.98), 0.98 (0.97-0.99), 0.98 (0.96-0.99), and 0.96 (0.93-0.97), suggesting excellent test-retest reliability.



## DISCUSSION

Our study found good agreement between the physical function scales of the HAQ questionnaires in patients with PsA, with both demonstrating excellent test-retest reliability. This corroborates with previous studies in cohorts of mixed rheumatic diseases <sup>4</sup>.

Previous studies have suggested that the physical function scale of the MDHAQ may be more sensitive to ‘floor effects’ compared to the HAQDI. In a US study of 144 patients with rheumatic diseases, 23 scored ‘0’ on the HAQDI whilst 14 scored ‘0’ on the MDHAQ <sup>5</sup>. In another US study of 140 female patients with rheumatoid arthritis (RA) or systemic lupus erythematosus (SLE) <sup>14</sup>, scores of ‘0’ were seen in >49% of RA and >63% of SLE patients for items shared between the HAQDI and MDHAQ. In contrast, for MDHAQ-specific physical function items, scores of ‘0’ were seen in <29% of RA and <41% of SLE patients.

Our results showed that when considering individual questions, the MDHAQ-specific questions did seem to be most sensitive to floor effects, with 38.3% patients reporting normal scores of ‘0’ compared to 64.6% for questions shared with the HAQDI. However, when considering total scores, a similar number of patients had normal scores of ‘0’ in both questionnaires including the subgroups with high impact disease (PsAID-12 score > 4), fibromyalgia and patient-reported remission suggesting overall similar performance in detecting floor effects.

In our cohort, HAQDI scores are consistently higher than MDHAQ scores, even with aids excluded. A greater proportion of patients had MDHAQ scores  $\leq 0.5$  suggesting minor functional impairment when their HAQDI scores were  $> 0.5$  than the other way around. For those with high-impact disease, more patients also had MDHAQ scores  $\leq 0.5$  compared to the HAQDI. Taken together, this suggests that the HAQDI may be better at detecting minor functional impairment compared to the MDHAQ. Despite adding two questions with increased sensitivity, the MDHAQ cannot detect the same breadth of functional impairment as the HAQDI due to fewer questions. This may be due to patients with PsA being generally younger with a higher baseline function compared to other rheumatic diseases, with more variable manifestations of functional impairment due to

disease heterogeneity <sup>15,16</sup>. Hence, a more detailed questionnaire may be required to detect minor functional impairment.

For low-impact disease (PsAID-12 score  $\leq 4$ ), the HAQ questionnaire scores clustered around the lower half of the 0 to 3 range, whereas for high-impact disease the distribution is more even. This suggests that low functional impairment generally occurs with low-impact disease. However, high-impact disease does not necessarily equate to high functional impairment, as other factors including skin symptoms and psychological impact contribute.

Strengths of our study include recruitment of patients from 3 separate centres and comparing the HAQ questionnaires in an unselected group of patients with PsA within routine clinical practice. Limitations include the different administration settings of the questionnaires to assess test-retest reliability, and the one-week interval meant some patients felt their disease activity state had changed. We were unable to analyse ceiling effects in our dataset, as only one patient had a HAQDI score of 3. Moreover, we did not include the psychological and clinical components of the HAQ questionnaires within our study, which would be important to assess in the future.

In conclusion, we show that although the MDHAQ-specific physical function questions are more sensitive to floor effects individually, with total scores both HAQ questionnaires perform similarly in detecting floor effects in patients with PsA. The MDHAQ remains an appropriate option for rapid assessments of physical function in clinical settings, however the HAQDI is overall better at detecting minor functional impairment, due to its increased breadth of questions.

## REFERENCES

1. Ritchlin CT, Colbert RA, Gladman DD. Psoriatic Arthritis. *N Engl J Med*. 2017;376:957–70.
2. Gudu T, Kiltz U, de Wit M, Kvien TK, Gossec L. Mapping the Effect of Psoriatic Arthritis Using the International Classification of Functioning, Disability and Health. *J Rheumatol*. 2017;44:193.

3. Fries JF, Spitz P, Kraines RG, Holman HR. Measurement of patient outcome in arthritis. *Arthritis Rheum.* 1980;23:137-45.
4. Pincus T, Swearingen C, and Wolfe F. Toward a multidimensional Health Assessment Questionnaire (MDHAQ): assessment of advanced activities of daily living and psychological status in the patient-friendly health assessment questionnaire format. *Arthritis Rheum*, 1999;42:2220-30.
5. Pincus T, Sokka T., and Kautiainen H. Further development of a physical function scale on a MDHAQ [corrected] for standard care of patients with rheumatic diseases. *J Rheumatol.* 2005;32:1432-9.
6. Pincus T, Swearingen CJ, Bergman M, Yazici Y. RAPID3 (Routine Assessment of Patient Index Data 3), a Rheumatoid Arthritis Index Without Formal Joint Counts for Routine Care: Proposed Severity Categories Compared to Disease Activity Score and Clinical Disease Activity Index Categories. *J Rheumatol.* 2008;35:2136.
7. Pincus T, Swearingen CJ. The HAQ compared with the MDHAQ: "keep it simple, stupid" (KISS), with feasibility and clinical value as primary criteria for patient questionnaires in usual clinical care. *Rheum Dis Clin North Am.* 2009;35:787-98
8. Tucker LJ, Ye W, Coates LC. Novel Concepts in Psoriatic Arthritis Management: Can We Treat to Target?. *Curr Rheumatol Rep.* 2018;20(11):71.
9. Taylor W, Gladman D, Helliwell P, Marchesoni A, Mease P, Mielants H. Classification criteria for psoriatic arthritis: Development of new criteria from a large international study. *Arthritis Rheum.* 2006;54:2665-2673.
10. Gossec L, de Wit M, Kiltz U, Braun J, Kalyoncu U, Scrivo R, et al. A patient-derived and patient-reported outcome measure for assessing psoriatic arthritis: elaboration and preliminary validation of the Psoriatic Arthritis Impact of Disease (PsAID) questionnaire, a 13-country EULAR initiative. *Ann Rheum Dis.* 2014;73:1012.
11. Chow S, Shao J, Wang H. *Sample Size Calculations in Clinical Research.* Second Edition. Chapman & Hall/CRC Biostatistics Series. 2008;52.
12. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1:307–10.
13. Tubergen A van, Debats I, Ryser L, Londoño J, Burgos-Vargas R, Cardiel MH, et al. Use of a numerical rating scale as an answer modality in ankylosing spondylitis-specific questionnaires. *Arthritis Care & Research.* 2002;47(3):242–8.

14. Annapureddy N, Giangreco D, Castrejón I, Shetty N, Pincus T, Block J et al. Sensitivity of Unique Multidimensional Health Assessment Questionnaire Items Compared to Items on Both the HAQ and MDHAQ in Patients with RA and SLE. [abstract] ACR/ARHP Annual Meeting 2014;353A
15. Gabriel SE, Michaud K. Epidemiological studies in incidence, prevalence, mortality, and comorbidity of the rheumatic diseases. *Arthritis Res Ther.* 2009;11:229.
16. Wilson FC, Icen M, Crowson CS, McEvoy MT, Gabriel SE, Kremers HM. Time trends in epidemiology and characteristics of psoriatic arthritis over three decades: A population-based study. *J Rheumatol.* 2009;36:361–7.

## TABLE AND FIGURE LEGENDS

- **Table 1. Clinical characteristics and questionnaire scores in clinic and at home one week later.**  
NSAIDs: non-steroidal anti-inflammatory drugs; csDMARDs: conventional synthetic disease modifying anti-rheumatic drugs; bDMARDs: biologic disease modifying anti-rheumatic drugs; MDHAQ: multi-dimensional health assessment questionnaire (scored 0-3); HAQDI: health assessment questionnaire disability index (scored 0-3); PsAID-12: PsA impact of disease questionnaire (scored 0-10).
- **Table 2. Summary of scores for individual questions within the MDHAQ and HAQDI in clinic.**  
MDHAQ: multi-dimensional health assessment questionnaire; HAQDI: health assessment questionnaire disability index. HAQ question 1a – dress self, 1b – shampoo hair, 2a – stand up from armless straight chair, 2b – get in/out of bed, 3a – cut meat, 3b – lift full cup to mouth, 3c – open new milk carton, 4a – walk outdoors on flat, 4b – climb 5 steps, 5a – wash/dry entire body, 5b – take a bath, 5c – get on/off toilet, 6a – reach and get down 5lb object from overhead, 6b – bend down, 7a – open car doors, 7b – open previously opened jars, 7c – turn taps on/off, 8a – run errands and shop, 8b – get in/out of car, 8c – do household chores. MDHAQ specific questions i – walk 3km, j – participate in recreational activities and sports.
- **Figure 1. Comparison of the HAQ questionnaires.** MDHAQ: multi-dimensional health assessment questionnaire; HAQDI: health assessment questionnaire disability index; PsAID-12: PsA impact of disease questionnaire. A-C: Histograms of HAQ questionnaire scores, D, E, G, H: Bland-Altman

Plots, F,I: scatter plots by impact (high impact: PsAID-12 score  $> 4$ , low impact: PsAID-12 score  $\leq 4$ ).