A mismatch between self-reported physical work load and the HAQ: early identification of rheumatoid arthritis patients at risk for loss of work productivity

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Abstract

Objective

To explore the combination of data on functioning and work load for early identification of patients at risk for diminished work productivity in rheumatoid arthritis (RA).

Patients and methods

In the FIN-RACo trial, 162 patients with recent onset RA and available for the workforce were treated with either a combination of disease-modifying antirheumatic drugs (DMARDs) or a single DMARD for 2 years. Otherwise, they received routine care and were followed up for 5 years. Data on their individual income and lost work days came from official registers. Loss of productivity was computed by the human capital approach. Self-reported data on physical work demand (Finnish Institute for Occupational Health Questionnaire) at baseline and on functioning (HAQ) at 6 months were linked according to the International Classification of Functioning, Disability and Health.

Results

Data on 112 patients were analyzable at 6 months; 35 (31%) of them had diminished capacity in functions required at paid work. Any mismatch between perceived abilities and requirements predicted future (7 through 60 months) loss of productivity – on average Euro 14,040 (95% confidence interval (CI): 9,143-20,511) per year in patients with the mismatch compared to Euro 3,043 (1,623-5,534) in those without any mismatch – and was associated with RA-related permanent work disability (hazard ratio: 11.6; 95%CI: 4.0-33.4).

Conclusion

Linking together self-reported data about functioning and work load helps in early identification of the RA patients at risk for loss of working days.

Key words

Rheumatoid arthritis, loss of productivity, work load, HAQ, ICF.

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Introduction

Rheumatoid arthritis (RA) has a poorly predictable course and variable outcome (1), but limited work capacity is a common consequence for patients of working age (2). In the FIN-RACo trial, three fourths of the patients with recent-onset RA lost working days, and one fourth became permanently work disabled over five years (3). Comparable results have been reported elsewhere (4-6). Given the adverse socioeconomic repercussions, the identification of patients at risk for work disability at the earliest is of utmost importance to optimize their treatment and start rehabilitation for maintenance of work capacity.

A person is able to be gainfully employed if his or her personal capabilities meet the requirements of the job. Conversely, any mismatch of capabilities and requirements results in diminished work capacity. Ample evidence shows that both poor functional capacity and occupational heavy labor are predictors of work disability in patients with RA (7-10). The mismatch between functional capabilities and work demand, however, has seldom been studied in rheumatology. An exception is the development of the Work Instability Scale for rheumatoid arthritis (11). It has shown validity against expert vocational assessment but its usefulness in practice has not been tested. In addition, the Work Limitations Questionnaire is available for assessment of health problem related activity limitations in the workplace, but its predictive validity regarding work productivity remains to be determined (12, 13).

In earlier reports, occupational heavy labor has been defined either by job title or by self-report using a simple ordinal scale (7-9). These indicators are, however, rather crude measures of physical demands during paid work. More detailed information can be obtained by direct measurement, which is accurate but costly and laborious or by subjective assessment using questionnaire, which is more suitable for larger patient groups (14). In Finland, a self-reported questionnaire including ten questions regarding physical work load has shown a fairly good correlation with observations made by a trained physiotherapist (15). This FIOH (Finnish Institute for Occupational Health) questionnaire (with one extra item, see appendix) is routinely used in vocational medicine in Finland.

With regard to functioning, the Stanford Health Assessment Questionnaire (HAQ) has shown good validity and predictive capacity in patients with RA and has been translated into many languages, including Finnish (16, 17).

Information about functioning and work requirements can be organized by use of the International Classification of Functioning, Disability, and Health (ICF) (18, 19). We have earlier linked the items of the HAQ to activity limitations of the ICF (3). Information regarding physical demands at work can be linked to the ICF accordingly. Consequently, the capacities or disabilities of a patient on one hand and the requirements of his or her work on the other can be "matched" and possible discrepancies – mismatches – revealed.

We have shown that poor 6-month treatment response as defined by the American College of Rheumatology (ACR) criteria (20, 21) is a strong predictor of future work incapacity as well as of indirect costs to society (22). Some patients with satisfactory ACR50 improvement, however, became permanently work disabled while others not responding to treatment kept in work.

In this study, we wanted to test whether the mismatch between physical demands of paid work and functioning based on data from the FIOH questionnaire and the HAQ, respectively, and organized according to the ICF, could further facilitate the identification of those patients at risk for loss of work capacity in early RA. The patient-reported work load was compared to expert opinion on work exposure in the patients' occupations.

Patients and methods

Study design

This study was embedded in a randomized, controlled trial (the Finnish Rheumatoid Arthritis Combination-Therapy Trial, FIN-RACo) comparing therapy with a combination of disease-modifying antirheumatic drugs

(DMARDs) to that with a single DMARD. This study has been described in detail elsewhere (23, 24). The patients were assessed at baseline and at regular doctor visits for 5 years or until lost to follow-up by use of the ACR Core Data Set variables (25).

Of the 195 patients starting the study, 162 were available for the work force, and of these 138 were gainfully employed at baseline (the rest were temporarily unemployed, in vocational training, or on maternity leave). During the trial, 3 patients died and 11 were lost to follow-up. At the 5-year visit, the patients were asked to fill in the FIOH questionnaire (15) (Appendix) describing their perceived work load at baseline, as well as at 5 years (if applicable) and to report in detail any changes in employment, occupation, or work requirements. They were also asked for permission to collect data on their work disability days from social insurance registers.

Finland has a national health insurance system, and all residents of Finland are entitled to a work disability benefit – either sickness allowance or, if work incapacity persists for at least one year, a disability pension – as compensation for lost income during disease-related inability to work (www.kela.fi). For each of the study patients, we calculated cumulative duration for sick leaves and RA-related disability pensions. The income before contracting RA could be calculated from the sickness allowance. Using the individual income data, lost productivity was estimated by the human capital approach (26), as described in detail previously (3).

Items of functioning (HAQ) and work load (FIOH questionnaire) when categorized according to the ICF

The 20 individual items (questions) of the HAQ at 6 months were linked to the ICF according to our earlier study (3). The linking was performed separately by two authors (K.P., M.A-K.), and discussion between the coders led to consensus. The HAQ yields three ICF categories: "mobility," "self-care," and "domestic life." In this study, the latter two categories (including 9 questions) were omitted as unrelated to the requirements of paid work measured by the FIOH questionnaire (15). The other 11 items were linked to three mobility subcategories of the ICF: "changing and maintaining body position," "carrying, moving, and handling objects," and "walking and moving" (Appendix). The individual HAQ items are scored from 0 to 3, and the highest score defined a patient's score in each subcategory. In this study, a score of 1 or more was defined as "disability."

At best modest correlations were found between the individual items of the FIOH questionnaire and lost working time (see Appendix for details). Question 9 regarding repetitive movements of the wrist or fingers was omitted because it showed an inverse correlation with lost working days probably reflecting light office work. Questions 1, 3, 4, 5, 6, and 8 could be included (Appendix). These items showed a good internal consistency with Cronbach's alpha of 0.84. Questions 3, 4, 5, 6, and 8 had three- to four-point ordinal scales. After exploring distributions of the scores, a score ≥2 was defined as indicating work load, with the exception of question 3 (standing) for which a score 3 (more than 4 hours per workday) was chosen to indicate relevant work load. Question 1 included three items indicating the number of lifts. Any lifting of objects heavier than 5 kilograms was deemed to indicate work load. The questions were linked to the three mobility subcategories of the ICF.

Any mismatch between a patient's functioning and work requirements in the three subcategories was recorded. For example, if a patient reported difficulty in opening a new milk carton or in any other functioning in the HAQ linked in the "carrying, moving, and handling objects" subcategory (see Appendix) and reported working more than half an hour per workday with his or her hand above shoulder level (question number 8 in the FIOH) and/or carrying or transferring manually loads heavier than 5 kilograms (question number 1 in the FIOH), mismatch in the "carrying, moving, and handling objects" subcategory was recorded. The number of mismatching subcategories (0-3) was counted for each patient.

Assessment of physical work demands from occupational titles

In comparison and to further verify the criterion validity of the questionnaire data, the presence of work load exposure with regard to the 6 items of the FIOH questionnaire was assessed based on occupational titles by two independent experts (E.V-J. and S.S.) of occupational medicine. These evaluators were blinded to all other patient information. The largest occupation groups among the blue collar workers were farmers, and among the white collar workers, secretaries and book-keepers. For 28 occupational titles, an experienced ergonomist was consulted regarding work content. Disagreements between the evaluators were solved by consensus. Work exposures could be assessed for 106 patients; for the remaining six subjects, their occupational titles were insufficiently informative to allow assessment of physical exposure. Inter-rater agreement was excellent for five work load factors (kappa coefficient (κ) between 0.87 and 0.96) and very good (κ=0.72) for one physical load factor (working with hand above shoulder level). Mismatch between work requirements and a patient's functional capacity was recorded in the same way as described for the FIOH questionnaire data.

Statistical methods

Results are expressed as means with standard deviation (SD) and 95% confidence interval (CI), and as medians with interquartile range (IQR). Confidence intervals for loss of productivity were obtained by bias-corrected and accelerated bootstrapping (5000 replications), because of the skewed distribution of the variable. Statistical comparison between groups was made by *t*-test, Mann-Whitney test, or χ^2 test. Analyses of the rates of disability pensions were based on product-limit estimation. A Cox proportional hazards regression model with a robust estimate of variance was performed to adjust for confounding factors. Internal consistency of scales was examined by Cronbach's alpha coefficient. The relationship between variables was investigated using Spearman's rank order correlation, and confidence intervals

for coefficients were obtained by bootstrapping. Inter-rater agreement was investigated by kappa statistics. Normality of variables was evaluated by Shapiro-Wilk statistics. A multiple imputation (Markov-chain Monte Carlo) method was applied to fill in missing values for individual HAQ questions; four patients (3.6%) missed 1 to 2 items (questions).

This study was performed according to the principles of the Declaration of Helsinki. The protocol was approved by the national health authorities and the ethics committees in all 18 participating hospitals. All patients gave written informed consent.

Results

Completed questionnaires (both the FIOH questionnaire and the HAQ) were available from 112 patients. Of them, 60 (54%) reported a baseline work load in the subcategory "carrying, 'moving, and handling objects," 81 (72%) in "changing and maintaining body position," and 71 (63%) in "walking and moving;" 14 (13%) had their work load fall into one, 30 (27%) into two, and 46 (41%) into three subcategories. Only 22 patients (20%) reported no physical work load that could be linked to any of the ICF subcategories. Based on occupational titles, the experts of the FIOH estimated the presence of work load exposure in "carrying, moving, and handling objects" in 50 (47%) of the 106 patients assessable, in "changing and maintaining body position" in 56 (53%), and in "walking and moving" in 58 (55%) patients. Medium to weak correlations appeared between the questionnaire data and the expert opinion data in the 3 subcategories: Spearman coefficients were 0.40 (95%CI: 0.22-0.58), 0.39 (0.22-0.56), and 0.27 (0.08 -0.46), respectively.

A total of 28 patients retired during the follow-up, 5 of them because of age while a RA-related disability pension was awarded to 23. Two patients were unemployed at 5-year visit. Of the 82 patients who kept in work, 57 did not report any change in working conditions during the follow-up. Their FIOH questionnaire profiles were almost identical regarding the study onset and the 5-year visit, whereas, expectedly, difference in profiles was seen in those 25 patients, who reported a change in working conditions. To evaluate possible recall bias concerning baseline work load, we separately examined the correlation between data obtained by questionnaire and by expert opinion in those two groups. No significant difference in agreement was found between those patients who experienced a work change and those who did not.

The mean HAQ index at 6 months was 0.27. While 59 (53%) patients reported no HAQ disability, 40 (46%) had function limitations in "carrying, moving, and handling objects," 30 (27%) in "changing and maintaining body position," and 33 (30%) in "walking and moving".

When coexistence of HAQ disability and physical work load according to the FIOH questionnaire was recorded, 18 patients (16%) had this coexistence in one, 7 patients (6%) in two, and 10 patients (9%) in three subcategories. Altogether, 35 patients (31%) perceived diminished capacity in the functioning that their work required. These patients had at baseline higher scores for global assessments of RA severity, more HAQ disability, and higher ESR than had the other patients (Table I).

Between the 6-month and 5-year visits, 60 (54%) of the 112 patients experienced sick leave. Of those, 20 patients ended on a permanent RA-related disability pension. Mean number of work disability days per patient-year was 78, median was 3 (IQR: 0-33). Mismatch in any one of the three subcategories of mobility at 6 months served as a predictor of permanent RA-related work disability ($p<0.001$) (Fig. 1). In another aspect, occurrence of any mismatch was associated with RA-related disability pension: Unadjusted hazard ratio (HR) was 11.2 (95%CI: 3.9-32.6), and when adjusted for sex, age, and education level, HR was 11.6 (95%CI: 4.0-33.4). A total of 16 (46%) of patients with mismatch became permanently work disabled after the 6-month visit compared to 4 (5%) of those without any mismatch (Fig. 2). When sick leaves were also included in the analysis, occurrence of any mismatch predicted the number of future (7 to 60 months) work disability days and the loss of productivity (Table II). Moreover, a "dose-relationship" appeared: the patients with 0, 1, 2, and 3 mismatches incurred on average 36, 137, 162, and 229 work disability days per patient-year, respectively.

The 6-month HAQ index showed a good correlation with work disability days and loss of productivity, as well: Spearman's coefficients were 0.48 (95%CI: 0.32-0.63) and 0.46 (95%CI: 0.28-0.62), respectively. Only one patient of those

Table I. Baseline demographic and clinical variables of 112 rheumatoid arthritis patients, by mismatch between work requirements (items of FIOH questionnaire) and 6-month functioning (items of HAQ).

Variable[1]	Mismatch between work requirements and functioning at 6-month visit: None n=77	Mismatch between work requirements and functioning at 6-month visit: One or more dimensions n=35	*p*
Number (%) of females	50 (68)	24 (67)	0.71
Age (yr)	45 ± 9	46 ± 9	0.87
Duration of education, (yr)	12 ± 4	10 ± 3	0.12
Disease duration (median, range, months)	8 (3-24)	8 (3-22)	0.63
Rheumatoid factor present (%)	71	71	1.0
ESR (mm/hr)	36 ± 22	44 ± 24	0.04
Swollen joint score	14 ± 7	14 ± 7	0.49
Tender joint score	18 ± 9	21 ± 10	0.13
Pain score	44 ± 25	56 ± 24	0.07
Patient's global assessment	44 ± 22	55 ± 24	0.04
Physician's global assessment	42 ± 18	56 ± 20	0.002
HAQ score	0.7 ± 0.5	1.2 ± 0.6	0.001
Larsen score (median, IQR)	2 (0-6)	0 (0-7)	0.57
Combination treatment (%)	40 (52)	14 (40)	0.24

[1]Plus-minus values are means ± SD.

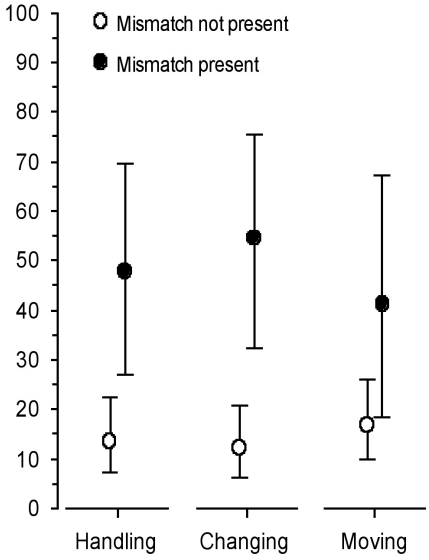

Fig. 1. Occurrence (with 95% confidence intervals) of permanent RA-related work disability by mismatch between work requirements and 6-month disability in subcategories of mobility category: "carrying, moving and handling objects" (Handling), "changing and maintaining body position" (Changing), and "walking and moving" (Moving).

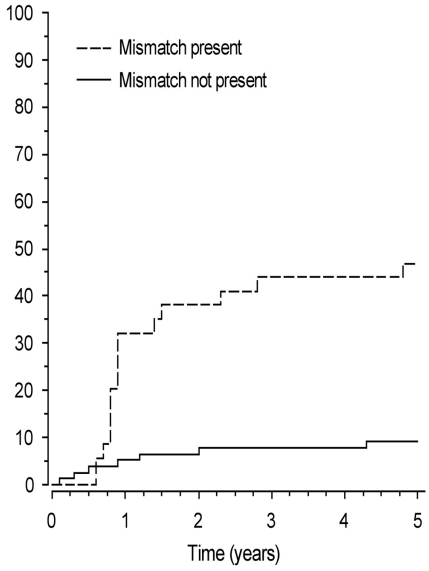

Fig. 2. Cumulative rate of permanent RA-related work disability pensions by mismatch group.

59 with HAQ index of 0 became permanently work disabled. Among the rest 53 patients with index of >0, the presence of mismatch could identify 16 of the 19 patients ending on an RA-related work disability pension.

The method based on expert opinion found mismatch in 25 of 106 patients compared to 35 of 112 patients when based on questionnaire data. Agreement between mismatches was very good (κ coefficient 0.76). The mismatch based on expert opinion also predicted loss of work productivity: From 7 through 60 months, the number of work disability days was 193 (95%CI: 124-258) and the monetary value of lost productivity Euro 13,985 per year (95%CI: 9,120-19,716) when the mismatch was present compared to 39 days (95% CI: 22-66) and Euro 4,098 per year (95%CI: 2,255-7,653) when absent. The mismatch based on the questionnaire data, however, could identify 11 more patients with average annual loss of productivity of Euro 15,253.

Table II. Work disability days and loss of productivity from 7 through 60 months in 112 patients by mismatch group. Means with 95% confidence interval.

Mismatch	Work disability days per patient-year	Lost productivity per patient-year (Euro)
Not present	36 (19-62)	3,043 (1,623-5,534)
Present	168 (113-224)	14,040 (9,143-20,511)

Discussion

To our knowledge, this is the first attempt to utilize a validated questionnaire for assessment of physical work load in patients with RA. Furthermore, this is the first time that disease-related and work-related risk factors for diminished work capacity have been linked to each other just as they are linked in real life, amplifying each other's impact. The ICF served to compare content of the questionnaires and to match corresponding data, as reported earlier (27).

A mismatch between self-reported work load and functioning showed a good predictive validity for loss of work productivity in early RA. The results are in accordance with everyday observations: patients with arthritis in their hands may be unable to do construction work but probably without much difficulty can perform administrative duties. The well-established effect of the HAQ disability index as a predictor of work disability is apparently always mediated by mismatch between patient functioning and work demands as the level of the HAQ that jeopardizes working ability differs according to physical work load (28). In case of no work data, only the absence of HAQ disability can be regarded as safe concerning work disability and loss of productivity (29, 30).

A mismatch based on expert opinion of work load was a predictor of loss of productivity, as well, but the work load questionnaire method could identify more patients at risk. Self-reported data on physical work load may reflect other components of work load than merely the physical aspect in accordance with the HAQ index, which is only partly explained by physical functional capacity (31). The predictive power of self-reported work load may be further amplified by the fact that health status has an impact on how an individual assesses his or her work (15). In this respect, our instrument may have similar properties as the Work Instability Scale and the Work Limitations Questionnaire although not including specific items for coverage of psychosocial factors.

The questionnaire data on physical work load were derived retrospectively, which carries a risk for recall bias. This, however, was not a problem for more than half of the patients, who experienced no change in working conditions during the 5-year follow-up: They actually reported their current work load. People tend to remember fairly well the crises in their life (32), and if a person has been in a job for many years, he or she may not have much difficulty in recalling, whether it was necessary to walk a lot during workdays or whether it was necessary to kneel or squat frequently, etc. Only three of our 112 patients reported having three or more jobs before the 5-year visit. The correlation between the self-reported data and the expert opinion demonstrated criterion validity with no difference between those patients who had experienced a change in working conditions and those had not. In computation of lost work productivity, any recall bias was ruled out by use of official register data on sick leave and disability pensions.

Several baseline factors are known to be associated with loss of future work

productivity (7-10). Accordingly, those patients with a mismatch had higher baseline scores in the patient's and physician's global assessment of RA severity, HAQ disability index, and ESR. These variables, however, are not very useful risk factors regarding individual patients; a better predictor, as we have shown, is response to treatment after 6 months of DMARD therapy, defined either by the ACR criteria (22) or simply by the HAQ (3). The present results show that the mismatch between self-reported work load and items of the HAQ further facilitates the correct prediction of a patient's risk for loss of work productivity.

The HAQ is a widely used instrument for assessment of functioning both in clinical practice and research (16, 17, 25). For assessment of work load, however, no uniform, internationally available questionnaire exists. Developing such an instrument remains a subject for additional in-depth studies and more international collaboration. The FIOH questionnaire is, however, ready for use in Finland (15). In general, inclusion of questions about work load in patient history might be helpful in identification of individuals at highest risk.

Our results emphasize the importance of patient-reported data in rheumatology and the need to develop facilities, *e.g.* software programs, to incorporate collection, analysis, and storage of questionnaire data into standard clinical care (33).

We estimated the cost of lost productivity by the human capital approach (HCA), which values an individual's productivity at its market price, *i.e.* gross income including employer's contribution or, for self-employed persons, statutory insurance expenses (26). This method has been used in most studies. The friction cost approach (FCA) (34), another method, assumes that someone currently unemployed will replace the disabled worker after a friction period, and usually yields estimates that are lower than those obtained by the HCA (30, 35). The assumptions of the FCA can be criticized (36). Because of lack of a valid instrument, we did not estimate presenteeism, *i.e.* loss of productivity while at work (37).

The present results are linked to the Finnish social insurance system and labor market, but may be generalized to other affluent welfare societies with generous social security benefits. In the USA with its more limited welfare facilities, the rates of permanent RA-related work disability have been lower than in European countries, and RA patients remain in working life, despite lower functional capacity than do the control patients in Finland (38). Consequently, presenteeism may be a bigger problem in the USA (39, 40), although no comparative data are available. The principle of matching data on functioning and work load in assessment of work capacity may be useful for predicting work capacity in other diseases that impact a person's functional capacity, as well.

In summary, the aim of treatment of patients with recent-onset RA is the restoration of normal functional and work capacity. Despite increasingly better drug treatment results, remission remains to be achieved in many cases, and impaired functioning may result in considerable productivity losses. Combination of HAQ data with self-reported work load (*e.g.* the FIOH questionnaire) by the help of the ICF constitutes a valid method for early identification of those patients who are at risk for imminent work disability and high societal cost. Further, the mismatch between work requirements and a patient's functioning shows "where the shoe pinches" and can guide interventions aimed at reversing the adverse advance. The usefulness of this principle should be verified in prospective clinical studies.

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Appendix

The FIOH questionnaire. Items 1, 3, 4, 5, 6, and 8 demonstrated face validity and were linked to the ICF. Matching ICF subcategories are shown in CAPITALS.

1. On the average, how many times per workday do you lift, carry of transfer manually loads of different weight listed below? HANDLING

• 6–15 kg _____times • 16–25 kg _____times • More than 25 kg _____times

2. On average, how many hours per workday do you sit in your work?

3. On average, how many hours per workday do you work standing? CHANGING

• Less than 2 hours • 2–4 hours • More than 4 hours

4. On average, how many kilometers do you think you walk during an ordinary workday? MOVING

• Less than 1 km • 1 to 5 km • More than 5 km

5. On average, how many hours per workday do you work kneeling or squatting? CHANGING

• Not at all • Less than ½ hour • ½ to 1 hour • More than 1 hour

6. On average, how many hours per workday do you work with your trunk bent forward (standing or kneeling)? CHANGING

• Less than ½ hour • ½–1 hour • 1–2 hours • More than 2 hours

7. How frequently do you rotate your trunk during an ordinary workday?

8. On average, how many hours per workday do you work with your hand above shoulder level? HANDLING

• Less than ½ hour • ½–1 hour • 1–2 hours • More than 2 hours

9. On average, how many hours per workday do you perform tasks involving repetitive movements of the wrist or fingers (*e.g.* keyboard work, driving screws)?

• Not at all • Less than 2 hours • 2–4 hours • More than 4 hours

10. On average, how many hours per workday do you work with your neck bent forward?

11. On average, how many hours per workday do you work with rotated neck?

Correlation between data from the individual questions and loss of productivity: Spearman's correlation coefficients 1) 0.26*, 2) -0.18, 3) 0.25*, 4) 0.17, 5) 0.24*, 6) 0.24*, 7) 0.22*, 8) 0.20*, 9) -0.05, 10) 0.14, 11) 0.04 (*significant at level <0.05).
Item 9 was omitted because of inverse correlation (see *Patients and methods* section).

The items of the HAQ linked to subcategories if the ICF category "mobility".

HAQ question	ICF code	Subcategory of "Mobility"
Are you able to:		
- Stand up from a straight chair?	d410	Changing
- Get in and out of bed?	d410	Changing
- Lift a full cup or glass to your mouth?	d445	Handling
- Open a new milk carton?	d445	Handling
- Walk outdoors on flat ground	d450	Moving
- Climb up five steps?	d455	Moving
- Reach and get down a 5-pound object (such as a bag of sugar) from just above your head?	d430	Handling
- Bend down to pick up clothing from the floor?	d410	Changing
- Open car doors?	d445	Handling
- Open jars which have been previously opened?	d445	Handling
- Turn faucets on and off?	d445	Handling