Assessment of fatigue in routine care on a Multidimensional Health Assessment Questionnaire (MDHAQ): a cross-sectional study of associations with RAPID3 and other variables in different rheumatic diseases

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Abstract

Objective

To characterise associations of fatigue with other variables within a multidimensional health assessment questionnaire (MDHAQ) in routine care of patients with different rheumatic diagnoses.

Methods

All patients complete MDHAQ, which includes fatigue on a 0–10 visual analogue scale (VAS), and routine assessment of patient index data (RAPID3), a composite of function, pain, and patient global. Physicians complete a RheuMetric checklist which includes 4 VAS for overall global status (DOCGL), inflammation, damage, and distress. Median score for fatigue and other MDHAQ and RheuMetric scores were compared in 4 diagnosis groups: rheumatoid arthritis (RA), osteoarthritis (OA), systemic lupus erythematosus (SLE), and fibromyalgia (FM), using a Kruskall-Wallis test. Associations of fatigue with other variables were analysed using Spearman correlations and multivariate regressions.

Results

612 patients were included: 173 RA, 199 with OA, 146 with SLE, and 94 with FM. Median fatigue was significantly higher in FM (7) than in RA (4), OA (5), and SLE (5). Fatigue was correlated significantly with all other MDHAQ scores, at higher levels in RA and SLE versus OA and FM. Fatigue was correlated significantly with DOCGL in RA, OA, SLE, but not FM. In multivariate analyses, fatigue scores were explained independently by higher pain and symptom number in RA; lower age and higher symptom number in OA; only higher pain in SLE; and none of the variables in FM.

Conclusion

Fatigue is common in rheumatic diseases and strongly associated with higher pain and number of symptoms. The MDHAQ provides a useful tool to assess fatigue in clinical settings.

Key words

fatigue, disease activity, patient reported outcomes, rheumatoid arthritis, systemic lupus erythematosus, osteoarthritis, fibromyalgia

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Introduction

Fatigue is an important problem for many patients with rheumatic diseases (1-3). About 41% of patients with RA reported substantial fatigue, ≥2 on a 0–10 visual analogue scale (VAS) (4), in contrast to 18% of normal individuals (5). Fatigue is even more prevalent in SLE, found in up to 90% of patients (6) with 50% of them considering fatigue as their most disabling symptom (7). The extent to which fatigue contributes or reflects disease activity, organ damage, and/or psychological distress varies considerably in individual patients. Fatigue has been associated with poor physical function and psychosocial variables (4-6, 8-10) in addition to increasing comorbidity burden (11).

Over the last decade, fatigue has been a subject of increasing interest among rheumatologists, and has been proposed an important outcome measure by Outcome Measures in Rheumatology (OMERACT) (2). Fatigue provides additional information to understand disease from the patient's perspective, and has been included in recent clinical trials as an outcome measure (12-14). However, most rheumatologists do not assess fatigue systematically in routine care in busy clinical settings even qualitatively as descriptive estimates, much less quantitatively, as scores on a self-report questionnaire.

Multiple patient self-report questionnaires have been developed to provide quantitative assessments of fatigue (15), including the vitality scale from the Medical Outcomes Study Short Form 36 (SF-36) (16), Bristol Rheumatoid Arthritis Fatigue Multi-Dimensional Questionnaire (BRAF MDQ) (15), Functional Assessment of Chronic Illness Therapy (FACIT) (10), and the Brief Fatigue Inventory (BFI) (17). Nonetheless, evidence has been reported that fatigue on a VAS is as sensitive to change as more complex multi-item instruments (18), although more detailed questionnaires may be required to analyse mechanisms of fatigue.

A multidimensional health assessment questionnaire (MDHAQ) (19) includes a VAS to estimate fatigue, in addition to other patient reported measures, such as routine assessment of patient index data (RAPID3), a composite of function, pain, and patient global estimate (PATGL), (20), as well as queries concerning sleep, anxiety and depression (19), a rheumatoid arthritis disease activity index (RADAI) of a self-reported joint count (21), a symptom checklist (22), and recent medical history. MDHAQ has been shown informative not only in rheumatoid arthritis (RA) (23, 24), but also in osteoarthritis (OA) (25), systemic lupus erythematosus (SLE) (25, 26), fibromyalgia (FM) (22, 27), spondyloarthropathies (28-31), and vasculitis (32).

The purpose of this study was to analyse data concerning fatigue in routine care on a VAS included on the MDHAQ, including possible associations with other MDHAQ variables, as well as physician-assigned scores for global status, inflammation, damage, and distress.

Materials and methods

Patients

All patients seen at the Division of Rheumatology at Rush University Medical Center complete an MDHAQ at every visit while waiting to see the rheumatologist in the infrastructure of routine care. In addition, physicians complete a RheuMetric [formerly RHEUMDOC (33)] checklist. The primary diagnosis was assigned by the treating physician according to ICD-9 codes. Patients older than 18 years, who had the four most prevalent primary diagnoses in the database, RA, OA, SLE, and FM, and who had complete MDHAQ and RheuMetric data, seen between September and December 2014, were included in this study.

Patient self-report MDHAQ

The MDHAQ is a 2-page questionnaire adapted from the original HAQ (34, 35), for use in a routine clinical setting, with primary purposes to improve the quality of clinical care and patient outcomes (19, 36). The MDHAQ includes 10 queries concerning activities to evaluate physical function (FN), scored 0 ("without any difficulty"), 1 ("with some difficulty"), 2 ("with much difficulty") or 3 ("unable to do"). The total score of 0–30 is recalculated as 0–10, using a scoring template on the

MDHAQ. The MDHAQ also includes 3 (0–10) visual analogue scales (VAS) for pain, patient global assessment (PATGL), and fatigue as 21 circles rather than a 10 cm line. The phrasing of the fatigue question was: "How much of a problem has UNUSAL fatigue or tiredness been for you OVER THE PAST WEEK?" with the anchors "Fatigue is no problem = 0" and "Fatigue is a major problem = 10".

RAPID3 (routine assessment of patient index data 3) is a composite index that includes the 3 patient-reported RA Core Data Set measures, FN, pain, and PATGL (23, 37), each scored 0–10 for a total of 0–30 (23). Four RAPID3 severity categories have been described in RA (23): high (>12), moderate (6.1–12), low (3.1–6), and near-remission (≤3). MDHAQ/RAPID3 has been found informative in OA, SLE, FM, in addition to RA and other rheumatic diseases (22, 24-30, 32, 38).

The MDHAQ also queries sleep quality, anxiety, and depression in the traditional, patient-friendly HAQ format (34, 35); scores for these items are not included in RAPID3. A self-report RA disease activity index (RADAI) joint count (21) is included on the MDHAQ. The RADAI self-report joint count queries patients to score pain in 16 specific joint groups, 8 each on the right and left sides: fingers, wrists, elbows, shoulders, hips, knees, ankles, and toes. Scoring options are 0 (=none), 1 (=mild), 2 (=moderate), or 3 (=severe) pain; total scores range from 0 to 48. RADAI self-report joint counts have been shown to be useful in patients with different rheumatic diseases (39). In addition, the MDHAQ includes a checklist of 60 symptoms (22), and a recent medical history (35). Demographic data on the MDHAQ include gender, date of birth, ethnicity, and years of formal education (19).

RheuMetric:
A physician checklist for usual care

Rheumatologists complete a one-page RheuMetric checklist (formerly RHEUMDOC) at each visit as part of usual care at Rush University Medical Center. RheuMetric includes 4 physician 0–10 VAS for overall global patient status (DOCGL), as well as 3 subscales to estimate levels of inflammation or reversible findings, damage or irreversible findings, and distress findings explained by neither inflammation nor damage (*e.g.* fibromyalgia). Although DOCGL was designed initially to assess inflammatory activity in RA, clinical decisions may be influenced by joint damage and patient distress, not explained by inflammation, and quantitative assessment of these indicators of severity appears of value (33).

Disease activity categories according to PATGL, DOCGL, and RAPID3

The proportion of patients in 4 disease activity categories according to DOCGL, PATGL, and RAPID3 was calculated for each diagnostic group. PATGL was selected to summarise the patient perspective, DOCGL the physician perspective, and RAPID3 as the most widely used RA index in routine clinical care, albeit by only 29% of rheumatologists (40).

Predefined categories for PATGL and DOCGL were: <1= remission, 1-3 = low disease activity, 3–6 = moderate and >6 = high disease activity. RAPID3 severity categories, were previously described as <3 = remission, 3.1–6 = low severity, 6.1–12 = moderate severity, and >12.1 = high severity (20, 23).

The minimally important difference for fatigue on a 0–10 VAS to be considered relevant worsening is between 1.13 and 1.26, as described in a large RA clinical practice (41); a difference of >1.3 between disease activity categories was considered clinically significant in this study.

Statistical analysis

MDHAQ and RheuMetric data for patients seen between September and December 2014 were collected in routine care, and entered in a database for analysis. Approval by the Institutional Review Board (IRB) of Rush University Medical Center was obtained for a retrospective chart review of data collected in routine care.

Median fatigue scores, other patient reported outcomes and demographic measuresincluded on the MDHAQ, and RheuMetric checklist scores were compared in the 4 diagnosis categories. Analysis of variance (ANOVA) was used to analyse differences in normally distributed variables, and Kruskall-Wallis one-way analysis of variance for non-normally distributed variables. Interpretation of statistical significance was adjusted for multiple comparisons. The strength of associations between fatigue and demographic measures, MDHAQ scores, and RheuMetric checklist variables was assessed using Spearman correlation in the four diagnosis groups. The proportion of patients in each disease activity category according to DOCGL PATGL, and RAPID3 was calculated for each diagnostic group and the median fatigue score was compared between these categories by Kruskall-Wallis one-way analysis of variance.

To determine which variables were associated with fatigue bivariate analyses were carried out with fatigue scores and demographic, psychosocial, and clinical variables included on the MDHAQ, in addition to the DOCGL subscales from the RheuMetric form. Variables associated with fatigue with a p-value ≤0.05 were entered into multivariate regression models with fatigue as the dependent variable. Through a backward stepwise process, variables were then removed one at a time until the final model contained only variables that were related to fatigue with a $p \leq 0.05$. All analyses were carried out in STATA 12.0® for Mac (StataCorp LP, College Station, TX).

Results

Patients

Overall, 612 patients were studied: 173 with RA, 199 with OA, 146 with SLE, and 94 with FM. The mean (SD) age of all patients was 56.6 (16.6) years; patients with OA were oldest, followed by RA, FM, and SLE (Table I). Patients with SLE and OA were more likely to be African-American. Most patients were female (>85%), and education level was similar in the 4 diagnosis groups.

Fatigue

The median fatigue VAS score was 5 for all patients, 4 for RA, 5 for OA, 5 for SLE and 7 for FM patients, signifi-

Table I. MDHAQ and RheuMetric scores in 612 patients according to four different rheumatic diagnoses.

	ALL PATIENTS (n=612)	Diagnostic Groups				
		RA (n=173)	OA (n=199)	SLE (n=146)	FM (n=94)	*p*-value
Demographic variables						
Mean Age, years (SD)	56.6 (16.6)	58.0 (15.9)	67.2 (12.1)	46.4 (15.2)	47.6 (13.2)	0.001
Gender, % female	89%	86.1%	85.4%	93.1	95.7%	0.012
Ethnicity, %						
Caucasian	32.5%	40.5%	30.7%	17.9%	44.7%	<0.001
Black	40.3%	30.6%	46.7%	46.9%	34.0%	
Hispanic	20.8%	23.7%	17.6%	24.8%	16.0%	
Asian	4.3%	2.9%	3.0%	10.4%	0%	
Other	2.1%	2.3%	2.0%	0%	5.3%	
Educational level, years	14 (12-16)	14 (12-16)	13.5 (12-16)	14 (12-16)	14 (12-16)	0.44
MDHAQ variables (Score range)						
Fatigue (0-10)	5 (2.0-7.5)	4 (1-7)	5 (2-7.5)	5 (1.5-7.5)	7 (5-8)	<0.001
Function (0-10)	2.3 (0.7-4.0)	2.7 (0.7-3.7)	2.7 (1.3-4.0)	1.3 (0-3.0)	3.3 (1.7-5.0)	<0.001
Pain (0-10)	6 (3-8)	5 (2-7.5)	7 (5-8.5)	4.5 (2-7.5)	7.5 (6-8.5)	<0.001
PATGL (0-10)	5 (2.5-7.5)	4.5 (1.5-7)	5.7 (3.5-8)	4.5 (1.2-6.7)	7 (5.0-8.5)	<0.001
RAPID3 (0-30)	14 (7.0-19.2)	11.8 (4.3-18.7)	15.5 (10.2-19.5)	10.7 (3.8-16.0)	18.5 (14.3-21.3)	<0.001
RADAI (0-48)	9 (4-17)	7.5 (2-16)	10 (5-16)	5 (2-15)	16.5 (10-27)	<0.001
# Sypmtoms (0-60)	9 (4-16)	7 (3-12)	8 (4-14)	9 (3-17)	16.5 (10.5-23.5)	<0.001
Depression (0-3.3)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-2)	0.006
Anxiety (0-3.3)	1 (0-1)	0 (0-1)	1 (0-1)	0 (0-1)	0 (0-2)	<0.001
Sleep (0-3.3)	1 (1-2)	1 (0-2)	1 (1-2)	1 (0-2)	1.5 (1-2)	<0.001
RheuMetric variables (Score range)						
	ALL PATIENTS (n= 363)	RA (n=108)	OA (n=131)	SLE (n=73)	FM (n=51)	*p*-value
Overall DOCGL (0-10)	4 (2.5-5)	3.5 (2-5)	4 (3.5-5)	3 (1.5-4)	5 (4-6)	<0.001
Inflammation (0-10)	0.5 (0-2)	1.5 (0.5-3)	0 (0-1)	1 (0-2.5)	0 (0-1)	<0.001
Damage (0-10)	3 (1-4.5)	3 (1-4)	4.0 (3-5)	1 (0.5-2.5)	1 (0-4)	<0.001
Distress (0-10)	0.5 (0-4)	0 (0-0.5)	0 (0-3)	0.5 (0-3)	5 (4.5-7)	<0.001

Values are median and interquartile range unless otherwise indicated. *p*-values according to Kruskall-Wallis one-way analysis of variance for continuous variables and chi square for categorical variables.
RA: rheumatoid arthritis; OA: osteoarthritis; SLE: systemic lupus erythematosus; FM: fibromyalgia; SD: standard deviation; PATGL: patient global estimate of status; RAPID3: routine assessment of patient index data 3.

Table II. Fatigue in 4 diseases severity categories according to the physician and the patient perspective using global assessments.

	RA n=173			OA n=199			SLE n=146			FM n=94		
	%	Fatigue, median (IQR)		%	Fatigue, median (IQR)		%	Fatigue, median (IQR)		%	Fatigue, median (IQR)	
Disease Activity Severity According to DOCGL												
Remission (<1)	13	0.5 (0-2)	p <0.001	7	0.2 (0-1.2)	p <0.001	21	1 (0-4.5)	p <0.001	2	NA	p<0.643
Low (1-3)	33	2 (0.2-4)		17	3 (2-3.5)		35	4 (2-7.5)		8	6.7 (4.7-7.2)	
Moderate (3-6)	39	5.7 (3.2-8)		62	6 (3-8)		34	5.5 (4-7)		69	7 (5-8)	
High (>6)	15	6 (4-8)		14	7 (5.5-10)		10	8.2 (5.5-9.5)		22	7.5 (6-8)	
Disease Activity Severity According to PATGL												
Remission (<1)	23	0.5 (0-1.5)	p <0.001	12	1.7 (0-4)	p <0.001	25	0.5 (0-1)	p <0.001	0	NA	p<0.002
Low (1-3)	18	2 (0.7-4.5)		12	3 (1.5-6.5)		16	2 (1.5-3.5)		8	7 (3-7.5)	
Moderate (3-6)	28	4 (3-6.5)		33	5 (2-6)		29	5 (4-7)		25	5 (4-7)	
High (>6)	31	7.5 (5.2-8.5)		43	7 (6-9)		30	8 (6.7-9)		67	7.75 (6-8.5)	
Disease Activity Severity According to RAPID3												
Remission (≤3)	23	0.5 (0-2)	p <0.001	6	0 (0-2)	p <0.001	23	0.5 (0-1)	p <0.001	0	NA	p <0.035
Low (3.1-6)	8	2 (0.5-5)		7	5 (1.5-7)		12	1.75 (1-3)		0	NA	
Moderate (6.1-12)	23	3 (1.75-4)		19	3 (1.5-4)		21	4 (3.5-6)		16	5 (2.5-7.5)	
High (>12)	46	7 (5-8.5)		68	6.5 (3.5-8)		44	7.5 (5.5-9)		84	7.5 (6-8)	

p-values according to Kruskall-Wallis one-way analysis of variance.

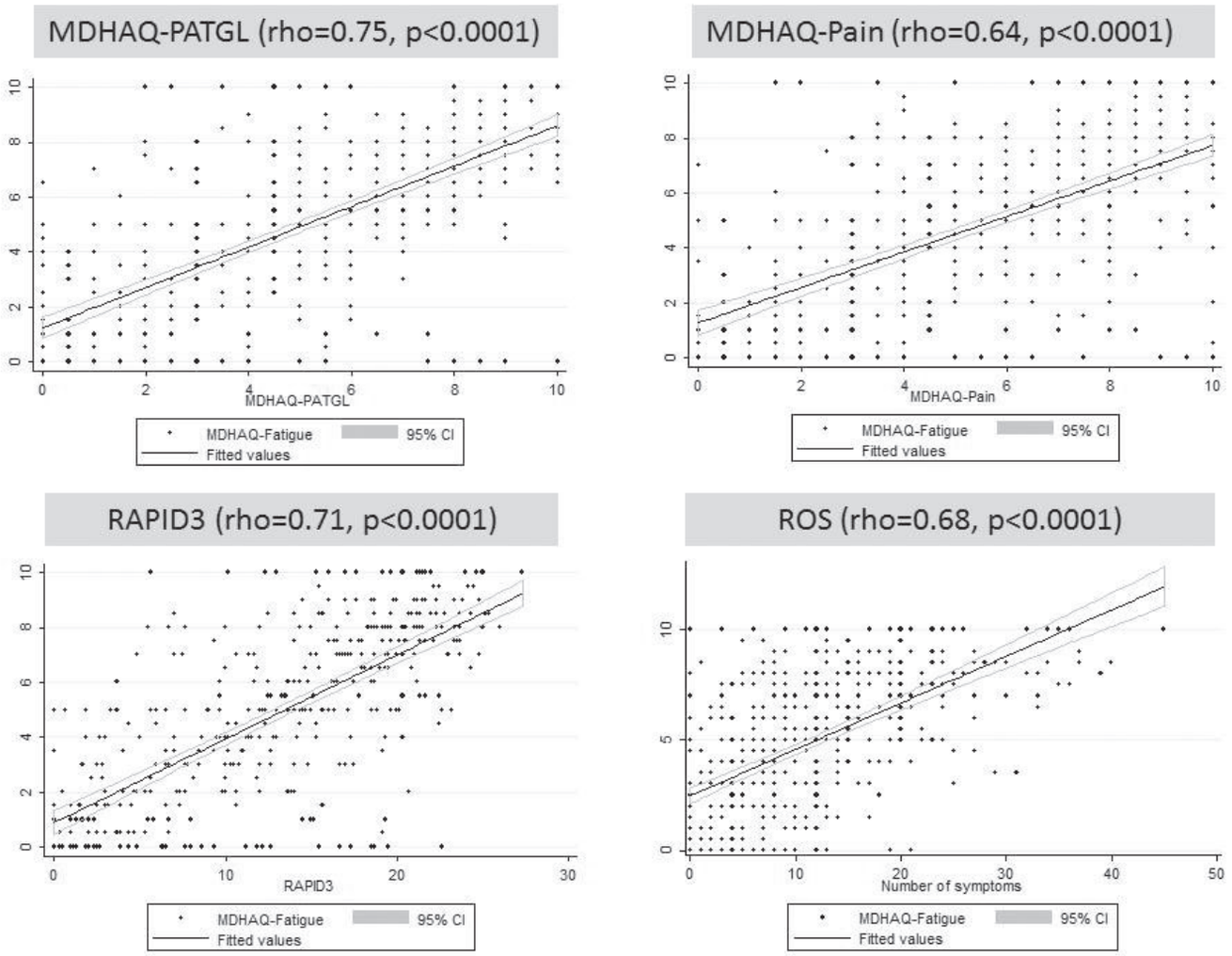

Fig. 1. Spearman correlations (black line; 95% confidence band, grey line) between fatigue and patient global estimate (MDHAQ-PATGL), pain score (MDHAQ-Pain), RAPID3, and number of symptoms (ROS) for all patients.

cantly higher in FM compared to the other diagnoses (p<0.001) (Table I). A similar pattern was seen among most MDHAQ scales, with highest scores in FM compared to OA, RA, and SLE patients (Table I). RheuMetric scores for overall DOCGL were highest in FM; highest scores for inflammation were seen in RA, for damage in OA, and for distress in FM (Table I), similar to other cohorts (33).

Fatigue scores were correlated inversely with both age (Spearman correlation rho= -0.11, p<0.05) and education level (rho= -0.08, p=ns), although only inverse correlations with age in all patients and OA were statistically significant (Table IV). Fatigue scores were correlated significantly with most other MDHAQ scores in all patients, particularly with PATGL (rho=0.75, p<0.001), RAPID3 (rho=0.71, p<0.001), number of symptoms (rho=0.68, p<0.001), and pain (rho=0.64, p<0.001) (Fig. 1), in addition to function and RADAI self-reported join counts (rho=0.50, p<0.001), sleep (rho=0.56, p<0.001), anxiety (rho=0.53, p<0.001), and depression (rho=0.50, p<0.001) (Table IV). Correlations of fatigue with MDHAQ scores for FN, pain, PATGL, RAPID3, and number of symptoms were higher in patients with RA (rho=0.63-0.77) or SLE (rho=0.59-0.87), than in patients with OA (rho=0.37-0.67) or FM (rho=0.37-0.59) (Table IV). Correlations of fatigue with scores for sleep quality also were statistically significant in all 4 groups (rho=0.43-0.61), lower than correlations with PATGL or RAPID3, and lowest in FM. Correlations of fatigue with anxiety and depression scores (rho=0.32-0.54) also were lower than with sleep quality in RA, OA, and SLE, but not in FM.

Physician global estimates were correlated significantly with fatigue scores in RA (rho=0.58, p<0.001), OA (rho=0.45, p<0.001), and SLE (rho=0.51, p<0.001), but not in FM (rho=0.15, p=ns). Fatigue score were correlated significantly with the inflammation subscale only in RA patients (rho= 0.38, p<0.01). Correlations of fatigue with physician estimates of distress were higher than with estimates of inflammation or damage in OA, SLE and FM, and almost identical for inflammation and distress in RA (Table IV).

Disease severity and fatigue

Median (IQR) fatigue scores were increased linearly according to the 4

Table III. Association between fatigue and demographic, psychosocial and clinical variables on the MDHAQ and RheuMetric.

	RA, n=173			OA, n=199			SLE, n=146			FM, n=94		
	β coefficient	*p	**p	β coefficient	*p	**p	β coefficient	*p	**p	β coefficient	*p	**p
Age, yrs	-0.15	0.06		-0.23	0.007	0.04	0.15	0.08		-0.18	0.10	
Female	0.07	0.40		0.04	0.61		0.20	0.02	--	0.04	0.69	
Function (0-10)	0.66	<0.001	--	0.35	<0.001	--	0.59	<0.001	--	0.32	0.006	--
Depression (0-3.3)	0.33	<0.001	--	0.30	<0.001	--	0.45	<0.001	--	0.37	0.001	--
Anxiety (0-3.3)	0.15	0.06		0.24	0.005	--	0.38	<0.001	--	0.31	0.005	--
PAIN (0-10)	0.64	<0.001	0.02	0.46	<0.001	--	0.76	<0.001	0.01	0.40	<0.001	--
RADAI (0-48)	0.52	<0.001	--	0.35	<0.001	--	0.55	<0.001	--	0.49	<0.001	--
#Symptoms	0.56	<0.001	0.03	0.45	<0.001	0.03	0.66	<0.001	--	0.57	<0.001	--
Inflammation	0.31	0.002	--	0.02	0.86		0.22	0.71		0.05	0.75	
Damage	0.14	0.16		0.19	0.06		0.36	0.003	--	0.03	0.82	
"Neither"	0.33	0.002	--	0.27	0.01	--	0.35	0.009	--	0.45	0.002	--
R-squared			0.63			0.51			0.62			0.25

RA: rheumatoid arthritis; OA: osteoarthritis; SLE: systemic lupus erythematosus; FM: fibromyalgia; PATGL: patient global estimate; DOCGL: doctor global estimate. *Bivariate p, **Multivariate p.

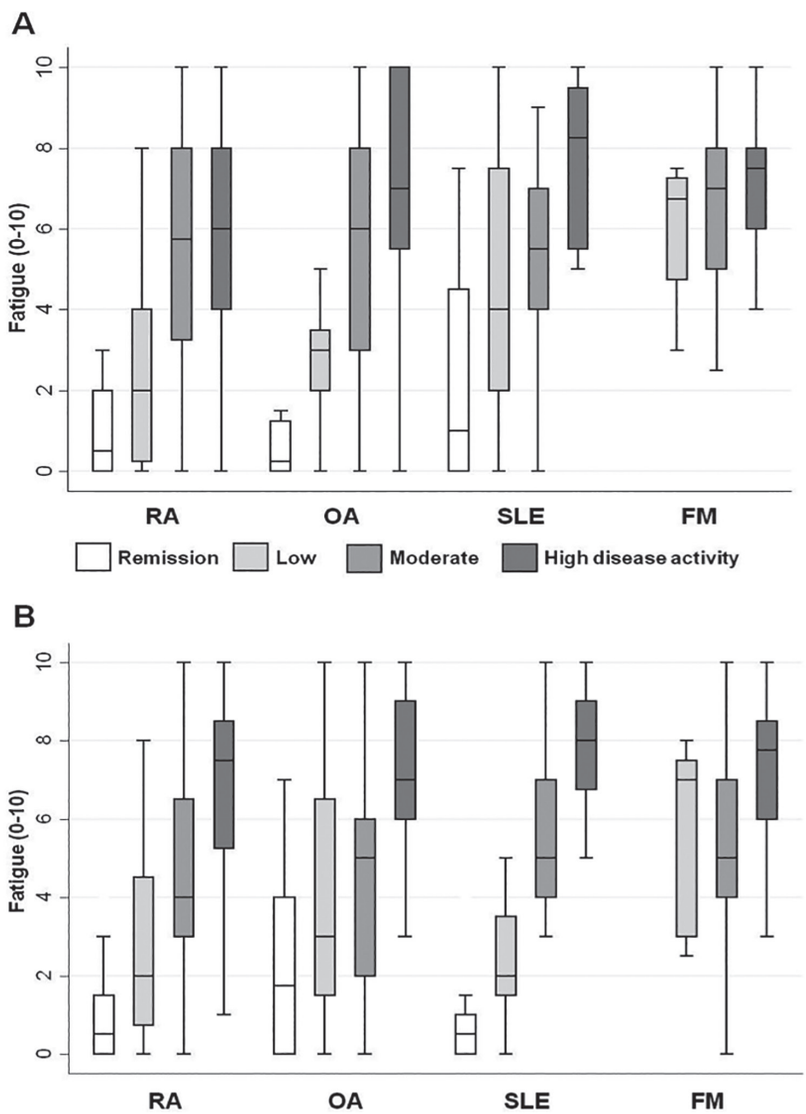

Fig. 2. Fatigue in different disease severity categories by diagnosis according to the physician global (**A**) and the patient global (**B**). Bars show median and percentiles 75 and 25, the lines outside the box are the 95% confidence interval. RA: rheumatoid arthritis; OA: osteoarthritis; SLE: systemic lupus erythematosus; FM: fibromyalgia.

severity categories for DOCGL in the four rheumatic diagnoses, although least steeply in FM, in which no patient was scored <1 (Fig. 2). Median fatigue scores also were increased linearly with severity categories for PATGL and RAPID3 in RA, OA, and SLE, but not in FM. Differences on the fatigue score between categories were statistically significant; most were >1.3, suggesting that they also were clinically significant (41) (Table II).

Regression analyses

A series of regression models including all variables, which were correlated at a level of $p<0.05$ in univariate analyses were performed for each diagnosis group (Table III). In RA patients, the model explained 63% of the variation in fatigue ($p<0.001$); pain and total number of symptoms was statistically significant. In OA patients, a similar regression model explained 51% of the variation in fatigue ($p<0.001$); age and total number of symptoms was statistically significant. In SLE patients, a model explained 62% of the variation in fatigue ($p<0.001$); only pain was statistically significant. In FM patients, the model explained only 25% of the variation in fatigue; no variables were statistically significant (Table III).

Discussion

Fatigue is a complex symptom, which may be affected not only by disease activity, but also by cognitive, behavioural, social, and health-related qual-

Table IV. Spearman correlations between fatigue and other variables included in the MDHAQ and RheuMetric.

	Spearman correlation with fatigue score (0-10)				
	All patients (n=612)	RA (n=173)	OA (n=199)	SLE (n=146)	FM (n=94)
Demographic variables					
Age	-0.11*	-0.09	-0.29*	0.15	-0.05
Education	-0.08	-0.12	-0.005	-0.19	-0.05
MDHAQ variables					
FUNCTION (0-10)	0.58***	0.71***	0.40**	0.59***	0.37
PAIN	0.64***	0.68***	0.47**	0.82***	0.54***
PATGL	0.75***	0.75***	0.67*	0.87***	0.53***
RAPID3 (0-30)	0.71***	0.77***	0.51***	0.86***	0.54***
RADAI (0-48)	0.58***	0.64***	0.37*	0.68***	0.57***
# SYMPTOMS	0.68***	0.63***	0.54***	0.74***	0.59***
Depression (0-3.3)	0.50***	0.32*	0.39*	0.49***	0.52**
Anxiety (0-3.3)	0.53***	0.38**	0.34	0.54***	0.53***
Sleep (0-3.3)	0.56***	0.59***	0.43***	0.61***	0.40***
RheuMetric variables					
DOCGL	0.52***	0.58***	0.45***	0.51***	0.15
Inflammatio	0.11	0.38**	0.02	0.22	-0.04
Damage	0.20**	0.16	0.19	0.28	0.05
Distress	0.40***	0.36**	0.26	0.38	0.38

*p<0.05, **p<0.01, ***p<0.001. RA: rheumatoid arthritis; OA: osteoarthritis; SLE: systemic lupus erythematosus; FM: fibromyalgia; PATGL: patient global estimate; DOCGL: doctor global estimate.

ity of life variables (42, 43). Clinically important levels of fatigue were seen in all 4 primary diagnoses reported here. Fatigue is correlated significantly with patient self-report of poor sleep quality but at lower levels than with RAPID3 or number of symptoms, indicating that patient perceptions of fatigue and sleep quality are related but independent constructs, and that fatigue and the number of symptoms may be an informative quantitative estimate of distress (22).

Fatigue scores were correlated inversely with both age and education. Correlations of education level with self-report scores for pain, physical function, and PATGL have long been recognised in the rheumatology literature (44, 45). The association of lower levels of fatigue with older age in our study was not expected, and will be of interest for further research.

Physician global estimates were correlated with fatigue in RA, SLE, and OA, but not in FM, the group of patients with the highest fatigue scores. Interestingly, fatigue was correlated significantly with the physician inflammation subscale only in RA. Correlations of fatigue with physician estimates of distress were higher than with estimates of inflammation or damage in SLE, OA, and FM, and almost identical for inflammation and distress in RA. These results suggest that physicians may interpret high fatigue as an indicator of distress.

In multivariate analyses, pain and number of symptoms were identified as explanatory variables for fatigue in RA, OA, and SLE but not in FM. These data suggest a considerably stronger association of fatigue with pain in systemic inflammatory diseases than in FM, in which explanatory power for pain is quite low.

Several limitations are seen in our study. First, we assess fatigue only according to a VAS, which appears considerably more desirable than having no quantitative data in routine care, but more elaborate instruments (8) may be needed to analyse types and mechanisms of fatigue in different conditions. Second, the cross-sectional design limits further insight into variables that may influence the course and impact of fatigue over time, which requires longitudinal data. Third, not a single "gold standard" is available to define disease activity or severity; we analysed the variables to estimate the patients and physician's global indicators as well as RAPID3. These scores may be discordant in most rheumatic diseases (46-51), and may recognise different disease constructs in different diagnoses, and within diagnosis in individual patients. Fourth, a matched age, sex and education control group was not included to compare with the different diagnosis groups, although fatigue is recognised in many individuals in the general population (5, 52). As noted, however, it appears considerably more desirable to assess fatigue on a VAS than to have no quantitative data concerning fatigue in routine care.

In conclusion, this study confirms that fatigue is highly prevalent in rheumatic diseases and it is correlated significantly with other indicators of disease severity in RA, and SLE, to a lesser degree in OA, and not significantly in FM. Fatigue scores are more strongly associated with higher pain and number of symptoms than with sleep quality. Quantitative data concerning fatigue can be collected in busy clinical settings on an MDHAQ, with no extra work for the doctor and minimal interference with clinic patient flow. It may be desirable to introduce routine scoring of fatigue into rheumatology care settings, to add to clinical decisions and improve patient outcomes.

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