Fibromyalgia Assessment Screening Tool: Clues to Fibromyalgia on a Multidimensional Health Assessment Questionnaire for Routine Care

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ABSTRACT. ***Objective.*** To develop feasible indices as clues to comorbid fibromyalgia (FM) in routine care of patients with various rheumatic diseases based only on self-report multidimensional Health Assessment Questionnaire (MDHAQ) scores, which are informative in all rheumatic diagnoses studied.

Methods. All patients with all diagnoses complete an MDHAQ at each visit; the 2011 FM criteria questionnaire was added to the standard MDHAQ between February 2013 and August 2016. The proportion of patients who met 2011 FM criteria or had a clinical diagnosis of FM was calculated. Individual candidate MDHAQ measures were compared to 2011 FM criteria using receiver-operating characteristic (ROC) curves; cutpoints to recognize FM were selected from the area under the curve (AUC) for optimal tradeoff between sensitivity and specificity. Cumulative indices of 3 or 4 MDHAQ measures were analyzed as fibromyalgia assessment screening tools (FAST).

Results. In 148 patients, the highest AUC in ROC analyses versus 2011 FM criteria were seen for MDHAQ symptom checklist, self-report painful joint count, pain visual analog scale (VAS), and fatigue VAS. The optimal cutpoints were ≥ 16/60 for symptom checklist, ≥ 16/48 for self-report painful joint count, and ≥ 6/10 for both pain and fatigue VAS. Cumulative FAST indices of 2/3 or 3/4 MDHAQ measures correctly classified 89.4–91.7% of patients who met 2011 FM criteria.

Conclusion. FAST3 and FAST4 cumulative indices from only MDHAQ scores correctly identify most patients who meet 2011 FM criteria. FAST indices can assist clinicians in routine care as clues to FM with a general rheumatology rather than FM-specific questionnaire. (First Release January 15 2020; J Rheumatol 2020;47:761–9; doi:10.3899/jrheum.190277)

Key Indexing Terms:
FIBROMYALGIA ASSESSMENT SCREENING TOOLS FIBROMYALGIA MULTIDIMENSIONAL HEALTH ASSESSMENT QUESTIONNAIRE

Fibromyalgia (FM) is a common disorder in the general population[1], with a considerably higher prevalence in people with rheumatic diseases[2,3,4,5]. As with most rheumatic diseases, no gold standard diagnostic marker is available for FM. In an effort to standardize the identification of FM, the American College of Rheumatology (ACR) developed FM classification criteria in 1990[6], based on the clinical information of 558 consecutive patients, 293 with FM according to experts in FM versus 265 controls. The combination of widespread pain and > 11 over 18 tender points identified on physical examination yields a sensitivity of 88% and specificity of 81%. These criteria were modified in 2010, with no tender point examination, but rather a patient questionnaire for widespread body pain and symptom severity as well as physician ratings, and designated as "preliminary diagnostic criteria" rather than classification criteria[7]. A further modification was introduced in 2011, based entirely on the patient self-report widespread pain index and symptom severity scale questionnaire, without any requirement for physician assessment, and was designed for "epidemiologic and clinical studies" but not intended for diagnosis of FM[8].

FM criteria are not used in most routine clinical care, other than by subspecialists. It is not feasible to ask patients with different diagnoses to complete different patient self-report questionnaires in busy clinical settings. As a consequence,

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Dr. Pincus holds a copyright and trademark on MDHAQ and RAPID3 (Routine Assessment of Patient Index Data 3), for which he receives royalties and license fees, all of which are used to support further development of quantitative questionnaire measurements for patients and doctors in clinical rheumatology care.

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clinicians may both fail to identify or incorrectly identify patients as having FM[9].

A multidimensional Health Assessment Questionnaire (MDHAQ) has been found informative in most rheumatic diseases studied[10], based on a RAPID3 (Routine Assessment of Patient Index Data 3 — an index within the MDHAQ). Additional MDHAQ scales have been reported to provide clues to FM, including a high pain score relative to physical function score[11] and a high number of positive responses on a symptom checklist[12].

This study examines an additional feature of the MDHAQ to provide clues to the presence of comorbid FM, without the need for administration of a separate, condition-specific FM questionnaire, recognizing that a clinical FM diagnosis requires the judgment of a clinician to synthesize all available information about a patient.

MATERIALS AND METHODS

Patients. All patients with all diagnoses at Liverpool Hospital, Australia, complete an MDHAQ at all visits before seeing the rheumatologist. The treating clinician assigns 1 or more diagnoses at the first and subsequent patient visits. Most of the patients included in this study (79%) had their first clinic visit and diagnosis(es) assigned prior to the study onset. All clinical diagnoses and all MDHAQ data are included in a database. All data were exported for analyses to STATA 12.0 for Mac (StataCorp LP).

Patients seen between February 2013 and August 2016 by KAG at a weekly clinic also completed a 2011 FM criteria questionnaire at the same time as the MDHAQ questionnaire to compare with candidate FM Assessment Screening Tool (FAST) indices. Patients included in the study were older than 18 years, had a primary diagnosis of any rheumatic condition except FM, and had complete MDHAQ and 2011 FM criteria cross-sectional data at a random visit during the study period. The primary diagnosis was assigned by the treating physician, who did not examine the 2011 FM criteria results when each diagnosis was assigned. Approval by the district Human Research and Ethics Committee was obtained for this study (LNR/13/LPOOL/370 Local project number 13/229LNR). All patients consent to the use of their anonymized data for research purposes, including publication.

Design of MDHAQ. The MDHAQ (Figure 1) is designed for use in routine care with a primary purpose to improve the quality of clinical care and patient outcomes[13]. It includes 10 queries concerning activities of daily living to evaluate physical function (FN) and 3 (0–10) visual numerical scales (VNS) for pain, patient's global assessment (PtGA), and fatigue. RAPID3 is a composite index that includes the 3 rheumatoid arthritis (RA) core dataset measures, FN, pain, and PtGA, each scored 0–10 for a total of 0–30. MDHAQ/RAPID3 has been found informative in osteoarthritis (OA), systemic lupus erythematosus (SLE), ankylosing spondylitis (AS), psoriatic arthritis (PsA), vasculitis, gout, and FM, in addition to RA[10,12,14-20].

The MDHAQ also includes 3 queries to rate how difficult it was to "get a good night's sleep" (sleep quality), to "deal with feelings of anxiety or being nervous" (anxiety), and to "deal with feelings of depression or feeling blue" (depression) in the traditional, patient-friendly HAQ format[21]. A self-report RA Disease Activity Index (RADAI) painful joint count is recorded[22] on the MDHAQ. The RADAI 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[23]. In addition, the MDHAQ includes a 60-symptom checklist[12] and recent medical history information[24]. Demographic data include sex, date of birth, ethnicity, and years of formal education[25].

2011 FM criteria. The 2011 FM criteria[8] were developed as a patient self-report questionnaire for epidemiologic and clinical studies, and consist of 2 scales: the Widespread Pain Index (WPI) and the symptom severity scale (SSS). The WPI component queries patients to indicate whether they have had pain or tenderness over the previous week in specific joints and areas, including the shoulder girdle, hip, jaw, upper back, lower back, upper arm, upper leg, chest, neck, abdomen, lower arm, and lower leg. Patients grade the right and left side of the body separately from 0 or 1 with a maximum total score of 19. The SSS queries patients to indicate the severity of 6 symptoms over the previous week. Three symptoms [fatigue, trouble thinking or remembering, and waking up tired (unrefreshed)] are scored 0–3: 0, no problem; 1, slight or mild problems, generally mild or intermittent; 2, moderate, considerable problems, often present and/or at a moderate level; and 3, severe, continuous, life-disturbing problems. The other 3 symptoms [pain or cramps in the lower abdomen, depression, or headache during the previous 6 months] are scored 0–1 (0 No, 1 Yes). When summed, the 6 items result in a total score between 0 and 12. A patient meets 2011 FM criteria if the following conditions are met: WPI ≥ 7 and SSS ≥ 5 or WPI between 3–6 and SSS ≥ 9, symptoms have been present at a similar level for at least 3 months, and the patient does not have a disorder that would otherwise sufficiently explain the pain. These criteria are used in our study as the reference standard against which the proposed MDHAQ/FAST indices are compared.

FAST indices based on MDHAQ scores. FAST composite cumulative indices were developed from MDHAQ candidate measures, including FN, pain visual analog scale (VAS), PtGA VAS, RAPID3, sleep quality, anxiety, depression, fatigue VAS, RADAI painful joint count, and a 60-symptom checklist. Receiver–operating characteristic (ROC) curves were constructed to recognize those that provided the highest area under the curve (AUC) compared to the 2011 FM criteria as the reference standard (Figure 2). ROC curves were computed for RAPID3 and PtGA, but these variables were not regarded as candidates for FAST indices because they appeared clinically more likely to be associated with somatic symptoms that could be observed by a clinician, such as dyspnea or joint swelling, and were not included in the 2011 FM criteria. The cutpoint for each score to be included in a FAST cumulative index was selected on the basis of the best tradeoff values between sensitivity and specificity on the ROC curve. An optimal cutpoint was identified for each measure on the basis of the ROC curve for that measure.

Statistical analysis. The proportions of patients who met 2011 FM criteria or a clinical diagnosis of FM [assigned by the treating rheumatologist (KAG)] were calculated. Means and SD of demographic measures and clinical characteristics in patients who did and did not meet FM by criteria were compared using t tests, and percentages using chi-square tests.

FAST3 and FAST4 composite cumulative indices were constructed from the optimal cutpoints of the candidate MDHAQ measures with the highest AUC under the ROC curves as described above. Agreement of FAST indices with the 2011 FM criteria as the reference standard was analyzed using the κ statistic[26] and ROC curves (of the indices) for AUC.

RESULTS

Patient characteristics. The study included 148 patients: 55 (37%) with RA, 21 (14%) with OA, 14 (10%) with PsA, and the remaining 58 (39%) with other rheumatologic diagnoses (Table 1). Among these patients, 24% with RA, 38% with OA, and 21% with PsA met 2011 criteria, while 22%, 38% and 29%, respectively, had a clinical diagnosis of comorbid FM. There were 13%, 29%, and 14%, respectively, who both met 2011 FM criteria and had a clinical diagnosis of FM (Table 1). Among all patients, 29 (20%) met the 2011 FM criteria, 31 (21%) were assigned a clinical diagnosis of FM, 18 (12%) had both a clinical diagnosis and met criteria, while 106 (72%) met neither a clinical diagnosis nor FM criteria (Table 1). Agreement between clinical and 2011 FM criteria was moderate (83.8%, κ 0.50, $p < 0.001$).

Multi-Dimensional Health Assessment Questionnaire (MDHAQ™)(R873AU-NP2E)

This questionnaire includes information not available from blood tests, X-rays, or any source other than you. Please try to answer each question, even if you do not think it is related to you at this time. Try to complete as much as you can yourself, but if you need help, please ask. There are no right or wrong answers. Please answer exactly as you think or feel. Thank you.

1. Please tick (√) the ONE best answer for your abilities at this time:

OVER THE PAST WEEK, were you able to:	Without **ANY** difficulty	With **SOME** difficulty	With **MUCH** difficulty	**UNABLE** to do
a. Dress yourself, including tying shoelaces and doing buttons?	☐ 0	☐ 1	☐ 2	☐ 3
b. Get in and out of bed?	☐ 0	☐ 1	☐ 2	☐ 3
c. Lift a full cup or glass to your mouth?	☐ 0	☐ 1	☐ 2	☐ 3
d. Walk outdoors on flat ground?	☐ 0	☐ 1	☐ 2	☐ 3
e. Wash and dry your entire body?	☐ 0	☐ 1	☐ 2	☐ 3
f. Bend down to pick up clothing from the floor?	☐ 0	☐ 1	☐ 2	☐ 3
g. Turn regular taps on and off?	☐ 0	☐ 1	☐ 2	☐ 3
h. Get in and out of a car, bus, train, or airplane?	☐ 0	☐ 1	☐ 2	☐ 3
i. Walk 3 kilometers, if you wish?	☐ 0	☐ 1	☐ 2	☐ 3
j. Participate in recreational activities and sports as you wish?	☐ 0	☐ 1	☐ 2	☐ 3
k. Get a good night's sleep?	☐ 0	☐ 1.1	☐ 2.2	☐ 3.3
l. Deal with feelings of anxiety or being nervous?	☐ 0	☐ 1.1	☐ 2.2	☐ 3.3
m. Deal with feelings of depression or feeling down?	☐ 0	☐ 1.1	☐ 2.2	☐ 3.3

2. How much pain have you had because of your condition OVER THE PAST WEEK? Please indicate below how severe your pain has been:

NO PAIN ○ PAIN AS BAD AS IT COULD BE

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10

3. Please tick (√) the appropriate spot to indicate the amount of pain you are having today in each of the joint areas listed below:

	None	Mild	Moderate	Severe		None	Mild	Moderate	Severe
a. LEFT FINGERS	☐ 0	☐ 1	☐ 2	☐ 3	i. RIGHT FINGERS	☐ 0	☐ 1	☐ 2	☐ 3
b. LEFT WRIST	☐ 0	☐ 1	☐ 2	☐ 3	j. RIGHT WRIST	☐ 0	☐ 1	☐ 2	☐ 3
c. LEFT ELBOW	☐ 0	☐ 1	☐ 2	☐ 3	k. RIGHT ELBOW	☐ 0	☐ 1	☐ 2	☐ 3
d. LEFT SHOULDER	☐ 0	☐ 1	☐ 2	☐ 3	l. RIGHT SHOULDER	☐ 0	☐ 1	☐ 2	☐ 3
e. LEFT HIP	☐ 0	☐ 1	☐ 2	☐ 3	m. RIGHT HIP	☐ 0	☐ 1	☐ 2	☐ 3
f. LEFT KNEE	☐ 0	☐ 1	☐ 2	☐ 3	n. RIGHT KNEE	☐ 0	☐ 1	☐ 2	☐ 3
g. LEFT ANKLE	☐ 0	☐ 1	☐ 2	☐ 3	o. RIGHT ANKLE	☐ 0	☐ 1	☐ 2	☐ 3
h. LEFT TOES	☐ 0	☐ 1	☐ 2	☐ 3	p. RIGHT TOES	☐ 0	☐ 1	☐ 2	☐ 3
q. NECK	☐ 0	☐ 1	☐ 2	☐ 3	r. BACK	☐ 0	☐ 1	☐ 2	☐ 3

4. Considering all the ways in which illness and health conditions may affect you at this time, please indicate below how you are doing:

VERY WELL ○ VERY POORLY

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10

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1.a-j FN (0-10):

1=0.3 16=5.3
2=0.7 17=5.7
3=1.0 18=6.0
4=1.3 19=6.3
5=1.7 20=6.7
6=2.0 21=7.0
7=2.3 22=7.3
8=2.7 23=7.7
9=3.0 24=8.0
10=3.3 25=8.3
11=3.7 26=8.7
12=4.0 27=9.0
13=4.3 28=9.3
14=4.7 29=9.7
15=5.0 30=10

2.PN (0-10):

4.PTGL (0-10):

RAPID3™ (0-30):

Cat:
HS = >12
MS = 6.1-12
LS = 3.1-6
R = ≤3

PLEASE TURN TO THE NEXT PAGE

Figure 1. The form for the multidimensional Health Assessment Questionnaire. Copyright: Health Report Services. Used with permission.

5. Please tick (√) if you have experienced any of the following over the last month:

__Fever	__Lump in your throat	__Paralysis of arms or legs
__Weight gain (>5 kg)	__Cough	__Numbness or tingling of arms or legs
__Weight loss (>5 kg)	__Shortness of breath	__Fainting spells
__Feeling sickly	__Wheezing	__Swelling of hands
__Headaches	__Pain in the chest	__Swelling of ankles
__Unusual fatigue	__Heart pounding (palpitations)	__Swelling in other joints
__Swollen glands	__Trouble swallowing	__Joint pain
__Loss of appetite	__Heartburn or stomach gas	__Back pain
__Skin rash or hives	__Stomach pain or cramps	__Neck pain
__Unusual bruising or bleeding	__Nausea	__Use of drugs not sold in stores
__Other skin problems	__Vomiting	__Smoking cigarettes
__Loss of hair	__Constipation	__More than 2 alcoholic drinks per day
__Dry eyes	__Diarrhea	__Depression - feeling blue
__Other eye problems	__Dark or bloody stools	__Anxiety - feeling nervous
__Problems with hearing	__Problems with urination	__Problems with thinking
__Ringing in the ears	__Gynecological (female) problems	__Problems with memory
__Stuffy nose	__Dizziness	__Problems with sleeping
__Sores in the mouth	__Losing your balance	__Sexual problems
__Dry mouth	__Muscle pain, aches, or cramps	__Burning in sex organs
__Problems with smell or taste	__Muscle weakness	__Problems with social activities

Please tick (√) here if you have had none of the above over the last month:_____

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5. ROS: ☐

6. When you awakened in the morning OVER THE LAST WEEK, did you feel stiff? ☐ No ☐ Yes
If "No," please go to Item 7. If "**Yes**," **please indicate the number of minutes_____, or hours_____**
until you are as limber as you will be for the day.

7. How do you feel TODAY compared to ONE WEEK AGO? Please tick (✓) only one.
Much **B**etter ☐ (1), **B**etter ☐ (2), the **S**ame ☐ (3), **W**orse ☐ (4), **M**uch **W**orse ☐ (5) than one week ago

8. How often do you exercise aerobically (sweating, increased heart rate, shortness of breath) **for at least one-half hour** (30 minutes)**? Please tick (✓) only one.**
☐ 3 or more times a week (3) ☐ 1-2 times per month (1)
☐ 1-2 times per week (2) ☐ Do not exercise regularly (0) ☐ Cannot exercise due to disability/ handicap (9)

9. How much of a problem has UNUSUAL fatigue or tiredness been for you OVER THE PAST WEEK?
FATIGUE IS ○ FATIGUE IS A
NO PROBLEM 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10 MAJOR PROBLEM

10. Over the last 6 months have you had: [Please tick (√)]

☐No ☐Yes An operation or new illness		☐No ☐Yes	Change(s) of arthritis or other medication
☐No ☐Yes Medical emergency or stay overnight in hospital		☐No ☐Yes	Change(s) of address
☐No ☐Yes A fall, broken bone, or other accident or trauma		☐No ☐Yes	Change(s) of marital status
☐No ☐Yes An important new symptom or medical problem		☐No ☐Yes	Change job or work duties, quit work, retired
☐No ☐Yes Side effect(s) of any medication or drug		☐No ☐Yes	Change of medical insurance, Medicare, etc.
☐No ☐Yes Smoke cigarettes regularly		☐No ☐Yes	Change of primary care or other doctor

Please explain any "Yes" answer below, or indicate any other health matter that affects you:

_____

_____

SEX: ☐ Female, ☐ Male **ETHNIC GROUP:** ☐ Asian, ☐ Black, ☐ Hispanic, ☐ White, ☐ Other_____
MARITAL STATUS: ☐ Single ☐ Married ☐ Divorced ☐ Widowed ☐ Separated

Your Occupation_____ **Please circle the number of years of education you have completed:**
Work Status: ☐ Full-time, ☐ Part-time, ☐ Disabled 1 2 3 4 5 6 7 8 9 10 11 12
☐ Homemaker, ☐ Self-Employed, ☐Retired, 13 14 15 16 17 18 19 20 more than 20
☐ Seeking work, ☐ Other_____

Please write your weight:_____kg height:_____cm

Your Name_____ **Date of Birth**_____ **Today's Date** _____

Page 2 of 2 Thank you for completing this questionnaire to help keep track of your medical care. R873AU2R

Figure 1. Continued.

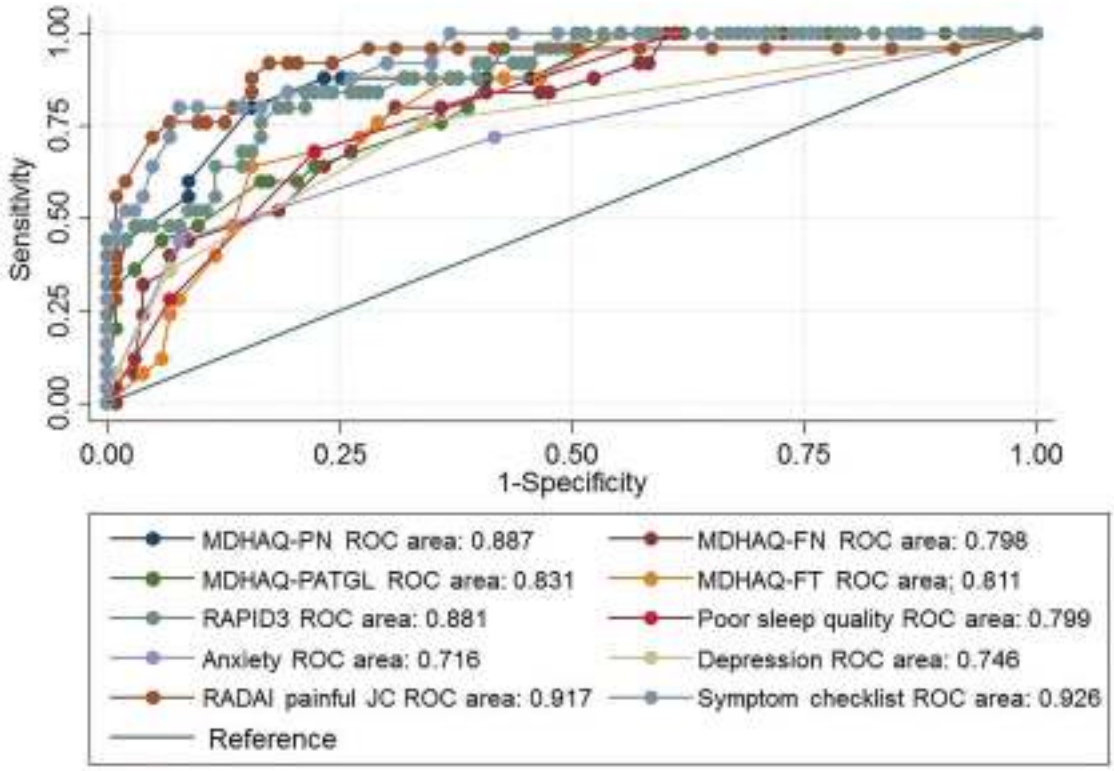

Figure 2. Receiver-operating characteristic (ROC) curve analysis of multidimensional Health Assessment Questionnaire (MDHAQ) variables versus 2011 FM criteria. FM: fibromyalgia; PN: pain; PATGL: patient's global assessment; RAPID3: Routine Assessment of Patient Index Data; RADAI: Rheumatoid Arthritis Disease Activity Index; JC: joint count; FN: function; FT: fatigue.

Table 1. Proportion of patients with different diseases meeting 2011 FM criteria and/or a clinical diagnosis of FM.

Diagnosis	Total	2011 FM Criteria Positive	Total Clinical FM Diagnosis	Both Meet 2011 FM Criteria, and FM Diagnosis Positive	Only 2011 FM Criteria Positive	Only Clinical FM Diagnosis Positive	Neither Meet 2011 FM Criteria nor FM Diagnosis
RA	55	13 (24)	12 (22)	7 (13)	6 (11)	5 (9)	37 (67)
OA	21	8 (38)	8 (38)	6 (29)	2 (10)	2 (10)	11 (52)
PsA	14	3 (21)	4 (29)	2 (14)	1 (7)	2 (14)	9 (43)
Other diagnoses	58	5 (9)	7 (12)	3 (5)	2 (3)	4 (7)	49 (85)
Total	148	29 (20)	31 (21)	18 (12)	11 (7)	13 (9)	106 (72)

Except for totals, data are n (%). FM: fibromyalgia; RA: rheumatoid arthritis; OA: osteoarthritis; PsA: psoriatic arthritis.

The majority of patients (80.4%) was female and white (68%) or Asian (12%). No statistically significant differences were seen in ethnicity or education level between those who did or did not meet 2011 FM criteria in this study (Table 2).

Comparison of MDHAQ scores with 2011 FM criteria. Patients who met 2011 FM criteria had significantly poorer scores on all MDHAQ scales, including for physical function, pain VAS, patient global VAS, self-report joint counts, symptom checklist, and fatigue VAS, compared to patients who did not meet criteria ($p < 0.001$; Table 2). ROC analyses indicated that the highest AUC values were seen for symptom checklist (0.926), self-report joint count (RADAI; 0.917), RAPID3 (0.881), pain VAS (0.887), PtGA (0.831), and fatigue VAS (0.811). Lower AUC versus the 2011 FM criteria (range 0.716–0.799) were seen for remaining MDHAQ scores including physical function, anxiety, depression, and sleep quality (Figure 2). These variables were not analyzed further despite being significantly different from scores in people with no FM, to develop an optimal, feasible index for clinical settings. PtGA and RAPID3 were not regarded as candidates for FAST indices.

The optimal cutpoints were ≥ 16 for symptom checklist and self-report painful joint count and ≥ 6 for pain and fatigue VAS. FAST3 cumulative indices include a cumulative score

Table 2. Characteristics of patients according to 2011 FM criteria.

Characteristics	Total, n = 148	FM		p
		2011 FM Criteria Positive, n = 29	2011 FM Criteria Negative, n = 119	
Age, yrs, mean (± SD)	56.4 (15.0)	57.3 (14.4)	56.2 (15.2)	0.72
Female, n (%)	119 (80.4)	24 (82.8)	89 (74.8)	0.36
Ethnicity, n (%)				
White	100 (68)	22 (75.9)	78 (65.5)	0.51
Asian	18 (12)	1 (3)	17 (14)	
Black	1 (1)	0 (0)	1 (1)	
Hispanic	7 (5)	2 (7)	5 (4)	
Others	22 (15)	4 (14)	18 (15)	
Formal education	11.8 (4.1)	12.0 (3.8)	11.8 (4.2)	0.83
MDHAQ Function (0–10), mean (± SD)	2.4 (2.1)	4.2 (1.9)	2.0 (1.9)	< 0.0001
MDHAQ Pain (0–10), mean (± SD)	4.4 (2.9)	7.6 (2.3)	3.6 (2.5)	< 0.0001
MDHAQ Global (0–10), mean (± SD)	4.3 (2.8)	7.1 (2.4)	3.7 (2.5)	< 0.0001
MDHAQ Fatigue (0–10), mean (± SD)	4.3 (3.0)	7.1 (2.0)	3.6 (2.8)	< 0.0001
RAPID3 (0–30), mean (± SD)	11.2 (6.8)	18.8 (5.5)	9.3 (5.8)	< 0.0001
RADAI (0–48), mean (± SD)	10.5 (10.1)	24.1 (10.5)	7.1 (6.4)	< 0.0001
Symptom checklist (0–60), mean (± SD)	10.8 (9.3)	22.3 (9.3)	8.0 (6.2)	< 0.0001
Clinical FM+, n (%)	31 (21)	18 (62)	13 (11)	< 0.001
Clinical FM–, n (%)	117 (79)	11 (34)	106 (89)	

FM: fibromyalgia; MDHAQ: multidimensional Health Assessment Questionnaire; RAPID3: Routine Assessment of Patient Index Data 3; RADAI: Rheumatoid Arthritis Disease Activity Index.

of the symptom checklist, painful joint count, and either a pain VAS called FAST3-P, or fatigue VAS called FAST3-F. A FAST4 cumulative index includes a cumulative score of the symptom checklist, painful joint count, and both pain and fatigue VAS (Figure 1).

FAST3-P of ≥ 2 correctly classified 90.9% of patients versus 2011 FM criteria, with a sensitivity of 81.5% and a specificity of 93.3% (Table 3). FAST3-F ≥ 2 correctly classified 89.4% of patients versus 2011 FM criteria, with a sensitivity of 77.8% and a specificity of 92.4% (Table 3). FAST4 ≥ 3 correctly classified 91.7% of patients versus 2011 FM criteria, with a sensitivity of 70.4% and a specificity of 97.1% (Table 3).

Agreement with a clinical diagnosis of FM was 81.1% for FAST3-P, 85.6% for FAST3-F, and 58.8% for FAST4 (Table 4). The κ values for FAST3–P, FAST3–F, and FAST4 versus

Table 3. Sensitivity and specificity of MDHAQ measures and FAST indices versus 2011 FM criteria.

Variables	Cutoff Point	Sensitivity, %	Specificity, %	Correctly Classified, %
Individual items on MDHAQ				
Symptom checklist, n = 148	≥ 16	79.3	84.9	83.8
RADAI, n = 132	≥ 16	74.1	87.6	84.8
MDHAQ-Pain, n = 148	≥ 6	86.2	73.9	76.3
MDHAQ-Fatigue, n = 148	≥ 6	75.8	75.6	75.7
FAST3-P (0–3)	≥ 1	96.3	70.5	75.7
	≥ 2	81.5	93.3	90.9
	3	43.9	90.7	90.1
FAST3-F (0–3)	≥ 1	96.3	65.7	72.0
	≥ 2	77.8	92.4	89.4
	3	51.8	99.1	89.4
FAST4 (0–4)	≥ 1	96.3	59.1	66.7
	≥ 2	88.9	85.7	86.4
	≥ 3	70.4	97.1	91.7
	4	48.1	99.1	88.6

MDHAQ: multidimensional Health Assessment Questionnaire; FM: fibromyalgia; FAST: FM Assessment Screening Tool; RADAI: Rheumatoid Arthritis Disease Activity Index self-report painful joint count; FAST3-P: FAST cumulative score of pain, self-report painful joint count, and symptom checklist; FAST3-F: FAST cumulative score of fatigue, self-report painful joint count, and symptom checklist; FAST4: FAST cumulative score of pain, fatigue, self-report painful joint count, and symptom checklist.

2011 criteria were 0.73, 0.68, and 0.72, respectively, and versus the clinical diagnosis were 0.44, 0.57, and 0.51, respectively (Table 4).

DISCUSSION

We found that FAST indices based on MDHAQ scales provide clues to the presence of FM in patients with other rheumatic diseases compared to the 2011 FM criteria as the reference standard, against which the proposed FAST criteria were examined in this study. The 2011 FM criteria are designated in the report title as "for clinical and epidemiological studies,"[8] but also may provide clues to the diagnosis of FM in the clinic. The total 2011 FM criteria score derived from this questionnaire as a continuous variable also provides information regarding the degree of "fibromyalgianess" that patients experience[27].

The 2011 report indicated that 21.1% of patients with RA, 16.8% with OA, and 36.7% with SLE met the revised FM criteria[8]. The symptom severity burden is similar in patients with other rheumatic diagnoses, and it has been suggested that a distinction between "primary" and "secondary" FM is not needed[28]. This recommendation supports use of these criteria to classify patients who have other rheumatic diagnoses and FM in the current report.

Agreement between the 2011 FM criteria and the clinical diagnosis of FM in this study was moderate (83.8%, κ 0.50, $p < 0.001$), a level somewhat higher than reported in another study (79.2%, κ 0.41)[9]. It is noteworthy that about 25% of previously diagnosed patients with FM did not satisfy the ACR 1990 classification criteria at the time of the 2010 study[7], and the modified ACR 2010 criteria were satisfied by 60% with a prior diagnosis of FM in the 2011 study[8]. These minor differences reflect differences between the clinicians, patients, and clinical environments in these studies, but general agreement in the range of 70–85% has been found.

One advantage of using the MDHAQ to identify FM is that it has been found informative in all rheumatic diseases studied[10]. It is not feasible in most busy clinical settings to add administration of another questionnaire, such as an additional FM-specific questionnaire. In addition, the FAST3 and FAST4 scores are easily calculated directly from the MDHAQ during the consultation.

Previous reports have identified clues to diagnosis and characterization of FM exclusively by self-report on the Fibromyalgia Impact Questionnaire[29] and MDHAQ[11,12]. FAST3 and FAST4 indices provide relatively high sensitivity and specificity for alerting the clinician to a possible diagnosis of FM compared to the 2011 FM criteria. An additional report from Rush University supports the use of MDHAQ indices to provide clues to the diagnosis of FM[30].

This study has a number of limitations. First, it is a cross-sectional study and patient symptoms may fluctuate over time; further longitudinal data may help to recognize the possible stability or sensitivity to change of the FAST indices, as well as whether a particular FAST3 or FAST4 may perform substantially better than others. Second, dichotomous criteria for the presence or absence of FM may obscure FM as a "spectrum" disorder of "fibromyalgianess"[27], although cutpoints may serve as convenient "anchors" for many continuous variables, including laboratory tests such as erythrocyte sedimentation rate, serum glucose, etc. Third, this study does not use the 2016 modification of the FM criteria[31], which was reported after commencement of this study, although no patients in the study had regional pain syndromes; therefore, it appears unlikely the modifications would have meaningfully changed the results. Fourth, FAST3 and FAST4 scores misclassify some patients according to the 2011 criteria; and further investigation in larger populations of patients with rheumatic disease is required.

It is not suggested that FAST indices are in any way a substitute for a careful evaluation to determine whether a

Table 4. Classification of FM according to FAST3-P, FAST3-F, and FAST4 compared to 2011 FM criteria and clinical diagnosis (n = 132).

	2011 FM Criteria		Clinical Diagnosis	
N = 132	Criteria Positive	Criteria Negative	Criteria Positive	Criteria Negative
FAST3-P–positive FM	22 (81.5%)	7 (6.7%)	16 (57.1%)	13 (12.5%)
FAST3-P–negative FM	5 (18.5%)	98 (93.3%)	12 (42.9%)	91 (87.5%)
	Correct: 90.9%, κ 0.73		Correct: 81.1%, κ 0.44	
FAST3-F–positive FM	21 (77.8%)	8 (7.6%)	19 (67.9%)	10 (9.6%)
FAST3-F–negative FM	6 (22.2%)	97 (92.4%)	9 (32.1%)	94 (90.4%)
	Correct: 89.4%, κ 0.68		Correct: 85.6%, κ 0.57	
FAST4–positive FM	19 (70.4%)	3 (2.9%)	14 (50%)	8 (7.7%)
FAST4–negative FM	8 (29.6%)	102 (97.1%)	14 (50%)	96 (92.3%)
	Correct: 91.7%, κ 0.72		Correct: 83.3%, κ 0.51	

FM: fibromyalgia; FAST3-P: Fibromyalgia Assessment Screening Tools cumulative score of pain, self-report painful joint count, and symptom checklist; FAST3-F: FAST cumulative score of fatigue, self-report painful joint count, and symptom checklist; FAST4: FAST cumulative score of pain, fatigue, self-report painful joint count, and symptom checklist.

patient has FM, or that there may not exist other reasons for certain patients to meet cutpoint values for FAST3 and FAST4. A definitive diagnosis of FM requires a careful history and examination of the patient, and interpretation of laboratory tests and other ancillary data. Nevertheless, it may be of considerable value to assess the presence of FM in patients with other rheumatic diseases using quantitative criteria from the 2011 FM questionnaire or the FAST indices to assist clinicians in recognizing this frequent diagnosis.

We have developed simple FAST cumulative, composite indices that provide clues to the presence of FM in patients with primary diagnoses of other rheumatic diseases. These indices are based entirely on the patient self-report MDHAQ questionnaire, which is used in routine care in the setting of the research and other rheumatology settings, and does not require a disease-specific FM questionnaire. FAST3 provides greater sensitivity but lower specificity than FAST4 for clues to FM; it may be desirable to use a FAST3-P index as the first screening tool for greater sensitivity, and check positive patients according to FAST4 for greater specificity. The FAST indices can be incorporated easily into routine care and may assist clinicians to identify patients with FM in the context of other comorbid rheumatic diseases. They remain a tool to support clinical judgment and are not a substitute for appropriate and thorough clinical history, physical examination, and comprehensive patient assessment for a diagnosis of FM.

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