The Symptom Intensity Scale, Fibromyalgia, and the Meaning of Fibromyalgia-like Symptoms

FREDERICK WOLFE and JOHANNES J. RASKER

ABSTRACT. ***Objective.*** To characterize a scale for the measurement of fibromyalgia (FM)-like symptoms; to investigate whether FM is a discrete disorder; to understand the significance of FM-like symptoms; and to investigate causal and noncausal factors in the development of such symptoms.

Methods. We evaluated 25,417 patients with rheumatic disease using the Symptom Intensity (SI) Scale, a self-report scale that combines a count of pain in 19 nonarticular regions with a visual analog scale for fatigue. We studied this scale in relation to demographics, clinical symptoms, and serious outcomes, including serious medical illnesses, hospitalization, work disability, and death.

Results. Compared with other rheumatic disease assessments, the SI scale was the best identifier of symptoms associated with FM content, including an increase in general medical symptoms. SI scale elevations were associated with increases in cardiovascular disorders, hospitalization, work disability, and death. Persons with socioeconomic disadvantage by reason of sex, ethnicity, household income, marital status, smoking, and body mass had increased SI scores. For almost all clinical variables studied, the prevalence and/or severity of the variable increased linearly with SI scores.

Conclusion. We identified a clinical marker for general symptom intensification that applies in all patients and is independent of a diagnosis of FM. We found no clinical basis by which FM may be identified as a separate entity. Higher scores on the SI scale were associated with more severe medical illness, greater mortality, and sociodemographic disadvantage, and these factors appear to play a role in the development of FM-like symptoms and symptom intensification. (First Release Sept 1 2006; J Rheumatol 2006;33:2291–9)

Key Indexing Terms:
FIBROMYALGIA SYMPTOM INTENSITY SCALE
RHEUMATOID ARTHRITIS SYMPTOMS OUTCOMES

Among those who accept it as an entity, the clinical concept of fibromyalgia (FM) has developed so that it is now understood to be a multisymptom complaint disorder that is associated with increased sensitivity to variously painful stimuli[1-3]. Among the prominent and important system complaints of persons with FM are sleep problems, fatigue, memory and thinking difficulties, and generalized pain and aching[1-3]. Tender points, the essential criterion of the American College of Rheumatology (ACR) FM criteria[4], are a physical finding that are not important as a patient symptom, and are often ignored by physicians in FM diagnosis[5].

We have recently suggested that alternative research criteria can be a practical tool for the identification of FM in research settings[5,6]. These survey FM criteria use a standardized questionnaire and require the presence of a certain number of patient-reported painful body areas (≥ 8 of 19) from the regional pain scale[7] and a fatigue score ≥ 6 on a 0–10 visual analog scale (VAS) for fatigue. The criteria, which appear to be consistent with the current concept of FM, are also consistent with physician and ACR diagnoses[5], and allow investigation of FM in large populations.

Regardless of whether one uses the ACR criteria or the survey criteria, a cutpoint divides persons into FM and non-FM status. It is possible to explore the relation of the number of positive tender points to various clinical measures, thereby quantifying the FM identification criterion, but the examination of large numbers of subjects for tender points coupled with detailed health assessments is impractical and has rarely been done in the clinical setting[8,9]. Consequently, research and clinical practice involving FM come down to classifying persons into groups who have and who do not have FM.

We describe the Symptom Intensity (SI) scale, which was constructed from the survey FM criteria items and appears to be an effective measure of FM symptom intensity and prevalence. In addition, the SI scale allows measurement and understanding of FM-like symptoms among researchers and clinicians who do not accept the concept of FM as a discrete disorder, and can serve as a bridge for those on opposite sides of the FM controversy. We used the SI scale to explore symptoms in a very large sample (N = 25,417) of unselected patients with rheumatic disease referred from the practices of

From the National Data Bank for Rheumatic Diseases, and University of Kansas School of Medicine, Wichita, Kansas, USA; University of Twente, Enschede, The Netherlands.

F. Wolfe, MD, National Data Bank for Rheumatic Diseases, University of Kansas School of Medicine; J.J. Rasker, MD, Department of Psychology, Faculty of Behavioral Sciences, University of Twente.

Address correspondence to Dr. F. Wolfe, National Data Bank for Rheumatic Diseases, Arthritis Research Center Foundation, 1035 N. Emporia, Suite 230, Wichita, KS 67214. E-mail: fwolfe@arthritis-research.org

Accepted for publication May 11, 2006.

community rheumatologists, thereby avoiding biased selection. In addition to describing the scale and its correlates, we asked the following questions: What does it mean to have FM symptoms? Can FM be considered to be a distinct entity? What "causes" contribute to FM and/or FM symptoms? How well does the SI scale identify key symptoms of FM compared with standard rheumatic disease assessments?

Although we use the term "fibromyalgia" throughout this report, its use should not imply that we do or do not endorse the controversial concept[1-3,10-13], only that it is impossible to describe, analyze, and discuss issues surrounding the FM concept without using the widely recognized term. In addition, we do not examine widespread pain as a separate entity, as has been done in a number of epidemiologic studies[14-17]. Instead, our report concerns the simultaneous assessment of pain extent and fatigue severity.

MATERIALS AND METHODS

Patients in this study were participants in the National Data Bank for Rheumatic Diseases (NDB) longitudinal study of rheumatic disease outcomes. NDB participants are recruited on an ongoing basis from the practices of United States rheumatologists, and are followed prospectively with semiannual, detailed, 28-page questionnaires, as described[18-21]. In this report we studied 25,417 patients with rheumatic disease who completed at least one semiannual questionnaire between January 1, 1999, and June 30, 2005. Of these patients, 19,400 (76.3%) had rheumatoid arthritis (RA), 5490 (23.6%) had a noninflammatory rheumatic disorder, and 527 (2.1%) had a non-RA inflammatory disorder. We used a random number generator to select a single questionnaire from each patient in the event a patient had completed more than one survey. This study was approved by the Via Christi institutional review board (IRB), Wichita, Kansas. All participants signed an IRB approved informed consent.

At each assessment we record demographic variables including age, sex, ethnic origin, marital status, smoking status, and household income. We also studied scales that are commonly used in rheumatology assessments. Patients report functional status using the Health Assessment Questionnaire (HAQ)[22,23]. Surveys also determine pain, global disease severity, and fatigue by VAS[24], and patients report if they have experienced any of 37 specific symptoms during the last 6 months in response to symptom review questions. The Patient Activity Scale (PAS), a summary measure of disease activity, is calculated using the formula: (VAS pain + VAS patient global + (HAQ × 3.33))/3[25]. Greater PAS values represent more disease activity in patients with RA and greater illness severity in non-RA patients. The mood scale used in this report represents the normalized Arthritis Impact Measurement Scales (AIMS), if available[26]; otherwise, it represents the Medical Outcomes Study (MOS) Short Form-36 (SF-36) mental health subscale[27]. Both scales are transformed to a 0–10 scale, with higher values representing greater mood abnormality. Lin's concordance correlation coefficient[28] for the 2 scales in 21,982 patients was 0.860 (95% CI 0.856 to 0.863), indicating a very high degree of concordance.

We record all medications and hospitalizations. The effect of comorbidity is assessed by a comorbidity score, which is the sum of 11 present or past comorbid conditions reported by the patient. Conditions include cancer, stroke, fracture, renal, neurologic, endocrine, gastrointestinal, cardiovascular, pulmonary, genitourinary, and psychiatric problems. In addition, rates of specific conditions, including preexisting pulmonary disease, myocardial infarction, and diabetes, are determined. We obtain information on deaths from family and physicians, and also systematically screen the US National Death Index[29,30] at yearly intervals for death information and causes of death.

The Symptom Intensity scale is derived from 2 separate scales, a VAS for fatigue[31,32] and the Regional Pain Scale (RPS)[7]. In diagnosing FM by survey, a patient is classified as having FM if the RPS score is ≥ 8 and the VAS fatigue score is ≥ 6[5,6]. The SI scale uses these 2 measures in continuous form according to the following formula: (VAS fatigue + (RPS/2))/2. This yields a scale with a range of 0 to 9.75. The 97.5th percentile for the SI scales in (survey) FM-negative patients is 6.25; the 2.5th percentile in (survey) FM-positive patients is 5.25.

Statistical methods. Because of the large sample size all statistical comparisons were significant at the 0.001 level, except as stated in the text. Therefore, we report confidence intervals and not p values. Graphs are generated by running line smooths of the y variable on all x variable predictors simultaneously; that is, the smooth is adjusted for all other covariates[33]. Using a simple type of backfitting, the resulting smoother is a locally linear function of the predictors for each observation.

The statistical methods used for analysis of concordance/correlation included Kendall's tau, which is related mathematically to the area under the receiver operating characteristic curve (ROC)[34]. Tau allows us to understand the degree to which assessment variables such as the SI scale and the HAQ are simultaneously associated with other study variables. Kendall's tau has a simple interpretation, the percentage concordance between variables. For example, a value of 0.20 (see Table 2) indicates that it is 20% more likely that a person with a high SI score will report paresthesias than a patient with a low SI score. A similar interpretation holds when both variables are continuous.

For multivariable analyses, we use linear regression. When the dependent variable is binary, we use Poisson regression and report relative risks (RR) according to the method of Zou[35]. Data were analyzed using Stata (Stata Corp., College Station, TX, USA), version 9.1.

RESULTS

The demographic, treatment, symptoms, and outcome status of the 25,417 study patients are shown in Table 1. Listed in order of prevalence are the most common symptoms that occurred during the 6 months prior to completion of the questionnaire. On average, patients reported 8.4 (SD 6.2) symptoms, the most common being fatigue, easy bruising, muscle pain, and paresthesias, among others, as shown in Table 1. The intensity of key symptoms is indicated by the VAS for pain, global, and fatigue, and by HAQ and PAS scores. During the 6-month period, 11.7% were hospitalized, and over the course of the study 7.0% died.

Modeling FM. To understand the relation of the SI scale and other commonly used clinical scales to FM-related variables, we identified the 20 symptom variables with the strongest associations with a series of predictor variables. These symptoms are shown in column 1 of Table 2, and are ordered according their association with the SI scale as measured by Kendall's tau. The first 12 variables in the column have been associated with FM as major complaints or have been noted to be more common in patients with this diagnosis.

We also examined the concordance of each symptom variable in column 1 with 6 independent or y-variables. Except for anxiety and depression, which were best explained by mood, the SI scale was significantly superior to all the other clinical measures in its correlation with the symptom variables. This would be expected for the first 3 variables (fatigue, muscle pain, and muscle weakness) as these are part of the SI scale definition. However, these variables also had the highest tau values for the other predictor scales (except for mood). Excepting anxiety and depression, differences between the SI

Table 1. Characteristics of 25,417 patients with rheumatic disease.

Variable	Mean or %	SD
Age, yrs	60.6	13.6
Sex, % male	21.0	
Married, %	66.6	
Non-Hispanic White, %	90.4	
College graduate, %	26.6	
Total Income — median US dollars	35,000	
Current smoker, %	15.3	
Body mass index	28.0	6.6
Total major comorbidity score ever	2.4	1.8
Myocardial infarction ever, %	7.6	
Death during followup, %	7.0	
Diabetic, %	9.9	
Anti-lipemic drugs, %	8.8	
Anti-hypertensives, %	37.5	
Cardiovascular medications, %	22.2	
Hospitalized, %	11.7	
Symptom intensity scale (0–10)	3.9	2.4
Fibromyalgia (survey criteria), %	20.8	
HAQ (0–3)	1.1	0.7
Patient activity score (0–10)	3.9	2.2
Pain (0–3)	4.2	2.8
Global severity (0–10)	3.7	2.5
Fatigue (0–10)	4.7	3.0
Symptom count (0–37)	8.4	6.2
Fatigue, %	64.6	
Bruising, %	44.6	
Muscle pain, %	42.3	
Paresthesias, %	41.8	
Muscle weakness, %	39.2	
Memory problem, %	35.5	
Dry eyes, %	35.4	
Dry mouth, %	35.4	
Headache, %	35.2	
Heartburn, %	30.4	
Pruritis, %	29.1	
Tinnitus, %	27.7	
Vision problem, %	27.3	
Depression, %	24.0	
Dyspnea, %	22.9	
Hearing problem, %	22.0	
Constipation, %	21.7	
Irritable bowel syndrome, %	14.3	

and the PAS scale, as well as the other scales, were significant, at $p < 0.001$. We also regressed each of the second through sixth column variables separately on all of the symptom variables taken together. So that the scale would not favor the SI scale, muscle pain, muscle weakness, and fatigue were omitted from the predictor (x) variables. The respective R-squares for the 6 assessment scale variables in linear regression analyses were SI scale 0.41, PAS 0.27, mood 0.28, pain 0.24, global 0.19, and HAQ 0.18.

Overall, these data indicate that the symptoms most associated with FM are also most associated with common rheumatic disease assessment scales, and that the SI scale is the best of the assessment scales for identifying symptoms and patients with high levels of symptoms.

Table 3 displays the results of similar analyses. However, in this table we compare the assessment scales (SI scale, PAS, mood, pain, global, and HAQ) with intensity scales. As determined by the SI scale construction, it was superior to other scales in identifying fatigue severity and regional pain; therefore, these comparisons are presented only for information purposes. However, the SI scale was also the strongest correlate of the symptom count scale (with fatigue and muscle symptoms omitted) as well as the sleep, mood, and gastrointestinal severity scales. Pain, global, and HAQ were better explained by one of those 3 variables than by the SI scale, as would be expected.

The meaning of FM symptoms. Based on the result of the above analyses and in agreement with the survey definition of FM, we used the SI scale as an indicator of FM symptom severity intensity and investigated the relation between FM symptom severity and various clinical and demographic variables.

The mean SI scale score was 3.88 (SD 2.40). Among patients satisfying the survey FM criteria, the mean SI score was 7.28 (SD 1.13) compared with 3.00 (SD 1.76) in those not satisfying the survey definition. In the graphs of data shown here, vertical lines indicate the 2.5th percentile of the SI scale for FM-positive patients (5.25) and the 97.5th percentile for FM-negative patients (6.25). Therefore the cutpoint for FM diagnosis is at approximately 5.75 units.

Figure 1 shows a linear relationship between the SI scale and key FM symptoms. There is no trace of a cutoff at the switching point between no-FM and FM; and increasing SI scores indicate an increased probability of symptom positivity or of symptom intensity (sleep disturbance scale). Although not shown graphically for reasons of space, the same linear relationship exists between the SI scale and the other FM variables of Tables 2 and 3, including symptom count, fatigue, muscle pain, muscle weakness, comorbidity score, and irritable bowel syndrome. This linear relation is also notable between the SI scale and general rheumatic disease variables, including HAQ, PAS, and VAS pain and patient global. The SI scale, therefore, can be interpreted as a general measure of symptom intensification that occurs in all patients regardless of diagnosis.

The associations noted in Figure 1 have no causal direction. However, it is possible to investigate elements of causality by examining factors that could not have been caused by symptom intensification. Figure 2 shows that SI decreases with age [tau –0.10 (95% CI –0.09 to –0.07)] and is associated with the probability of being female [tau 0.06 (95% CI 0.05 to 0.07)]. Less secure along the causal pathway, but still probable, is having minority ethnic status [tau 0.02 (95% CI 0.01 to 0.02)] and being not married [tau 0.02 (95% CI 0.02 to 0.03)]. Figure 3 also demonstrates that body mass [tau 0.11 (95% CI 0.10 to 0.12)], less education [tau 0.06 (95% CI 0.05 to 0.07), smoking (tau 0.04 (95% CI 0.04 to 0.05)], and reduced income (tau 0.13 to 0.14) are also all associated with

Table 2. The relation between clinical symptom variables, the symptom intensity (SI) scale, and other clinical assessment scales (N = 25,417). Values are Kendall's tau and 95% confidence intervals. Variables in column 1 are scored as present or absent.

Dependent Variable	SI Scale	PAS	Mood	Pain	Global	HAQ
Fatigue	0.28 (0.28, 0.29)	0.20 (0.19, 0.21)	0.19 (0.18, 0.20)	0.18 (0.18, 0.19)	0.18 (0.17, 0.18)	0.17 (0.16, 0.17)
Muscle pain	0.27 (0.27, 0.28)	0.21 (0.21, 0.22)	0.14 (0.14, 0.15)	0.22 (0.21, 0.23)	0.18 (0.17, 0.18)	0.16 (0.15, 0.16)
Muscle weakness	0.26 (0.26, 0.27)	0.23 (0.23, 0.24)	0.16 (0.15, 0.17)	0.21 (0.21, 0.22)	0.20 (0.19, 0.20)	0.20 (0.19, 0.21)
Memory problems	0.20 (0.20, 0.21)	0.16 (0.16, 0.17)	0.18 (0.17, 0.18)	0.15 (0.14, 0.15)	0.15 (0.14, 0.15)	0.13 (0.13, 0.14)
Paresthesias	0.20 (0.20, 0.21)	0.18 (0.17, 0.18)	0.13 (0.13, 0.14)	0.17 (0.17, 0.18)	0.15 (0.14, 0.15)	0.14 (0.13, 0.14)
Headache	0.19 (0.18, 0.19)	0.12 (0.12, 0.13)	0.13 (0.13, 0.14)	0.13 (0.13, 0.15)	0.10 (0.10, 0.11)	0.09 (0.08, 0.09)
Depression	0.18 (0.18, 0.19)	0.16 (0.15, 0.16)	0.23 (0.22, 0.24)	0.14 (0.13, 0.15)	0.15 (0.14, 0.15)	0.12 (0.11, 0.13)
Insomnia	0.17 (0.16, 0.17)	0.14 (0.13, 0.14)	0.15 (0.15, 0.16)	0.13 (0.12, 0.14)	0.12 (0.11, 0.12)	0.10 (0.10, 0.11)
Dry mouth	0.17 (0.17, 0.18)	0.15 (0.14, 0.15)	0.11 (0.11, 0.12)	0.13 (0.12, 0.13)	0.12 (0.12, 0.13)	0.14 (0.13, 0.14)
Dizziness	0.16 (0.15, 0.16)	0.12 (0.12, 0.13)	0.11 (0.11, 0.12)	0.11 (0.11, 0.12)	0.11 (0.10, 0.12)	0.10 (0.09, 0.11)
Vision problems	0.16 (0.15, 0.17)	0.13 (0.13, 0.14)	0.12 (0.11, 0.12)	0.12 (0.11, 0.13)	0.11 (0.11, 0.12)	0.11 (0.11, 0.12)
Anxiety	0.16 (0.15, 0.16)	0.14 (0.13, 0.14)	0.21 (0.20, 0.21)	0.12 (0.12, 0.13)	0.12 (0.12, 0.13)	0.11 (0.10, 0.11)
Easy bruising	0.13 (0.13, 0.14)	0.13 (0.12, 0.13)	0.08 (0.08, 0.09)	0.10 (0.10, 0.11)	0.10 (0.10, 0.11)	0.13 (0.12, 0.14)
Nausea	0.14 (0.13, 0.14)	0.10 (0.10, 0.11)	0.09 (0.09, 0.10)	0.10 (0.09, 0.11)	0.09 (0.08, 0.10)	0.08 (0.08, 0.09)
Pruritis	0.14 (0.13, 0.15)	0.12 (0.11, 0.12)	0.10 (0.09, 0.10)	0.10 (0.10, 0.11)	0.10 (0.09, 0.10)	0.10 (0.09, 0.11)
Dyspnea	0.14 (0.13, 0.15)	0.12 (0.12, 0.13)	0.10 (0.09, 0.10)	0.10 (0.09, 0.11)	0.11 (0.11, 0.12)	0.11 (0.10, 0.11)
Epigastric pain	0.14 (0.14, 0.15)	0.10 (0.09, 0.11)	0.09 (0.09, 0.10)	0.09 (0.09, 0.10)	0.09 (0.08, 0.09)	0.08 (0.07, 0.08)
Abdominal pain (lower)	0.13 (0.12, 0.13)	0.09 (0.08, 0.09)	0.08 (0.08, 0.09)	0.08 (0.08, 0.09)	0.07 (0.07, 0.08)	0.07 (0.06, 0.07)
Heartburn	0.13 (0.12, 0.13)	0.09 (0.09, 0.10)	0.09 (0.08, 0.09)	0.09 (0.08, 0.09)	0.08 (0.07, 0.09)	0.07 (0.06, 0.08)
Constipation	0.12 (0.11, 0.12)	0.10 (0.09, 0.10)	0.08 (0.08, 0.09)	0.09 (0.08, 0.10)	0.08 (0.08, 0.09)	0.08 (0.07, 0.08)

PAS: Patient Activity Scale, HAQ: Health Assessment Questionnaire.

Table 3. The relation between clinical symptom intensity variables, the symptom intensity (SI) scale, and other clinical assessment scales (N = 25,417). Values are Kendall's tau and 95% confidence intervals. Values are omitted when they are a component of the dependent variable.

Dependent Variable	SI Scale	PAS	Mood Scale	Pain	Global	HAQ
Fatigue (0–10)	0.70 (0.70, 0.70)	0.50 (0.50, 0.51)	0.37 (0.36, 0.38)	0.46 (0.46, 0.47)	0.45 (0.44, 0.46)	0.37 (036, 0.38)
RPS (0–19)	0.62 (0.62, 0.63)	0.40 (0.39, 0.41)	0.26 (0.25, 0.27)	0.38 (0.38, 0.39)	0.33 (0.32, 0.33)	0.33 (0.32, 0.33)
PAS (0–10)	0.54 (0.54, 0.55)		0.37 (0.36, 0.37)			
Pain (0–10)	0.50 (0.50, 0.51)		0.31 (0.30, 0.32)		0.50 (0.49, 0.51)	0.43 (0.42, 0.44)
Global (0–10)	0.46 (0.46, 0.47)		0.36 (0.35, 0.37)	0.50 (0.49, 0.51)		0.43 (0.42, 0.43)
Symptom count (0–32)	0.43 (0.43, 0.44)	0.35 (0.34, 0.35)	0.32 (0.31, 0.33)	0.31 (0.30, 0.32)	0.30 (0.29, 0.30)	0.29 (0.28, 0.29)
HAQ (0–3)	0.41 (0.41, 0.42)		0.28 (0.27, 0.29)	0.43 (0.42, 0.44)	0.43 (0.42, 0.43)	
Sleep (0–10)	0.40 (0.39, 0.41)	0.39 (0.38, 0.40)	0.34 (0.33, 0.34)	0.37 (0.36, 0.38)	0.37 (0.36, 0.37)	0.28 (0.27, 0.29)
Mood (0–10)	0.38 (0.37, 0.38)	0.37 (0.36, 0.37)		0.31 (0.30, 0.32)	0.36 (0.35, 0.37)	0.28 (0.27, 0.29)
Gastrointestinal (0–10)	0.32 (0.31, 0.33)	0.28 (0.27, 0.29)	0.25 (0.24, 0.26)	0.27 (0.26, 0.28)	0.25 (0.24, 0.25)	0.21 (0.21, 0.22)

PAS: Patient Activity Scale, HAQ: Health Assessment Questionnaire. RPS: Regional Pain Scale.

SI. It should be noted that many of these associations are weak. However, taken as a whole in a multivariable regression, and under the hypothetical assumption of a causal link, they explain 11% of SI scale variance (R^2 0.11).

The SI scale, illness, and illness outcomes. Adjusted for age and sex, a 1-unit increase in the SI score was associated with an increased risk of mortality [RR 1.12 (95% CI 1.10 to 1.14)] (Figure 4), having diabetes [RR 1.14 (95% CI 1.12 to 1.15)], and being hospitalized [RR 1.12 (95% CI 1.10 to 1.13)]. Although these 1-unit changes in RR seem small, they are not. For example compared with patients in the first quartile of the SI scale, the age and sex-adjusted relative risk of mortality for patients in the fourth quartile was 2.01 (95% CI 1.81 to 2.33). In addition to these data, the associations extended to myocardial infarction in the last 6 months [RR 1.19 (95% CI 1.12 to 1.27)], myocardial infarction ever [RR 1.11 (95% CI 1.09 to 1.13)], and the use of cardiovascular [RR 1.09 (95% CI 1.08 to 1.10)] and antihypertensive medications [RR 1.10 (95% CI 1.06 to 1.14)], and lipid-lowering drugs [RR 1.03 (95% CI 1.02 to 1.05)]. We also identified an association between the number of lifetime comorbid conditions and SI scale (Figure 4, lower right panel). A 1-unit increase in the SI scale was associated with a –0.25 (95% CI 0.25 to 0.27) increase in the comorbidity score in a univariate analysis. After adjusting for age, sex, education, ethnicity, marital status, household income, mood, and body mass index (BMI), a 1-unit increase in the SI scale was associated with a 0.23 (95% CI 0.22 to 0.24) unit increase in the comorbidity score. Consequences of illness, as measured by US Social Security disability benefit payments in patients aged < 62 years, were increased in those

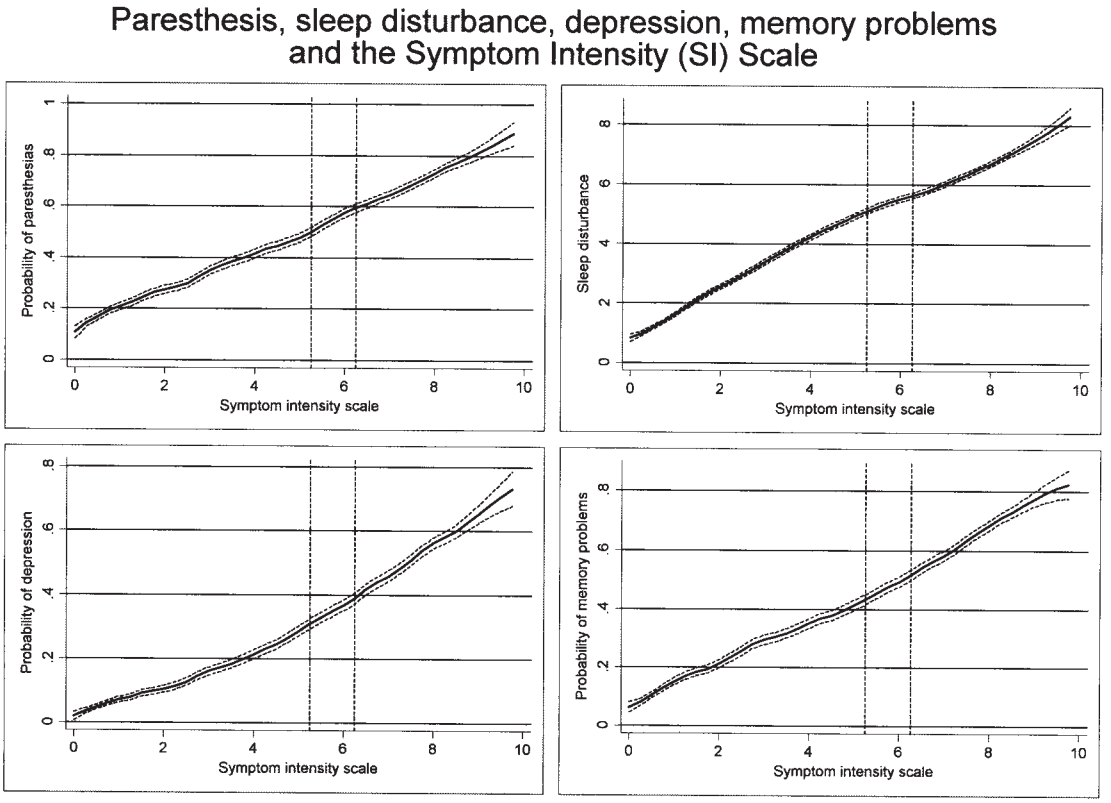

Figure 1. Graphs of characteristic FM-type symptoms as a function of SI scale values, adjusted for age and sex. Predicted values and their 95% confidence intervals are generated by running line smooths of the symptom variable on the SI scale, adjusted for age and sex.

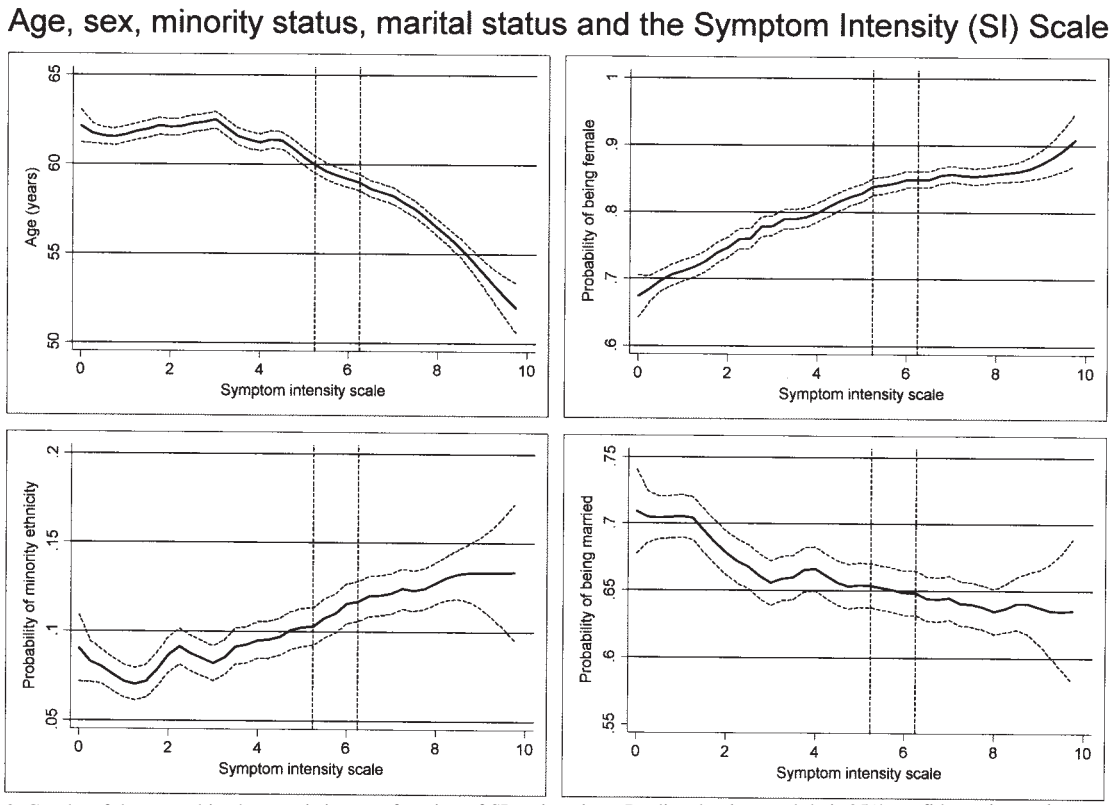

Figure 2. Graphs of demographic characteristics as a function of SI scale values. Predicted values and their 95% confidence intervals are generated by running line smooths of the y-axis variable on the SI scale, adjusted for age and sex in the case of ethnicity and marital status.

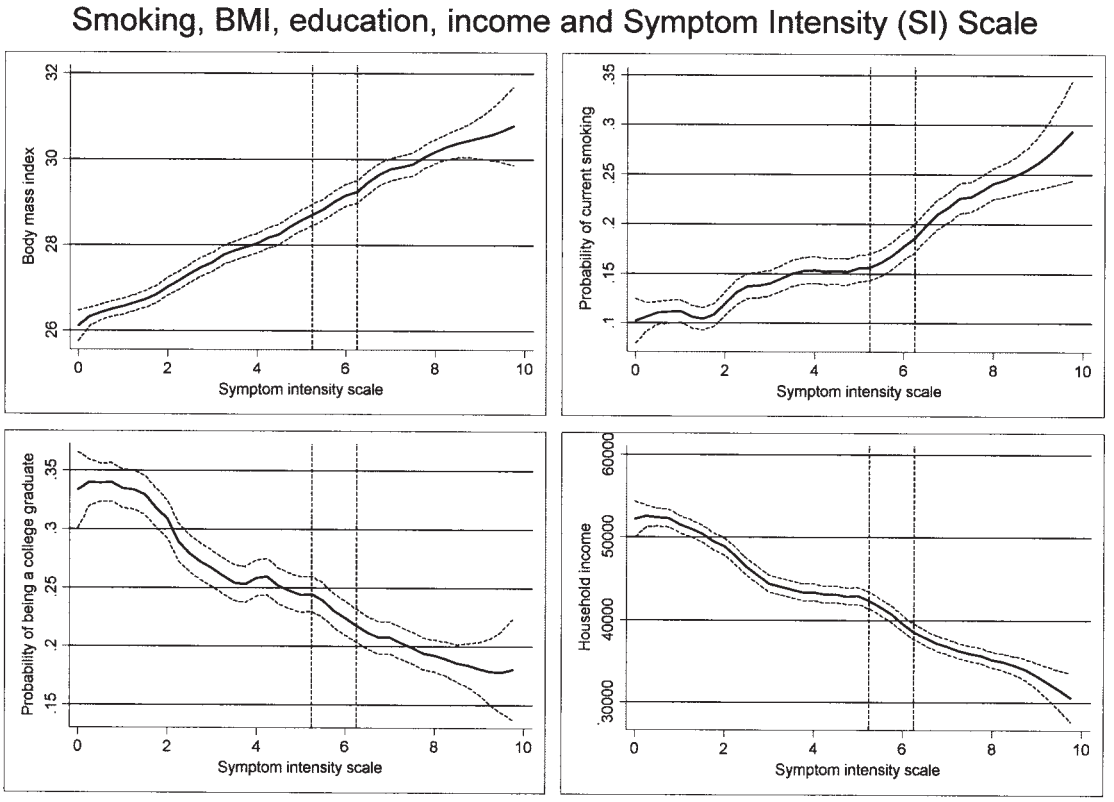

Figure 3. Graphs of sociodemographic and behavioral factors and their relation to the SI scale values, adjusted for age and sex. Predicted values and their 95% confidence intervals are generated by running line smooths of the symptom variable on the SI scale, adjusted for age and sex.

with greater SI scores [RR 1.23 (95% CI 1.22 to 1.25)]. The interpretation of the data of this section is to indicate an association between increasing SI scale scores and important medical illness and mortality.

DISCUSSION

The SI scale identifies well the characteristic features of persons diagnosed as having fibromyalgia (Table 2). Survey FM criteria, which rely on the fatigue and nonarticular pain scores that are a part of the SI scale, do as well in identifying patients with FM as expert diagnosis or ACR criteria[5]. The SI scale has several advantages compared with the ACR tender point criterion. It does not require physical examination; it identifies the 2 key and meaningful features of FM, widespread pain and fatigue; and it is practical for use in epidemiologic survey research. At a level of approximately 5.25 the SI scale identifies 95% of patients who would satisfy survey FM criteria. It seems reasonable, therefore, to use the scale as a surrogate for FM features.

Using the SI scale in that manner, the data of this study provide strong evidence against FM as a distinct clinical entity. In almost every illustration (Figures 1 to 4) and in all analyses, there is a linear increase in the SI scale as other variables become more prevalent or increase in severity. This is not to say that it might or might not be clinically useful to identify people with high levels of SI and diagnose them as having FM. However, there appears to be no clinical basis to do this. The recent findings of altered pain processing and hormonal response differences among persons diagnosed as having FM by the ACR criteria are quite consistent with the findings of our study[1,2,36-38], as they apply to the tail of the SI scale distribution.

One important conclusion of this study is that symptom intensity, defined by widespread pain and fatigue, exists in varying degrees in all patients with rheumatic disease. Fewer than 3% of study subjects had an SI score of 0; and because of the protean nature of the symptoms identified, we chose to call the scale a symptom intensity scale rather than a fibromyalgia intensity scale.

The SI scale offers insights into the characteristics of people who have increased fatigue and aching. Medical illness, not necessarily only rheumatic disease illness, appears to lie on the causal pathway to symptom intensity. We found that the risk of death was associated with SI scale elevations, as was diabetes, myocardial infarction, and hospitalization (Figure 4), and also with the use of cardiovascular and antihypertensive treatment. Even after adjustment for demographics, health behaviors, and mood, a 1-unit increase in SI scale was associated with a 0.23 (95% CI 0.22 to 0.24) unit increase in the number of comorbid conditions. One way to interpret

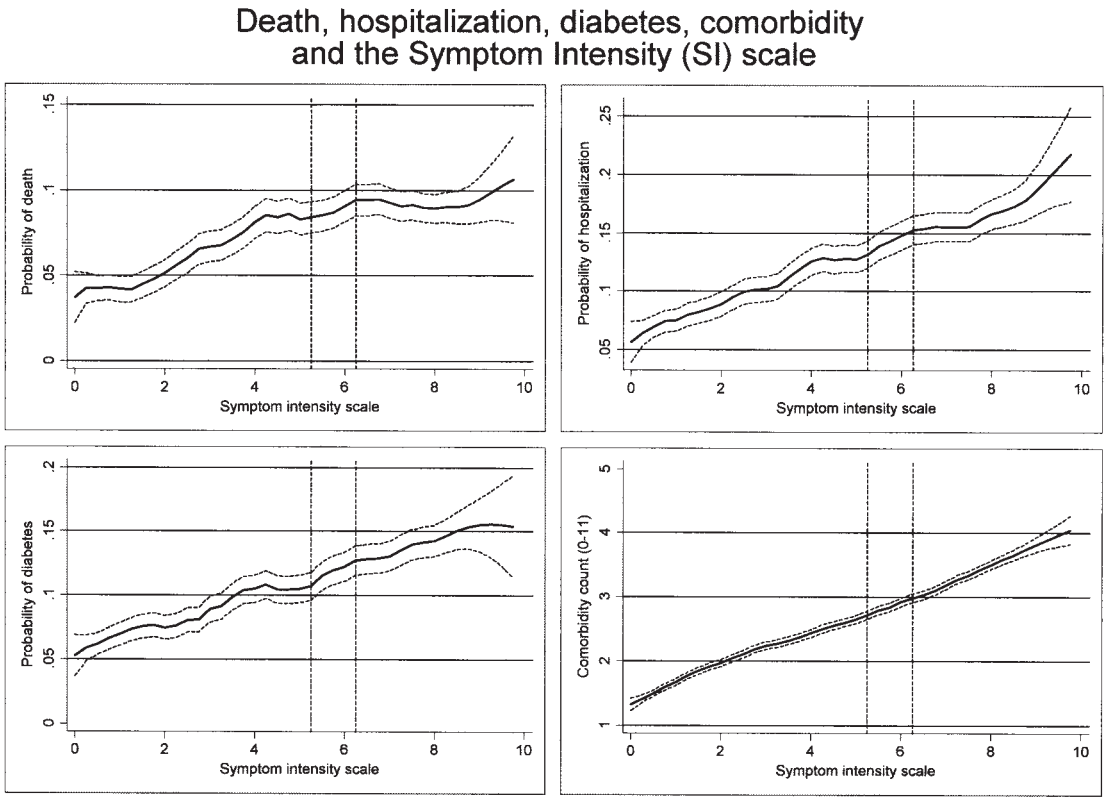

Figure 4. Graphs of disease and outcome variables as a function of SI scale values, adjusted for age and sex. Predicted values and their 95% confidence intervals are generated by running line smooths of the symptom variable on the SI scale, adjusted for age and sex.

these data is to suggest that they indicate that illness increases SI — because of either biological factors or psychological factors, or some combination of both of these.

We also found an association between US Social Security disability awards and SI [RR 1.23 (95% CI 1.22 to 1.25)]. Work disability is a special case in which the direction of causality may differ in individual patients and, hence, can be considered bidirectional. However, in some individuals at least, it is possible that underlying disabling illnesses lead to SI. Taken together, these data and the comorbidity data above suggest that illness lies on the causal pathway to SI.

We also found evidence of an association between certain behaviors and SI. A 1-unit change in the SI scale was associated with a 0.50 (95% CI 0.46 to 0.53) unit change in BMI, and a 1-unit change in SI scale was associated with a relative risk of being a smoker of 1.09 (95% CI 1.08 to 1.11).

Among demographic variables, younger age, being female, having less education, having less income, being unmarried, and being African American, Hispanic or Native American were all associated with increased SI scores. Age, sex, marital status, education, ethnicity, and smoking explained 6.3% of SI variance. When household income was added to the model, explained variance increased to 9.2%, and when BMI was added, explained variance increased to 11.8%. One must be careful in interpreting these results, as household income is also related to severity of illness, and BMI could relate to inactivity related to illness. Even so, these data suggest that that sociodemographic and behavioral characteristics are linked to SI.

Our findings provide information that might illuminate the FM debate. Our data indicate that FM diagnosis represents an arbitrary cutpoint on a continuum. We found no evidence that a discrete or stepwise change in symptoms or outcomes occurs at any point along the continuum. In this report the cutpoint is on the SI scale, but the same principle applies when tender points and the ACR FM criteria are considered. An argument rages as to whether FM is a legitimate diagnosis[1-3,10-13]. One criticism of the FM concept is that FM is merely the codification of the tail of a pain-symptom-distress distribution, and therefore does not represent a disease entity. Such a criticism finds strong support from the data in this study. However, there are many examples when tails of distributions have been used and may be useful for classification. For example, elevated depression or anxiety scores can be used to diagnose clinical mood states, and elevations on a series of mental health scales have categorized various other psychiatric states. Whether a cutpoint on the tender point count or the SI scale should be a point of classification and diagnosis depends perhaps on whether the classification serves a useful clinical or research purpose, or is neutral or even harmful to such purposes. Our data cannot address such issues.

Perhaps more important, however, we identified a clinical

marker for FM-like symptoms in the SI scale, for as the level of the SI scale increases patients experience and/or report more symptoms of every sort. Factors that contribute to elevation of the scale include measures of socioeconomic disadvantage, including sex, ethnicity, education, and income, as well as behavioral factors like smoking and obesity. We also found evidence that scale elevations were associated with serious medical illnesses and mortality. We hypothesize that elevations on the SI scale are driven by physical illness or emotional stress related to such illnesses. Our data also indicate that psychological factors could play a role, although cross-sectional data such as we have presented cannot distinguish the direction of causality in regard to such factors. Higher SI scores, then, appear to identify patients who experience more symptoms, who have more severe illness, and who have some degree of sociodemographic disadvantage. However, this appears to be characteristic of the human response to illness and sociodemographic status.

Although the SI scale worked better than other scales in this study, this is not to say that it is the best of all available scales to measure symptom intensity. In addition, it might be possible to weight the RPS and fatigue constituents somewhat differently from the way we did. However, a simple 0–10 scale (actually 0–9.75) is easy to construct, is intuitively understandable, and worked quite well in these analyses.

Community studies of FM prevalence have found rates that are much lower than we report here[39-41]. However, the rates reported here are consistent with studies in patients with RA and other medical conditions[42].

In summary, there is no clinical basis by which fibromyalgia may be identified as a separate entity. The symptom complex that is most characteristic of FM, widespread pain and fatigue, exists as a continuous variable across all patients, and is not specific for FM. Higher scores on the SI scale are associated with more severe medical illness, greater mortality, and sociodemographic disadvantage, and these factors appear to play a role in the development of FM-like symptoms and symptom intensification. The SI scale can provide an effective way to measure generalized symptom increase.

REFERENCES

1. Clauw DJ, Crofford LJ. Chronic widespread pain and fibromyalgia: what we know, and what we need to know. Best Pract Res Clin Rheumatol 2003;17:685-701.
2. Crofford LJ, Clauw DJ. Fibromyalgia: where are we a decade after the American College of Rheumatology classification criteria were developed?. Arthritis Rheum 2002;46:1136-8.
3. Goldenberg DL. Fibromyalgia and related syndromes. In: Hochberg M, Silman AJ, Smolen JS, Weinblatt ME, Weisman MH, editors. Rheumatology. 3rd ed. Philadelphia: Mosby; 2003:701-12.
4. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia: Report of the Multicenter Criteria Committee. Arthritis Rheum 1990;33:160-72.
5. Katz RS, Wolfe F, Michaud K. Fibromyalgia diagnosis: A comparison of clinical, survey, and American College of Rheumatology criteria. Arthritis Rheum 2006;54:169-76.
6. Wolfe F, Michaud K. Severe rheumatoid arthritis (RA), worse outcomes, comorbid illness, and sociodemographic disadvantage characterize RA patients with fibromyalgia. J Rheumatol 2004;31:695-700.
7. Wolfe F. Pain extent and diagnosis: development and validation of the regional pain scale in 12,799 patients with rheumatic disease. J Rheumatol 2003;30:369-78.
8. Akkasilpa S, Goldman D, Magder LS, Petri M. Number of fibromyalgia tender points is associated with health status in patients with systemic lupus erythematosus. J Rheumatol 2005;32:48-50.
9. Wolfe F. The relation between tender points and fibromyalgia symptom variables: evidence that fibromyalgia is not a discrete disorder in the clinic. Ann Rheum Dis 1997;56:268-71.
10. Wallace DJ, Clauw DJ. Fibromyalgia and other central pain syndromes. Philadelphia: Lippincott Williams & Wilkins; 2005.
11. Hazemeijer I, Rasker JJ. Fibromyalgia and the therapeutic domain. A philosophical study on the origins of fibromyalgia in a specific social setting. Rheumatology Oxford 2003;42:507-15.
12. Gordon DA. Fibromyalgia — real or imagined? J Rheumatol 2003;30:1665.
13. Croft P, Burt J, Schollum J, Thomas E, Macfarlane G, Silman A. More pain, more tender points: Is fibromyalgia just one end of a continuous spectrum? Ann Rheum Dis 1996;55:482-5.
14. Croft P, Schollum J, Silman A. Population study of tender point counts and pain as evidence of fibromyalgia. BMJ 1994;309:696-9.
15. Croft P, Rigby AS, Boswell R, Schollum J, Silman AJ. The prevalence of widespread pain in the general population. J Rheumatol 1993;20:710-3.
16. Macfarlane GJ, McBeth J, Silman AJ. Widespread body pain and mortality: prospective population based study. BMJ 2001;323:662-5.
17. McBeth J, Macfarlane GJ, Hunt IM, Silman AJ. Risk factors for persistent chronic widespread pain: a community-based study. Rheumatology Oxford 2001;40:95-101.
18. Wolfe F, Michaud K, Choi HK, Williams R. Household income and earnings losses among 6,396 persons with rheumatoid arthritis. J Rheumatol 2005;32:1875-83.
19. Wolfe F, Michaud K. A brief introduction to the National Data Bank for Rheumatic Diseases. Clin Exp Rheumatol 2005;23:S168-71.
20. Wolfe F, Michaud K. Heart failure in rheumatoid arthritis: rates, predictors, and the effect of anti-tumor necrosis factor therapy. Am J Med 2004;116:305-11.
21. Wolfe F, Michaud K. Lymphoma in rheumatoid arthritis: the effect of methotrexate and anti-tumor necrosis factor therapy in 18,572 patients. Arthritis Rheum 2004;50:1740-51.
22. Fries JF, Spitz PW, Young DY. The dimensions of health outcomes: the Health Assessment Questionnaire, disability and pain scales. J Rheumatol 1982;9:789-93.
23. Fries JF, Spitz PW, Kraines RG, Holman HR. Measurement of patient outcome in arthritis. Arthritis Rheum 1980;23:137-45.
24. Wolfe F, Hawley DJ, Wilson K. The prevalence and meaning of fatigue in rheumatic disease. J Rheumatol 1996;23:1407-17.
25. Wolfe F, Michaud K, Pincus T. A composite disease activity scale for clinical practice, observational studies and clinical trials: The Patient Activity Scale (PAS/PAS-II). J Rheumatol 2005;32:2410-5.
26. Meenan RF, Gertman PM, Mason JH, Dunaif R. The Arthritis Impact Measurement Scales. Arthritis Rheum 1982;25:1048-53.
27. Stewart AL, Hays RD, Ware JE. The MOS Short-form General Health Survey. Med Care 1988;26:724-35.
28. Lin LI-K. A concordance correlation coefficient to evaluate reproducibility. Biometrics 1989;45:255-68.
29. Doody MM, Hayes HM, Bilgrad R. Comparability of national death index plus and standard procedures for determining causes of death

in epidemiologic studies. Ann Epidemiol 2001;11:46-50.
30. Edlavitch SA, Baxter J. Comparability of mortality follow-up before and after the National Death Index. Am J Epidemiol 1988;127:1164-78.
31. Wolfe F. Fatigue assessments in rheumatoid arthritis: comparative performance of visual analog scales and longer fatigue questionnaires in 7760 patients. J Rheumatol 2004;31:1896-902.
32. Riemsma RP, Rasker JJ, Taal E, Griep EN, Wouters JMGW, Wiegman O. Fatigue in rheumatoid arthritis: The role of self-efficacy and problematic social support. Br J Rheumatol 1998;37:1042-6.
33. Royston P, Cox NJ. A multivariable scatterplot smoother. Stata Journal 2005;5:405-12.
34. Newson R. Parameters beyond "nonparametric" statistics: Kendall's tau, Somers' D and median differences. Stata Journal 2002;2:45-64.
35. Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol 2004;159:702-6.
36. Clauw DJ, Schmidt M, Radulovic D, Singer A, Katz P, Bresette J. The relationship between fibromyalgia and interstitial cystitis. J Psychiatr Res 1997;31:125-31.
37. Clauw DJ, Williams D, Lauerman W, et al. Pain sensitivity as a correlate of clinical status in individuals with chronic low back pain. Spine 1999;24:2035-41.
38. Crofford LJ, Pillemer SR, Kalogeras KT, et al. Hypothalamic-pituitary-adrenal axis perturbations in patients with fibromyalgia. Arthritis Rheum 1994;37:1583-92.
39. Wolfe F, Ross K, Anderson J, Russell IJ, Hebert L. The prevalence and characteristics of fibromyalgia in the general population. Arthritis Rheum 1995;38:19-28.
40. White KP, Speechley M, Harth M, Ostbye T. The London Fibromyalgia Epidemiology Study: the prevalence of fibromyalgia syndrome in London, Ontario. J Rheumatol 1999;26:1570-6.
41. Gran JT. The epidemiology of chronic generalized musculoskeletal pain. Best Pract Res Clin Rheumatol 2003;17:547-61.
42. Wolfe F, Cathey MA. Prevalence of primary and secondary fibrositis. J Rheumatol 1983;10:965-8.