Seasonal Symptom Severity in Patients with Rheumatic Diseases: A Study of 1424 Patients

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ABSTRACT. ***Objective.*** To examine the nature of seasonal symptoms, their prevalence, and differences among rheumatic disorders by examining longitudinal data over a period of up to 24 years.

Methods. We used a questionnaire assessment of seasonal symptoms using the Seasonal Pattern Assessment Questionnaire (SPAQ) in 1424 patients with rheumatoid arthritis (RA), osteoarthritis (OA), and fibromyalgia (FM). Clinical status was evaluated with standard assessment measures, and reported symptoms were compared with actual seasonal differences measured for periods of up to 24 years.

Results. About 50% of patients with rheumatic disease reported exacerbation of rheumatic symptoms (pain, global severity, and fatigue) by seasonal changes. The presence of seasonal symptoms was not related to diagnosis or to seasonal affective disorder (SAD) symptoms, and symptoms were less common in older patients and in men. The number of symptoms and the severity of allied factors (depression, anxiety, pain, global severity, number of months with seasonal symptoms) were increased in persons with FM and/or complete SAD symptoms. Using circular statistics, the modal months for worse symptoms were December and January, and for best symptoms was July. Bimodal patterns of seasonality were identified for global severity, joint pain, fatigue, and socialization. Seasonal symptoms differed as to the degree at which they were dispersed around the 12 month circle. When pain and global severity measurements obtained over a 24 year period were analyzed, pain was slightly increased in the summer and global severity was not related to season at all. Even when patients who specifically reported worse symptoms in winter and best symptoms in summer were examined, no effect of season could be found.

Conclusion. Seasonal rheumatic symptoms are commonly reported across all rheumatic diseases, but appear to reflect perception rather than reality since reported symptoms do not agree with measured clinical scores. In addition, regardless of seasonal complaints, measured pain and global severity scores are not worse in winter. Although patients with FM and Season (+) patients report more severe symptoms, their pattern of reporting and their actual scores do not differ according to season compared to persons without FM or positive seasonality. (J Rheumatol 2001;28:1900–9)

Key Indexing Terms:
SEASONAL SYMPTOMS SEASONAL PATTERN ASSESSMENT QUESTIONNAIRE
SEASONAL AFFECTIVE DISORDER SEASONALITY
OSTEOARTHRITIS FYBROMYALGIA
HEALTH ASSESSMENT QUESTIONNAIRE DISABILITY RHEUMATOID ARTHRITIS

Recognition of seasonal affective disorder (SAD) and criteria to diagnose it[1,2] have led to a general exploration of seasonal factors associated not only with depression, but with other medical symptoms[2-12]. Weather and season are often suggested by patients with rheumatic disease as causes for changes in joint related symptoms, but few investigators have found significant associations with either weather or season[4,13-25]. Climatic or seasonal changes may play a role in fibromyalgia (FM), as noted by Yunus, *et al*[26], and later by others[18,20,27,28]. But weather is not the same thing as seasonality, which is related primarily to length of daylight. In rheumatic diseases, seasonality is of interest, particularly because of the link between pain and depression and the link between depression and seasonality. Special interest has been aroused by patients with FM[16,27,29,30], who report a large number of seasonal symptoms and in whom neurohormonal disturbances have been well documented.

Several items must be obtained in order to investigate links between seasonality and rheumatic disease symptoms. First, one must determine whether seasonality exists, using widely recognized and validated criteria. To do this we administered the Seasonal Pattern Assessment Questionnaire (SPAQ)[31]. Second, data for rheumatic disease

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symptoms must be obtained by repeated assessment of symptoms over all the months of (many) years, and these assessments must be independent of the SPAQ self-report of seasonality. Third, a broad spectrum of patients must be studied so that the findings can be generalized beyond a single rheumatic illness. Such links have not been investigated previously. In addition, the pattern of seasonality has not been described in rheumatic disease, nor the association with demographic and rheumatic disease measures; nor have factors associated with seasonal symptoms or exacerbation of symptoms been studied.

MATERIALS AND METHODS

Patients. Our study sample consisted of 1424 patients with rheumatic disease who were participants in a longterm rheumatic disease outcome study and who completed the SPAQ questionnaire administered in 1991. In addition, all clinical data collected on these patients during up to 24 years of followup beginning with the first clinic visits were used to compare their questionnaire responses to their actual clinic data. The maximum number of individual responses studied in our analyses totaled 32,661. All data were collected contemporaneously and were available in a computerized data bank. The characteristics of these patients and the data bank research has been reported[32-34]. All patients in this report completed the SPAQ in 1991.

Clinical diagnosis and assessment methods. Patients with rheumatoid arthritis (RA), osteoarthritis (OA), and FM met established criteria for diagnosis[35-40]. For patients with more than one clinic visit, cross sectional study data are data collected at a visit closest to the time of the SPAQ administration.

We administered the CLINHAQ at each clinic visit[41,42]. This instrument contains self-reports for the Health Assessment Questionnaire (HAQ) disability index[43,44], Arthritis Impact Measurement Scales (AIMS) anxiety and depression index[45], visual analog scale (VAS) for pain, and VAS global severity among other items.

In addition, patients in this survey received the SPAQ, a validated instrument for the assessment of seasonal symptoms and the diagnosis of SAD[9,31,46-48]. A seasonal score is obtained by summing the results of 6 variables, each calculated on a 0–6 scale of increasing abnormality. The 6 variables, mood, appetite, weight, sleep, energy, and socializing, are scored on the basis of how much change the season causes in the each item: 0 = no change; 1 = light change; 2 = moderate change; 3 = marked change; 4 = extremely marked change. The summary score ranges from 0 to 24. Patients with scores above 11 are considered to represent a high degree of seasonality and represent the usual cutoff for this scale (SPAQ +).

In addition, each of the above 8 items is split into an "is worse/is better" question for each of the 12 months. Thus there are 16 separate items that are asked over 12 months, or a total of 192 items. In addition to the total seasonality score and the SPAQ (+)/SPAQ (–) dichotomy noted above, we also calculated the total score for the 12 months for each of the 16 items and noted whether patients were positive for each of the 16 items in any of the 12 months. Finally, using circular statistics, we determined the modal months for the 16 items and determined whether patients were positive for any of the items during the modal months. The modal months are defined as the month found by the circular statistic and the months immediately before and after that month.

Statistical analyses. Data were analyzed using Stata version 6.0[50]. All tests were 2 tailed, and the level of statistical significance was set at 0.05. In Table 1, groups were compared by ANOVA using the Scheffe multiple comparisons test or by chi-square where appropriate.

Because seasonal data are circular rather than continuous (January is next to December), circular statistics[51] were utilized to describe and analyze the seasonal data. Beginning with January, which was assigned a value of 15°, each month was categorized by adding an additional 30°. After processing, the direction of the data can be shown for each individual patient (Figure 1). The y axis indicates the number of patients with a specific direction. Both unimodal and bimodal distributions can be observed. Table 2 presents summary data for the graphs. The mean values represent the mean direction for all patients and for each patient group. Strength is a measure of dispersion, and ranges from 0 to 1. For example, if all the patients had the same direction, the strength would be 1. If all the direction data were equally spread or if half were in one direction and half in the other, then the strength would be 0. Two tests were used to evaluate uniformity of the circular data. The Rayleigh test tests a null hypothesis of uniformity against an alternative hypothesis of unimodality. The Kuiper test tests a null hypothesis of uniformity against any alternative. Analyses followed the Stata[50] program suite developed by Prof. N.J. Cox[52].

Multivariable logistic regression was used to calculate the odds ratios (OR) of Tables 3 and 4. Generalized estimating equations (GEE) were used to study the relationship between actual clinical values and seasonally reported alterations.

RESULTS

Demographics, clinical and SPAQ variables. Patients differed by age and sex, reflecting the expected patterns of 3 diagnostic groups. Patients were further divided according to diagnosis and seasonal score [season (+)]. Patients with SPAQ scores > 11 were categorized as having high seasonality based on previous research[49]. Seventeen percent of all patients, 13.2% of patients with RA, 14.4% of patients with OA, and 23.0% of patients with FM had high seasonal scores. The differences in seasonal positivity among the 3 patient groups were significant ($p < 0.001$), and patients with FM had more high seasonal scores than did the patients with RA and OA. Diagnostic groups also differed in 12 of the 13 clinical and SPAQ questionnaire items, with most of the differences, as shown in Table 1, reflecting greater abnormality in patients with FM compared to other patients.

As might be expected, season (+) patients had high scores ($p < 0.001$) for the constituent SPAQ variables in Table 1. In addition, they had higher scores for anxiety (mean 4.8, SD 2.1 vs 3.6, SD 2.0), depression (mean 3.4, SD 1.9 vs 2.4, SD 1.8), global severity (mean 51.8, SD 21.6 vs 40.0, SD 22.6), pain (mean 1.7, SD 0.7 vs 1.3, SD 1.8), and HAQ disability (mean 1.6, SD 0.7 vs 1.1, SD 0.7). The data show that more abnormal clinical scores are found both in season (+) patients and those with FM, and that more patients with FM are season (+) than other patients.

Monthly variation of symptoms. To evaluate the pattern and extent of seasonality, circular statistics were employed, including graphs of distribution of seasonal direction (Figures 1, 2). As shown in Table 2, fewer than half the patients report seasonal symptom change. Figures 1 and 2 present self-reported seasonal scores for the 16 monthly assessment questions for patients who reported at least one month in which a symptom was present. Against the null hypothesis that symptoms do not differ according to month, the figures reveal that worse conditions of joint pain, overall status (feel best/feel worst), etc, occur in the winter, with the maximum direction generally occurring in December or January. A smaller peak is usually seen in July, suggesting

Table 1. Demographic and clinical characteristics of study patients.

Variable	Total, n = 1424	RA, n = 614	OA, n = 375	FM, n = 435
Age, yrs	59.9 (13.87)[c]	60.80 (13.10)[h]	68.3 (11.76)	51.5 (11.7)[d,e]
Sex, % women	81.5[c]	75.2	79.2	92.4[d,e]
Education, yrs	12.8 (2.45)[c]	12.5 (2.48)	12.8 (2.49)	13.1 (2.34)[f]
Ethnic origin, % Caucasian	96.2	97.2	94.9	95.8
Marital status, % married	67.4	69.5	62.4	68.9
AIMS anxiety, 0–10	3.9 (2.12)[c]	3.3 (1.98)	3.5 (2.04)	4.7 (2.07)[d,e]
AIMS depression, 0–10	2.5 (1.84)[c]	2.3 (1.77)	2.4 (1.72)	3.0 (1.93)[d,e]
Global severity, 0–100	41.8 (22.92)[c]	38.4 (22.71)	41.3 (22.13)	47.0 (22.97)[d,f]
VAS pain, 0–3	1.4 (0.79)[c]	1.2 (0.77)[j]	1.4 (0.79)	1.6 (0.76)[d,e]
HAQ disability, 0–3	1.1 (0.74)[b]	1.2 (0.79)[j]	1.0 (0.70)	1.0 (0.70)[g]
SPAQ items				
Sleep length, 0–4	0.9 (1.05)[c]	0.8 (0.93)[j]	0.9 (1.07)	1.2 (1.15)[d,f]
Social activity, 0–4	1.2 (1.11)	1.2 (1.06)	1.2 (1.12)	1.3 (1.16)
Mood, 0–4	1.2 (1.09)[c]	1.1 (1.00)	1.1 (1.04)	1.6 (1.18)[d,g]
Weight, 0–4	0.9 (0.99)[c]	0.7 (0.87)[i]	0.9 (1.07)	1.0 (1.04)[d,e]
Appetite, 0–4	0.8 (0.97)[c]	0.7 (0.88)	0.8 (1.01)	1.0 (1.05)[d,f]
Energy level, 0–4	1.4 (1.16)[c]	1.3 (1.13)	1.4 (1.12)	1.7 (1.20)[d,f]
Total SPAQ score, 0–24	6.5 (4.79)[c]	5.7 (4.43)	6.3 (4.79)	7.8 (5.03)[d,g]
SPAQ, scores > 11, %	16.5[c]	13.2	14.4	23.0[d,f]

SPAQ: Seasonal pattern assessment questionnaire, SPAQ items: How much do the following change with the seasons: 0 = no change, 1 = light change, 2 = moderate change, 3 = marked change, 4 = extremely marked change. [a]p = 0.002, ANOVA; [b]p < 0.001, ANOVA; [c]p < 0.001, ANOVA; [d]FM group differs from RA group; p < 0.001; [e]FM group differs from OA group, p < 0.001; [f]FM group differs from OA group, p < 0.01; [g]FM group differs from OA group, p < 0.05; [h]RA group differs from OA group, p < 0.05; [i]RA group differs from OA group, p < 0.01; [j]RA group differs from OA group, p < 0.001.

Table 2. Circular direction and strength of seasonal symptoms for all patients and subgroups of RA, OA, and FM.

Symptom	n (% positive)	Overall Direction, mean (95% CI)	Strength	RA Direction, mean (95% CI)	Strength	OA Direction, mean (95% CI)	Strength	FM Direction, mean (95% CI)	Strength
Winter symptoms									
Sleep most	454 (32.0)	14.3 (12.0, 16.5)	0.48	15.5 (11.9, 19.0)	0.50	18.3 (14.7, 21.8)	0.59	9.2 (4.6, 13.7)	0.40
Most joint pain	687 (48.4)	17.3 (14.6, 20.0)	0.33	21.2 (16.8, 25.7)	0.31	20.8 (15.6, 26.0)	0.34	11.8 (7.4, 16.3)	0.34
Socialize least	644 (45.4)	32.6 (29.9, 35.2)	0.34	29.2 (25.1, 33.3)	0.34	39.4 (31.7, 47.2)	0.24	33.4 (29.5, 37.2)	0.41
Feel worst	723 (50.9)	24.1 (21.0, 27.3)	0.27	29.2 (25.1, 33.2)	0.33	23.4 (14.7, 32.0)	0.21	18.7 (13.1, 24.4)	0.25
Most rest	367 (25.8)	4.9 (357.4, 12.8)	0.15	6.8 (356.3, 17.0)	0.18	7.3 (358.0, 16.6)	0.25	343.3 (281.1, 45.5)	0.04
Eat most	622 (43.8)	347.4 (345.7, 349.0)	0.56	345.9 (343.5, 348.3)	0.60	349.6 (346.0, 353.3)	0.51	347.8 (344.9, 350.6)	0.56
Gain weight	676 (47.6)	355.2 (353.7, 356.6)	0.59	352.9 (350.7, 355.2)	0.61	0.8 (357.7, 3.9)	0.59	353.8 (351.2, 356.4)	0.58
Least energy	654 (46.1)	351.2 (336.8, 5.5)	0.06	22.6 (5.8, 39.5)	0.08	256.5 (231.4, 281.5)	0.08	353.6 (337.9, 9.3)	0.10
Summer symptoms									
Socialize most	710 (50.0)	218.5 (212.5, 224.5)	0.14	221.7 (212.2, 231.3)	0.14	266.1 (237.7, 294.4)	0.06	207.8 (201.0, 214.5)	0.22
Feel best	892 (62.8)	186.5 (183.4, 189.6)	0.25	191.4 (187.0, 195.9)	0.27	171.5 (163.3, 179.7)	0.19	188.3 (183.4, 193.3)	0.27
Sleep least	518 (36.5)	196.1 (193.9, 198.3)	0.46	196.2 (193.0, 199.5)	0.50	197.3 (193.4, 201.3)	0.48	194.7 (190.3, 199.0)	0.40
Lose weight	471 (33.2)	176.3 (174.5, 178.2)	0.58	180.4 (177.6, 183.2)	0.59	177.7 (174.0, 181.4)	0.59	171.1 (168.0, 174.2)	0.56
Eat least	459 (32.3)	189.2 (187.4, 191.1)	0.58	193.3 (190.4, 196.2)	0.60	182.6 (178.3, 186.9)	0.52	188.4 (185.5, 191.2)	0.61
Most energy	706 (49.7)	178.6 (174.8, 182.3)	0.23	176.1 (170.6, 181.6)	0.25	171.9 (162.5, 181.2)	0.19	184.5 (178.7, 190.3)	0.25
Least joint pain	580 (40.8)	187.0 (184.4, 189.2)	0.43	185.7 (181.7, 189.6)	0.36	188.8 (184.6, 193.0)	0.47	187.3 (184.0, 190.6)	0.50
Least rest	397 (28.0)	201.7 (195.4, 208.4)	0.17	188.4 (180.5, 196.3)	0.23	206.8 (197.0, 216.6)	0.24	225.1 (204.0, 246.3)	0.09

Patients without seasonal preference were not included in the analyses. Overall n is 1424. N with symptoms shown in Column 2. For all variables in all groups, the Rayleigh and Kuiper tests of uniformity were significant at p < 0.001.

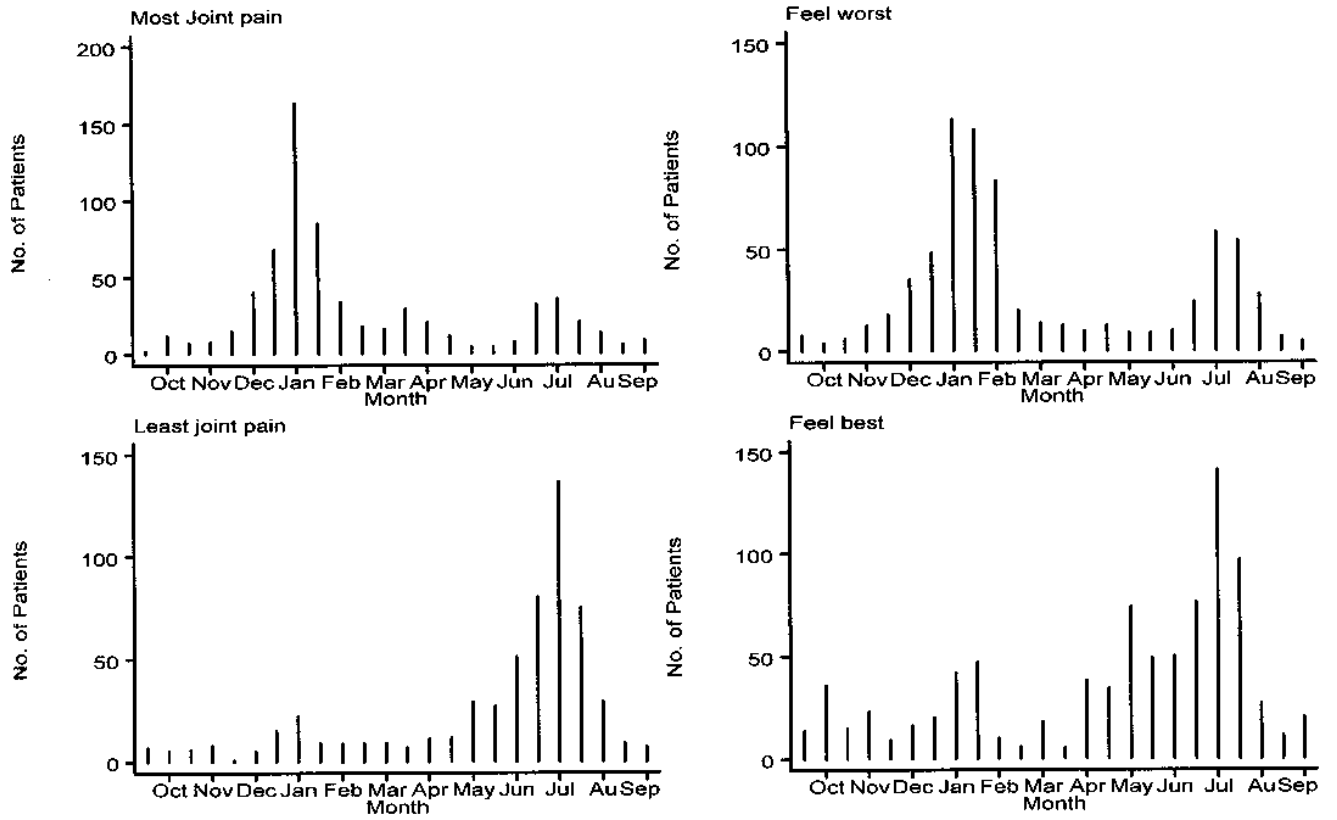

Figure 1. Direction of seasonal symptoms related to joint pain and overall severity.

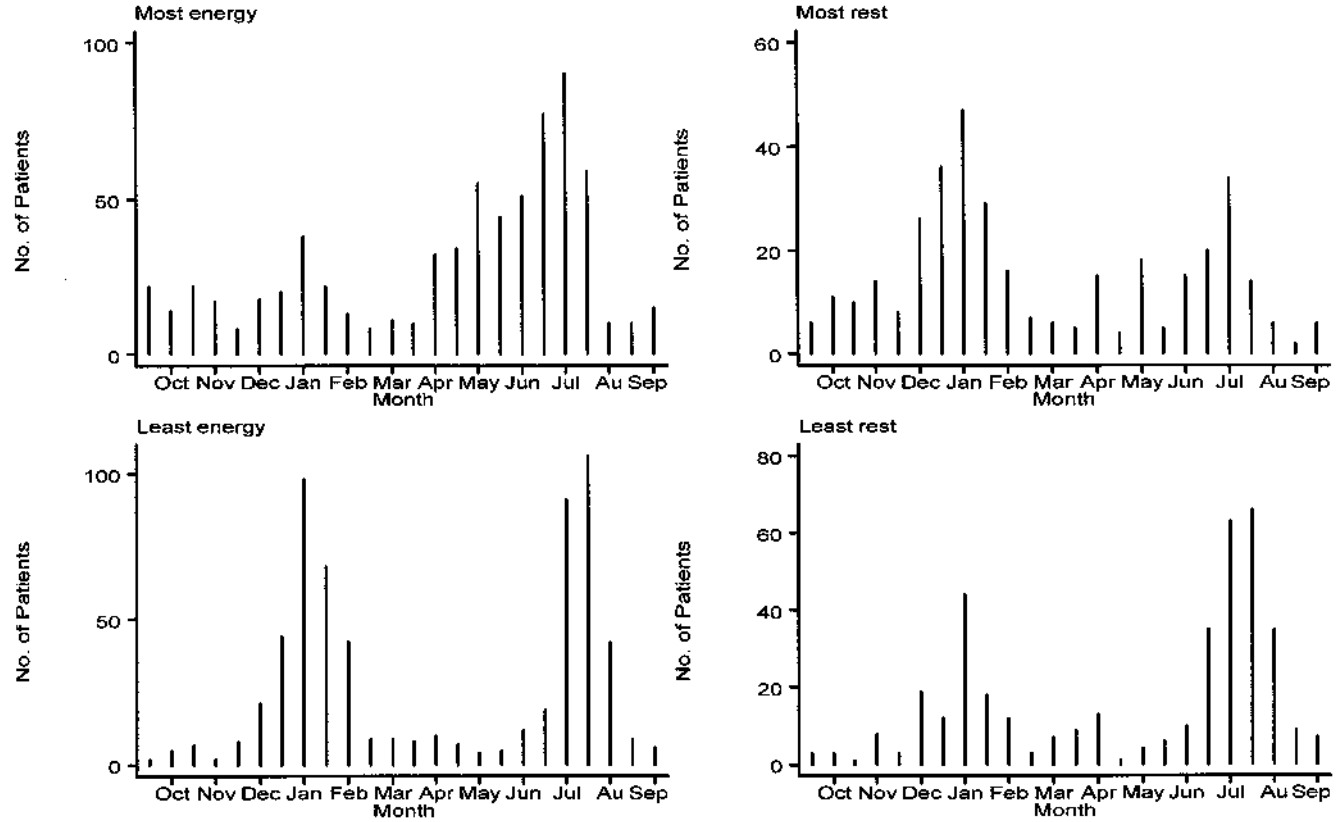

Figure 2. Extent and direction of seasonal symptoms related to energy and rest.

some degree of bimodality among patients. Neutral months occur in the spring and fall seasons. Further confirmation of the seasonal pattern comes from the Rayleigh and Kuiper tests that test the null hypothesis of uniformity against any alternative. Test results indicate that among those reporting seasonal complaints the monthly pattern of examined variables was nonuniform ($p < 0.01$). From the strength statistic it can clearly be seen that there is far more dispersion for joint pain, overall severity, and fatigue than there is for sleep and eating measures. This indicates less agreement regarding which seasons are most important among those with greater dispersion or less strength among the patients' self-reports. Among the illustrations, several patterns can be observed. In the first pattern there is a distinct reciprocal seasonal response. This can be seen most clearly for weight gain and eating. The pattern for joint pain and overall severity reflects some degree of bimodality, while rest and least energy reflect distinct bimodality. The third pattern of dispersed values, reflected in the low strength score, is that seen for most energy.

The most commonly attributed seasonal effects (in order of strength) that are linked to rheumatic disease symptoms are least joint pain/most joint pain, followed by feel worst/feel best, and perhaps by the energy pair. In rheumatic disease terminology, these factors could be labeled as pain, global severity, and fatigue. Nonrheumatic symptoms (strictly speaking) fluctuated in their seasonal contribution from socialize most (50.0%) to most rest (25.8%).

Overall, the data in Figures 1 and 2 and Table 2 indicate that 62.8% of patients report season influences on how they feel. Forty-nine percent report that their energy (fatigue) is influenced by season, and 48.4% notice the effect of season on joint pain. In addition, among those with these factors, winter is the most bothersome season and summer (July) the most helpful season. Among rheumatic disease related symptoms, feel worst and most joint pain are rather dispersed. These data indicate that, to varying degrees, patients believe that season affects their rheumatic symptoms and their overall status.

Predictors of seasonal symptoms. Since it might be expected that patients with FM or those with high seasonal scores would have different patterns of symptoms according to month, we assessed the pattern of symptoms by group (Table 2). For each of the symptoms assessed there was no clinically significant difference by group, although statistically significant differences (as seen by overlapping confidence intervals) were sometimes seen, owing to the large sample size. But mean vectors were quite similar, indicating no clinically significant difference. These data show that the direction of symptoms does not differ by diagnostic group. Similarly, season (+) and season (–) patients were not significantly different.

To assess symptom severity, a score for each symptom was calculated by summing the monthly scores. This score variable ranged from 0 to 12, with each month in which a symptom was present contributing 1 to the score. Using linear regression, season (+) patients and patients with FM had significantly more abnormal scores, the only exception being socialize less for the patients with FM, which was not significant ($p = 0.095$).

Table 3 further characterizes the association between diagnosis and covariate factors by estimating logistic regression models. In Table 3, we compared patients reporting at least one month in which a specific symptom effect was noted compared to patients who noted no effect; in other words, patients positive for a symptom effect versus those negative for the effect. Each line in Table 3 is the result of a separate multiple logistic regression of the dependent variable of Column 1. The contribution of each variable is summarized by its odds ratio and an asterisk indicating a degree of statistical significance, if present. For example, the first row in Table 3 indicates that patients with FM report joint pain worse (OR 1.34), but as shown in Figure 2, this effect is lost when anxiety is added to the model. In general, Table 3 shows that there were few effects that could be linked to diagnosis. Importantly, younger age was increasingly associated with seasonal symptom attribution. Women had increased symptom attribution relating to weight and sleep in these multivariable analyses. Anxiety played some role in these symptoms, and the effect of FM diagnosis was lost when anxiety was included in the model.

The results of the analyses show that the presence or pattern of symptoms is not generally related to diagnosis or season positivity, but that diagnosis and seasonality are related to symptom intensity or severity. That is, seasonal symptoms occur across all groups, but are more severe in those with FM or high seasonality scores. In addition, older patients are less affected by seasonal changes and younger patients are more affected, according to their self-reports.

Seasonal symptoms, increased pain and severity scores. To analyze whether patient perceptions accurately reflect patient status, we used data collected beginning in 1974, which was stored in the computerized data bank. Depending on the variable, up to 32,259 observations on the 1424 patients were analyzed (Table 4). Figure 3 shows that pain scores, global severity scores, and weight are generally similar across the 12 months, and that the increased pain and severity (feeling worse) reported in December through February in Figures 1 and 2 are not present in actual clinical measurements. We tested this further in several ways. Using a generalized estimating equation for population averaged data, we first tested whether pain and global severity scores were greater in the winter months, as suggested by the survey. Results of these tests showed that pain (coeff. –0.028, SE 0.007, $p < 0.001$) and patient global severity (coeff. –0.848, SE 0.208, $p < 0.001$) were slightly greater in the non-winter months. Next we studied whether persons who reported that pain and global severity were increased in

Table 3. Effect of predictor variables on presence or absence of seasonal symptoms using multiple logistic regression.

Dependent Variable	Predictor Variables						
	OA	FM	Age Q1	Age Q2	Age Q3	Sex	Anxiety
Joint pain worse	1.07	1.11	2.33***	1.41*	1.20	1.03	
Joint pain worse	1.04	1.02	2.29***	1.40*	1.23	1.07	1.04
Feel better	1.18	1.22	1.96***	1.45*	1.40*	1.00	
Feel better	1.10	1.08	1.91***	1.46*	1.43*	1.04	1.08**
Socialize more	1.01	1.03	1.54**	1.34	1.07	0.84	
Socialize more	1.00	0.92	1.49*	1.32	1.06	0.85	1.09**
Gain weight	1.04	1.22	1.87***	1.41	1.21	0.97	
Gain weight	1.03	1.09	1.78***	1.36	1.16	0.93	1.05
Sleep less	1.47**	1.40*	1.42*	1.08	0.86	1.17	
Sleep less	1.37*	1.21	1.35	1.09	0.84	1.14	1.09**
Eat more	1.05	1.11	1.82***	1.38*	1.14	0.88	
Eat more	1.00	1.00	1.78***	1.38	1.13	0.86	1.04
Lose weight	1.01	1.28	2.04***	1.36	0.96	1.49**	
Lose weight	0.99	1.16	1.92***	1.32	0.92	1.43*	1.05
Socialize least	0.98	1.08	1.49*	1.24	1.09	0.81	
Socialize least	0.94	0.92	1.45*	1.30	1.11	0.80	1.08*
Feel worst	0.99	1.34*	2.78***	1.94***	1.61**	0.93	
Feel worst	0.97	1.20	2.78***	1.95***	1.66**	0.98	1.07*
Eat least	1.03	1.53**	1.67**	1.09	1.24	1.27	
Eat least	0.99	1.33	1.65**	1.09	1.24	1.27	1.08**
Sleep more	1.45**	1.41*	1.79***	1.42*	1.13	1.37*	
Sleep more	1.39*	1.24	1.72**	1.43*	1.12	1.36*	1.06*
Most energy	1.12	1.30*	2.44***	1.61**	1.41*	1.12	
Most energy	1.08	1.22	2.37***	1.58**	1.41*	1.14	1.05
Least joint pain	0.92	0.89	2.62***	1.41*	1.22	1.31	
Least joint pain	0.90	0.85	2.62***	1.47*	1.31	1.33	1.05
Least energy	1.03	1.24	1.95***	1.55**	1.31	1.16	
Least energy	0.98	1.14	1.87***	1.58**	1.27	1.17	1.04
Most rest	1.21	0.97	1.89***	1.29	1.05	1.29	
Most rest	1.16	0.92	1.82**	1.24	1.02	1.28	1.04
Least rest	1.15	1.19	1.74**	1.41	1.13	1.11	
Least rest	1.09	1.06	1.67**	1.39	1.09	1.11	1.06

Symptoms were considered to be present if they were reported for one or more months. Age Q1–Age Q3 are lower quartiles of age. Each line represents a separate regression. The statistic is the odds ratio compared to the reference category for the association of the predictor variable with the symptom variable in Column 1 as estimated in multivariable logistic regression. Reference categories are RA for OA and FM, the 4th quartile of age for the quartiles 1–3 of age, and male sex for sex. Anxiety is a continuous variable (0–10). Also examined but not shown were depression, global severity, VAS of pain, and HAQ disability. *$p < 0.05$; **$p \leq 0.01$; ***$p < 0.001$.

December, January, or February had increased pain levels compared to those who did not have pain or global severity symptoms in those months. Pain scores (coeff. 0.014, SE 0.033, p = 0.681) and global severity scores (coeff. –1.461, SE 1.051, p = 0.164) were not increased among those patients. Since it is possible that the effect is only manifested during the winter months, we reran the analyses comparing winter (+) patients with winter negative (–) patients for pain during the winter months. Results for pain (coeff. 0.026, SE 0.037, p = 0.471) and global severity (coeff. –1.319, SE 1.116, p = 0.237) did not show an increase in the winter months for those who indicated increased pain in those months. We then compared patients who were positive in both the best and worst modal months for a given symptom, and analyzed the data only from the paired winter and summer modal months. This is a rigorous analysis since it tests the case most likely to be true. However, even in these analyses, pain and global severity did not differ in the 2 monthly periods (p = 0.725 and 0.349).

We then examined whether patients who scored high on the seasonality index [seasonal (+) patients] had higher levels of pain overall and in the winter or summer months. Seasonal (+) patients had statistically and clinically higher scores for pain and global severity both in the winter and summer months (winter pain coeff. 0.257, SE 0.054, p < 0.001; winter severity 8.673, 1.345, < 0.001; summer pain 0.288, 0.041, <0.001; summer severity 8.346, 1.242, < 0.001), as might be expected. But analyses that included as independent variables both seasonal status (+/–) and

Table 4. Pain, global severity, and weight in the clinic as predicted by season and SPAQ questionnaire items.

Dependent Variable	Predictor	Controlling for	Patients	n (Observations)	Coefficient (SE)	p
Pain, 0–3	Winter months		All months	1424 (28,554)	–0.028 (0.007)	< 0.001
	Modal mo		All months	1424 (28,554)	0.014 (0.033)	0.681
	Modal mo		Winter months	1383 (8500)	0.026 (0.037)	0.471
	Winter mo	Season (+)	All months	1424 (28,196)	–0.028 (0.007)	< 0.001
	Winter mo		Winter (+)/Summer (+)	322 (5813)	–0.006 (0.017)	0.725
	Winter mo	Season (+)	Winter (+)/Summer (+)	199 (5764)	–0.005 (0.017)	0.742
Global severity, 0–100	Winter mo		All months	1424 (32,661)	–0.848 (0.208)	< 0.001
	Modal mo		All months	1424 (32,661)	–1.461 (1.051)	0.164
	Modal mo		Winter months	1384 (9324)	–1.320 (1.116)	0.327
	Winter mo	Season (+)	All months	1402 (32,258)	–0.860 (0.209)	< 0.001
	Winter mo		Winter (+)/Summer (+)	208 (1461)	–0.458 (0.459)	0.349
	Winter mo	Season (+)	Winter (+)/Summer (+)	207 (4680)	–0.466 (0.490)	0.342
Weight, lbs	Winter mo		All months	1424 (28,554)	0.477 (0.478)	0.019
	Modal mo		All months	1055 (13,280)	2.181 (2.487)	0.380
	Modal mo		Winter months	711 (4492)	3.662 (4.037)	0.228
	Winter mo	Season (+)	All months	1206 (15,096)	0.435 (0.178)	0.322
	Winter mo		Winter (+)/Summer (+)	209 (2593)	1.386 (0.425)	< 0.001
	Winter mo	Season (+)	Winter (+)/Summer (+)	208 (2586)	1.372 (0.427)	< 0.001
	Winter mo		Winter (–)/Summer (–)	697 (8584)	–0.032 (0.234)	0.889

Predictor: Winter months = scores in December, January, and February versus other months. Modal months = scores of patients indicating symptom worsening during modal months for pain, global severity, or weight.
Controlling for: Season (+) = patients with a score of 11 or greater on SPAQ seasonality measure.
Patients: All months: analysis on patients. Winter months: analysis of patient data during winter months. Winter (+)/Summer (+): analysis on patients having a worse symptom during winter months and a best symptom during summer months. Winter (–)/Summer (–): analysis on patients having no worse symptom during winter months and no best symptom during summer months.

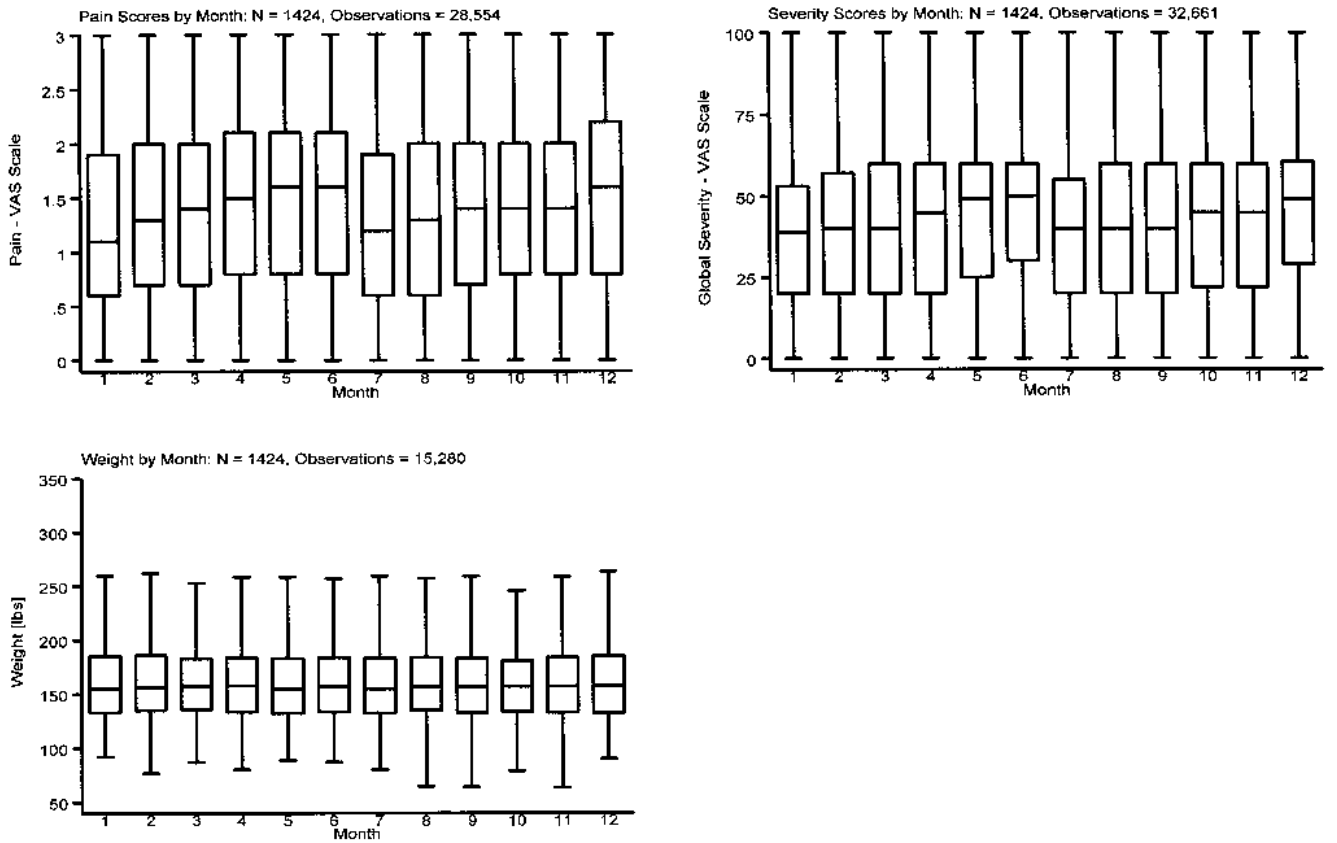

Figure 3. Monthly scores for pain, global severity, and weight gain for patients followed for up to 25 years. Number of observations range from 28,544 for pain and weight to 32,661 for global severity. No clear seasonal pattern can be discerned.

winter and summer modal positivity for data in the summer and winter months indicated no effect of season. These data show, then, that regardless of how the data are analyzed, self-reports of increased pain and global severity in the winter months are not found when actual clinical data are analyzed. Of secondary interest, season (+) patients have increased pain and global severity compared to season (–) patients.

We also analyzed comparative weight in the summer and winter months using the same analyses as above (Table 4). In contrast to the results above, patients who noted seasonal weight changes did, in fact, have changes of about 1.3 lbs, but patients who did not note such seasonal effects did not actually change weight in the different seasons.

DISCUSSION

There are a number of important results from our study. First, with regard to symptoms that are primarily germane to patients with RA or other rheumatic disease, we found no associations between season and actual pain and severity measurements, or between seasonal (as expressed in the SPAQ questionnaire) and actual measurements made in the clinic during different seasons. In approaching these analyses of pain and global severity, we first tested whether seasonal effects could be observed generally when winter months were compared with all other months. We then examined whether patients who reported worsening in the modal months for worsening of pain or global severity actually had more abnormal scores in the modal months. We compared these patients to other patients in the specific modal months. Finally, in the most rigorous and focused model, we measured pain in the worst/best modal month pair groups for those who indicated in the SPAQ that pain was influenced in those months. In none of these analyses did we discern any effect of season or any agreement with what the patients had reported in the SPAQ. The sample size was very large, and had there been any effect we would have detected it. Except for our previous report, which did not utilize the SPAQ to identify seasonal patients[53], this longitudinal methodology combined with the identification of self-reported season-sensitive patients has not been utilized previously.

Among the questions we investigated, *pari parsu*, is whether the SPAQ is a valid and reliable instrument to detect actual seasonal effects in contrast to reported effects, and more generally whether rheumatic disease symptoms are related to season (not weather). Our negative findings in regard to rheumatic disease symptoms are in accord with the results of others[54,55], illustrating the weakness of instruments that rely on distant recall of symptoms that are difficult to quantify. We note that this weakness is apparent only for the rheumatic disease symptoms we have investigated, not to the investigation of SAD, the primary use of the SPAQ[56]. It should also be pointed out that we were able to verify that those who reported changes in weight actually had such changes, with an average change over the seasons of 1.4 lbs. This accurate but small effect may reflect the differences between effects that are easily quantifiable by patients with those that are more difficult (e.g., pain).

Seasonality in rheumatic diseases differs from weather sensitivity, which has been the subject of previous reports[15,16,18,19,21,23-25,57-60]. In rheumatic diseases, seasonality is of interest, particularly because of the link between pain and depression and the link between depression and seasonality. Special interest has been aroused by patients with FM with a large number of seasonal symptoms. In our study, we found that patients with FM as well as patients who are season (+) both have more abnormal scores for all rheumatic disease measurements (including anxiety and depression). In addition, they endorse more months as being seasonal and, of course, seasonal scores and FM are linked. On the other hand, we found no evidence that patients with FM [or season (+) patients] differed from other rheumatic disease patients or non-season (+) patients in the pattern of their seasonality, nor did they have actual increases in rheumatic disease symptoms in the worst and best months. Our finding in regard to these 2 groups is one of increased self-reported severity and attribution. In this respect, others have linked reporting of high seasonality scores with various psychological disorders, including somatization[6,61]. Thus it is of great importance to distinguish reported seasonal effects from actual seasonal effects. We have previously reported no difference in mood according to season in patients with rheumatic disease. The clinical significance of our study data casts doubt on the actuality of seasonal effect as well as its place in the hypotheses regarding season and physical and emotional symptomatology.

Our data characterize both the circular direction of the seasonal attribution and the dispersion of the attributed symptom alteration. Rest, energy, and socialization, for example, are widely dispersed symptoms, in contrast to weight and sleep changes, which are much more focused. It should therefore be easier to detect seasonal effects in the most focused areas. This may reflect more accurate perceptions on the part of patients or much greater effect on seasonality for some symptoms in contrast to others.

About 50% of patients with rheumatic disease reported exacerbation of rheumatic symptoms (pain, global severity, and fatigue) by seasonal changes. The presence of seasonal symptoms was not related to diagnosis or to SAD symptoms, and symptoms were less common in older persons and in men. The number of symptoms and the severity of allied factors (depression, anxiety, pain, global severity, and the number of months with seasonal symptoms) were increased in patients with FM and/or all SAD symptoms. Using circular statistics, the modal months for worse symptoms were December and January, and for best symptoms, July. Bimodal patterns of seasonality were identified for global

severity, joint pain, fatigue, and socialization. Seasonal symptoms differed in the degree at which they were dispersed around the 12 month circle. When pain and global severity measurements obtained over a 19 year period were analyzed, pain was slightly increased in the summer and global severity was not related to season at all. Even when patients who specifically reported worse symptoms in winter and best symptoms in summer were examined, no effect of season could be found. We conclude that seasonal rheumatic symptoms are commonly reported across all rheumatic diseases, but appear to reflect perception rather than reality since reported symptoms do not agree with measured clinical scores. In addition, regardless of seasonal complaints, measured pain and global severity scores are not worse in winter. Although patients with FM and season (+) patients reported more severe symptoms, their pattern of reporting and their actual scores did not differ according to season compared to persons without FM or positive seasonality.

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