

ORIGINAL ARTICLE

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The association between arthritis and the weather

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Abstract Despite the pervasiveness of the idea that arthritis is influenced by the weather, scientific evidence on the matter is sparse and non-conclusive. This study, conducted in the Australian inland city of Bendigo, sought to establish a possible relationship between the pain and rigidity of arthritis and the weather variables of temperature, relative humidity, barometric pressure, wind speed and precipitation. Pain and rigidity levels were scored by 25 participants with osteoarthritis and/or rheumatoid arthritis four times per day for 1 month from each season. Mean pain and rigidity scores for each time of each day were found to be correlated with the meteorological data. Correlations between mean symptoms and temperature and relative humidity were significant (P <0.001). Time of day was included in the analysis. Stepwise multiple regression analysis indicated that meteorological variables and time of day accounted for 38% of the variance in mean pain and 20% of the variance in mean rigidity when data of all months were considered. A post-study telephone questionnaire indicated 92% of participants perceived their symptoms to be influenced by the weather, while 48% claimed to be able to predict the weather according to their symptoms. Hence, the results suggest (1) decreased temperature is associated with both increased pain and increased rigidity and (2) increased relative himidity is associated with increased pain and rigidity in arthritis sufferers.

Key words Rheumatoid arthritis · Osteoarthritis · Weather · Cold sensitivity · Sensitivity to humidity

Introduction

Anecdotes concerning the influence of the weather with arthritis symptoms are historically of widespread occurence. Hippocrates is said to have referred to the relationship between the elements and disease (Rentschler et al. 1929). Some anecdotes go so far as to say that the relationship is sufficiently precise that arthritics can predict the weather changes by their symptoms. One commentary cites the Australian Bureau of Statistics 1989 Disability Survey as stating that 4% of disability is due to musculoskeletal conditions. Arthritis was the most commonly reported condition with an incidence of 11% for the population. Osteoarthritis and rheumatoid arthritis are the two most common types. While arthritis related costs are estimated to be two billion dollars per annum in Australia (Brooks and March 1993), the personal cost of pain and disability are immeasurable.

Given that arthritis is a significant cause of pain and disability and that everyone with arthritis has at least the potential to be exposed to the weather, the issue of the possible effects of the weather on arthritis is of great interest to arthritics, their families and others involved in their care. Both health care professionals and biometeorologists have not yet been given sufficient evidence to provide advice and recommendations on the topic. Some attempts have been made to research the possible relationship between the weather and symptoms of arthritis. Two studies documenting the effect of climate on pain produced by disease appeared in the last century (Mitchell 1877; Everett 1879 cited in Rentschler et al. 1929). Rentschler et al. (1929) questioned 367 hospitalized people daily for a year. However, these early studies lack the methodological and statistical rigour demanded by today’s standards. Twelve subsequent studies have been identified that contribute some information to the debate. The contribution has been obtained by various methods, including: surveys comparing climate to incidences of arthritis (Kellgren et al. 1953; Harris 1984), prospective blind experiment (Hollander and Yeostros 1963), survey of laboratory data (Latman 1981), qualitative reporting of perceptions (Johansson and Sullivan 1975), questioning of arthritics (Lawrence and Molyneux 1968; Guedj and Weinberger 1990), diary keeping or self scoring (Patberg et al. 1985; Sibley 1985; Dequeker and Wuestenraed 1986) and repeated examinations (Van de Laar et al. 1991).

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Researchers who documented findings supporting a relationship between the weather and arthritis include Rentschler et al. (1929), Kellgren et al. (1953), Hollander and Yeostros (1963), Lawrence and Molyneux (1968), Harris (1984), Patberg et al. (1985), Dequeker and Wuestenrand (1986), Guedj and Weinberger (1990) and Arber et al. (1994). The findings of Johansson and Sullivan (1975) give somewhat less direct support. Only three items of research have been identified suggesting that the weather is not associated with arthritis (Sibley 1985; Latman 1981; Van de Laaer et al. 1991). Not one study identified to date has been able to replicate another directly; thus the comparability of these studies is limited indicating the need for further detailed study and statistical evaluation. The basic question of “does the weather influence the symptoms of arthritis?” has not been satisfactorily answered. Exploration of the two elements of this enigma constitute the purpose of the present study – to determine if there is a relationship between the mean pain and mean rigidity of rheumatoid and osteoarthritis and the weather in the Australian city of Bendigo (36° 45′ S, 144° 17′ E).

Methods

Subjects

A sample (*n*=25; 23 female and 2 male) of adult volunteers residing in their own homes in Bendigo was utilised. Community organizations likely to have middle-aged or elderly members were approached for subjects likely to qualify in the study, arthritis being more common in advancing years. Participants were asked not to provide data for days where they were in hospital (an artificial environment) or were out of Bendigo. All participants were >51 years of age and were English speaking Caucasians, although no effort was made to exclude people of other ethnic backgrounds. The population of Bendigo is predominately Anglo-Saxon in origin. Participants gave their written, informed consent to participate and specifally gave permission for their doctor to release information about the diagnosis of their arthritis. To avoid any bias in participant data recording, the purpose of the study was partially explained to participants as being “…to examine the patterns of arthritis in everyday life”. The use of a partial rather than a full explanation of the study’s intent was considered justified and approved by the Human Research Ethics Committee of La Trobe University, Bendigo.

Diagnosis

All participants suffered from rheumatoid arthritis and/or osteoarthritis. The presence of arthritis was confirmed by the participants’ medical practitioners according to well accepted and prespecified criteria. The criteria selected for the diagnosis of rheumatoid arthritis of the American Rheumatism Association has 91–94% sensitivity with 89% specificity for rheumatoid arthritis compared to a non-rheumatic control (Arnett et al. 1988). The diagnostic criteria of Altman et al. (1986) were utilized for osteoarthritis. The sensitivity of this approach is 88% with a specificity of 93% (Altman et al. 1986). A verbal statement from the participants was accepted in some cases, when the reticence became evident of medical practitioners to complete the form providing the diagnostic information despite the explicit permission of the participants.

Participant data

Data were gathered in the form of a grid-style diary in which participants utilized a numerical ten-point scale indicating the severity of the symptoms. The diaries were recorded four times per day, at meal times and on retiring in the evening, for 1 month from each season. The months used were October (spring 1993), February (summer 1994), May (autumn 1994) and July (winter 1994). Due to the long intervals of data collection and numbers of participants involved, the procedure for assessing symptoms was necessarily one which could be self administered.

Times of data recording were purposefully phrased, as mentioned previously, to enhance subject compliance by enabling the participant to link diary keeping with other everyday activities such, as meals or the taking of medication. The diary needed to be compact, clear and easy to complete. Participants had ready access to their previous scores as this has been found to enhance accuracy (Scott and Huskisson 1979). Quantitative terms attached to the scale were selected by the participant, since relative pain or rigidity was the point of interest (Swriwantakul et al. 1982). For example, lesser pain or no pain could be represented by score 0 and extreme pain by a score of 10. The presence or absence of confounding variables was noted by entering a code on the grid, as follows: swimming/hydrotherapy, use of heating, air-conditioning, and extra stress. These variables may be analysed in the future but have not been considered for the purposes of the current study. Other confounding variables such as sleeping habits or ventilation of the home were beyond the scope of the present study.

The post-study telephone questionnaire

To assess participants’ perceptions of their own sensitivity to weather, a telephone questionnaire was conducted after return of the diaries for the last month. The questions asked were: (1) Do you belive your arthritis symptoms are affected by the weather? (2) If so, how often are they affected? (3) How are the symptoms affected by the weather? (4) Do you think you can predict the weather by your symptoms?

Meteorological data collection

The study was conducted in the Australian inland city of Bendigo, which has a temperate climate with a mean annual rainfall of 550 mm (Bureau of Meteorology 1988). A comparison of mean long-term values of the meteorological variables for Bendigo and the means of the weather variables for the months under study for Bendigo are summarized in Table 1. Meteorological data for the months under study were collected at Bendigo by the Australian Bureau of Meteorology and supplied either as hourly observations from the automatic weather station (AWS) or from the observer field book when the AWS failed. The field book was documented at 0600, 0900, 1500 and 2100 hours. Where AWS data was available the times selected for comparison were 0700, 1200, 1800 and 2200 hours. Meteorological parameters utilized in the comparison were wind speed (km/h), dry bulb temperature (°C), barometric pressure (hPa) corrected to mean sea-level (msl), and precipitation (mm). Relative humidity expressed as a percentage was also calculated. Some meteorological data were missing due to failure of the AWS. From the entire study 17 cases of wind speed data were missing, seven of temperature, nine of relative humidity, seven of precipitation and nine of barometric pressure.

Statistical analysis

Data from participant diaries were processed for analysis by the Statistical Package for the Social Sciences (SPSS) software. Mean values using data from all participants were calculated for pain and rigidity for each time of each day and of each month. These means were then compared with the actual meteorological information closest to the time of participant data entry. SPSS was used

Table 1 Mean weather recordings[a] for Bendigo: long-term data with data of present study italicised in parenthesis

	October	February	May	July
Wind speed				
Strong wind days[b]	2(*0*)	1(*0*)	1(*5*)	1(*0*)
Gale days[b]	0(*0*)	0(*1*)	0(*0*)	0(*0*)
Barometric pressure at mean sea-level				
0900 hours (hPa)	1016.6(*1017.6*)	1014.9(*1014.1*)	1021.3(*1020.3*)	1020.8(*1024.9*)
1500 hours (hPa)	1014.1(*1015.1*)	1012.0(*1012.5*)	1018.8(*1018.1*)	1018.5(*1022.6*)
Relative humidity				
0900 hours (%)	64(*68*)	60(*67*)	84(*76*)	90(*88*)
1500 hours (%)	46(*50*)	34(*38*)	60(*49*)	66(*57*)
Precipitation				
Monthly (mm)	53(*56.4*)	33(*59.8*)	55(*18.6*)	56(*10.6*)
Temperature				
Mean minimum °C	8.2(*6.6*)	14.7(*15.1*)	6.4(*5.0*)	3.3(*0.4*)
Mean maximum °C	19.9(*18.5*)	28.6(*28.6*)	15.9(*16.6*)	12.0(*13.3*)

[a] Wind speed represents 33 years of recording, barometric pressure 76 years of recording, relative humidity and temperature 29 years of records, and precipitation 125 years of records
[b] Strong wind days (41–61 km/h), gale days (>62 km/h) (Source: Bureau of Meteorology, National Climate Centre; Bureau of Meteorology 1988)

to plot graphs comparing mean pain and mean rigidity to the meteorological parameters. Pearson's product moment correlation coefficients were calculated between the dependent symptom variables and the independent time and weather variables.

To estimate the proportion of the variance explained by the regression, R^2 was calculated on Pearson's correlation coefficients. R^2 expresses the proportion of variance in the dependent variable (mean pain or mean rigidity) which is explained by each independent meteorological variable (Norman and Streiner 1994). Time of day was included in the analysis and treated as an independent variable using stepwise multiple regression because the time of day influences various meteorological parameters. Time of day may exert its influence on symptoms by virtue of its association with the weather, or via another factor(s). Morning symptoms may be exacerbated by overnight immobility, sleep hormone changes, ventilation of the bedroom or by some other factors that are not within the scope to be examined by this study.

To determine whether combinations of meteorological variables or time of day, rather than single variables were associated with variation in the mean symptoms, multiple regression was employed. Two equations were utilized for each month. In one equation mean pain was treated as a dependent variable of temperature, barometric pressure, relative humidity, wind speed and precipitation. The second equation substituted mean rigidity for mean pain. Data were analysed by stepwise selection of significant independent variables. The overall value of R^2 indicates how much of the variance in mean pain or mean rigidity is accounted for by the listed independent variables. In stepwise multiple regression, as each independent variable is added to the equation, all other independent variables already in the equation are checked to ascertain if their level of significance is maintained despite the addition of the next variable (Dawson-Saunders and Trapp 1994).

Table 2 Means and standard deviations for symptoms by time of data collection

	Breakfast	Lunch	Dinner	Retiring
October:				
Mean pain	4.479	3.742	3.898	4.224
SD	3.445	3.118	3.140	3.225
Mean rigidity	3.971	3.184	3.309	3.716
SD	2.800	2.443	2.706	2.900
February:				
Mean pain	3.796	3.006	2.923	3.354
SD	3.113	2.920	2.843	2.838
Mean rigidity	3.149	2.434	2.572	2.753
SD	2.659	2.103	2.165	2.163
May:				
Mean pain	4.204	3.513	3.476	3.653
SD	3.252	3.089	2.975	2.959
Mean rigidity	3.511	2.685	2.735	3.230
SD	2.615	2.259	2.270	2.272
July:				
Mean pain	4.527	4.085	4.043	4.251
SD	2.454	2.155	2.086	2.092
Mean rigidity	3.406	2.904	2.851	3.048
SD	1.826	1.819	1.741	1.887

Results

Characteristics of participant data

Descriptive statistics relating to participants' scored pain and rigidity for each time of data collection for each month of the study are presented in Table 2. The data demonstrate that for both mean pain and mean rigidity in each month the mean score is highest at breakfast time, lowest at lunch then increases to some extent at dinner and on retiring, although not to the same value as the level of breakfast. The standard deviations of some scores are almost as large as the means indicating a large degree of variance in the scores of individuals with the month.

Characteristics of the meteorological data

With regard to temperature, the months under study were not unusual compared to the long-term means except for the July mean minimum temperature being well below

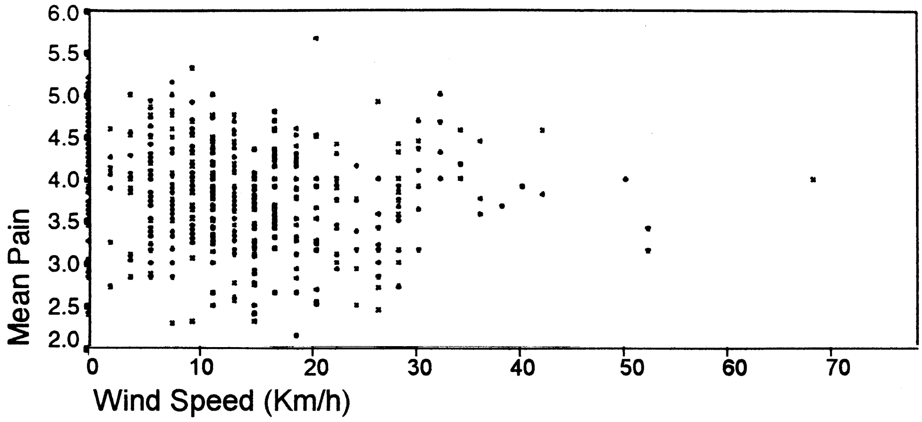

Fig. 1 Scattergram of mean pain and wind speed (Pearson's correlation coefficient –0.1773, P <0.001)

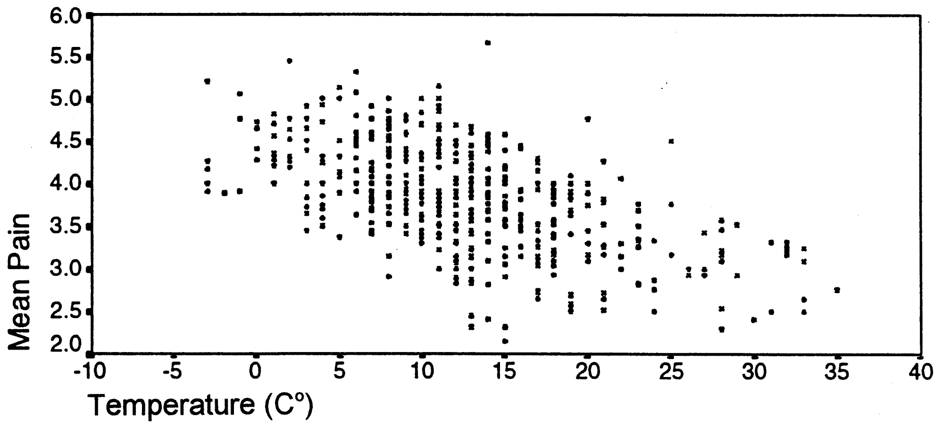

Fig. 2 Scattergram of mean pain and air temperature (Pearson's correlation coefficient –0.5752, P <0.001)

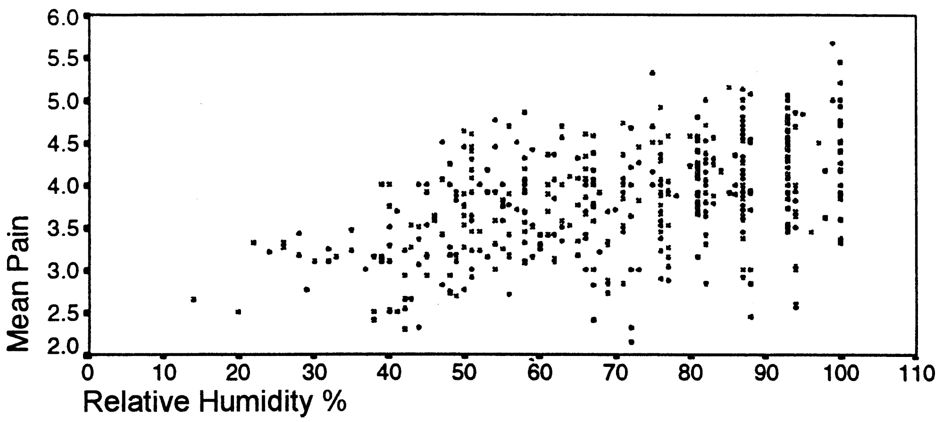

Fig. 3 Scattergram of mean pain and relative humidity (Pearson's correlation coefficient 0.4893, P <0.001)

the long-term mean (Table 1). However with regard to rainfall, only the October data resembled the long-term monthly mean. February precipitation was above average while May and July precipitation was well below the long-term monthly mean reflecting the drought that occurred througout Victoria between autumn 1994 and autumn 1995.

Comparison of symptoms to the weather: correlation

Figures 1–6 depict the relationships of mean symptoms and weather variables for all months of data collection which reached statistical significance according to the calculation of Pearson's correlation co-coefficients. The data of Table 3 summarize Pearson's correlation coefficients calculated for mean pain and mean rigidity, weather variables and time of day. Wind speed was significantly and negatively correlated to mean rigidity in October (P <0.001), May and July (P <0.01). Significant correlation between mean pain and wind speed was found in May and July (P <0.01). The overall correlation between wind speed and mean pain over all months was significantly related (P <0.001).

Temperature was found to have a consistent degree of negative correlation with mean symptoms throughout the

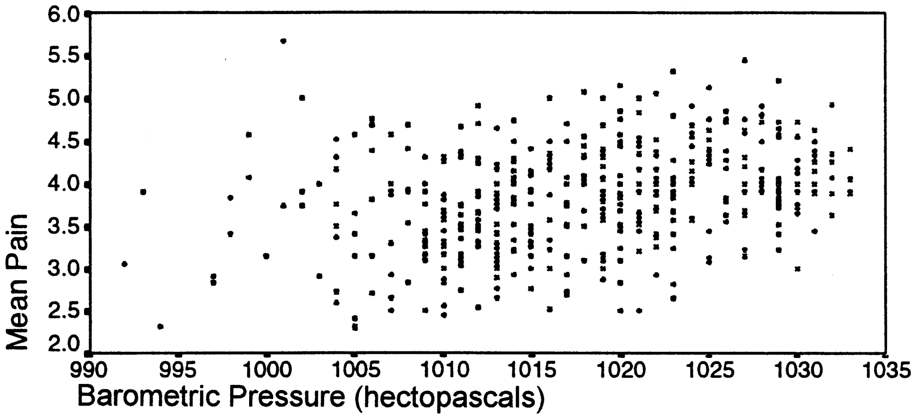

Fig. 4 Scattergram of mean pain and barometric pressure (Pearson's correlation coefficient 0.1297, $P < 0.01$)

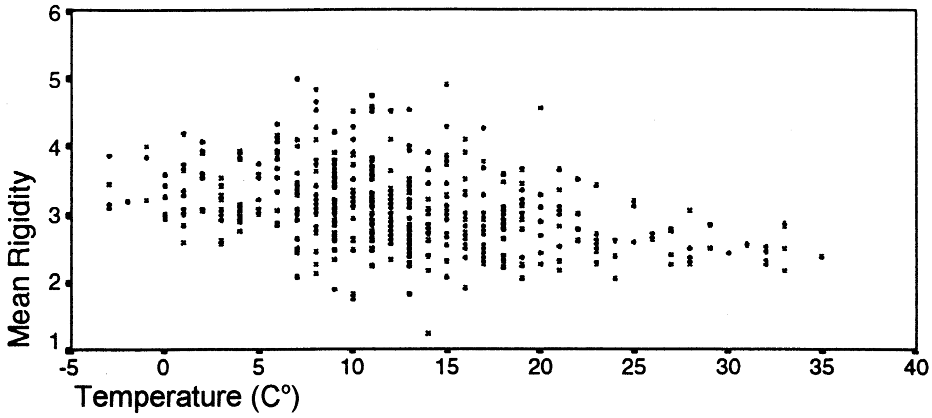

Fig. 5 Scattergram of mean rigidity and temperature (Pearson's correlation coefficient –0.3939, $P < 0.001$)

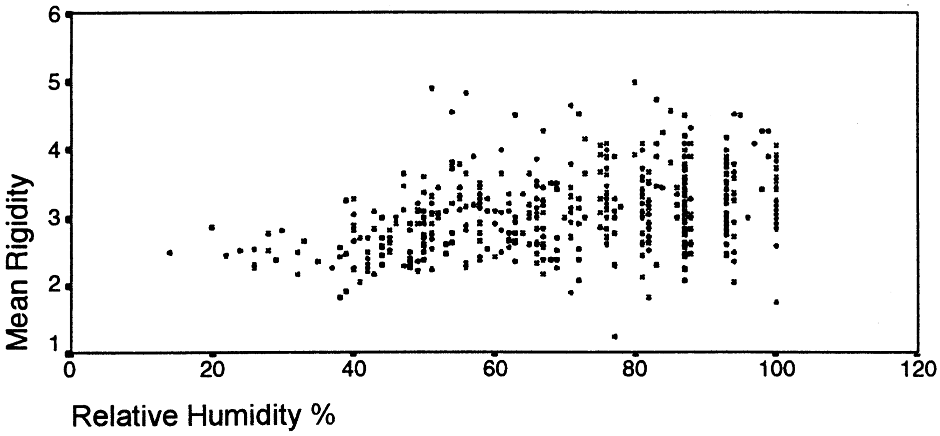

Fig. 6 Scattergram of mean rigidity and relative humidity (Pearson's correlation coefficient 0.3899, $P < 0.001$)

study. Temperature was significantly correlated to both mean pain and mean rigidity in each individual month ($P < 0.001$); the exception to this high corrrelation was July when the correlation of mean pain and temperature reached lower significance ($P < 0.01$). All months combined reached high statistical significance ($P < 0.001$). Relative humidity and mean symptoms were positively correlated and produced equally consistent degrees of significance. The correlations of each individual month were significant ($P < 0.001$) with the relationship between relative humidity and mean pain in May being somewhat less significant ($P < 0.01$). Over all months, relative humidity was significantly correlated to mean pain and mean rigidity ($P < 0.001$).

There were no significant correlation between mean symptoms and precipitation. Barometric pressure was significantly correlated to mean pain in July and with all months combined ($P < 0.01$). Time of day was significantly and negatively correlated to mean pain in February and May ($P < 0.001$) and to mean rigidity in February and July ($P < 0.001$). When all months were combined, time of day was found to be significantly correlated to mean pain and mean rigidity ($P < 0.001$).

Table 3 Pearson's correlation coefficients for meteorological variables, time and mean symptoms

	Wind speed	Temerature	Relative humidity	Precipitation	Barometric pressure	Time
October: (*n*=111)						
Mean pain	–0.1600	–0.4361**	0.5117**	0.1835	–0.0518	–0.1342
Mean rigidity	–0.3412**	–0.4435**	0.4739**	0.0788	0.0672	–0.1866
February: (*n*=101)						
Mean pain	–0.1033	–0.3821**	0.4312**	–0.0278	0.0769	–0.3487**
Mean rigidity	–0.1580	–0.3503**	0.4817**	–0.0304	–0.1523	–0.3556**
May: (*n*=120)						
Mean pain	–0.2489*	–0.4409**	0.2588*	0.0681	0.1575	–0.3370**
Mean rigidity	–0.2388*	–0.4285**	0.3291**	0.0018	0.1300	–0.0984
July: (*n*=124)						
Mean pain	–0.2534*	–0.2455*	0.4016**	–0.0432	0.2500*	–0.1725
Mean rigidity	–0.2431*	–0.3917**	0.3545**	–0.0301	0.1666	–0.3359**
All months (*n*=456)						
Mean pain	–0.1773**	–0.5752**	0.4893**	–0.0583	0.1297*	–0.2227**
Mean rigidity	–0.0945	–0.3939**	0.3899**	–0.0407	0.0767	–0.2130**

* P <0.01, ** P <0.001

Table 4 Most influential meteorological variables, by stepwise multiple regression[a]

	Wind speed	Temperature	Barometric pressure	Precipitation	Relative humidity	Time
October:						
Mean pain	x	x	x	x	0.26181	x
Mean rigidity	x	0.25342	x	x	0.22457	x
February:						
Mean pain	x	x	x	x	0.18592	0.22733
Mean rigidity	x	x	0.31694	0.27725	0.23200	0.34703
May:						
Mean pain	x	0.19442	x	x	x	0.27060
Mean rigidity	x	0.18363	x	x	x	x
July:						
Mean pain	x	x	0.20113	x	0.16127	x
Mean rigidity	x	0.15512	x	x	x	0.23349
All months:						
Mean pain	x	0.33083	0.36934	0.38437	0.37686	0.35316
Mean rigidity	x	0.15512	x	x	0.20001	0.18181

[a] x represents pairs of variables accounting for negligible variance

Explaining variation in symptoms: multiple regression

Using stepwise multiple regression, the meteorological factors accounting for significant variation in the mean symptoms are summarized in Table 4. In October the variation in mean pain was significantly explained by relative humidity while the variation in mean rigidity was significantly explained by relative humidity and temperature. The variation in mean pain in February was significantly explained by relative humidity and time of day, with variation in mean rigidity being explained by relative humidity, precipitation, barometric pressure and time of day. In May the variation in mean pain was significantly explained by temperature followed by time of day. Variation in mean rigidity in May was explained by temperature. Mean pain variation in July was attributed to relative humidity followed by barometric pressure. Mean rigidity variation in July was attributed to temperature followed by time of day. When all months are combined, the variation in mean pain was explained by temperature, time of day, barometric pressure, relative humidity and precipitation. Variation in mean rigidity was explained by temperature, time of day and relative humidity.

Variables entered after the first contributed much less than the first entered variable to explanation of the variation. Both temperature and relative humidity were entered first on five occasions, indicating the importance of these factors in relation to symptoms. Time was always selected after another variable of greater significance.

Results of post study telephone questionnaire

All participants were able to be contacted for the telephone questionnaire: 92% stated that they believed their arthritis symptoms were affected by the weather, 8% stated that they did not believe this to be true of themselves. Of the entire sample, 20% stated their symptoms were occasionally influenced by the weather, 56% responded as being frequently influenced and 16% as always affected.

The stated influence of the weather on symptoms was as follows: symptoms worse when cold (41.5%); symptoms worse when humid (14.6%); symptoms worse before rain (12.2%); symptoms worse with frost (9.8%); symptoms worse in changeable weather (7.3%); and symptoms worse with storms, when hot, after frost, or when windy (all 2.4%). Eleven participants (44%) stated their symptoms were affected by more than one aspect of the weather. Although 48% of the sample stated that they could predict the weather by changes in their arthritis symptoms, 44% stated that they could not thus predict the weather. The remaining 8% stated their symptoms as not being affected by the weather.

The correlation coefficients shown in Table 3 indicated that the most significant weather variable in relation to symptoms is temperature closely followed by relative humidity. The multiple regression analysis supports this finding (Table 4). The percentage of references to cold exacerbating symptoms was 41.5%, with increased humidity being cited in 14.6% of references. Both Pearson's correlation coefficients and multiple regression indicate the association between increased relative humidity and exacerbated symptoms was of secondary importance to decreased temperature.

Discussion

Mean symptom scores of various months show the trend of an inverse relationship between mean temperature and mean symptom scores. A positive relationship is noted between mean symptoms and mean relative humidity for the months under study. These data indicate an association between mean symptoms of arthritis and actual weather variables. The most significant independent variables are, in descending order, temperature, relative humidity and time of day. Wind speed did not contribute to explaining the variance in symptoms when the analysis was via stepwise multiple regression.

Although previous research into the association between arthritis and the weather has varied greatly in methodology and location, the findings of this study are in agreement with some previous findings. The main finding that mean pain and mean rigidity are significantly influenced by lower temperature and higher relative humidity is in accordance with the observations of Edstrom et al. (1948) and Kellgren et al. (1953).The finding from this study of mean rigidity exacerbated by increased relative humidity concurs with three previous studies (Rasker et al. 1986; Hollander and Yeostros 1963; Harris 1984), while others have documented the reverse (Dequeker and Wuestenraed 1986; Guedj and Weinberger 1990). Patberg et al. (1985) demonstrated a negative correlation between pain and actual vapour pressure as another measurement of humidity.

A positive correlation was demonstrated between temperature and pain by Patberg et al. (1985), Dequeker and Wuestenraed (1986) and Guedj and Weinberger (1990), whereas this study indicates a negative correlation. The finding of a weaker correlation between mean pain and barometric pressure was consistent with the findings of Hollander and Yeostros (1963), Harris (1984) and Guedj and Weinberger (1990). Only Guedj and Weinberger demonstrated a relationship between precipitation and symptoms which this study failed to do. Their study, in common with all others has not shown a relationship between wind speed and symptoms.

Comparing the results of this and other studies has revealed that some previous results are substantiated while others are not. Whilst most methods of study have had limitations, such contradictions are unlikely to be due to variation in methods; Subtle combinations of weather variation may well account for the differences in symptoms. Hollander an Yeostros (1963) actually concluded that a combination of increased relative humidity and decreased barometric pressure was responsible for aggravated symptoms.

While this study indicated that 92% of sufferers perceived themselves to be weather sensitive, only 62% of the sample studied by Sibley (1985) believed their symptoms were influenced by the weather. The differences in the extent of this belief are not crucial to this study but may be accounted for by random error. It could be speculated that time elapsed since the last change in the weather, or last severe attack, of arthritis may have had an impact on the percentage of the sample believing themselves to be weather sensitive.

No attempt has been made to substantiate claims by individuals that they are weather sensitive or that they can predict the weather. The comparisons made are between mean pain, mean rigidity and weather data. Time series analysis may reveal delayed effects of the weather on symptoms or the predictive effects of symptoms but was outside the scope of the current work. The small sample size has not allowed for the consideration of subsets of participants, hence the sample is not further divided into subgroups according to type of arthritis, gender or age.

A further study with the duration of a complete year would yield more sensitive results. For example, symptoms may respond in advance of, or after, weather variation. Time series analysis would be beneficial to detect such trends and test the hypothesis that arthritics can predict the weather. In any future analysis, the time of day could be excluded as a confounding variable by correlating mean pain and mean rigidity scores for each day, with the weather variable means for the same day.

Relative humidity and temperature, as the most significantly related variables, may be regarded as factors when selecting a suitable climate or microclimate for people with arthritis. From Figs. 2 and 5, temperatures >20 °C could be extrapolated as associated with reduced mean pain and rigidity. Relative humidity <40% is associated with lower mean pain and rigidity (Figs. 3 and 6). Although arthritics should avoid exposure to the cold, some may consider air conditioning as necessary to avoid the discomfort of excessive heat. The effect of evaporative air-conditioners is to make the internal atmosphere more humid compared to refrigerated units. However, cost of purchase, operating costs and the feasibility of air-conditioning an area are also pertinent factors.

In conclusion, the data collected and analysed in the present study suggest that lower temperatures and higher relative humidity are associated with increased pain and rigidity. The effects of confounding variables need to be considered as not being possible to eliminate in the current study. Symptoms may be concurrently influenced by a variety of factors, including exercise, rest, medication, other illness, hormonal changes, hydrotherapy, massage, stress, room ventilation, and participant behaviour.

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