A SURVEY OF RHEUMATOID ARTHRITIS IN WEST CORNWALL

A REPORT TO THE EMPIRE RHEUMATISM COUNCIL

BY

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I. INTRODUCTION

In the autumn of 1955, I was asked by the Scientific Advisory Committee of the Empire Rheumatism Council to carry out a survey of the prevalence of rheumatoid arthritis in a representative community in Cornwall. Some 250 homes were visited to establish a clinical diagnosis and also a similar number of homes of control families. At the same time information was collected which it was thought might have a bearing on the aetiology of the disease.

II. SUMMARY OF PREVIOUS SURVEYS

(1) **British Isles.**—A survey was carried out in 1922 by some 49 general practitioners scattered throughout England and Wales, with aggregate lists of 90,891, who recorded all insured patients consulting them for "rheumatic conditions". A high prevalence of rheumatic complaints was found in the North-West of England, but this excess was due largely to osteo-arthritis and lumbago. When rheumatoid arthritis alone was considered, the incidence was found to be relatively high in the Southern half of England (Ministry of Health, 1924).

The Department of Health, Scotland (1945) collected numbers of insured persons off work and certified as suffering from any form of articular rheumatism from the Annual Reports for the years 1932-37 (pub. 1934-39). This sample is heavily weighted with men, the women in the younger age groups numbering only one-third of the total.

Stocks (1949) analysed sickness rates for rheumatism from the Wartime Social Service Survey for the years 1944-47. This survey was carried out monthly, some 45,000 people between the ages of 16 and 65 being visited annually. The sample was carefully distributed to cover the whole country and all grades of society.

Lawrence and Aitken-Swan (1952) and Kellgren, Lawrence, and Aitken-Swan (1953) made a survey of rheumatic complaints recalled over a period of 5 years before interview amongst miners in the Manchester coalfields, and also investigated a 1 in 10 house sample in the town of Leigh, Lancashire. A group of the patients interviewed in the course of this survey were reviewed 5 years later (Kellgren and Lawrence, 1956).

Miall (1955), working with Cochrane, Cox, and Jarman (1955), carried out a clinical, x-ray, and pathological survey of some sixty cases of rheumatoid arthritis amongst miners in the Rhondda Fach.

Logan (1953) searched the records of a group of eight general practitioners and from these estimated the prevalence of rheumatoid arthritis in a mixed population of 21,092; this work is the most comparable with the present survey.

The relevant results of these earlier surveys are set out in Table I (overleaf).

Mortality rates are of no use in estimating the prevalence of rheumatoid arthritis, but may be of some value in estimating the distribution of the disease. The Registrar-General's mortality figures for rheumatoid arthritis in the British Isles for the years 1950-55 are shown in Table II (overleaf). It will be noted that the lowest rate is that in England and Wales, that in Eire being by far the highest. With the exception of Northern Ireland, there has been a tendency for rates to rise during the 6 years under consideration.

(2) **World Distribution.**—Earlier writers seem to have had the impression that rheumatoid arthritis is essentially a disease of temperate climates. For example, Bach (1935) estimated that it was twenty times more prevalent in Northern Europe than in the tropics.

Date	Authors	Type of Sample	Age Group (yrs)	Diagnostic Criteria
1924	Ministry of Health	State insurance patients of 43 English and three Welsh general practitioners	16-65 (See Note 2)	General practitioners' consultations classified into nine rheumatism groups
1945	Department of Health Scotland	Incapacity due to chronic rheumatism amongst all insured personnel	16-65	Sickness certificates
1949	Stocks	Random population samples of general population, taken monthly over the year	16-65	Self diagnosis
1952	Lawrence and Aitken-Swan	Miners and sample of population of Leigh, Lancs.	16+ but more than half in age group 20-50	"Complaints" over 5-year period in reply to questionnaire and clinical examination
1953	Kellgren, Lawrence, and Aitken-Swan	Random sample of Leigh, Lancs.	15+	"Complaints" at time of interview and clinical examination
1953	Logan	General practitioner records—eight doctors	16+	Entry on doctor's cards
1955	Miall	Males in Welsh mining village where progressive massive fibrosis was known to be prevalent	16+	Characteristic history of polyarthritis of peripheral joints with or without residual physical signs, supported by: x-ray evidence or positive Rose test
1956	Kellgren and Lawrence	Random sample of Leigh, Lancs.	55-64	Clinical, x-ray, and blood agglutination

Note 1: Prevalence rates refer to moderate and severe cases.

Note 2: Age group of population at risk unknown, but assumed to be the same as that of Approved Societies of England and Wales:

ESTIMATED AGE DISTRIBUTION OF POPULATION AT RISK

Age Groups (yrs)	16-24	25-34	35-44	45-54	55-64	Over 65	Total
Per 1,000 Males	260	256	212	156	92	24	1,000
Males in Population at Risk	15,079	14,847	12,296	9,048	5,336	1,392	57,998
Per 1,000 Females	456	271	145	80	40	8	1,000
Females in Population at Risk	14,999	8,914	4,769	2,631	1,316	263	32,893

TABLE II
DEATH RATES FROM RHEUMATOID ARTHRITIS
PER 100,000 POPULATION
BRITISH ISLES, 1950-1955

Population	1950	1951	1952	1953	1954	1955
England and Wales	1.6	1.7	1.5	1.7	2.0	2.3
Scotland	1	1	2	2	3	3
Northern Ireland	3.2	3.8	3.9	2.3	2.0	2.3
Eire	3	4	4	5	5	5

Table III (opposite) shows figures from the World Health Organization Epidemiological and Vital Statistics Reports (1948-50), and gives the average

mortality rates for the 3 years 1947-49 in countries recording more than a hundred deaths a year. These rates are based on the classification used in the 5th Decennial Revision of the International List of Causes of Death and Mortality (International Institute of Statistics and Health Organization of the League of Nations, 1938), and are thus not comparable with the rates given in Table II.

In general, the mortality rates are seen to be high in the British Isles and the Northern European countries, and low in the Southern European and Mediterranean countries. The U.S.A. and the British Dominions of Canada, New Zealand, and Australia show comparatively low rates.

I
OF RHEUMATOID ARTHRITIS

Size of Sample (No. of cases in brackets)			Notes	Prevalence Rate (per 1,000)		
Male	Female	Total		Male	Female	Total
58,169 (83)	32,720 (97)	90,891 (180)	Female sample heavily weighted in 16-24 age group (see Note 2). Incidence highest in Scotland and Eastern areas of England	1.43	2.95	2.0
			Female sample heavily weighted in younger age group	3.6	3.7	3.7
42,140 (109)	51,692 (354)	93,832 (463)		2.6	6.6	4.9
3,673 (43)	3,085 (136)	6,758 (179)		11.7	36.6	26.4
1,298 (18)	1,600 (52)	2,898 (70)		13.9	32.5	24
8,994 (23)	12,048 (88)	21,092 (111)		2.55	7.3	5.2
9,430 (66)			Of this group of cases 20 per cent. showed no x-ray changes and 15 per cent. a negative Rose differential agglutination test	7.0		
173 (3)	207 (7)	380 (10)	The survey was planned to discover the prevalence of x-ray and blood agglutination changes in the general population (see Note 1)	17.3	33.7	26.3

TABLE III
DEATHS FROM CHRONIC RHEUMATISM AND GOUT
PER 100,000 INHABITANTS

Country	1947		1948		1949	
	No.	Per 100,000	No.	Per 100,000	No.	Per 100,000
Australia ..	159	2.1	173	2.2	181	2.3
Austria	189	2.7	216	3.1	132	1.9
Belgium	494	5.8	529	6.1	450	5.2
Canada	148	1.2	175	1.4	169	1.2
Egypt	143	2.1	123	1.6	66	0.8
Eire	257	8.6	199	6.6	233	7.8
England and Wales ..	1,534	3.6	1,463	3.4	1,586	3.6
France	370	0.9	341	0.8	391	0.9
Germany	1,185	2.5	1,225	2.6	1,498	3.1
Holland	181	1.9	196	2.0	200	2.0
Italy	695	1.5	604	1.3	703	1.5
Japan	1,699	2.2	1,243	1.5	1,286	1.6
Northern Ireland	61	4.5	56	3.7	63	3.6
Scotland	98	1.9	166	2.1	72	1.4
Spain	388	1.4	485	1.7	480	1.7
United States of America ..	1,808	1.3	1,847	1.3	1,830	1.3

III. AREA AND POPULATION OF PRESENT
SURVEY

The West Penwith Peninsula (Fig. 1, overleaf) was chosen because it has a population of something over 40,000 within clearly-defined boundaries, assuming a prevalence rate of 5 per 1,000 adult population (Stocks, 1949; Logan, 1953) the area should contain some 150 cases of rheumatoid arthritis. The area comprises four local authorities (populations in brackets): Penzance Borough (20,626); St. Ives Borough (9,051); St. Just Urban District (4,125); West Penwith Rural District, less the parishes of Hayle, Phillack, Gwinear, St. Erth, St. Hilary, and Perranuthnoe (9,101). (Total: 42,903.)

Age Structure.—Table IV (overleaf) shows the age structure of this population, with percentage figures for England and Wales for comparison; 40.5 per cent. of the population are over the age of 45 years, compared with 34.9 per cent. of the population of England and Wales. This is only partly due to the influx of retired people; the chief reason is the emigration of younger men and women to find work elsewhere.

Fig. 1.—Area of survey.

TABLE IV
WEST PENWITH—AGE STRUCTURE OF POPULATION
(1951 CENSUS)

Age Group	Number (West Penwith)	Total (per cent.)	
		West Penwith	England and Wales*
0-4	3,267	7.61	8.58
5-9	2,926	6.82	7.31
10-14	2,599	6.06	6.61
15-19	2,466	5.75	6.25
20-24	2,515	5.86	6.71
25-29	2,801	6.53	7.42
30-34	2,652	6.18	7.00
35-39	3,006	7.01	7.57
40-44	3,303	7.70	7.71
45-49	3,134	7.30	7.19
50-54	2,708	6.31	6.44
55-59	2,724	6.35	5.51
60-64	2,454	5.72	4.86
65-69	2,255	5.26	4.14
70-74	1,844	4.30	3.23
75-79	1,287	3.00	2.07
80-84	610	1.44	0.99
85-89	282	0.66	0.34
90-94	59	0.14	0.08
95+	11	0.03	0.01
Total	42,903	100.0	100.0

* 1 per cent. Sample Tables.

Industrial Structure.—West Penwith is the site of a very early civilization. Trading in copper and tin with the Middle East civilization was well established by 2000 B.C., and in consequence when Julius Caesar arrived in Britain, West Cornwall was populated by a vigorous and progressive race, mining the local ore, forging their own metal weapons, bartering their ingots of tin for the commodities of foreign parts, dressed in woven cloth from the East, and living in stone-built villages.

For centuries, tin-mining, fishing, and agriculture remained their staple occupations. The advent of steam power permitted a more thorough exploitation of the metal deposits, and the mid-19th century was Cornwall's most prosperous tin-mining era. In 1870 the miners numbered more than 50,000 and were producing 40 per cent. of the world's tin from 340 mines, but by 1900 the exhaustion of the more accessible lodes, combined with the advent of cheap alluvial tin from Malaya, had killed the industry.

In the lean years which followed, the younger generation sought employment in the hard rock mines of West Africa and India, returning 30 or 40 years later with enough money on which to retire, but often with lungs affected by silico-tuberculosis. Today the older inhabitants include many cases of silico-tuberculosis, so that any relationship between tuberculosis and rheumatoid arthritis should be discernible.

Such is the background of the present population of West Penwith. An old civilization, proud, independent, and much intermarried. Around the coast live the fishermen of Newlyn, Mousehole, Porthcurno, Sennen, and St. Ives, while rich market gardens, that have been tilled for centuries, fill the narrow, fertile valleys that run to the South. To North and South lie the prosperous tourist centres of St. Ives and Penzance. To the West are the rocks of Land's End, and the somewhat bleak and derelict mining areas of St. Just and Pendeen. The detailed industrial structure (*cf.* Central Statistical Office, 1948) is given in Table V (opposite).

TABLE V
WEST PENWITH—INDUSTRIAL STRUCTURE, 1955

Class	No.
Ia Agriculture	1,665
Ib Fishing	279
II Mining	469
III Mining Products	46
IV Chemicals	12
V Metal Manufacturers	1
VI Engineering and Shipbuilding	146
VII Vehicles	293
VIII Metal Goods	41
IX Precision Instruments	52
X Textiles	40
XI Leather	—
XII Clothing	119
XIII Food and Drink	259
XIV Wood and Ash	58
XV Paper and Printing	59
XVI Other Manufactured Goods	255
XVII Building	1,000
XVIII Gas, Electricity, Water	202
XIX Transport	1,311
*XX Distribution	2,194
XXI Insurance	128
XXII National and Local Government	713
XXIII Professional	830
XXIV Miscellaneous Services	1,981
XXV Ex-Service Men	17
Total	12,153

* Includes Hotels, Cafes, etc.

IV. CASE FINDING

After the willing help of Dr. St. John Brooks, Medical Consultant at Penzance, had been secured, an approach was made to the general practitioners at a meeting of the local Medical Society. Much assistance was obtained from the general medical practitioners and district nursing staff. Permission to visit their patients was readily granted and practitioners prepared a list of cases of rheumatoid arthritis known to them in their practices. Similar lists were obtained from the Rheumatism Clinic and the Physiotherapy Department at Penzance Hospital, and from the District Nurses. In this way, 262 names were obtained (Table VI).

Controls.—As the survey included the investigation of certain epidemiological factors, suitable controls had also to be included.

The Executive Council records contain the date of

TABLE VI
SOURCES OF REPUTED CASES OF RHEUMATOID ARTHRITIS

Source	No. of Cases	Percentage of Total
Doctors	97	37
Nurses	104	40
Physiotherapy Unit	13	5
Other	48	18
Total	262	100

birth and are indexed both alphabetically and by doctors. I was thus able to select a random control for each patient from the same doctor's list, matched as regards sex, age, and area of residence.

V. DIAGNOSTIC CRITERIA

Working in the Rhondda Fach, Miall (1955) used the following criteria:

- (1) Characteristic history of polyarthritis involving peripheral joints, whether residual physical signs were present or not;
- (2) Either (a) Radiological evidence of rheumatoid arthritis in hands or feet,
Or (b) A positive differential agglutination test (Rose, Ragan, Pearce, and Lipman, 1948).

When planning the present survey, I decided that, in a scattered rural community with indifferent bus services, it would be unrealistic to expect patients to travel some 10-15 miles to Penzance Hospital for an x-ray examination and sheep cell agglutination test; I therefore based the diagnosis on the patient's medical history and a clinical examination. Remarking on the difficulty of diagnosis, Kellgren and Lawrence (1956) state:

"For practical purposes there appears to be a useful clinical dividing line at 'Typical rheumatoid arthritis of moderate or great severity affecting the hands and feet'."

In the present survey the patients were graded on a clinical basis similar to that suggested by Kellgren and Lawrence.

VI. FINDINGS

(1) *Prevalence and Severity of Disability.*—With the exception of a small number of patients who were attending the Rheumatism Clinic, all the 262 cases notified were visited in their homes. After clinical examination, 95 cases were discarded* and 167 were accepted as suffering from rheumatoid arthritis.

* The discarded cases were classified as follows:			
Osteo-arthritis	30	Psychological condition	4
Muscular rheumatism	12	Nervous disease	5
Rheumatic fever	2	Dead	7
Polyarthritis, not thought to be rheumatoid	5	Left district	7
Traumatic condition	8	Refused examination	1
Spondylitis	3	Outside area of survey	7
		Unclassified	4

The patients with rheumatoid arthritis were then classified according to the severity of their symptoms (Table VII).

TABLE VII
CLASSIFICATION OF 167 PATIENTS ACCEPTED AS
CASES OF RHEUMATOID ARTHRITIS, BY SEX

Group	Clinical Assessment	Male	Female	Total
1	Probable, but doubtful ..	3	14	17
2	Definite, but mild ..	7	52	59
3	Moderately severe ..	13	48	61
4	Severe ..	2	28	30
Total		25	142	167

The diagnosis in Group 1 is open to doubt pending confirmation by x-ray examination, and these seventeen cases were therefore omitted from further analysis, bringing the numbers down to a total of 150 definite cases.

Patients included in Group 3 may be defined as "housebound", *i.e.* able to get around a little in the house and even to do light jobs, but unable to go out shopping, etc., without assistance.

Patients included in Group 4 are virtually "bed-bound", although a few manage to sit in a bedroom chair for a few hours each day. The plight of many of these Group 4 patients is pathetic. An analysis of home circumstances shows four to be well cared for in long-stay geriatric annexes, two in the Cheshire Home, and a further two in nursing homes. Most of the remaining 21 are looked after by devoted relations or friends, to whom the patients know themselves to be burdens. A few, fighting to the

last to maintain their independence, live entirely alone, relying on good neighbours (who still exist in country districts) to give them their meals, and on the District Nurse to wash them; one of them has been bedridden for 15 years. Such patients receive official material help in the form of wheel chairs, Dunlopillo mattresses, and other aids to nursing which are of great value, but more active help from voluntary organizations, in the form of regular visiting is much to be desired.

Table VIII shows that the prevalence rate of definite, clinical rheumatoid arthritis is 4.4 per 1,000. A break-down into local authority areas gives very similar figures considering the small numbers involved, indicating that the area has been evenly covered and that there is no special circumstance in any one area tending to vary the prevalence.

This rate may be compared with the figure of 4.9 per 1,000 given in the Ministry of Health Social Surveys (Stocks, 1949), and that of 5.2 per 1,000 obtained from the examination of general practitioners' records by Logan (1953). Stocks' figures are based on self diagnosis of the community investigated, and Logan's on a survey of patients' National Health Service medical cards; in consequence, both are liable to include mild forms of rheumatoid arthritis excluded from the present survey.

(2) *Age of Patients*.—An analysis of the age groups of the 150 patients is shown in Table IX and in Fig. 2 (opposite). The curve is fairly smooth and rises to a peak in the 45-54 age group.

TABLE VIII
PREVALENCE OF RHEUMATOID ARTHRITIS, BY SEX, IN WEST PENWITH

Local Authority Area	Population aged 16 and Over			Cases of Rheumatoid Arthritis Groups 2, 3, and 4			Prevalence Rate per 1,000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Penzance	7,371	8,834	16,205	9	56	65	1.2	6.2	3.9
St. Ives	3,013	4,221	7,234	3	27	30	1.0	6.1	4.0
St. Just	1,416	1,749	3,165	4	12	16	2.8	6.8	5.1
West Penwith	3,265	3,751	7,016	6	33	39	1.8	8.7	5.5
Total	15,065	18,555	33,620	22	128	150	1.4	6.7	4.4

TABLE IX
AGE AT ONSET OF RHEUMATOID ARTHRITIS IN 150 PATIENTS

Age Group	Age at Onset				Population at Risk			Prevalence Rate per 1,000		
	Male	Female	Total	Per cent. of Total	Male	Female	Total	Male	Female	Total
15-24	2	12	14	10	2,115	1,375	4,490	0.96	8.7	3.1
25-34	1	23	24	16	2,597	2,856	5,453	0.38	7.9	4.4
35-44	5	26	31	21	3,021	3,288	6,309	1.6	7.9	4.9
45-54	6	31	37	24	2,641	3,201	5,842	2.3	9.7	6.3
55-64	5	21	26	17	2,153	3,024	5,178	2.3	6.9	5.2
65+	3	15	18	12	2,538	3,810	6,348	1.2	3.9	2.8
Total ..	22	128	150	100	15,065	18,555	33,620	1.4	6.9	4.4

Fig. 2.—Age at onset of rheumatoid arthritis, shown as a percentage of the total by age group, in 150 cases, in Groups II, III, and IV.

This age distribution is very similar to that given by Fletcher and Lewis-Faning (1945); in an analysis of 254 patients with rheumatoid arthritis, they found the average age at onset to be 49 years in men and 48 years in women. If the present series is broken down into the same age groups as those used by Fletcher and Lewis-Faning, the following comparison can be made (Table X).

TABLE X
PERCENTAGE AGE AT ONSET

Age Group	Fletcher and Lewis-Faning (1945)	Present Survey
Under 20	1.3	5.4
20-30	12.6	14.8
31-40	18.1	14.8
41-50	20.5	26.2
51-60	28.7	20.8
61-70	18.8	16.2

The mean age in the Empire Rheumatism Council Survey was 41 years, but this may be due in part to the fact that the patients were largely hospital cases. As will be shown later, the more acute cases tend to occur in the lower age groups and such cases are likely to obtain hospital beds. 70 per cent. of the Empire Rheumatism Council patients were aged between 25 and 54 years. In the present series, 64 per cent. come into this age group.

A larger proportion of the more severe cases in the present series were found to have started the disease at a comparatively early age. Fig. 3 shows the age at onset of Group 2 cases plotted against that of Groups 3 and 4.

(3) **Sex Ratio.**—In the present series, 22 patients were men and 128 were women, a ratio of 1 to 5.5 (corrected for sex distribution of the population). This is a higher proportion of women than has been recorded in recent surveys, but the other surveys have been carried out on hospital patients and in specialized industries.

Fig. 3.—Age at onset of rheumatoid arthritis, shown as a percentage of the total, in Group II, and Groups III and IV combined.

Higher ratios are recorded by earlier writers: Fox and Van Breemen (1934) found that "A large majority of the patients are women, variously estimated at 1 to 7 or 9"; the figures given by the Ministry of Health (1924) were as high as 1 : 8 in the older age groups. In the present series the disparity between the sexes is greatest in the lower age groups, a point noted by Copeman (1955).

In the present series the onset occurred before the age of 35 in only 14 per cent. of the men as compared with 27 per cent. of the women.

A summary of previous findings on the sex ratio is given in Table XI.

TABLE XI
SEX RATIO

Year	Author	Size of Sample	Ratio Men/Women
1924	Ministry of Health	180 (16-24 yrs)	1 : 2
1934	Fox and Van Breemen		1 : 7 or 9
1945	Fletcher	352	1 : 1.62
1949	Stocks	463	1 : 2.5
1950	Empire Rheumatism Council	532	1 : 1.62
1950	Edinburgh (<i>quoted by</i> Empire Rheumatism Council) ..	400	1 : 3.48
1952	Lawrence and Aitken Swan	179	1 : 3.2
1953	Logan	111	1 : 2.8

(4) **Heredity.**—A family history of rheumatoid arthritis was obtained very frequently. 35 per cent. of cases claimed to have a near relative with the

TABLE XII
CASES OF RHEUMATOID ARTHRITIS IN NEAR RELATIVES (CLINICAL DIAGNOSIS)

Series		No. in Series	Relationship								No. of Families Involved	No. of Relatives Affected
			Father	Mother	Brother		Sister		Sibling			
					No.	Cases of Rheuma- toid Arthritis	No.	Cases of Rheuma- toid Arthritis	No.	Cases of Rheuma- toid Arthritis		
Patients with Rheumatoid Arthritis	Men	21	1 0	0 4	144	1 2	136	1 8	280	12 (4·3%)	101	17 (17%)
	Women	113										
Controls	Men	21	0 0	0 1	209	0 0	211	0 2	420	2 (1%)	110	3 (2·7%)
	Women	110										

Significant (14.3 ± 4.1).

Fig. 4.—Two typical pedigrees of affected families: (a) a professional family in St. Ives, (b) a tin-mining family in St. Just.

disease, as against 3 per cent. of controls. Many of these near relatives were dead or had left the district and could not be traced, and the findings in Table XII have therefore been limited to second cases amongst near relatives which could be confirmed by visiting or by hospital notes.

In the 113 index cases, rheumatoid arthritis was confirmed in 3.5 per cent. of mothers and 6.1 per cent. of sisters; siblings gave an incidence of 4.3 per cent. Second cases occurred in 17 per cent. of the 101 families included in this inquiry, as compared with 2.7 per cent. of control families, a finding which is statistically significant (14.3 ± 4.1). Two typical pedigrees are shown in Fig. 4.

These results correspond with those of Miall (1955), who, using a similar strict clinical diagnosis of rheumatoid arthritis in near relatives, found that 4.1 per cent. of siblings were affected.

A summary of the findings of previous surveys on the heredity factor in rheumatoid arthritis is given in Table XIII (opposite).

(5) Association with Endocrine Dysfunction

(a) *Thyroid Gland.*—A note was made of thyroid dysfunction amongst patients and their near relatives, and amongst controls. No significant difference was found (Table XIV, opposite).

(b) *Diabetes.*—Patients, controls, and near relatives were likewise questioned concerning diabetes. No significant difference was found (Table XIV).

(6) *Factors affecting Female Patients.*—Ninety-three women with Grade II, III, or IV rheumatoid arthritis, who were able to give a reliable record of their menstrual history, were considered under this head, and were compared with 92 controls.

(a) *Marital State.*—Twenty-eight were spinsters, and the 65 married women had had between them 110 children. Of the 92 controls, nine were spinsters, and the 83 married women had had between them 171 children.

(b) *Menopause.*—Rheumatic symptoms were first noted within a year before or after the termination of menstruation in 21 patients (22.5 per cent.) and within 2 years of its termination in a further ten patients (9.5 per cent.).

Fletcher and Lewis-Faning (1945), in a survey of 206 women patients, found that the disease was associated with the menopause in twenty cases (9.6 per cent.).

In the Empire Rheumatism Council's survey of 111 patients who had reached the menopause (Lewis-Faning, 1950), the disease had started within a year

TABLE XIII
RHEUMATOID ARTHRITIS IN NEAR RELATIVES—SUMMARY OF PREVIOUS INQUIRIES

Year	Author	Size of Sample of Rheumatoid Arthritis Cases	Parents Affected		Siblings Affected		Second Case in Family (Per cent.)
			Father (Per cent.)	Mother (Per cent.)	Total	Per cent. Affected	
1928	Ministry of Health	180					42
1928	Strangeways (<i>quoted in Ministry of Health Report</i>)	200					56
1947	Fletcher	254					4.7
1950	Empire Rheumatism Council	532 Cases 532 Controls	7 3	15 9	2,151 2,143	3.8 1.8	
1952	Barter	100 Cases 100 Controls					5.3
1955	Miall	59 Cases 89 Controls	1 2		244 334	4.1 —	
1956	Present Survey (see Table XII)	113 Cases 110 Controls	0.9 —	3.5 1	280 420	4.3 1	17 2.7

TABLE XIV
THYROID DYSFUNCTION AND DIABETES IN PATIENTS, CONTROLS, AND NEAR RELATIVES

Series		Total	Thyroid Dysfunction		Diabetes	
			No.	Per cent.*	No.	Per cent.*
Patients		113	8	7	—	—
Controls		110	3	2.7	2	0.5
Parents	Patients	226	1	0.45	6	2.6
	Controls	214	1	0.46	3	1.4
Siblings	Patients	280	3	1.1	4	1.4
	Controls	343	4	1.2	4	1.1

* Not significant.

of the termination of menstruation in 24 per cent. of cases, a finding very similar to that in the present series.

(c) *Menstruation*.—Thirty-seven women patients who had developed rheumatoid arthritis before the menopause were questioned to ascertain whether menstruation had any effect on the severity of the rheumatic symptoms. Thirty-one stated that menstruation had no effect, three stated that their joints were worse, and three claimed some alleviation of symptoms during menstruation.

When menstruation had an adverse effect, this was noted for 24–48 hours before the menstrual flow; two of the three patients concerned stated that the symptoms were alleviated once menstruation had started.

(d) *Pregnancy*.—Ten patients who were under 70 years of age at the time of the interview had borne children after the onset of rheumatoid arthritis (eleven pregnancies). In one confinement, rheumatic symptoms had not been materially affected, but the symptoms had been definitely, and

in many cases dramatically, relieved in the other ten confinements, although the rheumatic pains invariably returned 2 to 3 months after delivery.

In the Empire Rheumatism Council's survey (Lewis-Faning, 1950), 21 out of 22 patients who became pregnant after the onset of rheumatoid arthritis, had improved during pregnancy, but seventeen of them had become worse again after parturition.

(7) *Association of Rheumatic Fever*.—Spender and Garrod (1897) described a form of rheumatoid arthritis which followed attacks of rheumatic fever. The differential diagnosis may be very difficult, particularly when in rheumatic fever the inflammation invades the small joints of the hands. Three such cases were cited by Fletcher and Lewis-Faning (1945).

One such case which occurred in West Penwith is of sufficient interest to record:

A blacksmith, aged 38, had had at the age of 17 a classical attack of rheumatic fever, and had been kept in bed by his doctor for 6 weeks. Most of the larger

Fig. 5(a-c).—Enlarged finger joints in a blacksmith aged 38 who developed rheumatoid arthritis after an attack of rheumatic fever at the age of 17.

joints in his limbs were affected in succession, but the condition gradually subsided under treatment with salicylates, and the patient was able to return to work. Two years later, pain and swelling returned to the ankles, elbows, wrists, and phalanges. These pains have never left him, but the patient has managed to continue working.

Some of the phalangeal joints are grossly enlarged, and a few years ago a surgeon suggested amputating one of the swollen fingers. The patient now takes pride in showing how he can lift 56 lb. with a finger which might have been amputated (Fig. 5a-c).

A diagnosis of arthritis following rheumatic fever was made, but this case is further complicated by the fact that the elder brother, who is 44 years old and also a blacksmith, also has moderately severe rheumatoid arthritis (Fig. 6a and b, opposite).

Table XV shows the number of patients who gave a history of rheumatic fever in childhood or immediately before the onset of rheumatoid arth-

ritis. These amounted to 9.7 per cent. as against 7.3 per cent. of the controls. Only those with a definite history of a prolonged period in bed with rheumatic fever are included. An equal number of patients also gave somewhat indefinite histories of "growing" pains.

TABLE XV
RHEUMATIC FEVER IN PATIENTS AND CONTROLS,
BY SEX
(PATIENTS UNDER 70 YEARS OF AGE)

Series	Sex	Size of Sample	History of Rheumatic Fever	
			No.	Per cent.*
Patients	Men	21	2	9.5
	Women	92	9	9.8
	Total ..	113	11	9.7
Controls	Men	21	—	—
	Women	89	6	6.7
	Total ..	110	6	7.3

* Not significant 1.3 ± 4.0 .

Fig. 6(a and b).—Finger joints of a blacksmith aged 44, elder brother of the above, who had developed moderately severe rheumatoid arthritis but had not had rheumatic fever.

No support for the association of rheumatic fever and rheumatoid arthritis can be drawn from the present small series.

Glover (1928) found a history of rheumatic fever in 20 per cent. of men and 18 per cent. of women rheumatoid arthritis patients, but rheumatic fever was a far more common disease in the early 1920s. Fletcher and Lewis-Faning (1945), in a survey of 254 rheumatoid arthritis patients, found only ten (4 per cent.) who had had rheumatic fever.

If rheumatic fever were truly a predisposing cause of rheumatoid arthritis, one might expect to see some reduction in the incidence of rheumatoid arthritis following on the reduced numbers of cases of rheumatic fever, but Table II seems to show that rheumatoid arthritis is tending to become more rather than less common. The sex ratio is also against any clear association, rheumatic fever being rather more common in males.

(8) Association with Pulmonary Tuberculosis.—Miall (1955) found an association between pulmonary tuberculosis and rheumatoid arthritis in his x-ray survey of a Welsh mining community. A history of pulmonary tuberculosis was twice as frequent amongst rheumatoid arthritis patients as amongst controls in the present series, but, owing to the small numbers of patients, the findings were not significant (Table XVI).

(9) Predisposing Factors

(a) Trauma.—In the past this has often been cited as a cause of rheumatoid arthritis (Spender

TABLE XVI
PULMONARY TUBERCULOSIS IN PATIENTS, CONTROLS,
AND NEAR RELATIVES

Series		Total	History of Pulmonary Tuberculosis	
			No.	Per cent.*
Subjects	Patients ..	113	9	8
	Controls ..	110	4	3.7
Parents	Patients ..	226	7	3.1
	Controls ..	214	7	3.2
Siblings	Patients ..	280	8	2.8
	Controls ..	343	8	2.3

* Not significant.

and Garrod, 1897), but more recent opinion suggests that, although trauma may well decide the joints affected by osteo-arthritis, it is not an aetiological factor in rheumatoid arthritis. In the present survey, trauma had occurred on only four occasions within a year of the onset of rheumatoid arthritis.

(b) Psychological Stress and Strain.—The collection and evaluation of evidence regarding psychological factors was difficult, in that intimate details of family life are not readily imparted to a comparative stranger, and the results shown in Table XVII (overleaf) may underestimate the importance of stress. On the other hand, a rheumatic patient is more likely than a control to remember emotional incidents which might be connected with his illness.

TABLE XVII
PSYCHOLOGICAL STRESS AND STRAIN, BY SEX
(PATIENTS UNDER 70 YEARS OF AGE)

Series	Sex	Size of Sample	Psychological Factor (within 2 yrs of onset)		
			Unconnected	Possible	Probable
Patients	Men	21	15	3	3
	Women	93	36	31	26
	Total ..	113	55	29	29 (25 per cent.)*
Controls	Men	21	17	2	2
	Women	86	72	7	7
	Total ..	107	89	9	9 (8.4 per cent.)*

* Statistically significant: 20 ± 4.2 .

Examples of the types of stress to which these patients had been subjected are given below:

(i) *Domestic Unhappiness (11 cases).*—One woman aged 65 had led a very hard life. Her husband deserted her when her second son was 4 years old, and arthritis started at about this time. One son had since died of spinal trouble, and the second was under treatment for cancer of the lung.

(ii) *Tragic or Sudden Death (10 cases).*—One woman aged 38 had married at the age of 25. She had always been scared of childbirth, and when first married went to live with her married sister, who died in childbirth only 2 months later. The patient took to her bed with rheumatoid arthritis the following month, and has now been bedridden for 13 years.

(iii) *Worry—Business, Financial, and Family (4 cases).*

(iv) *Trouble arising from the War (3 cases).*

(v) *Retirement from Business (2 cases).*

Previous writers differ on the importance to be attached to psychological factors in the aetiology of rheumatoid arthritis. Glover (1928) stated that all writers were agreed that the onset of rheumatoid arthritis could often be traced to mental stress, sudden shock, continuous anxiety over relatives, domestic unhappiness, and financial worry. Bach (1935) stated that an unusual number of women patients attributed their symptoms to their experiences while doing war work in France or to the emotional strain caused by the death of a fiancé at the front. Gordon (1939) remarked on the changes in circulation, secretory glands, and plain muscle that can be brought about by over-activity of the autonomic nervous system. He found that the onset of disease followed emotional crises in 28 per cent. of fifty patients. Fletcher (1947) remarked that psychological factors were "particularly noticeable in the London 'blitz' of 1940-41 and again

when the flying bombs and rockets commenced to arrive. Not only were cases arising *de novo*, as a result of these stresses, but old cases became reactivated". He quoted an analysis (previously unpublished) of 27 per cent. of a series of 200 cases of rheumatoid arthritis in which precipitating emotional factors were present (p. 129):

Long-continued illness of a relative ..	8
Air-raid incidents	12
Financial and business worries ..	14
Domestic unhappiness	12
Worry over the fate of a relative in the war	6
Fear of an expensive law suit and its consequences	2

On the other hand, the Empire Rheumatism Council (Lewis-Fanning, 1950), in a survey of 500 cases, could find no significant difference in the degree of stress to which patients and controls had been subjected.

VII. COMMENTARY

(1) **Data.**—The method of collecting data from general practitioners, nurses, and clinics worked smoothly but was not 100 per cent. complete; for instance, two further cases were discovered when questioning control subjects concerning their family history.

The controls were selected from the Executive Council Register of patients on doctors' lists. The method proved laborious in that the Register was by no means up to date, and contained many names of persons who had left the district, moved house, or died. In future it may be possible to obtain the help of the Ministry of Health Social Survey team, who might note the required information in the course of their routine visits.

(2) **Prevalence.**—The prevalence rates and sex ratio in West Penwith correspond reasonably closely with the findings of previous surveys.

(3) **Heredity.**—In considering heredity, it is important to decide whether to accept a history suggestive of rheumatoid arthritis in a near relative or to demand a clinical diagnosis, thus excluding all relatives who have died or are too far off to be investigated. Using the first method, the present survey shows a family history of rheumatoid arthritis in 35 per cent. of cases (compare Glover, 1928: 40 per cent. family history), but using the second method it was possible to confirm diagnosis by clinical examination or hospital notes in only 17 per cent. of cases.

(4) **Aetiology.**—No obvious association, positive or negative, was found between diabetes and rheu-

matoid arthritis, though superficially the two conditions have aetiological points in common, both being diseases of middle life, frequently associated with the menopause, and having a sex ratio of approximately 1 : 3.

An interesting finding was the apparent association between the activity of the female sex glands and rheumatoid arthritis. The number of children tended to be larger in control families (two children per family) and spinsters were more numerous amongst the women patients. Almost one-third of the women patients developed the first symptoms of arthritis within 2 years of the termination of menstruation. In ten of eleven cases in which the disease began in the child-bearing years and pregnancy followed, there was a spectacular alleviation of rheumatoid symptoms during pregnancy.

The importance of psychological factors in the aetiology of rheumatoid arthritis has been under discussion ever since the disease was first described as a separate entity by Garrod (1858). The part played by stress is difficult to determine, and expert evidence is much divided, but the present survey suggests that stress plays an important part in the medical history of persons susceptible to rheumatoid arthritis.

Information concerning occupation, susceptibility to allergic states, and skin conditions was collected; the figures are too small to have significance, but are available for inclusion with other surveys. Only one case of psoriasis was encountered amongst the 150 patients with rheumatoid arthritis, whereas two cases were recorded in the control series.

(5) Disability.—The severity of the disease varied widely and it is difficult to understand why some cases remain static for many years in a comparatively mild state whilst others rapidly progress to cripple-dom. In all degrees of severity, however, it seems that the disease burns itself out, a course compatible with the influence of an adverse psychological background with which the patient finally comes to terms.

Whatever the cause of the final arrest, the physician must always work to this end, and ensure that the joints are maintained in a good functional position in the hope of eventual improvement.

SUMMARY

A survey of the prevalence of rheumatoid arthritis has been carried out in a circumscribed area of West Cornwall with a population of 42,903.

Some 260 patients, of whom 167 were diagnosed as cases of rheumatoid arthritis, were visited in their homes, together with an equal number of matched controls.

The rheumatoid arthritis patients were classified according to severity, in four grades. Grade I patients were those in which the diagnosis could not be accepted without confirmatory x-ray examination, and, as this was not available in the field, they were excluded from further analysis.

There were 150 patients with definite clinical rheumatoid arthritis (Grades II, III, and IV) giving a prevalence rate of 4.1 per thousand, with a sex ratio of 1 to 5.5. The maximum onset occurred in the 45-54 age group, but there was a tendency for the more severe cases to develop the disease at an earlier age.

The influence of heredity in the series was significant, 17 per cent. of patients having second cases amongst parents and siblings, compared with 2.7 per cent. of controls (14.3 ± 4.1). Only second cases confirmed by clinical examination or hospital notes were included.

No significant difference was found in the prevalence of thyroid or pancreatic dysfunction.

The findings suggest that the female sex glands play some part in the aetiology; in women patients, the onset of rheumatoid arthritis occurred within one year of the termination of the menopause in 22.5 per cent. of cases, and within 2 years in almost one-third. Pregnancy, which occurred on eleven occasions after the onset of rheumatoid arthritis, resulted in a marked but transient relief of rheumatic symptoms in nine of the ten patients concerned. There was an undue proportion of spinsters amongst rheumatoid arthritis patients, and, amongst the married women, the size of children was smaller than in the control series.

Rheumatic fever was not found more frequently in the past history of the rheumatoid arthritis patients than in that of the controls, although in one or two instances rheumatoid arthritis followed closely after attacks of rheumatic fever.

Pulmonary tuberculosis was found approximately twice as frequently in the patients as in the controls, but the size of the sample is too small for this finding to be statistically significant.

Physical trauma to the joints was of no aetiological importance, but psychological stress or strain within 2 years of the onset of rheumatoid arthritis occurred in 25 per cent. of patients as against 8.4 per cent. of controls (difference 16.6 ± 5.4).

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Enquête sur l'arthrite rhumatismale en Cornouailles de l'Ouest (Compte-rendu à l'Empire Rheumatism Council)

RÉSUMÉ

On a effectué une enquête sur la fréquence de l'arthrite rhumatismale dans une partie circonscrite de Cornouailles de l'Ouest, avec une population de 42.903.

Près de 260 sujets, dont 167 diagnostiqués comme cas d'arthrite rhumatismale, ainsi qu'un nombre égal de témoins assortis, furent visités à leur domicile.

Ceux atteints d'arthrite rhumatismale furent classés, selon la sévérité, en quatre grades. Dans le Grade I se trouvèrent ceux chez qui on ne pouvait pas accepter le diagnostic sans une confirmation radiologique, et comme les circonstances ne s'y prêtaient pas, on les exclut de toute analyse ultérieure.

Il y avait 150 malades avec une arthrite rhumatismale cliniquement définie (Grades II, III et IV) donnant une fréquence de 4,1 par mille, les sexes étant en proportion de 1 à 5,5. Le début de la maladie était le plus fréquent à l'âge de 45 à 54 ans, mais on nota la tendance des cas plus sévères à débuter à un âge plus jeune.

L'influence de l'hérédité dans cette série fut significative, 17% des malades ayant un parent, un frère ou

une soeur atteints, tandis que pour les témoins l'atteinte familiale ne se voyait que chez 2,7% ($14,3 \pm 4,1$). Ces pourcentages d'atteinte familiale comprennent seulement des cas confirmés par un examen clinique ou par un dossier d'hôpital.

On ne trouva pas de différence significative dans la fréquence des troubles thyroïdiens ou pancréatiques.

Les résultats suggèrent que les glandes sexuelles de la femme jouent un rôle étiologique; l'arthrite rhumatismale débuta chez 22,5% des femmes au cours de l'année qui suivit la ménopause et chez presque un tiers avant que deux ans se soient écoulés. La grossesse survenant après le début de l'arthrite rhumatismale apporta un soulagement marqué, bien qu'éphémère, à neuf sur dix malades. Il y avait une forte proportion de vieilles filles parmi les atteintes d'arthrite rhumatismale, et parmi les mariées le nombre d'enfants des malades était inférieur à celui des témoins.

Les antécédents personnels de rhumatisme articulaire aigu ne furent pas plus fréquents chez les malades que chez les témoins, bien que dans un ou deux cas la maladie chronique succéda rapidement à l'aiguë.

On trouva de la tuberculose pulmonaire presque deux fois plus souvent chez les rhumatisants que chez les témoins, mais la série n'est pas assez grande pour que ce fait soit statistiquement significatif.

Le traumatisme articulaire fut sans importance étiologique, mais la fatigue et la tension psychologique au cours des deux ans précédant le début de l'arthrite rhumatismale survinrent chez 25% des malades et seulement chez 8,4% des témoins (différence $16,6 \pm 5,4$).

Estudio de la artritis reumatoide en Cornualla Occidental (Informe para el Empire Rheumatism Council)

SUMARIO

Se estudió la incidencia de la artritis reumatoide en una región circunscrita de Cornualla Occidental, con una población de 42.903.

Cerca de 260 sujetos, 167 de ellos diagnosticados como casos de artritis reumatoide, así como un número igual de testigos apareados, fueron visitados en sus casas.

Los sujetos con artritis reumatoide fueron clasificados, según la severidad, en cuatro grados. En el Grado I se colocaron aquellos en que el diagnóstico no se pudo aceptar sin confirmación radiológica, a no ser esto posible en las condiciones del estudio, todos fueron excluidos del analisis ulterior.

Hubo 150 enfermos con artritis reumatoide clínicamente definida (Grados II, III y IV) dando una incidencia de un 4,1 por mil y una proporción de sexos de 1 a 5,5. El comienzo de la enfermedad fué más frecuente a la edad de 45 a 54 años, pero se notó la tendencia a un empuje más temprano de los casos más graves.

La influencia de la herencia en esta serie fué significativa, encontrándose un segundo caso en la familia (padre, madre, hermano o hermana) de un 17% de los enfermos y tan sólo de un 2,7% ($14,3 \pm 4,1$) de los testigos. Se incluyen aquí solamente segundos casos confirmados por un examen clínico o por fichas hospitalarias.

No hubo diferencia significativa en la incidencia de los disturbios tiroideos y pancreáticos.

Los datos sugieren que las glándulas sexuales de la mujer desempeñan un papel etiológico: la artritis reumatoide empezó en el 22,5% de las mujeres durante el primer año que siguió el fin de la menopausia y en casi

una tercera parte de ellas dentro de dos años. El embarazo trajo un alivio marcado, aunque efímero a nueve de la diez reumáticas en que ocurrió. Hubo una fuerte proporción de solteras entre las mujeres con artritis reumatoide y las casadas reumáticas tuvieron menos hijos que las casadas sanas.

Los antecedentes personales de reumatismo poliarticular agudo no fueron más frecuentes en los enfermos que en los testigos, aunque en un o dos casos la enfermedad crónica sucedió rápidamente a la aguda.

Se vieron casi dos veces más casos de tuberculosis pulmonar entre los reumáticos que entre los testigos, pero esta serie es demasiado pequeña para que este hecho tenga un significado estadístico.

El trauma articular no tuvo importancia etiológica, pero la fatiga y la tensión psicológica en el curso de los dos años que precedieron el comienzo de la artritis reumatoide sobrevinieron en un 25% de los enfermos y sólo en un 8,4% de los testigos (diferencia de $16,6 \pm 5,4$).