

OSTEO-ARTHROSIS

PREVALENCE IN THE POPULATION AND RELATIONSHIP BETWEEN SYMPTOMS AND X-RAY CHANGES

BY

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From a study of rheumatic complaints in an urban population (Kellgren, Lawrence, and Aitken-Swan, 1953), it was concluded that osteo-arthrosis was the most frequent cause of loss of work due to rheumatic disease in females and that it came third as a cause of such incapacity in males. Anderson, Duthie, and Moody (1962) and Anderson and Duthie (1963) have since reached similar conclusions in groups of miners and dock-workers. The relative importance of osteo-arthrosis was confirmed by Mason (1956), who found it to be by far the largest diagnostic group among patients attending a physiotherapy department. In an *x*-ray survey of a random sample of the Leigh population aged 55 to 64 years, it was found that 83 per cent. of males and 87 per cent. of females had osteo-arthrosis in one joint or other and that the condition was present in four or more joints in 29 per cent. of males and 47 per cent. of females (Kellgren and Lawrence, 1958). In a later study in which samples of the population from age 15 were examined, it was observed that both the number of joints involved and the severity of the disease as determined radiologically was similar in males and females up to age 54, but that the disease thereafter became more severe and more generalized in females (Kellgren, Lawrence, and Bier, 1963). The joint pattern was also similar in males and females in the younger age groups but changed after age 55, when the distal and proximal interphalangeal joints of the fingers, the metacarpophalangeal, and the 1st carpometacarpal joints were more frequently affected in females. The wrists and hips, on the other hand, were more commonly affected in males.

But, although osteo-arthrosis occurs with considerable frequency in population samples and is almost universal in the older age groups, mere prevalence statistics give little indication of its importance to the community whether as a cause of suffering or of economic loss. In a survey of coal-mining and other occupational groups in which

routine *x*-rays of the knees were taken, it was found that only 24 per cent. of men with definite radiological evidence of osteo-arthrosis gave a history of pain in the knees. Of those without radiological evidence, 8 per cent. gave such a history (Kellgren and Lawrence, 1952).

The reasons for this low complaint rate and the factors which determine the occurrence of symptoms are by no means clear. A climatic influence has been suggested. Thus, in a survey of rheumatic complaints in Leigh, complaints attributed to osteo-arthrosis were rather more frequent in those working in cold or wet conditions than in those in a more equable environment (Kellgren and others, 1953). Coal-miners working in a wet seam lost more work from knee symptoms than those in dry seams, though the radiological changes were no different (Lawrence, 1955). Moreover, textile and foundry employees working in a warm environment have been found to have less incapacity than the rest of the population despite a high prevalence of radiological change (Lawrence, 1961; Lawrence, Dingwall-Fordyce, and Molyneux, 1966). Duthie, on the other hand, has found no evidence of any climatic influence.

Cobb, Merchant, and Rubin (1957) observed that pain and swelling in osteo-arthrotic joints were seldom found without morning stiffness and that persons with *x*-ray evidence of osteo-arthrosis but no morning stiffness had only a small chance of having pain at the relevant site. They suggested that most of the symptoms of osteo-arthrosis are at least in part due to a rheumatoid component.

Kellgren (1961) suggested that some of the painful episodes in this condition may be due to a ligamentous sprain or traumatic synovitis following minor injury to a joint rendered unstable by the disease.

In the present paper the prevalence of osteo-arthrosis in populations in Northern England is reported and its relationship to symptoms in the region of the joints investigated.

Material and Completion Rate

The present study is based on the Leigh random sample and the Wensleydale area sample. Papers by Lawrence and Bennett (1960) and by Bremner (1961) should be consulted for details of the method of sampling and of the clinical and x-ray examinations. Since these surveys were reported certain additions have been made. In Leigh a further sample of persons aged 65 and over has been examined to increase the numbers available in this age group which tends to be low in a true random sample. In Wensleydale the completion rate has been raised by examining at home a further sample of those who were unable to attend for x ray in the original survey. The number from the combined Leigh-Wensleydale sample who have been x rayed at the present time is shown in Table I. In both sexes 86 per cent. had one or more x rays. The proportion varied from 80 per cent. in the older females to 91 per cent. in females aged 25 to 34. In males it varied from 83 per cent. in the youngest age group to 90 per cent. in the 25 to 34 age group. Those who had only a clinical examination and blood test have not been included in the Table.

x rays were taken of the hands, feet, and cervical spine, and, from the age of 35 onwards, the lumbar spine and knees. The hips were included in those aged 55 and over. Thus it was possible to investigate the relationship of x ray changes to symptoms on a wide variety of joints. Bias was avoided by reading the x rays without knowledge of the clinical features. In some instances special x rays were taken in addition to those routinely studied. These included such joints as the elbow, shoulder, and dorsal spine, or joints normally examined only at a higher age. These were counted in the number of joint groups affected in Table IIA but not in IIB or any of the subsequent Tables. The joint group is defined as all joints of one type, *e.g.* the distal interphalangeal joints of the fingers. The carpometacarpal and intracarpal joints are included in one group. Only those persons in the sample who had adequate x rays to determine the number of joint groups affected were included in the study. Even so the reader will find that the total given

as having been x rayed varies in different Tables, as a number of individuals refused x ray of one part of their body.

Respondents were asked whether they suffered from rheumatic pain and if so whether it had been present in the past week and whether it had resulted in loss of work at any time. In addition, during the physical examination of each joint, the respondent was asked whether he had ever had pain in that joint. In this way symptoms which had been forgotten during the initial history-taking were frequently remembered and recorded. It is likely that, apart from those pains giving rise to loss of work, most of these symptoms were not such as to lead to a consultation with the family doctor. In an earlier study it was found that only some 50 per cent. of persons with symptoms attributable to osteo-arthritis consulted their doctor about it (Kellgren and others, 1953).

Results

Prevalence

The prevalence of osteo-arthritis in this population sample is shown in Fig. 1 and Tables IIA and B (opposite and overleaf). Adequate data were available on 1,098 males and 1,198 females.

As this sample is selected so as to contain more than the true proportion of the population in the older age groups, prevalence based on the total numbers in all age groups examined would be meaningless. Instead the percentage prevalences in the various age groups were added together and divided by the number of age groups to obtain an "unweighted mean" prevalence. The standard population thus adopted by us omits the youngest age groups, under 15 years, as not interesting in our problem, uses decennial age groups from 15-64 years, and also includes a single age group of 65 years and over: within this range, it gives somewhat more than their true weight to the older age groups but the overall difference is not great in a population of the present age distribution in the United Kingdom as will

TABLE I
COMPLETION RATE IN THE COMBINED LEIGH AND WENSLEYDALE ENLARGED SAMPLES IN 1963,
BY AGE AND SEX

Sex	Age Group (yrs)	Total in Sample	Not Available, Refused, or x rays Incomplete	Examined and x rayed	
				No.	Per cent.
Male	15-24	216	36	180	83
	25-34	204	21	183	90
	35-44	220	32	188	85
	45-54	278	39	239	86
	55-64	164	20	144	88
	65+	195	31	164	84
	Total	1,277	179	1,098	86
Female	15-24	199	27	172	86
	25-34	195	17	178	91
	35-44	248	32	216	87
	45-54	257	28	229	89
	55-64	215	36	179	83
	65+	281	57	224	80
	Total	1,395	197	1,198	86

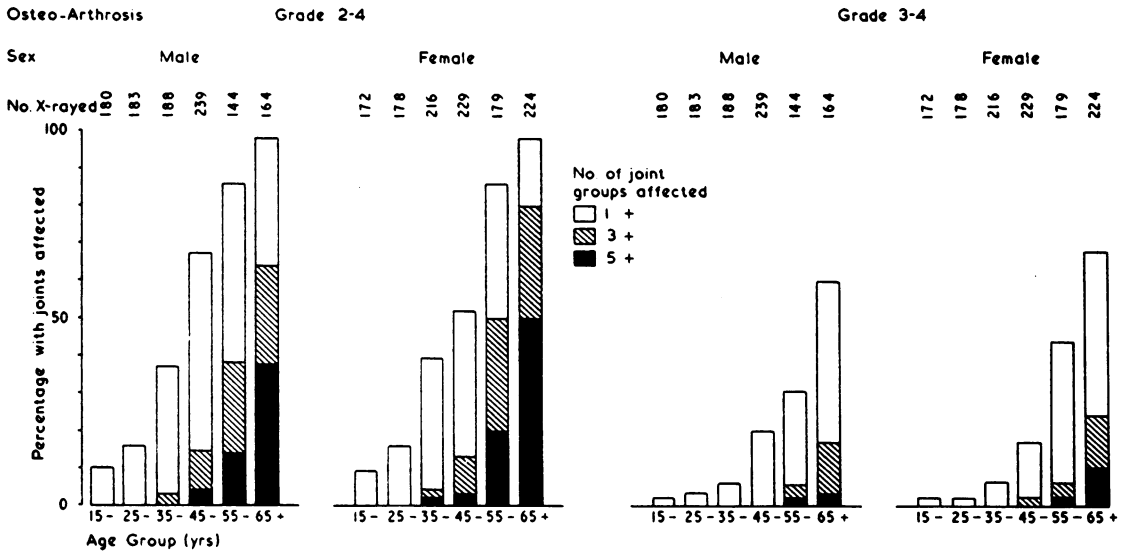


Fig. 1.—Prevalence of grades of osteo-arthritis in combined Leigh and Wensleydale samples, by sex, age, and number of joints affected.

TABLE IIIA

AGE AND SEX DISTRIBUTION OF RADIOLOGICAL OSTEO-ARTHROSIS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Number of joint groups affected of those x rayed routinely and specially, by two grades of severity

Sex	Age Group (yrs)	Total No. of Persons x rayed	Number of Joint Groups with Osteo-arthritis											
			Grade 2-4			Grade 3-4			Grade 2-4			Grade 3-4		
			1+	3+	5+	1+	3+	5+	1+	3+	5+	1+	3+	5+
Number of Persons						Per cent. of Total x rayed								
Male	15-24	180	17	0	0	2	0	0	9.4	0	0	1.1	0	0
	25-34	183	30	0	0	4	0	0	16.4	0	0	2.2	0	0
	35-44	188	72	4	0	11	0	0	38.3	2.1	0	5.9	0	0
	45-54	239	159	33	6	46	0	0	66.5	13.8	2.5	19.2	0	0
	55-64	144	124	54	18	43	6	1	86.1	37.5	12.5	29.9	4.2	0.7
	65+	164	159	104	61	95	26	4	97.0	63.4	37.2	57.9	15.8	2.4
	Total 15+	1098	561	195	85	201	32	5	51.1	17.8	7.7	18.3	2.9	0.5
Unweighted Mean								52.3	19.5	8.7	19.4	3.3	0.5	
Weighted Mean								49.0	16.5	7.0	16.9	2.6	0.4	
Female	15-24	172	13	0	0	1	0	0	7.6	0	0	0.6	0	0
	25-34	178	26	0	0	1	0	0	14.6	0	0	0.6	0	0
	35-44	216	84	6	2	12	0	0	38.9	2.8	0.9	5.6	0	0
	45-54	229	140	28	5	36	3	2	61.2	12.2	2.2	15.7	1.3	0.9
	55-64	179	154	90	34	78	10	2	86.1	50.3	19.0	43.6	5.6	1.1
	65+	224	218	178	109	152	54	19	97.3	79.5	48.7	67.9	24.1	8.5
	Total 15+	1198	635	302	150	280	67	23	53.1	25.2	12.5	23.4	5.6	1.9
Unweighted Mean								51.0	24.1	11.9	22.3	5.2	1.8	
Weighted Mean								51.9	24.9	12.3	23.0	5.5	1.9	

Note: The weighted means are based on the age distribution of males and females in England and Wales according to the Population Census of 1961.

ANNALS OF THE RHEUMATIC DISEASES

TABLE IIb

AGE AND SEX DISTRIBUTION OF RADIOLOGICAL OSTEO-ARTHRITIS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Number of joint groups affected of those x rayed routinely, by two grades of severity

No. of Joint Groups x rayed Routinely	Sex	Age Group (yrs)	Total No. of Persons x rayed	Number of Joint Groups with Osteo-arthritis											
				Grade 2-4			Grade 3-4			Grade 2-4			Grade 3-4		
				1+	3+	5+	1+	3+	5+	1+	3+	5+	1+	3+	5+
				Number of Persons						Per cent. of Total x rayed					
9	Male	15-24	179	13	0	0	1	0	0	7.3	0	0	0.6	0	0
		25-34	182	27	0	0	5	0	0	14.8	0	0	2.8	0	0
		35-44	184	49	1	0	5	0	0	26.6	0.5	0	2.7	0	0
		45-54	236	138	19	2	34	0	0	58.5	8.1	0.8	14.4	0	0
		55-64	142	115	33	6	33	4	0	81.0	23.2	4.2	23.2	2.8	0
		65+	162	145	82	39	76	19	2	89.5	50.6	24.1	46.9	11.7	1.2
		Total 15+	1085	487	135	47	154	23	2	44.9	12.4	4.3	14.2	2.1	0.2
		Unweighted Mean								46.2	13.7	4.9	15.1	2.4	0.2
	Female	15-24	170	9	0	0	0	0	0	5.3	0	0	0	0	0
		25-34	173	26	0	0	1	0	0	15.0	0	0	0.6	0	0
35-44		216	67	3	1	8	0	0	31.0	1.4	0.5	3.7	0	0	
45-54		224	113	19	4	29	2	0	50.5	8.5	1.8	13.0	0.9	0	
55-64		176	142	61	13	66	6	0	80.7	34.7	7.4	37.5	3.4	0	
65+		222	215	153	64	131	39	7	96.8	68.9	28.8	59.0	17.6	3.2	
	Total 15+	1180	572	236	82	235	47	7	48.6	20.0	7.0	19.9	4.0	0.6	
	Unweighted Mean								46.5	18.9	6.4	19.0	3.7	0.5	
11	Male	35-44	166	65	4	0	10	0	0	49.2	2.4	0	6.0	0	0
		45-54	201	133	28	6	35	0	0	65.2	13.9	3.0	17.4	0	0
		55-64	127	107	45	14	33	5	0	84.3	35.4	11.0	25.9	3.9	0
		65+	120	115	76	45	68	21	2	95.8	63.3	37.5	56.7	17.5	1.7
	Female	35-44	185	69	3	2	11	0	0	37.3	1.6	1.1	6.0	0	0
		45-54	204	129	27	5	33	3	1	63.2	13.2	2.5	16.2	1.5	0.5
		55-64	160	138	77	25	68	9	1	86.3	48.2	15.6	42.5	5.6	0.6
		65+	163	162	128	77	113	38	13	99.4	78.5	47.2	69.3	23.3	8.0
13	Male	55-64	125	107	51	16	34	5	0	85.6	40.8	12.8	37.2	4.0	0
		65+	120	116	80	51	76	23	2	96.7	66.7	42.5	63.3	19.2	1.7
	Female	55-64	154	134	79	28	67	8	1	87.0	51.3	18.2	43.5	5.2	0.6
		65+	160	159	130	80	114	41	13	99.4	81.2	50.0	71.3	25.6	8.1

be seen by comparison with the prevalence values weighted by the age distribution in England and Wales in 1961 (weighted mean) which are also given in Table IIA. Table III shows the weights given in this comparison together with those applicable if the age

distribution of 1951 had been used. It will be seen that Table IIA shows more agreement between the two sexes in the unweighted than in the weighted means; this is due to the sex differences in age distribution demonstrated in Table III.

TABLE III

POPULATION OF ENGLAND AND WALES AGED 15+ YEARS BASED ON THE REGISTRAR GENERAL'S DATA (Population Census 1961, General Volume)

Age Group (yrs)		Male		Female	
		1961	1951	1961	1951
Total No. (thousands)	15+	16,879.5	16,067.1	18,640.3	17,999.3
Percentage of Total Numbers	15-24	18.1	17.2	16.2	15.9
	25-34	17.5	19.5	15.5	17.9
	35-44	18.4	20.5	17.0	18.9
	45-54	18.7	17.1	17.7	17.4
	55-64	14.8	12.6	15.5	13.9
	65+	12.5	12.3	18.2	15.9
	55+	27.3	24.9	33.7	29.8
	15+	100.0	100.0	100.0	100.0

It is suggested that in all surveys in which adequate numbers are available in each age group, the "unweighted mean" prevalence should be given so as to facilitate the comparison between surveys in different countries and at different times.

In the standard population using unweighted means, 52 per cent. of males and 51 per cent. of females had Grade 2 to 4 osteo-arthrosis in one joint or other. Grade 1 osteo-arthrosis has been omitted from Tables IIA and B since this is the doubtful category. There was a female preponderance of both those with 3+ and 5+ joint groups involved at the Grade 2 to 4 level. This preponderance did not appear till after the age of 55. Grade 3 to 4 osteo-arthrosis was present in one joint or other in 19 per cent. of males and 22 per cent. of females. Up to age 55 the prevalence was slightly greater in males and after this in females.

Conclusions as to the number of joints involved are of course influenced by the number of joints *x* rayed. Since in many population surveys only the hands, feet, and cervical spine are included as a routine, data which would be obtained from such a survey are given in Table IIB under the heading "Nine". Involvement of five or more groups of joints at Grade 2 to 4 osteo-arthrosis was present in only 5 per cent. of males and 6 per cent. of females (unweighted mean) when only these three *x* rays were used, as compared with 9 and 12 per cent. in Table IIA.

When *x* rays of the knees and lumbar spine were included giving a coverage of eleven joint groups, the numbers involved closely approached that in the total sample in each of the age groups in which these joints were routinely *x* rayed. Inclusion of the hips and sacro-iliac joints still further increased the number of joints involved, so that 43 per cent. of males and 50 per cent. of females aged 65 and over had five or more groups of joints affected, compared with 24 per cent. and 29 per cent. in those with *x* rays of the hands, feet, and neck.

Relationship of Symptoms to X Ray Changes

Since rheumatoid arthritis (RA) is not an uncommon cause of joint pain, it has been necessary to consider those with and without rheumatoid arthritis separately in studying symptoms. In order to be certain that rheumatoid arthritis was excluded from the non-rheumatoid group, a rather wider definition than usual has been used. Those with probable or definite disease by the American Rheumatism Association's criteria have, of course, been included in the rheumatoid group. Those not falling into this category but considered by the clinician to

have definite (Grade 2 to 4) rheumatoid arthritis, those with a past history of polyarthrititis or with Grade 2 to 4 radiological evidence of the disease or a positive sheep-cell agglutination test (SCAT) were included in an intermediate group. In the present population samples of Leigh and Wensleydale, 26 males and 75 females had probable or definite rheumatoid arthritis, but when this intermediate group was included 200 males and 296 females fell into the "rheumatoid" group. Tables IV to VIII and their accompanying histograms are all arranged in a similar way in order to show clearly the numbers of subjects involved and in part of the Tables the full age grouping. Since many of the subgroups by age, particularly in the higher grades of osteo-arthrosis are extremely small or show nil entries, over-all percentage prevalences of symptoms have been worked out from the total numbers without adjustment to any particular pattern of age distribution. An inspection of the Tables will however support our thesis that age does not appear to affect the relationship of symptoms to osteo-arthrosis but that, in most joint groups examined, symptoms are closely related to the degree of radiological osteo-arthrosis. The reader may notice from the Tables that a larger proportion of total rheumatoids than total non-rheumatoids showed definite osteo-arthrosis (Grade 2 to 4). This is, however, merely a function of the differing age distribution in the two groups: from the data presented in Tables IV to VI, we worked out the average percentage prevalence of definite osteo-arthrosis in the three groups of hand joints examined for each age group and give below the unweighted mean prevalence for the two broad age groups 15 to 44 years and 45+ years, "rheumatoid" comprising here both "intermediate" and "probable and definite".

PERCENTAGE PREVALENCE OF GRADE 2 TO 4 OSTEO-ARTHROSIS IN AVERAGE OF THREE JOINT GROUPS, UNWEIGHTED MEANS OF THREE AGE GROUPS

Age (yrs)	Sex	Non-rheumatoid	Rheumatoid
15-44	M	1.3	2.1
	F	1.2	1.6
45+	M	28.4	29.9
	F	35.3	37.2

It will be observed that, when a correction is made for age in this way, the prevalence of osteo-arthrosis was only slightly greater in the rheumatoid group.

In a similar way, *i.e.* for the average of the three joint groups and as unweighted means, we worked out the percentage of subjects with pain amongst

those with no or only doubtful osteo-arthritis (Grade 0 to 1).

PERCENTAGE WITH PAIN IN THE APPROPRIATE DISTRIBUTION, UNWEIGHTED MEANS OF THREE AGE GROUPS

Age (yrs)	Sex	Non-rheumatoid	Rheumatoid
15-44	M	2.4	18.4
	F	3.2	19.7
45+	M	4.1	16.4
	F	7.5	26.8

The slight increase of pain in the older age group may well be accounted for by the greater proportion

with doubtful osteo-arthritis. As the higher grades of osteo-arthritis are too rare in the younger age groups, a similar calculation was not possible for these grades.

The distal interphalangeal joints of the fingers may be cited as an example. Osteo-arthritis (Grade 2 to 4) was present in 246 males and 351 females from a total of 1,097 males and 1,195 females who had x rays of the hands (Table IV and Fig. 2, opposite).

Of the males who were x rayed, 52 stated that they had pain in the distal interphalangeal joints. When the 200 males in the two rheumatoid groups were

TABLE IV
RELATIONSHIP OF SYMPTOMS TO RADIOLOGICAL EVIDENCE OF OSTEOARTHRITIS IN THE DISTAL INTERPHALANGEAL JOINTS OF THE FINGERS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES (cf. Fig. 2)

Sex	RA or Non-RA	Age Group (yrs)	Total x rayed	Grade of Osteo-arthritis (Radiological)									
				0-1			2			3-4			
				Total No.	With Pain		Total No.	With Pain		Total No.	With Pain		
					No.	Per cent of Total		No.	Per cent of Total		No.	Per cent of Total	
Male	(a) Non-RA	15-24	166	166	0	0	0	—	—	0	—	—	
		25-34	169	166	3	1.8	2	0	0	1	0	0	
		35-44	165	156	5	3.2	8	1	12.5	1	0	0	
		45-54	200	155	1	0.6	40	3	7.5	5	0	0	
		55-64	104	55	0	0	41	5	12.2	8	0	0	
		65+	93	32	1	3.1	44	2	4.6	17	3	17.6	
		Total	897	730	10	1.4	135	11	8.1	32	3	9.4**	
		(b) RA Intermediate	Total	174	100	9	9.0	55	7	12.7	19	5	26.3
		(c) RA Probable and Definite	Total	26	21	5	23.8	3	0	0	2	2	100
		(b) + (c)	15-24	14	13	1	7.7	0	—	—	1	1	100
		25-34	14	14	1	7.1	0	—	—	0	—	—	
		35-44	22	22	2	9.1	0	—	—	0	—	—	
		45-54	39	27	4	14.8	10	1	10.0	2	1	50.0	
		55-64	40	22	4	18.2	15	4	26.7	3	1	33.3	
		65+	71	23	2	8.7	33	2	6.1	15	4	26.7	
	Total	200	121	14	11.6	58	7	12.1	21	7	33.3*		
Female	(a) Non-RA	15-24	164	164	0	0	0	—	—	0	—	—	
		25-34	157	157	2	1.3	0	—	—	0	—	—	
		35-44	181	167	1	0.6	12	—	—	2	—	—	
		45-54	170	131	4	3.1	36	3	8.3	3	1	33.3	
		55-64	115	52	2	3.9	49	4	8.2	14	4	28.6	
		65+	112	22	0	0	49	2	4.1	41	10	24.4	
		Total	899	693	9	1.3	146	9	6.2	60	15	25.0**	
		(b) RA Intermediate	Total	221	122	11	9.0	66	17	25.8	33	15	45.5
		(c) RA Probable and Definite	Total	75	29	7	24.1	24	7	29.2	22	10	45.5
		(b) + (c)	15-24	8	8	2	25.0	0	—	—	0	—	—
		25-34	20	20	0	0.0	0	—	—	0	—	—	
		35-44	35	34	5	14.7	1	0	0	0	—	—	
		45-54	58	44	4	9.1	10	1	10.0	4	2	50.0	
		55-64	64	30	7	23.3	25	6	24.0	9	3	33.3	
		65+	111	15	0	0.0	54	17	31.5	42	20	47.6	
	Total	296	151	18	11.9	90	24	26.7	55	25	45.5		

Probability of difference in proportion of pain between Osteo-arthritis Grades 0-1 and 3-4: * = <0.05 ** = <0.01.

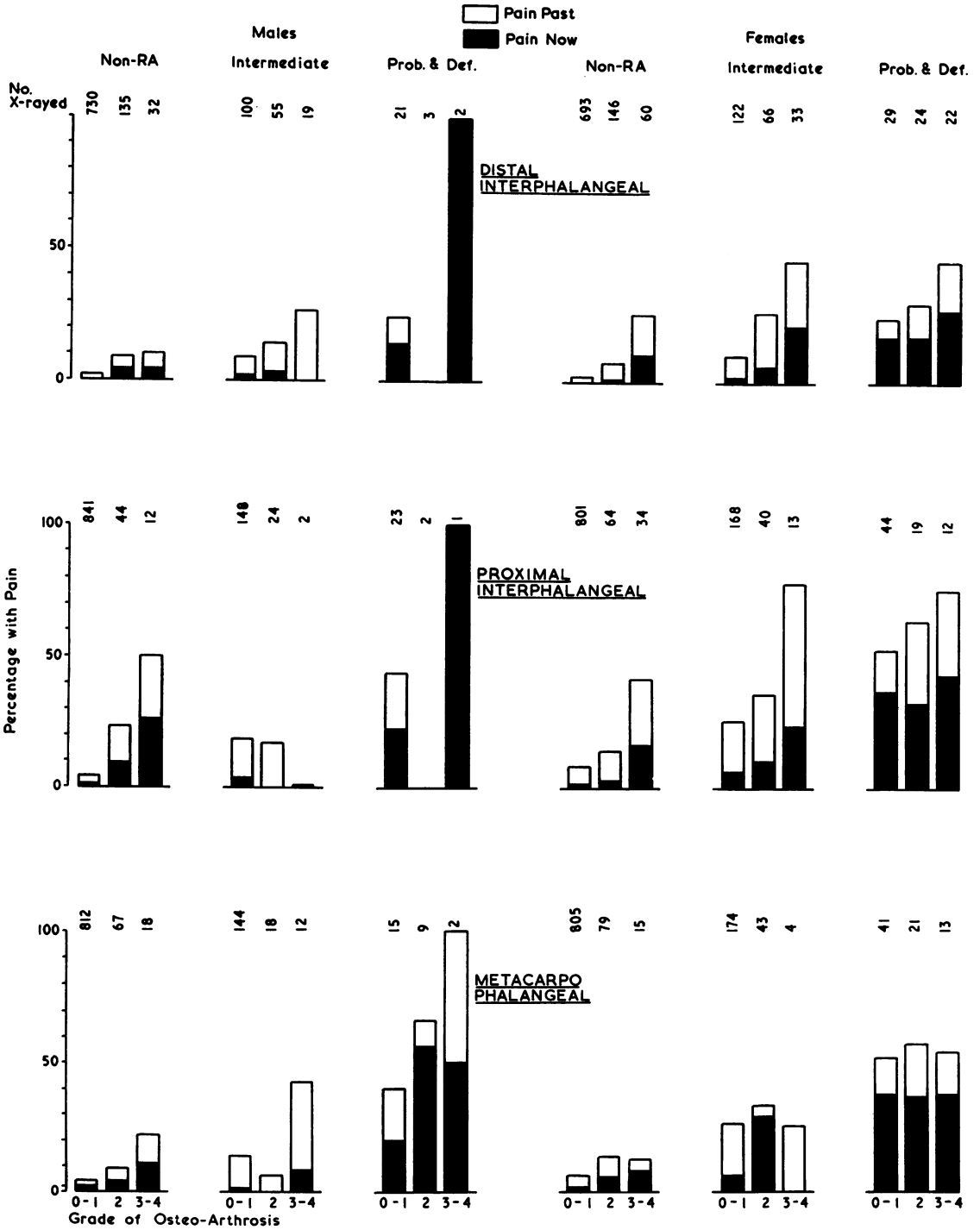


Fig. 2.—Relationship of grade of osteo-arthritis of the finger joints to symptoms, by diagnosis and sex.

TABLE V

RELATIONSHIP OF SYMPTOMS TO RADIOLOGICAL EVIDENCE OF OSTEO-ARTHRITIS
IN THE PROXIMAL INTERPHALANGEAL JOINTS OF THE FINGERS
IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES (cf. Fig. 2)

Sex	RA or Non-RA	Age Group (yrs)	Total x rayed	Grade of Osteo-arthritis (Radiological)								
				0-1			2			3-4		
				Total No.	With Pain		Total No.	With Pain		Total No.	With Pain	
No.	Per cent. of Total		No.	Per cent. of Total		No.	Per cent. of Total					
Male	(a) Non-RA	15-24	166	166	2	1.2	0	—	0	—	—	—
		25-34	169	169	8	4.7	0	—	0	—	—	—
		35-44	165	161	5	3.1	4	1	25.0	0	—	—
		45-54	200	189	15	7.9	11	4	36.4	0	—	—
		55-64	104	93	3	3.2	10	2	20.0	1	0	0
		65+	93	63	3	4.8	19	3	15.8	11	6	54.5
	Total	897	841	36	4.3	44	10	22.7	12	6	50.0**	
	(b) RA Intermediate	Total	174	148	27	18.2	24	4	16.7	2	0	0
	(c) RA Probable and Definite	Total	26	23	10	43.5	2	0	0	1	1	100.0
	(b) + (c)	15-24	14	14	2	14.3	0	—	0	—	—	—
25-34	14	14	4	28.6	0	—	0	—	0	—	—	
35-44	22	22	6	27.3	0	—	0	—	0	—	—	
45-54	39	35	6	17.1	4	1	25.0	0	—	—	—	
55-64	40	36	9	25.0	4	1	25.0	0	—	—	—	
65+	71	50	10	20.0	18	2	11.1	3	1	33.3		
Total	200	171	37	21.6	26	4	15.4	3	1	33.3		
Female	(a) Non-RA	15-24	164	164	2	1.2	0	—	0	—	—	—
		25-34	157	157	8	5.1	0	—	0	—	—	—
		35-44	181	181	16	8.8	0	—	0	—	—	—
		45-54	170	160	14	8.8	8	2	25.0	2	1	50.0
		55-64	115	82	9	11.0	25	2	8.0	8	4	50.0
		65+	112	57	5	8.8	31	5	16.1	24	9	37.5
	Total	899	801	54	6.8	64	9	14.1	34	14	41.2**	
	(b) RA Intermediate	Total	221	168	44	26.2	40	14	35.0	13	10	76.9
	(c) RA Probable and Definite	Total	75	44	23	52.3	19	12	63.2	12	9	75.0
	(b) + (c)	15-24	8	8	2	25.0	0	—	0	—	—	—
25-34	20	20	4	20.0	0	—	0	—	0	—	—	
35-44	35	34	7	20.6	1	1	100.0	0	—	—		
45-54	58	53	21	39.6	4	1	25.0	1	1	100.0		
55-64	64	45	16	35.6	16	6	37.5	3	2	66.7		
65+	111	52	17	32.7	38	18	47.4	21	16	76.2		
Total	296	212	67	31.6	59	26	44.1	25	19	76.0**		

Probability of difference in proportion of pain between Osteo-arthritis Grades 0-1 and 3-4: * = <0.05 ** = <0.01.

excluded, only 24 males had pain, the proportion rising from 1 per cent. in those without definite radiological evidence of osteo-arthritis to 9 per cent. in those with Grade 3 to 4 change. Of the females, 100 stated that they had had pain in the distal interphalangeal joints but of the 899 non-rheumatoid females only 33 had had pain, the prevalence rising from 1 per cent. in those without definite evidence of osteo-arthritis to 25 per cent. in those with Grade 3 to 4 change.

Of the 174 males in the "intermediate group", 21 had had pain in the distal interphalangeal joints, the prevalence rising from 9 per cent. in those with Grade 0 to 1 osteo-arthritis to 26 per cent. in those

with Grade 3 to 4 change. In the 221 females in the intermediate group it rose from 9 to 46 per cent.

There were only 26 males with probable or definite rheumatoid arthritis and seven of these had had pain in the distal interphalangeal joints, five of the 21 with Grade 0 to 1 osteo-arthritis and all those with Grade 3 to 4 change. Of the 75 females with probable or definite disease, 24 had had pain in the distal interphalangeal joints, the frequency varying from 24 to 46 per cent. with increasing severity of osteo-arthritis.

The general pattern is the same in all the peripheral joints. There is a gradient in the frequency of symptoms between those with Grade 0 to 1 and 3 to 4

OSTEO-ARTHROSIS

TABLE VI

RELATIONSHIP OF SYMPTOMS TO RADIOLOGICAL EVIDENCE OF OSTEO-ARTHROSIS
IN THE METACARPOPHALANGEAL JOINTS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES (cf. Fig. 2)

Sex	RA or Non-RA	Age Group (yrs)	Total x rayed	Grade of Osteo-arthritis (Radiological)									
				0-1			2			3-4			
				Total No.	With Pain		Total No.	With Pain		Total No.	With Pain		
					No.	Per cent. of Total		No.	Per cent. of Total		No.	Per cent. of Total	
Male	(a) Non-RA	15-24	166	166	0	0	0	—	—	0	—	—	
		25-34	169	166	7	4.2	2	1	50.0	1	0	0	
		35-44	165	165	5	3.0	0	—	—	0	—	—	
		45-54	200	176	7	4.0	22	2	9.1	2	1	50.0	
		55-64	104	86	5	5.8	15	1	6.7	3	1	33.3	
	65+	93	53	4	7.6	28	2	7.1	12	2	16.7		
		Total	897	812	28	3.4	67	6	9.0	18	4	22.2*	
		(b) RA Intermediate	Total	174	144	20	13.9	18	1	5.5	12	5	41.5
		(c) RA Probable and Definite	Total	26	15	6	40.0	9	6	66.7	2	2	100.0
		(b) + (c)	15-24	14	14	3	21.4	0	—	—	0	—	—
		25-34	14	13	4	30.8	0	0	0	1	0	0	
		35-44	22	21	4	19.0	1	0	0	0	—	—	
		45-54	39	33	5	15.2	6	2	33.3	0	—	—	
		55-64	40	30	6	20.0	9	2	22.2	1	1	100.0	
		65+	71	48	4	8.3	11	3	27.3	12	6	50.0	
	Total	200	159	26	16.4	27	7	25.9	14	7	50.0*		
Female	(a) Non-RA	15-24	164	164	3	1.8	0	—	—	0	—	—	
		25-34	157	156	7	4.5	1	0	0	0	—	—	
		35-44	181	177	9	5.1	3	0	0	1	0	0	
		45-54	170	159	11	6.9	11	0	0	0	—	—	
		55-64	115	86	9	10.6	24	5	20.8	5	0	0	
	65+	112	63	9	14.3	40	6	15.0	9	2	22.2		
		Total	899	805	48	6.0	79	11	13.9	15	2	13.3	
		(b) RA Intermediate	Total	221	174	45	25.9	43	14	32.6	4	1	25.0
		(c) RA Probable and Definite	Total	75	41	21	51.2	21	12	57.2	13	7	53.9
		(b) + (c)	15-24	8	8	2	25.0	0	—	—	0	—	—
		25-34	20	20	5	25.0	0	—	—	0	—	—	
		35-44	35	32	7	21.9	2	0	0	1	1	100.0	
		45-54	58	53	18	34.0	4	1	25.0	1	1	100.0	
		55-64	64	52	17	32.7	11	6	54.6	1	1	100.0	
		65+	111	50	17	34.0	47	19	40.4	14	5	35.7	
	Total	296	215	66	30.7	64	26	40.5	17	8	47.1		

Probability of difference in proportion between Osteo-arthritis Grades 0-1 and 3-4: * = < 0.05 ** = < 0.01.

osteo-arthritis, and this gradient is similar in the non-rheumatoid, intermediate rheumatoid, and rheumatoid groups, though starting on a higher level in the intermediate group and on a still higher level in the probable-definite group. On the whole the gradient is rather greater in those without rheumatoid arthritis. Pain present at the time of the survey shows much the same gradient as total pain.

Exceptions to these generalizations are the wrists and metacarpophalangeal joints. These show little or no relationship between osteo-arthritis and symptoms in females and the possibility that unrecognized rheumatoid arthritis is obscuring the

relationship between osteo-arthritis and symptoms must be considered. It would seem that rheumatoid arthritis is the main cause of symptoms in these joints in this sex.

The numbers with probable or definite rheumatoid arthritis are small in the males and this accounts for the uneven results.

In view of the difficulty some respondents had in localizing pain in the individual joints of the fingers, a grading was given for generalized osteo-arthritis in the hand x rays, according to readings made by Prof. J. H. Kellgren. This grading showed a significant association with pain in the hands in the non-

rheumatoid group and some association in the In the spine the association between osteo-intermediate group (Table VII and Fig. 3, opposite). arthrosis of the apophyseal joints and symptoms

TABLE VII
RELATIONSHIP OF SYMPTOMS TO RADIOLOGICAL EVIDENCE OF OSTEO-ARTHROSIS
IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES (Fig. 3 Hands, Fig. 4 Spine, Fig. 5 Legs and Feet)

Joint Group	Sex	RA or Non-RA	Total x rayed	Grade of Osteo-arthritis (Radiological)								
				0-1			2			3-4		
				Total No.	With Pain		Total No.	With Pain		Total No.	With Pain	
					No.	Per cent. of Total		No.	Per cent. of Total		No.	Per cent. of Total
Carpometacarpal	Male	Non-RA	897	827	18	2.2	52	2	3.8	18	6	33.3 **
		RA Intermediate	174	143	9	6.3	21	2	9.5	10	3	30.0)*
RA Probable and Definite		26	22	6	27.3	2	0	0.0	2	1	50.0)	
Female	Non-RA	898	792	27	3.4	74	15	20.2	32	11	34.4 **	
	RA Intermediate	221	167	33	19.8	36	9	25.0	18	9	50.0)*	
	RA Probable and Definite	75	48	17	35.4	19	5	26.3	8	3	37.5)	
Wrists	Male	Non-RA	896	838	36	4.3	44	4	9.1	14	6	42.9 **
		RA Intermediate	172	150	20	13.3	17	3	17.6	5	2	40.0)*
		RA Probable and Definite	26	21	7	33.3	2	1	50.0	3	3	100.0)
Female	Non-RA	897	871	57	6.5	24	1	4.2	2	0	0.0	
	RA Intermediate	219	196	46	23.5	18	3	16.7	5	0	0.0	
	RA Probable and Definite	74	65	19	29.2	6	3	50.0	3	1	33.3)	
Hands—Generalized Osteo-arthritis	Male	Non-RA	897	734	19	2.6	103	7	6.8	60	11	18.3 **
		RA Intermediate	174	95	12	12.6	41	7	17.1	38	7	18.4
		RA Probable and Definite	26	19	11	57.9	3	1	33.3	4	2	50.0)
Female	Non-RA	899	680	29	4.3	109	23	21.1	110	30	27.3 **	
	RA Intermediate	221	112	30	26.8	47	10	21.3	62	27	43.6	
	RA Probable and Definite	75	24	14	58.3	20	11	55.0	31	15	48.4)	
Cervical Spine	Male	Non-RA	895	812	302	37.1	67	26	38.8	16	11	68.7*
		RA Intermediate	173	144	75	52.1	22	10	45.5	7	2	28.6
		RA Probable and Definite	26	21	9	42.9	3	2	66.7	2	2	100.0)
Female	Non-RA	892	825	326	39.6	58	23	39.7	9	5	55.5	
	RA Intermediate	222	188	122	64.4	22	18	81.8	12	8	66.7	
	RA Probable and Definite	75	57	33	57.9	14	12	85.7	4	3	75.0)	
Lumbar Spine	Male	Non-RA	483	385	199	51.7	78	46	59.0	20	11	55.0
		RA Intermediate	125	96	42	43.8	18	10	55.5	11	10	90.9)*
		RA Probable and Definite	22	14	4	28.6	5	4	80.0	3	2	66.7)
Female	Non-RA	494	416	199	47.9	64	36	56.3	14	8	57.2	
	RA Intermediate	166	143	75	52.4	18	12	66.7	5	2	40.0)	
	RA Probable and Definite	61	44	26	59.1	10	8	80.0	7	3	42.9)	
Hips	Male	Non-RA	164	137	8	5.8	11	0	0	16	9	56.3**
		RA Intermediate	75	59	8	13.6	8	2	25.0	8	2	25.0
		RA Probable and Definite	12	8	0	0.0	3	0	0	1	0	0.0
Female	Non-RA	178	167	16	9.6	5	0	0	6	6	100.0**	
	RA Intermediate	92	81	17	21.0	4	2	50.0	7	5	71.5	
	RA Probable and Definite	46	39	6	15.4	4	1	25.0	3	3	100.0)	
1st metatarsophalangeal	Male	Non-RA	891	739	16	2.2	118	5	4.2	34	9	26.5**
		RA Intermediate	172	132	18	13.6	32	2	6.3	8	5	62.5)*
		RA Probable and Definite	26	16	4	25.0	8	3	37.8	2	1	50.0)
Female	Non-RA	897	701	27	3.8	147	19	12.9	49	13	26.5 **	
	RA Intermediate	220	151	23	15.2	56	9	16.1	13	3	23.1	
	RA Probable and Definite	74	44	17	38.6	17	6	35.3	13	3	23.1)	

Probability of difference in proportion of pain between Osteo-arthritis Grades 0-1 and 3-4: * = <0.05 ** = <0.01.

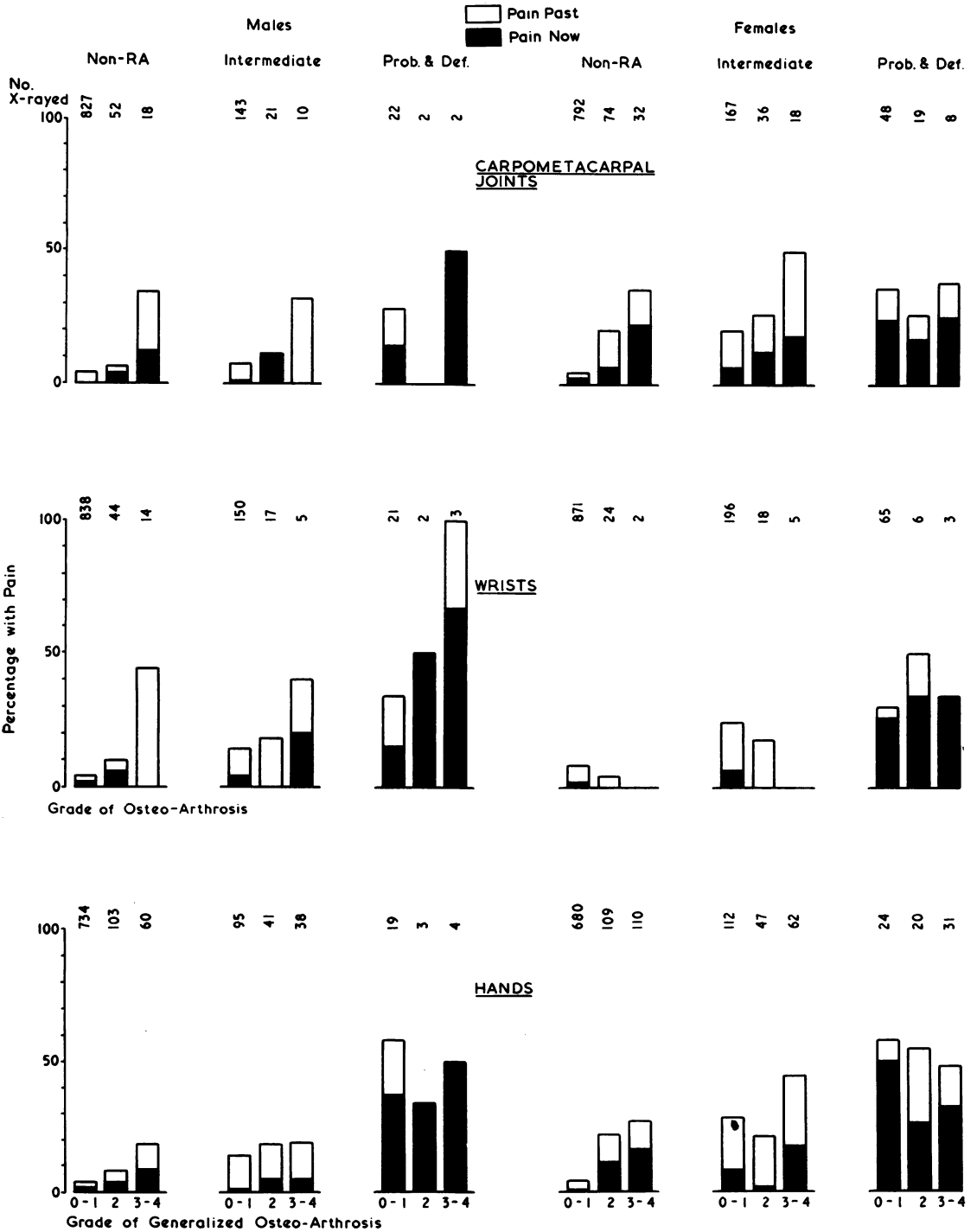


Fig. 3.—Relationship of grade of osteo-arthritis of the hand and wrist to symptoms, by diagnosis and sex.

was less definite. There was a significant association between Grade 3 to 4 osteo-arthritis and pain in the neck, shoulder, and arms in the non-rheumatoid males, but the complaint rate was only double that found in the Grade 0 to 1 group (Table VII and Fig. 4). The pain was limited to the neck in some and to the shoulders in others, but was generally in the neck-shoulder-brachial distribution (C4-6). In the intermediate males there was a reverse trend but it was not significant. In female non-rheumatoids, the same trend was apparent as in the males. There was no relationship between osteo-arthritis and symptoms in the female intermediate rheumatoids, but the relationship was significant at the 5 per cent.

level in probable and definite rheumatoids if males and females were taken together.

Osteo-arthritis of the Lumbar Spine.—This was not associated with any increase of symptoms in the non-rheumatoid males (Table VII and Fig. 4). Prolonged incapacity (3 months or more) from lumbar-sciatic pain—not shown in the Tables—was present in 19 per cent. of non-rheumatoid males with Grade 3 to 4 osteo-arthritis compared with 7 per cent. of those with Grade 0 to 1 but the association was not significant. In the rheumatoid males, on the other hand, there was significantly more pain in those with Grade 3 to 4 osteo-arthritis. This

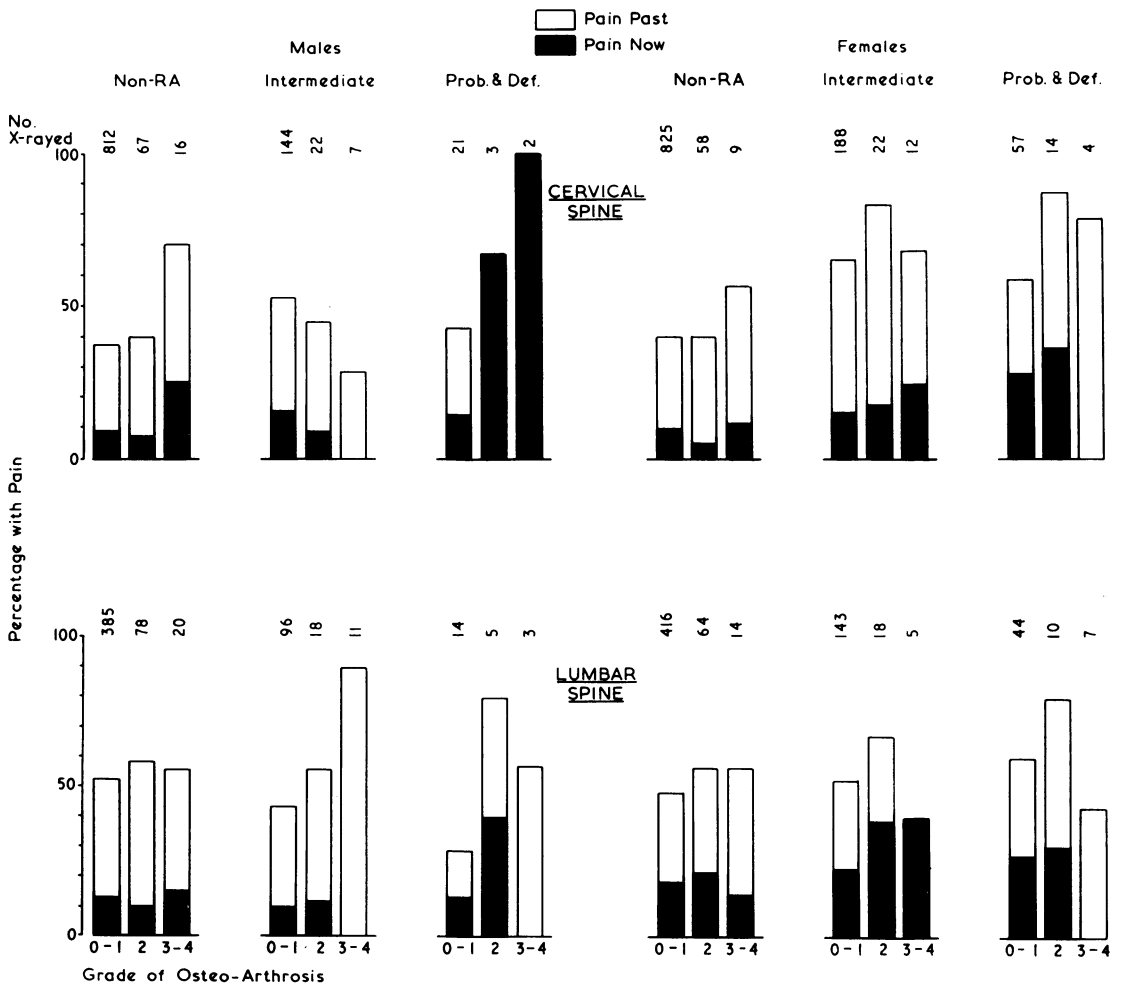


Fig. 4.—Relationship of grade of osteo-arthritis of the cervical and lumbar spine to symptoms, by diagnosis and sex.

difference may depend on the presence of a third cause of lumbar-sciatic pain. Lumbar disk degeneration, for example, which is known to be associated with lumbar-sciatic pain, was more frequent in all age groups in the rheumatoids with Grade 3 to 4 osteo-arthritis than in those with Grade 0 to 1 osteo-arthritis. No such association between disk degeneration and osteo-arthritis was found in the non-rheumatoid males.

In females, there was no association between symptoms and osteo-arthritis in either the rheumatoid or non-rheumatoid group.

There was no pain in the hip in those with Grade 2 osteo-arthritis of that joint in the non-rheumatoid group (Table VII and Fig. 5, overleaf) but eight of them had knee pain, three without osteo-arthritis of the knees. According to the age distribution, six would have been expected to have knee pain; this point will be discussed later. A feature of Grade 3 to 4 osteo-arthritis of the hips was the high disability rate. A quarter of both males and females with this grade of change had lost 3 months or more from

work because of hip pain. This applied equally in the rheumatoid and non-rheumatoid groups. Only 1 per cent. of those with Grade 0 to 1 osteo-arthritis had such prolonged disability and these were mainly females with rheumatoid arthritis. Disability was particularly marked when both the hips and knees were affected.

Osteo-arthritis of the Knees (Table VIII and Fig. 5).—The knees differed from the other joints in that symptoms were almost as frequent in the non-rheumatoid as in the rheumatoid group. The high complaint rate, 23 per cent. in males and 20 per cent. in females without osteo-arthritis or rheumatoid arthritis, indicates either that some other cause of pain is important in the knee or that minor degrees of change are more difficult to recognize than in other joints. In some of those without osteo-arthritis or rheumatoid arthritis, the pain followed an injury to the knee, in others it appeared to be referred from the hip or spine. In most, however, the cause was undetermined. It is of interest that

TABLE VIII
RELATIONSHIP OF SYMPTOMS TO RADIOLOGICAL EVIDENCE OF OSTEO-ARTHROSIS IN THE KNEES
IN PERSONS AGED 35+ YEARS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Sex	RA or Non-RA	Age Group (yrs)	Total x rayed	Grade of Osteo-arthritis (Radiological)								
				0-1			2			3-4		
				Total No.	With Pain		Total No.	With Pain		Total No.	With Pain	
					No.	Per cent. of Total		No.	Per cent. of Total		No.	Per cent. of Total
Male	(a) Non-RA	35-44	162	153	27	17.6	8	3	37.5	1	1	100.0
		45-54	194	178	43	24.2	14	6	42.9	2	2	100.0
		55-64	103	74	16	21.6	22	7	31.8	7	3	42.9
		65+	91	67	22	32.8	16	9	56.2	8	4	50.0
		Total	550	472	108	22.9	60	25	41.7	18	10	55.5*
	(b) RA Intermediate	Total	145	103	32	31.1	36	18	50.0	6	5	83.3
(c) RA Probable and Definite	Total	24	18	10	55.5	6	5	83.3	0	—	—	
(b) + (c)	35-44	22	20	5	25.0	2	1	50.0	0	—	—	
	45-54	39	36	14	38.9	3	2	66.7	0	—	—	
	55-64	38	27	13	48.1	9	6	66.7	2	2	100.0	
	65+	70	38	10	26.3	28	14	50.0	4	3	75.0	
	Total	169	121	42	34.7	42	23	54.3	6	5	83.3	
Female	(a) Non-RA	35-44	176	169	21	12.4	6	4	66.7	1	1	100.0
		45-54	168	146	34	23.3	18	6	33.3	4	3	75.0
		55-64	110	66	18	27.3	30	14	46.7	14	10	71.4
		65+	112	57	15	26.3	35	15	42.9	20	17	85.0
		Total	566	438	88	20.1	89	39	43.3	39	31	79.5**
	(b) RA Intermediate	Total	187	123	42	34.1	40	26	65.0	24	18	75.0
	(c) RA Probable and Definite	Total	73	34	18	52.9	21	18	85.7	18	16	88.9
	(b) + (c)	35-44	32	28	12	42.9	3	1	33.3	1	1	100.0
		45-54	56	51	22	43.1	3	1	33.3	2	2	100.0
		55-64	60	37	15	40.5	15	11	73.3	8	8	100.0
65+		112	41	11	26.8	40	31	77.5	31	23	74.2	
Total		260	157	60	38.2	61	44	72.2	42	34	80.9**	

Probability of difference in proportion of pain between Osteo-arthritis Grades 0-1 and 3-4: * = <0.05 ** = <0.01.

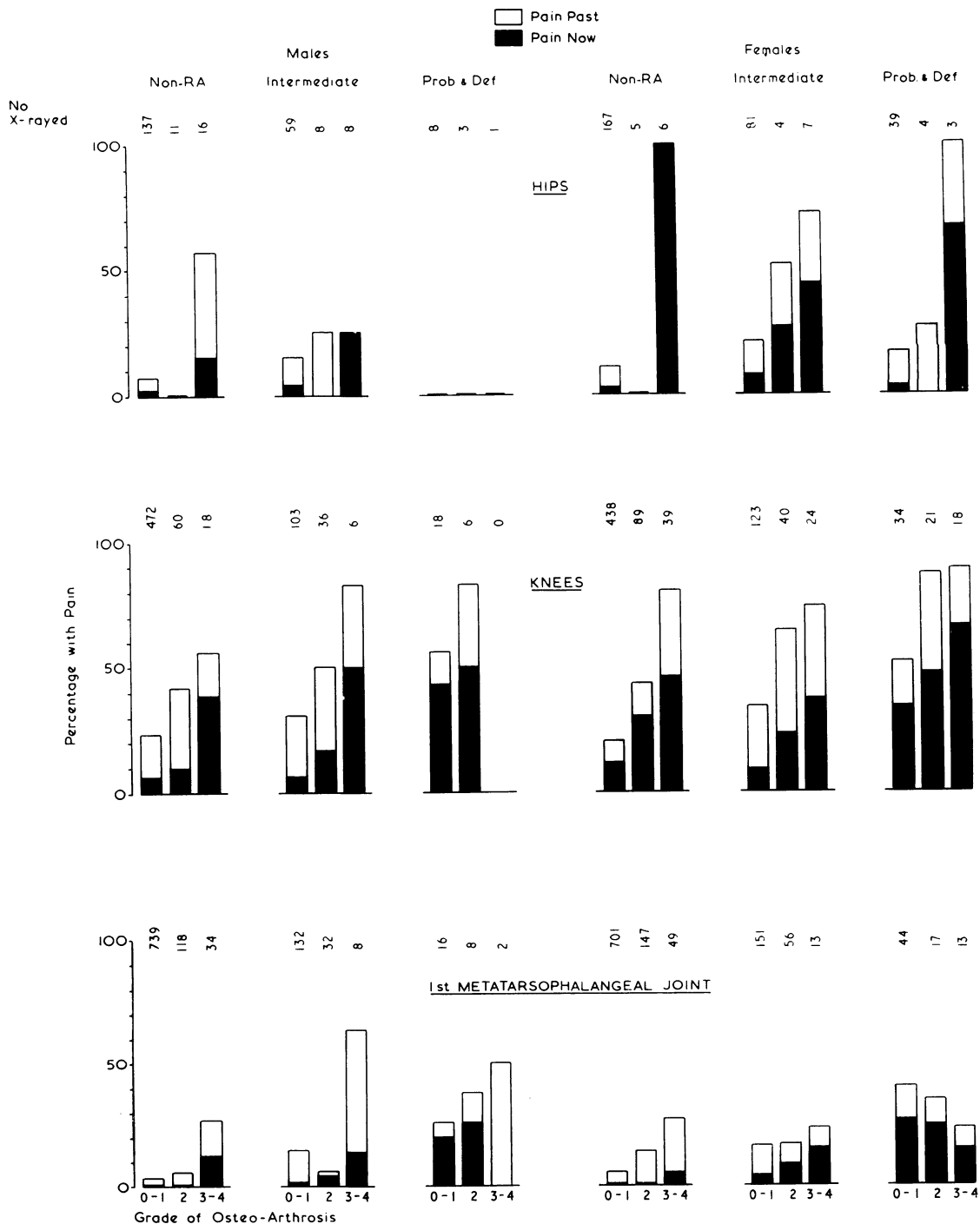


Fig. 5.—Relationship of grade of osteo-arthritis of the hips, knees, and first metatarsophalangeal joint to symptoms, by diagnosis and sex.

only 6 per cent. of males and 7 per cent. of females in this category had pain actually at the time of the survey, compared with 39 per cent. and 46 per cent. respectively of those with Grade 3 to 4 osteo-arthrosis. A feature of osteo-arthrosis in the knees was its relationship to loss of work from knee pain (Table IX). This showed a steeper gradient with increasing severity of osteo-arthrosis than simple pain, the proportion losing 3 months or more from knee pain rising from 1.5 to 8 per cent. in the non-rheumatoid males and from 1 to 5 per cent. in the non-rheumatoid females ($P < 0.05$). This also applied on a higher level in the rheumatoid groups, but was significant only in the males and females combined ($P < 0.05$).

As might be expected, obesity had some influence not only on the prevalence of osteo-arthrosis in the knees but also on the occurrence of symptoms in

those with osteo-arthrosis. The influence of obesity appeared to be greater in males, in whom it was significant in both the rheumatoid and non-rheumatoid groups ($P < 0.05$). In the females this influence was observed only in those without rheumatoid arthritis (Table X and Fig. 6, overleaf). Obesity had also a significant influence on knee pain in males without osteo-arthrosis ($P < 0.05$). It did not affect the frequency of pain in the hands, fingers, or thumbs in relation to generalized osteo-arthrosis in the hands (Fig. 7, overleaf).

There was little osteo-arthrosis in the tarsal and lateral metatarsophalangeal joints (not shown in the Tables). These demonstrated much the same relationship between osteo-arthrosis and symptoms as other joints but, whereas both males and females showed quite a marked association in the tarsal joints, this was limited to females in the case of the

TABLE IX
RELATIONSHIP OF MENTAL STABILITY TO KNEE PAIN AND DISABILITY
IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Sex	RA or Non-RA	Mental Stability	Total x rayed Age 35+	Grade of Osteo-arthrosis (Radiological)													
				0-1						2-4							
				Total No.	Knee Pain	Off Work		Knee Pain	Off Work		Total No.	Knee Pain	Off Work		Knee Pain	Off Work	
						1 wk +	3 mth +		1 wk +	3 mth +			1 wk +	3 mth +			
				Numbers			Per cent. of Total			Numbers			Per cent. of Total				
Male	Non-RA	Normal or Doubtful	513	446	104	10	6	23.4	2.3	1.4	67	30	4	4	44.3	6.0	6.0
		Neurotic	24	18	3	0	0	16.7	0	0	6	3	2	2	50.0	33.3	33.3
		Not stated or Psychotic	13	8	1	1	1	12.5	12.5	12.5	5	2	0	0	40.0	0	0
	Total	550	472	108	11	7	22.9	2.3	1.5	78	35	6	6	44.9	7.7	7.7	
	RA Intermediate	Normal or Doubtful	134	95	28	15	7	29.5	15.8	7.4	39	21	12	7	53.9	30.8	17.9
		Neurotic	7	5	3	2	0	60.0	20.0	0	2	1	1	1	50.0	50.0	50.0
Not stated or Psychotic		4	3	1	0	0	33.3	0	0	1	1	1	1	100	100	100	
Total	145	103	32	17	7	31.1	16.5	6.8	42	23	14	9	54.8	33.3	21.4		
RA Probable and Definite	Normal or Doubtful	24	18	10	5	4	55.6	27.8	22.2	6	5	3	2	83.3	50.0	33.3	
	Neurotic	0	0	—	—	—	—	—	—	0	—	—	—	—	—	—	
Total	24	18	10	5	4	55.6	27.8	22.2	6	5	3	2	83.3	50.0	33.3		
Female	Non-RA	Normal or Doubtful	500	390	76	8	4	19.5	2.1	1.0	110	61	6	5	55.5	5.5	4.5
		Neurotic	60	44	12	1	0	27.3	2.3	0	16	9	2	1	56.3	12.5	6.3
		Not stated or Psychotic	6	4	0	—	—	0	—	—	2	0	—	—	—	—	—
	Total	566	438	88	9	4	20.1	2.1	0.9	128	70	8	6	54.7	6.3	4.7	
	RA Intermediate	Normal or Doubtful	161	109	37	17	6	34.0	15.6	5.5	52	37	11	8	71.2	21.1	15.4
		Neurotic	18	10	4	0	0	40.0	0	0	8	4	1	0	50.0	12.5	0
Not stated or Psychotic		8	4	1	0	0	25.0	0	0	4	3	2	1	75.0	50.0	25.0	
Total	187	123	42	17	6	34.1	13.8	4.9	64	44	14	9	68.8	21.9	14.1		
RA Probable and Definite	Normal or Doubtful	69	33	18	8	6	54.6	24.2	18.2	36	31	14	12	86.2	38.9	33.4	
	Neurotic	1	0	—	—	—	—	—	—	1	1	1	0	100	100	0	
	Not stated or Psychotic	3	1	0	—	—	0	—	—	2	2	1	0	100	50.0	0	
Total	73	34	18	8	6	52.9	23.5	17.7	39	34	16	12	87.2	41.0	30.8		

TABLE X
RELATIONSHIP OF OBESITY TO KNEE PAIN AND RADIOLOGICAL EVIDENCE OF
OSTEO-ARTHROSIS IN THE KNEE IN PERSONS AGED 35+ YRS
IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Sex	RA or Non-RA	Obesity	Total x rayed	Grade of Osteo-arthritis Knee (Radiological)					
				0-1			2-4		
				Total No.	With Pain		Total No.	With Pain	
No.	Per cent. of Total		No.	Per cent. of Total					
Male	Non-RA	Absent	419	370	76	20.5	49	15	30.6
		Present	131	102	32	31.4	29	20	69.0
		Not stated	0	—	—	—	—	—	—
		Total	550	472	108	22.9	78	35	44.9
	RA Intermediate	Absent	110	81	25	30.8	29	12	41.4
		Present	35	22	7	31.8	13	11	84.6
		Not stated	0	—	—	—	—	—	—
		Total	145	103	32	31.1	42	23	54.8
	RA Probable and Definite	Absent	16	13	7	53.9	3	2	66.7
Present		8	5	3	40.0	3	3	100.0	
Not stated		0	—	—	—	—	—	—	
	Total	24	18	10	55.5	6	5	83.3	
Female	Non-RA	Absent	344	304	55	18.1	40	16	40.0
		Present	220	134	33	24.6	86	54	62.8
		Not stated	2	0	—	—	2	0	0.0
		Total	566	438	88	20.1	128	70	54.7
	RA Intermediate	Absent	114	84	27	33.3	30	20	66.7
		Present	72	38	15	39.5	34	24	70.6
		Not stated	1	1	0	0	0	—	—
		Total	187	123	42	34.1	64	44	68.8
	RA Probable and Definite	Absent	36	22	11	50.0	14	13	92.8
Present		35	11	6	54.6	24	20	83.3	
Not stated		2	1	1	100.0	1	1	100.0	
	Total	73	34	18	52.9	39	34	87.2	

lateral metatarsophalangeal joints. In view of the small numbers with osteo-arthritis in this joint group, no significance can be attached to this.

Morning Stiffness.—It was not possible to grade morning stiffness according to replies from different observers as in the survey by Cobb and others (1957), since in most instances the question was asked by only one physician. The relationship of morning stiffness to pain has been studied in the hands and knees (Table XI, overleaf; Fig. 6, opposite; Fig. 7, overleaf).

It was not possible fully to confirm the findings of Cobb and his colleagues. Symptoms were rather more frequent in those with morning stiffness than in those without in the non-rheumatoid group regardless of whether osteo-arthritis was present or not. This applied in the intermediate group in both sexes in relation to osteo-arthritis in the knee, and in the males also in relation to generalized osteo-arthritis in the hands, but in the rheumatoid group symptoms were not consistently more frequent in

those with morning stiffness than in those without. The difference in the proportion with pain in the presence and absence of morning stiffness reaches at least as low as the 5 per cent. probability level in the various male categories, except in the non-rheumatoid males with osteo-arthritis Grade 2 to 4 where there are only fifteen subjects with morning stiffness. In female non-rheumatoids and both rheumatoid categories combined, the difference reaches at least as low as <0.05 probability only in osteo-arthritis of the knee Grade 0 to 1 but not at Grade 2 to 4.

Other Causes of Symptoms

Injury and Symptoms.—The importance of trauma as a cause of osteo-arthritis has been stressed in the past. Stecher (1948) observed that Heberden's nodes often resulted from injury. In a survey in Leigh the knee was the most frequent site of traumatic osteo-arthritis (Kellgren and Lawrence, 1958). We have therefore made an analysis of

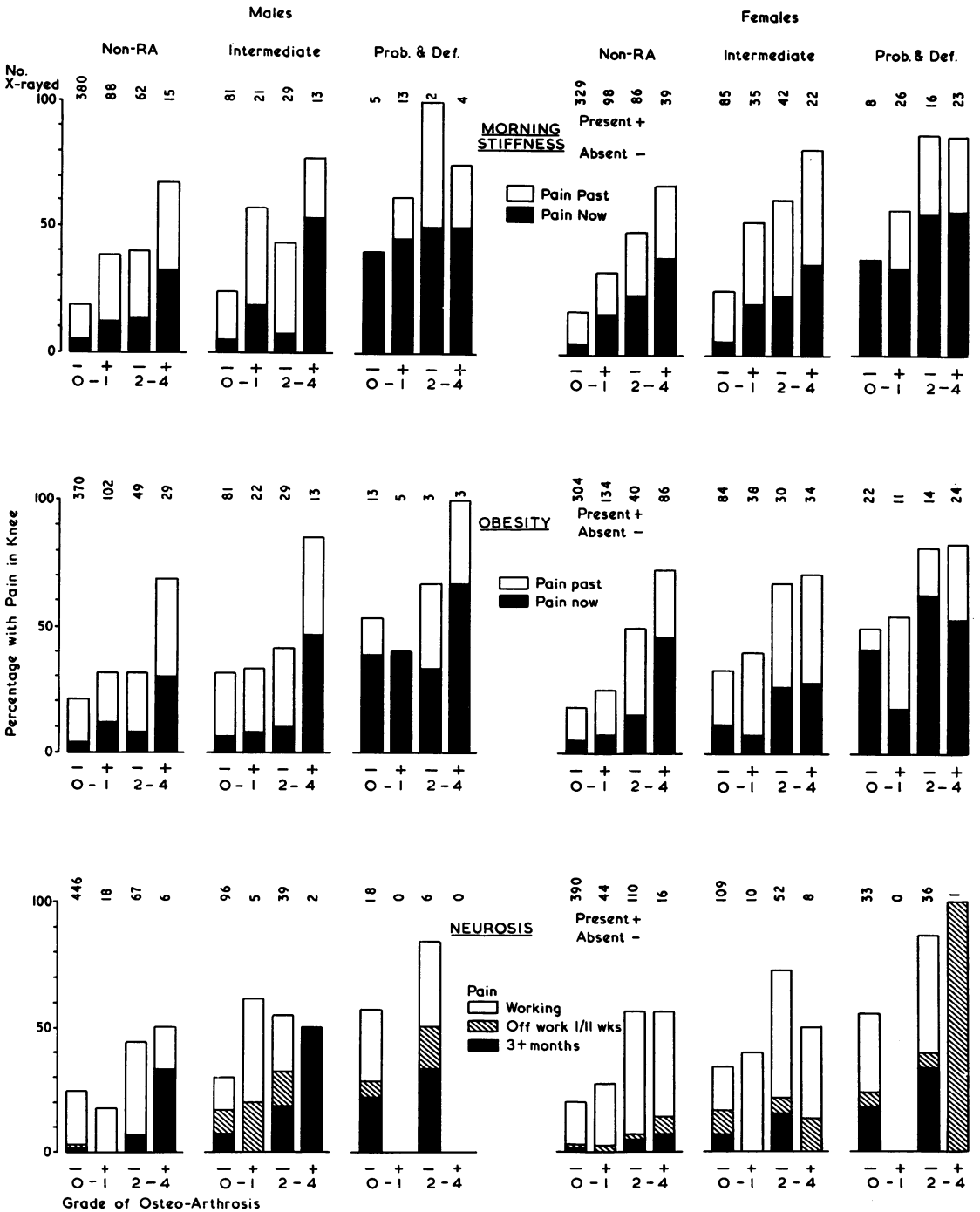


Fig. 6.—Relationship of morning stiffness, obesity, and neurosis to knee pain in osteo-arthritis of the knees, by grade of osteo-arthritis diagnosis, and sex.

TABLE XI

RELATIONSHIP OF MORNING STIFFNESS TO KNEE PAIN AND RADIOLOGICAL EVIDENCE OF OSTEO-ARTHRISIS IN THE KNEE IN PERSONS AGED 35+ YRS IN THE LEIGH AND WENSLEYDALE ENLARGED SAMPLES

Sex	RA or Non-RA	Morning Stiffness	Total x rayed	Grade of Osteo-arthritis Knee (Radiological)					
				0-1			2-4		
				Total No.	With Pain		Total No.	With Pain	
	No.	Per cent. of Total		No.	Per cent. of Total				
Male	Non-RA	Absent	442	380	72	19.0	62	25	40.3
		Present	103	88	33	37.5	15	10	66.7
		Not stated	5	4	3	75.0	1	0	0
		Total	550	472	108	22.9	78	35	44.9
	RA Intermediate	Absent	110	81	19	23.5	29	13	44.3
		Present	34	21	12	57.2	13	10	76.9
		Not stated	1	1	1	100.0	0	—	—
		Total	145	103	32	31.1	42	23	54.8
	RA Probable and Definite	Absent	7	5	2	40.0	2	2	100.0
Present		17	13	8	61.5	4	3	75.0	
Not stated		0	0	—	—	0	—	—	
Total		24	18	10	55.6	6	5	83.3	
Female	Non-RA	Absent	415	329	55	16.7	86	43	50.0
		Present	137	98	32	32.7	39	26	66.7
		Not stated	14	11	1	9.1	3	1	33.3
		Total	566	438	88	20.1	128	70	54.7
	RA Intermediate	Absent	127	85	22	25.9	42	26	62.0
		Present	57	35	19	54.3	22	18	81.8
		Not stated	3	3	1	33.3	0	—	—
		Total	187	123	42	34.2	64	44	68.8
	RA Probable and Definite	Absent	24	8	3	37.5	16	14	87.5
Present		49	26	15	57.7	23	20	87.0	
Not stated		0	0	—	—	0	—	—	
Total		73	34	18	53.0	39	34	87.2	

these two joints to determine the relationship between injury and symptoms. Of the 32 males with Grade 3 to 4 osteo-arthritis of the distal interphalangeal joints, three had pain; one of these had no history of injury, one had a history of fractured 2nd, 3rd, and 4th digits but on the side which was free of pain, and the third gave a history of injury only to the chest. Of the 135 with Grade 2 osteo-arthritis, eleven had pain; five of these gave a history of injury to the affected finger but no indication of its relationship to the painful episodes. In four injury had probably preceded the osteo-arthritis; one on the other hand had an injury to the right 2nd and 3rd digits but had bilateral pain in the distal interphalangeal joints, and one had been blown up in the first war but had no pain in the fingers till 1952. The remainder gave no history of a related injury. There was thus no direct relationship of injury to the onset of symptoms in any non-rheumatoid males with osteo-arthritis of the distal interphalangeal joints. Nor did any of the non-rheumatoid females

with osteo-arthritis of these joints give a history of injury to the fingers.

A history of injury to the knee joint is not uncommon especially in males. Of the ten males with Grade 3 to 4 osteo-arthritis in the knees and symptoms, one had had an injury to the legs, of which the left had been amputated, but the duration of symptoms in the right knee and the date of injury was not given. Another had a history of injury to the right knee but had osteo-arthritis and symptoms in both knees. A third gave a history of a cartilage operation to the affected knee 33 years previously but had had no injury before his recent onset of symptoms. A fourth gave a history of a dislocated cartilage but not in the knee which was causing pain. A fifth had had trouble with his knees since war wounds 36 years before. A sixth had twisted his right knee but had osteo-arthritis and symptoms in both knees. It would thus seem that injuries of the type likely to be remembered are not responsible for the onset of symptoms of osteo-arthritis. This

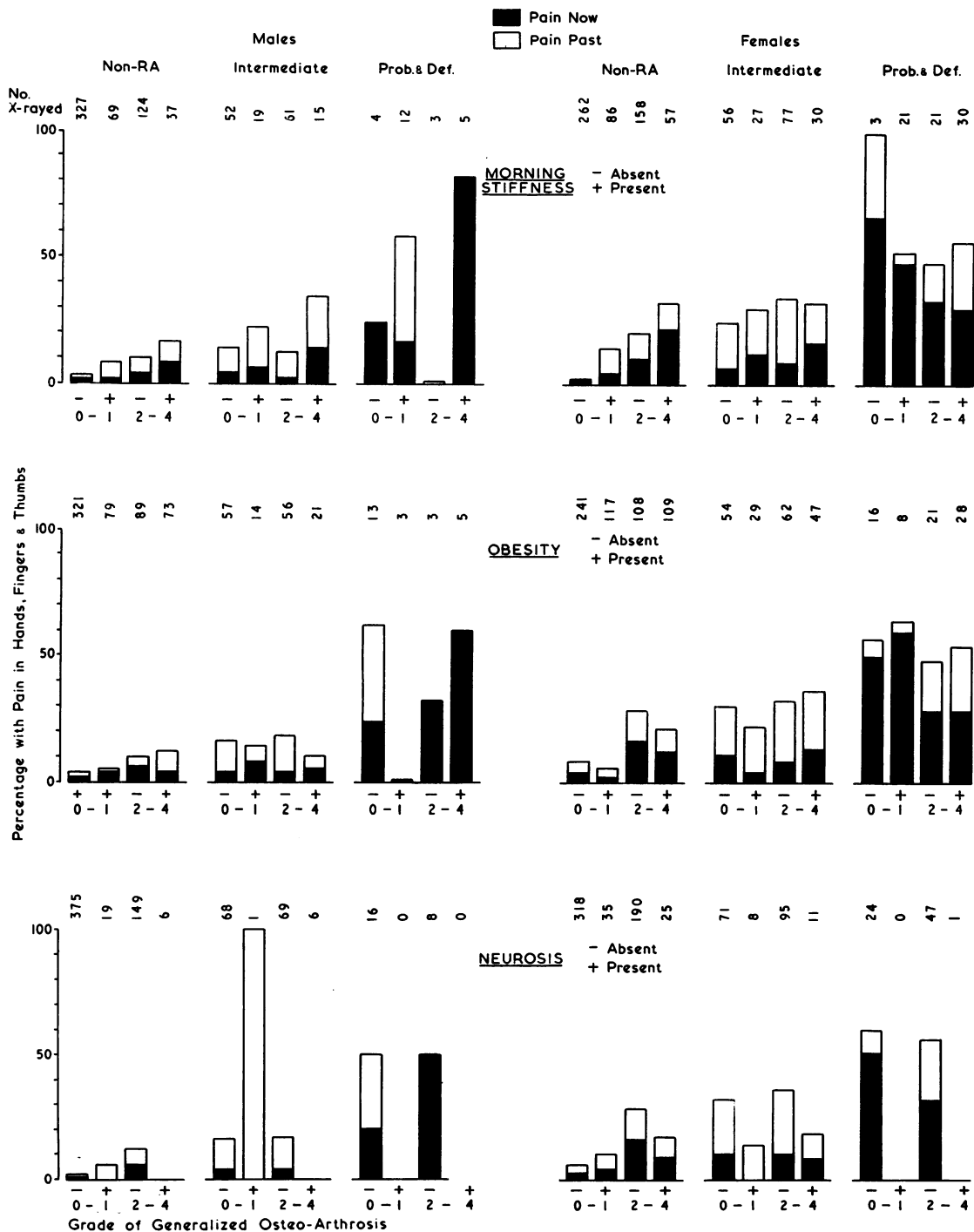


Fig. 7.—Relationship of morning stiffness, obesity, and neurosis to hand and finger pain in generalized osteo-arthritis of the hands, by grade of osteo-arthritis, diagnosis, and sex.

does not exclude minor trauma as a cause of the painful episodes associated with osteo-arthritis.

Neurosis and Complaint Rate.—It is often taken for granted that mentally unstable persons complain more and therefore are more likely to have symptoms in association with any organic disease which may be present. To determine whether this applied in osteo-arthritis, each respondent in the Leigh and Wensleydale surveys was given a grading for mental stability according to the following code:

- 0 = stable
- 1 = doubtful
- 2 = neurotic
- 3 = psychotic

This grading had previously been checked against a series of psychometric tests and found to correlate satisfactorily (Heron and Braithwaite, 1953). There was no evidence that the complaint rate in osteo-arthritis was affected by mental instability in either sex (Table IX and Figs 6 and 7). In each group the proportion losing work from rheumatic complaints was roughly the same in the neurotic and mentally stable persons. Loss of work from other complaints may have been greater in the less stable individuals but this was not determined. The neurotic individuals with osteo-arthritis of the knees lost slightly more work in the non-rheumatoid group, but this did not approach significance and the total complaint rate was much the same as in the stable and unstable persons with osteo-arthritis. Pain in the hands was actually less in the neurotic individuals with osteo-arthritis of the hands than in the mentally stable. Indeed none of the neurotic males with *x* ray evidence of generalized osteo-arthritis in the hands had symptoms (Fig. 7).

Damp Housing.—The number of damp houses in the population sample in Leigh was small. Only nineteen of the respondents there lived, at the time of the survey, in houses designated by the Council as very damp, *i.e.* having defective subsoil drainage or structural defects. There were seventy respondents living in damp houses in Wensleydale; these were houses in which the damp was severe enough to justify demolition but they were probably less damp than those defined by the stricter criteria in Leigh. In the damp houses the frequency of knee pain in those with *x* ray changes of osteo-arthritis was much the same as in the dry houses and, though there was more pain at the time of the survey and more loss of work in those living in the damp houses, the numbers involved were too small for any conclusions to be drawn. The only significant finding was a greater prevalence of knee pain in the non-rheumatoid females living in damp houses. This was not due to their having more osteo-arthritic

change or to a difference in age distribution, and there was no evidence that those with osteo-arthritis had moved out of the damp houses. In view of the large number of houses which were described as damp in Wensleydale, it must be considered whether less strict criteria were used to determine dampness in that area. When Leigh and Wensleydale were analysed separately, it was found that the complaint rate of osteo-arthritis of the knees from those living in damp houses in Leigh was higher than that from those in the dry houses. The numbers, though they supported previous findings in Leigh, were too small for any conclusions to be drawn.

Bone Cysts.—These are a prominent feature of osteo-arthritis. They have been shown to be associated with defects in the articular cartilage and subchondral bone, and it has been suggested that they are formed when synovial fluid is forced through under pressure during movement of the joint. If the fluid content of the cysts is under pressure at such times it would seem reasonable to expect that pain might result. Bone cysts are encountered most frequently in the metacarpophalangeal joints of the hands. In the Leigh and Wensleydale surveys, 46 males and 31 females had cysts in the neighbourhood of these joints. Pain was not significantly more frequent in those with cysts than in those without, and the numbers were too small to confirm the relationship to symptoms in those with osteo-arthritis. Bone cysts are a frequent finding in osteo-arthritis of the hips. Of the persons with Grade 3 to 4 osteo-arthritis of the hips in the Leigh and Wensleydale samples, 21 had bone cysts, of these eleven had had pain in the hips. Of the twenty without bone cysts, fourteen had had pain. Thus it would seem unlikely that bone cysts are an important cause of pain in the hips, nor was there an increased complaint rate in association with bone cysts in other joints studied.

Discussion

The increasing importance of osteo-arthritis in the community should first be stressed. Even in the past decade there has been an appreciable rise in the proportion of the population over the age of 55 years. It is in this age range that osteo-arthritis begins to produce incapacity.

From the analyses which have been presented, it is clear that, except in the lumbar apophyseal joints, the presence of osteo-arthritis carries a definite predisposition to symptoms in the affected region and that this predisposition is related to the degree of *x* ray change. The most striking association between the *x* ray changes of osteo-arthritis and symptoms was found in the 1st metatarsophalangeal

joints, where the frequency of symptoms rose from 2 to 26 per cent. with increasing x ray change in males. It is evident, however, that osteo-arthritis is a predisposing factor rather than a cause of symptoms, since most of those with the disease had no symptoms in the corresponding region. On comparing Figs 1 to 7 and the supporting Tables, the reader should bear in mind that, in our sample comprising the adult population of any age, the proportion of people with symptoms in osteo-arthritis Grade 0 to 1 is mostly based on sizeable total numbers (700 to 800 in the non-rheumatoid and 100 to 200 in the rheumatoid intermediate group) so that the upper 5 per cent. confidence limits lie, in the non-rheumatoid, only 1 to 4 per cent. and, in the rheumatoid intermediate group, only 6 to 9 per cent. above the percentages shown, whereas the total number of subjects with osteo-arthritis Grade 2 (mild but definite) is rarely above 100 and that of subjects with osteo-arthritis Grade 3 to 4 (moderate to severe) is rarely above thirty. Occasionally it is, even in the above groups, considerably smaller, so that one has to reckon here with much wider confidence limits. Thus, in the Tables for the various joint groups, the 5 per cent. confidence limits for the higher grades of osteo-arthritis are not uncommonly 20 per cent. or more below or above the percentages shown. This applies particularly to males, in whom (as shown in Table II) moderate or severe osteo-arthritis is less frequent than in females. We felt it was interesting enough to show the picture in full detail for the small probable and definite rheumatoid group, although the numbers involved here in the various sub-groups were often small.

In spite of these natural deficiencies of our sample, certain features repeat themselves with remarkable regularity in many of the joint groups examined. Except for the spinal, sacro-iliac, and knee joints, which will have to be considered separately, the proportion with pain lies, in the non-rheumatoids with osteo-arthritis Grade 0 to 1, usually well below 10 per cent., particularly in males, and there was a fairly smooth rise, seldom to less than 20 per cent. in those with osteo-arthritis Grade 3 to 4, again with somewhat lower proportions in males than females. The individual differences are significant at the 5 or 1 per cent. levels of probability as indicated in the Tables by single and double asterisks and the repetition of similar findings in many joint groups makes them the more impressive.

The hip joint seems to stand out somewhat in our data, with no pain at osteo-arthritis Grade 2 in male and female non-rheumatoids, but, considering that the upper 5 per cent. confidence limit of 0 per cent. in a sample of sixteen (taking males and fe-

males together) is 21 per cent., this finding by itself is statistically unremarkable and becomes interesting only in connexion with the tentative medical explanation given above. On adding those with Grade 2 osteo-arthritis to those with Grade 3 to 4, the combined group, again taking male and female non-rheumatoids together, still differs from Grade 0 to 1 at the 1 per cent. level of significance.

Though the total rheumatoid groups are considerably smaller than the non-rheumatoid, this—according to the differing age distribution—mainly affects osteo-arthritis Grade 0 to 1, while the other osteo-arthritic sub-groups are usually—but not without exception—more equal in size. This gives some strength to our further comparison. Indeed, it is easy to see from Figs 2 to 5 that, in practically all the joint groups, there is a rise in the proportion of symptoms with the grade of osteo-arthritis and that this closely parallels the rise in the non-rheumatoid groups, though from a higher starting point at osteo-arthritis Grade 0 to 1, which rarely lies lower than 10 per cent. in the intermediate and 30 per cent. in the probable and definite group. Again, significant differences between the lowest and the highest grades of osteo-arthritis have been indicated in the Tables, taking, in this calculation, intermediate, probable, and definite cases together. Considering the numbers involved, it is not surprising that the rheumatoids do not show as many significant differences as the non-rheumatoids, and the male rheumatoids less than the females, but the general trend seems undisputable.

The two spinal regions examined, the cervical and lumbar, present a picture very different from that of the other joint groups. Both male and female non-rheumatoids show, in osteo-arthritis Grade 0 to 1, a complaint rate of nearly 40 per cent. in the cervical spine and about 50 per cent. in the lumbar spine. This does not appear very different from the findings in the rheumatoid group. Since the osteo-arthritis Grade 0 to 1 sub-group is particularly large in both spinal regions, separate sortings (not shown in the Table and Figure) were made for osteo-arthritis Grade 0 and Grade 1, but the findings in each of these two grades were very much alike. There was some increase of complaint rate in non-rheumatoids with Grade 1 osteo-arthritis, but this was comparatively slight, whilst in the rheumatoids the picture at higher grades of osteo-arthritis was more irregular. This is not surprising, considering the small numbers involved. A clear rise in the number with symptoms from increasing severity of osteo-arthritis, however, came out in considering the lumbar spine in the male rheumatoids, probably because of a closer linkage than in the non-rheuma-

toid males with lumbar disk degeneration, which started at an earlier age in the rheumatoids than in the non-rheumatoids. It seems likely that disk degeneration plays a major role in the causation of pain in the spinal regions. This subject will be dealt with more fully in another paper.

The factors which determine whether symptoms arise are not easily determined. Cobb's suggestion that most of the symptoms of osteo-arthritis are due to rheumatoid arthritis is not supported by this study. Those with rheumatoid arthritis had on the whole more joint pain whether osteo-arthritis was present or not, but there was no evidence of any synergic effect, and indeed there was in most joint groups a closer relationship between the grade of osteo-arthritis and symptoms in the non-rheumatoid than in the rheumatoid subjects. In those with both diseases, the effect appears to be purely additive. If this is so, it would be expected that those joints, such as the metacarpophalangeal and cervical apophyseal, which are frequently affected in rheumatoid arthritis, would show less correlation between osteo-arthritis and symptoms in females whether overt rheumatoid arthritis is present or not. This is in fact the case. Cobb based his conclusions mainly on an association between morning stiffness and the complaint rate due to osteo-arthritis. When the osteo-arthritis complaint rate in those with and without morning stiffness is compared in the Leigh and Wensleydale populations, it is evident that the rate is increased in those with stiffness but is less affected by morning stiffness than by osteo-arthritis. Most osteo-arthrotic subjects, when asked about morning stiffness, stated that their stiffness was increased by any type of rest and was not particularly severe in the mornings.

There was no evidence that the complaint rate due to osteo-arthritis was different in males and females, except possibly in the distal interphalangeal joints of the fingers, where, in the absence of rheumatoid arthritis, it rose from 1 to 25 per cent. in females with increasing severity of osteo-arthritis but only from 1 to 9 per cent. in males. This may be due to the greater number of affected distal interphalangeal joints in females who more often have a generalized form of the disease, whereas in males the condition is more often traumatic and affects a single joint.

The absence of any correlation between *x*-ray changes and symptoms in the lumbar spine is not surprising, since the effect of osteophyte formation on the apophyseal joints may well be to stabilize the spine rather than to diminish its stability. In general, the relationship of *x*-ray changes to symptoms appears to be determined mainly by the

natural mobility of the joint. This is well illustrated in the fingers, where the association of symptoms with *x*-ray changes is greater in the proximal than in the distal interphalangeal joints.

The present data do not permit a definite conclusion as to the cause of painful episodes in osteo-arthritis. Overt trauma, though a frequent cause of the disease, seems to have little effect on the complaint rate in those with pre-existing disease. Mechanical factors must play an important part, as shown by the effect of obesity on the knees and by the striking difference in complaint rate between those with Grade 2 and with Grade 3 to 4 osteo-arthritis. The main difference between these two grades is the degree of wear of the articular cartilage, which is negligible in the Grade 2 but appreciable in those with Grade 3 change or above. The degree of trauma which is required to produce ligamentous strain in such unstable joints may well be so slight as to be forgotten by the respondent. Moreover, the relationship to trauma may be direct. Lloyd-Roberts (1953) found that fragments from the degenerate articular surfaces, presumably detached by trauma are taken up by the synovial membrane and give rise to an inflammatory response and fibrosis. The shortening of the capsule which follows may, he thinks, give rise to pain on movement. According to Trueta (1954), there is an associated hypervascularity of juxta-articular bone which may also be a source of pain.

The effect of damp is not well demonstrated in this survey, possibly because of the small number of really damp houses to be found in a sample of this size. It would seem likely that the criteria for dampness were less rigid in Wensleydale, and this may have obscured a real effect. It is perhaps of interest that, in the original Leigh survey, when all houses classified as damp by the sanitary inspector were included, there was little difference in the prevalence of clinical osteo-arthritis and disk degeneration, whereas when only very damp houses (*i.e.* those with defective subsoil drainage or structural defect) were included the difference was more marked. We consider that the harmful effect of damp housing must remain in doubt.

The association of symptoms with bone cysts must be considered unproven. It would seem likely that these cysts are an important cause of pain in osteo-arthritis, though they may sometimes give rise to pain independently of the presence of the arthrosis.

The symptomatology of generalized osteo-arthritis has not been discussed in this paper, as it is to be analysed in detail in a later communication dealing specifically with the generalized forms of the disease.

Summary

A combined urban-rural population in the North of England was questioned about musculo-skeletal pain and loss of work, and was submitted to a clinical examination of the joints and to a routine series of joint x rays. A sample of blood was tested for rheumatoid factor by the sheep-cell agglutination test. The x rays were read without knowledge of the history or clinical state.

After standardization of the adult population for age and sex by the unweighted mean, the prevalence of osteo-arthritis was found to be 52 per cent. in males and 51 per cent. in females. Five or more joint groups were affected in 9 per cent. of males and 12 per cent. of females, the proportion increasing rapidly with age to a maximum of 37 per cent. in males and 49 per cent. in females aged 65 and over. When minimal disease was excluded, the prevalence of osteo-arthritis was 19 per cent. in males and 22 per cent. in females, and five or more joint groups were affected in 0.5 per cent. of males and 1.8 per cent. of females. Standardization to the 1961 population of England and Wales gave slightly lower prevalences in the males.

On the basis of the clinical, radiological, and serological findings, the population was divided into a rheumatoid and a non-rheumatoid group. In the non-rheumatoid group there was a significant correlation between x-ray changes of osteo-arthritis and the frequency of symptoms in the corresponding distribution. This was present in all joints except those of the lumbar spine and was only marginal in the cervical spine. In the rheumatoid groups there was a higher rate of symptoms, but the increase of complaints with severity of osteo-arthritis was no greater than in the non-rheumatoid group. Morning stiffness was associated with an increase of symptoms in the hands and knees in the non-rheumatoid group regardless of whether osteo-arthritis was present or not.

Obesity was associated with an increase of pain in the knees in persons with osteo-arthritis but had little influence in those without.

Persons with osteo-arthritis who had been classified as neurotic did not have a higher complaint rate than those not so classified, nor did those with a history of injury.

Persons with osteo-arthritis living in damp houses did not have significantly more than the expected proportion of symptoms, but the numbers in very damp houses were small.

Symptoms were only slightly more when bone cysts were present in the metacarpophalangeal joints, but showed no relationship to symptoms in the hip joints.

We wish to express our thanks to Prof. J. H. Kellgren for permission to use his x-ray readings of the hand films and for his advice and criticism. We are indebted to Mr. H. Clusky, Sanitary Inspector to the Leigh Town Council, and to Mr. K. Jolley, of the Hawes (Wensleydale) Rural Council, for providing information on the damp houses in their areas.

For the statistical tables appearing in this paper a compiler consisting of "Atlas Autocode" and a number of inter-related routines for the "Analysis of Surveys" by D. Y. Downham, J. McKay, and D. Rutovitz and a guide to its use by the Manchester University Department of Social and Preventive Medicine (unpublished communication) were used. One of the authors (FB) received from D. Y. Downham some personal guidance in the application of the compiler. Our thanks are due to this team for their valuable assistance and to Manchester University for access to the Atlas Computer.

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L'ostéo-arthrose.—Sa fréquence dans la population et le rapport entre les symptômes et les altérations radiologiques.

RÉSUMÉ

On interrogea une population combinée urbaine et rurale au Nord d'Angleterre sur la douleur musculo-squelettique et la perte du temps de travail et on la soumit à un examen clinique des articulations et à une série systématique de radiographies. On préleva du sang pour la réaction de Waaler-Rose et pour y rechercher le facteur rhumatoïde. On interpréta les radiographies sans connaître les antécédents ou l'état clinique des sujets.

Après avoir ajusté sans biais les chiffres de la population adulte, ayant égard à l'âge et au sexe, à la dis-

tribución normale standardisée, on trouva que 52 pour cent des hommes et 51 pour cent des femmes furent atteints d'ostéo-arthrose. Cinq ou plus groupes d'articulations furent atteintes en 9 pour cent des hommes et 12 pour cent des femmes. Cette proportion augmenta rapidement avec l'âge pour atteindre un maximum de 37 pour cent pour les hommes et 49 pour cent pour les femmes après l'âge de 64 ans. Lorsqu'on exclut la lésion "minime", on trouve une fréquence d'ostéo-arthrose de 19 pour cent chez des hommes et de 23 pour cent chez des femmes; l'atteinte d'un minimum de cinq groupes d'articulations s'observa alors en 0,5 pour cent des hommes et en 1,8 pour cent des femmes. Lorsqu'on standardise la distribution pour la faire correspondre à celle de la population anglaise et galloise de l'an 1961, on trouve la fréquence un peu plus basse chez les hommes.

Selon les résultats de l'examen clinique, radiologique et sérologique, la population fut divisée en rhumatoïde et non-rhumatoïde. Dans le groupe non-rhumatoïde il y eut une corrélation significative entre les signes radiographiques d'ostéo-arthrose et la fréquence des symptômes dans la distribution correspondante. L'ostéo-arthrose fut présente dans toutes les articulations sauf celles de la colonne lombaire et ne fut que marginale dans la colonne cervicale. Dans le groupe rhumatoïde, les symptômes furent plus fréquents, mais cette fréquence, liée à la sévérité de l'ostéo-arthrose, ne fut pas plus haute que celle dans le groupe non-rhumatoïde. L'enraidissement matinal fut associé à l'augmentation des symptômes aux mains et aux genoux dans le groupe non-rhumatoïde, indépendamment de l'existence de l'ostéo-arthrose.

L'obésité fut associée à l'augmentation de la douleur aux genoux chez des personnes atteintes d'ostéo-arthrite, mais non pas chez les autres.

Les personnes atteintes d'ostéo-arthrose et désignées comme "névrosées" n'accusèrent pas plus de symptômes que les autres; il en fut de même pour les accidentés.

Les personnes atteintes d'ostéo-arthrose qui habitaient dans une maison humide n'accusèrent guère plus de symptômes, mais le nombre de maisons très humides était petit.

Il y eut un peu plus de symptômes en présence des kystes articulaires métacarpophalangiennes, sans rapport toutefois aux symptômes articulaires de la hanche.

Osteoartritis.—Su frecuencia en la población y las relaciones entre los síntomas y las alteraciones radiológicas

SUMARIO

Se interrogó una población combinada rural y urbana del Norte de Inglaterra sobre el dolor músculo-

esquelético y ausencias del trabajo y se la sometió a un examen clínico de las articulaciones y a una serie sistemática de radiografías. Se recogió sangre para la reacción de Waaler-Rose y para buscar el factor reumatoide. Se interpretaron las radiografías sin conocer la historia o la condición clínica de los sujetos.

Después de haber estandarizado sin bias la distribución de la población adulta, tomando en cuenta la edad y el sexo, se halló que un 52 por ciento de los hombres y un 51 por ciento de las mujeres tuvieron osteoartritis. Cinco o más grupos de articulaciones fueron afectados en un 9 por ciento de los hombres y un 12 por ciento de las mujeres. Esta proporción aumentó rápidamente con la edad para llegar a su máximo del 37 por ciento en los hombres y del 49 por ciento en las mujeres de más de 64 años. Cuando se excluye la lesión "minimal" se observa la osteoartritis en un 19 por ciento de los hombres y en un 23 por ciento de las mujeres y la implicación de cinco o más grupos de articulaciones ocurre en un 0,5 por ciento de los hombres y en un 1,8 por ciento de las mujeres. Cuando se estandariza las cifras para hacerlas corresponder a las de la población inglesa y galesa de 1961, se halla una frecuencia algo menor en los hombres.

Según los resultados del examen clínico, radiológico y serológico, la población fué dividida en grupos reumatoide y non-reumatoide. En el grupo non-reumatoide hubo una correlación significativa entre las alteraciones radiográficas de osteoartritis y la frecuencia de los síntomas en la distribución correspondiente. Esto se vió en todas las articulaciones excepto en las de la columna lumbar y marginalmente en la columna cervical. En el grupo reumatoide los síntomas fueron más frecuentes, pero esta frecuencia, ligada a la severidad de la osteoartritis, no fué mayor que la en el grupo non-reumatoide. La rigidez matinal fué asociada con el aumento de los síntomas en las manos y las rodillas en el grupo non-reumatoide, independientemente de la existencia de la osteoartritis.

La obesidad fué asociada al aumento del dolor en la rodilla en personas con osteoartritis, pero no lo fué en los demás.

Las personas con osteoartritis clasificadas como neuróticas no tuvieron más síntomas que los demás; lo mismo se aplica a los con una historia de accidente.

Personas con osteoartritis viviendo en casas húmedas no acusaron significativamente más síntomas, pero el número de casas muy húmedas fué pequeño.

Hubo algo más síntomas en presencia de quistes metacarpofalangeos, pero no hubo tal relación con síntomas articulares de la cadera.