EXTENDED REPORT

Osteoarthritis of finger joints in Finns aged 30 or over: prevalence, determinants, and association with mortality

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Background: Prevalence and risk factors of osteoarthritis (OA) in finger joints have been amply explored in previous studies. However, no study has focused on finger joint OA as a predictor of mortality.

Objective: To investigate finger joint OA for its associations with alleged risk factors and with life expectancy in an extensive health survey.

Methods: From 1978 to 1980 a representative population sample of 8000 Finns aged 30 years or over was invited to participate in a comprehensive health examination; 90% accepted. Hand radiographs were taken from 3595 subjects. By the end of 1994, 897 of these had died.

Results: The prevalence of OA of Kellgren's grade 2 to 4 in any finger joint and in at least two symmetrical pairs of distal interphalangeal joints (DIPs) was 44.8% and 16.0%, respectively. Age and body mass index were significant determinants for OA both in any finger joint and in symmetrical DIP OA. The history of physical workload in women showed a positive association with OA in any finger joint. Smoking in men seemed to protect against symmetrical DIP OA. As adjusted for the determinants above, symmetrical DIP OA predicted mortality in women (relative risk (RR), 1.23; 95% confidence interval (95% CI) 1.01 to 1.51), but not in men (RR 0.89; 95% CI 0.68 to 1.16). In men, however, OA in any finger joint significantly predicted cardiovascular deaths (RR 1.42; 95% CI 1.05 to 1.92).

Conclusion: OA in any finger joint and symmetrical DIP OA have different risk factor profiles and predict mortality in different patterns between men and women.

The hand is a common site of peripheral osteoarthritis (OA), which is underestimated as a cause of disability and, in addition, its effect on quality of life may be considerable.¹ The most common sites for finger OA are distal interphalangeal joints (DIPs), proximal interphalangeal joints (PIPs), and the base of the thumb.^{2–6} Cross sectional studies have estimated the prevalence of radiographic hand OA in those over 65 years as ranging from 64 to 78% in men and 71 to 99% in women.^{5–10} Several studies have suggested an association between hand OA and osteoarthritis in weight-bearing joints.^{11–14} Therefore, hand OA may also be an important indicator of a systemic tendency towards OA, which may involve the weightbearing joints.¹⁵

Present theories of the pathogenesis of OA suggest that both systemic and local factors affect the likelihood of OA development in a joint.^{16–17} It is thought that the systemic factors (age, sex, racial characteristics, genetics, etc) establish the foundation for cartilage properties but that the local biomechanical factors (degree of joint loading, joint injury, increased weight bearing on account of obesity, joint deformity, etc) have a crucial influence on the final qualities of articular cartilage, its wellbeing, or breakdown. Thus, local biomechanical factors determine the site and severity of OA.

Obesity as a risk factor for OA has been thought to affect development of the disease through mechanical loading of weightbearing joints.^{18–20} On the other hand, there is also evidence of an association between hand OA and obesity.^{21–23} In addition to age and obesity, female sex and workload are alleged risk factors for OA in finger joints.

There is evidence that OA in general may predict shortened life expectancy.²⁴ It is not known, however, whether OA predicts cardiovascular mortality. Such an association might be expected, because patients with OA seem to have an adverse profile of metabolic risk factors for coronary heart disease.^{25–27}

To date, in most studies on radiographic hand OA, the population has been limited to small geographical areas, has involved only one sex, or the study group has been small.^{3–4 6 7 10 11 14 28} We therefore chose to examine these relationships using the Mini-Finland Health Survey.²⁹ This is an epidemiological project aimed at a comprehensive evaluation of the health of the Finnish adult population. We investigated OA in finger joints and its associations with age, sex, smoking, body mass index (BMI), pain, functional disability, mortality, and hip and knee OA.

MATERIALS AND METHODS

Population

The study population was a stratified two stage cluster sample drawn from the population register to represent Finnish adults aged 30 years or over.²⁹ In the first stage, 40 representative areas were selected. In the second stage, a systematic sample of inhabitants was drawn from each area. The sample comprised 8000 people (3637 men, 4363 women) from 69 municipalities (fig 1).

Baseline examination

The subjects were gathered between 1977 and 1980. The examinations were carried out by the mobile clinic of the Social Insurance Institution in two phases: a screening phase and a diagnostic (clinical) phase. A total of 7217 people (90% of the sample) participated in the screening phase. The distribution of sex, age, and level of education among the

Abbreviations: BMI, body mass index; CI, confidence interval; DIP, distal interphalangeal; IP, interphalangeal; MCP, metacarpophalangeal; OA, osteoarthritis; OR, odds ratio; PIP, proximal interphalangeal; RR, relative risk

Figure 1 The flow of operations during the Mini-Finland Health Survey.

participants corresponded closely with that of the whole Finnish population.²⁹

The methods used for studying musculoskeletal diseases and the basic results of the Mini-Finland Health Survey have been described in detail elsewhere.²⁹⁻³⁰ Together with the invitation to the health examination, the subjects received a questionnaire eliciting information on previous diseases, admissions to hospital, operations, and drugs used. A specific interview on the musculoskeletal system included questions on musculoskeletal pains and disorders, and their consequences. To screen musculoskeletal impairment a standardised joint function test, including flexion of fingers and opposing movement of the thumb, was carried out by specially trained nurses.

The subjects with a disease history, symptoms, or findings suggestive of musculoskeletal diseases were invited to participate in the diagnostic (clinical) phase (fig 1). Of those examined, 3775 (52%) fulfilled at least one of the screening criteria, and a posteroanterior hand x ray examination was made in 3595 people (95%). Physical examinations were carried out by specially trained doctors according to a standardised written protocol.²⁹⁻³³ This included measures for grading deformity, including Heberden's nodes in fingers, mobility, and tenderness of all limb joints. OA was diagnosed on the basis of medical history, symptoms, and physical examination, and then further divided into different diagnostic subcategories.

A follow up musculoskeletal examination of a sample of study subjects was carried out about one year after the baseline examination to investigate the stability of findings over time.³² Repeated physical status of hand joints was available for 204 subjects. Among these subjects, the prevalence of Heberden's nodes was 10.8% at the baseline examination and 9.8% at the follow up examination. The κ value for agreement

between the two examinations was 0.58 (crude agreement 92.2%), and McNemar's test indicated no systematic difference ($p=0.62$).

Radiological methods

Standard criteria were used for assessing the joint space narrowing and osteophytes.³⁴⁻³⁵ Radiographs were read by a radiologist who was unaware of the clinical findings.³⁶ Each joint of both hands was graded individually, and classified as follows: 0 = no OA; 1 = doubtful OA; 2 = minimal OA; 3 = moderate OA; 4 = severe OA. OA was considered to be present if the grade was 2 or more in at least one of the joints. The reliability of the readings was estimated by measuring intraobserver and interobserver agreement, using the correlation coefficient κ as an indicator of agreement.³⁶ The reader classified 84.9% of the joints in the same way at the first and second reading; κ was 0.71, which is generally regarded as a good agreement. Two readers classified 73.5% of the joints in the same way; κ was 0.53, which is considered a moderate agreement. When classifying the examinees as "OA present" and "OA absent", the intraobserver agreement was excellent; κ was 0.89.³⁶ Both interobserver and intraobserver agreements were highest in DIP and metacarpophalangeal (MCP) joints and lowest in wrist joints.

Two different kinds of finger OA types were defined for the current study: OA of Kellgren's grade 2 to 4 in any finger joint (OA in any finger joint) including DIP, PIP, MCP, and the thumb interphalangeal (IP) joints. A subcategory for OA in any finger joint was OA of Kellgren's grade 2 to 4 in at least two DIP joints symmetrically (symmetrical DIP OA) including all DIP joints except the thumb IP joints.

Definition of risk factors

The basic questionnaire included questions about the participants' present and previous occupations involving exposure to (a) lifting or carrying heavy objects, (b) stooped, twisted, or otherwise awkward work postures, (c) vibration of the whole body or the use of vibrating equipment, (d) continuously repeated series of movements, and (e) paced work (working speed determined by a machine). The subject was considered to have been exposed to one of the above if they reported it either in the most recent or present occupation. These exposures were recorded as dichotomies (no = 0, yes = 1), and the total number of these risk factors was designated "the sum index of physical stress at work".³²

Standing height and weight were measured at the screening examination and BMI (weight/height² in kg/m²) was used as a measure of relative weight. Smoking history was obtained in a standard interview. The following categories were used in this study: never smoked; ex-smoker; current smoker of pipe or cigars or fewer than 10 cigarettes a day; and current smoker of 20 cigarettes or more a day. The education level was divided into three classes according to the number of years of education.

Follow up

The mortality of the subjects has been systematically followed up since the baseline examination. The mortality information was obtained from the Central Statistical Office of Finland. The principal causes of death were coded according to the 8th Revision of the International Classification of Diseases. This study covers the deaths that occurred until the end of 1994, denoting a follow up period of 15-17 years and an overall experience of 43 632 person-years. Altogether 897 deaths occurred during the follow up; of these, 497 were due to cardiovascular diseases.

Statistical methods

Adjusted prevalences of hand OA were estimated using a general linear model.³⁷ Differences in the prevalence of finger OA

Figure 2 The prevalence and 95% CIs of OA of Kellgren grade 2 to 4 in any finger joint (white columns), OA in at least two distal interphalangeal joints symmetrically (dark grey columns), and one or more Heberden's nodes (light grey columns) in men and woman aged 30 or over.

between subgroups or between levels of suspected risk determinants and their first degree interaction terms were analysed with a logistic regression model.³⁸ Relative risks were estimated as adjusted odd ratios. The Cox's lifetable regression model was used to estimate the associations between finger OA and mortality.³⁹ Potential confounding and effect modifying factors were also entered into the models. Significance of interactions was tested by entering interaction terms into the models. The 95% confidence intervals (95% CIs) of the relative risk (RR) estimates and the likelihood ratio statistics (χ^2 values expressed as p values) were based on the models.

RESULTS

Prevalence of finger OA

The prevalence of OA in any finger joint and its subcategory, the symmetrical DIP OA, increased with age in both sexes (fig 2). Table 1 presents the prevalence rates of OA in each joint by sex and age. The age adjusted prevalence of OA in any finger joint for men and women was 44.3% and 48.1%, respectively, and the corresponding prevalence of symmetrical DIP OA was 10.2% and 20.6%, respectively. The prevalence of Heberden's nodes was 4.6% for men and 13.4% for women (fig 2).

Determinants

There was a positive gradient between BMI and the prevalence of both OA in finger joint and symmetrical DIP OA (table 2). The subjects with BMI ≥ 35 kg/m² had an about twofold risk of OA in any finger joint or symmetrical DIP OA as compared with subjects with normal BMI (20.0–24.9 kg/m²). The associations were similar in men and women, and adjustments for the other risk determinants did not notably affect the odds ratios.

The sum index of physical stress at work showed different associations with OA in any finger joint between men and women (p value for interaction = 0.04): there was a positive gradient in women but no association in men (table 2). The association was mainly due to close associations between

workload and OA in PIP and MCP joints among women (data not shown). The physical stress index did not show any relation to symmetrical DIP OA in either sex.

There was a decreased prevalence of symmetrical DIP OA in male smokers compared with never smokers, but such an association could not be seen in women (p value for interaction = 0.03). In the men who smoked 20 cigarettes or more a day, the odds ratio of symmetrical DIP OA was 0.40 (95% CI 0.18 to 0.86). For any finger OA, smoking also showed a weak negative association in men but not in women.

Pain, impaired function, and comorbidity

There was a moderately increased prevalence of restriction in the flexion of fingers 2 to 4 (OR 1.59; 95% CI 1.08 to 2.34) and in the opposing movement of the thumb (OR 1.42; 95% CI 1.00 to 2.03) in OA in any finger joint, but not in symmetrical DIP OA. Finger pain associated positively with both OA in any finger joint (odds ratio (OR) 1.38; 95% CI 1.14 to 1.67) and symmetrical DIP OA (OR 1.68; 95% CI 1.34 to 2.10).

Heberden's node seemed to be associated more often with the risk of symmetrical DIP OA (OR 4.97; 95% CI 3.81 to 6.50) than with OA in finger joint (OR 3.47; 95% CI 2.51 to 4.80). We found no relation between the radiological hand OA and clinically diagnosed knee OA or hip OA. Nor was there any relation between radiological hand OA and neck pain or low back pain. Neither symmetrical DIP OA nor OA in any finger joint showed any significant association with screening positively among the 1092 subjects who were examined independently of the screening results, the ORs being 1.16 (95% CI 0.75 to 1.80) and 1.33 (80.95 to 188), respectively.

The presence of at least one Heberden's node was closely associated with finger pain (OR 2.56; 95% CI 2.00 to 3.27), with restricted flexion of fingers 2 to 4 (OR 2.36; 95% CI 1.54 to 3.62), and with restricted opposing movement of the thumb (OR 2.11; 95% CI 1.34 to 3.32). There was a slightly increased risk of having one or more Heberden's nodes in the finger if the person also had knee OA (OR 1.31; 95% CI 1.01 to 1.69) or

Table 1 Prevalence of hand OA of Kellgren grade 2 or more in right (R) and left (L) hand in men and women aged ≥ 30 years

Joint	Men						Women					
	30–45	45–55	55–64	65–74	≥ 75	Total	30–45	45–55	55–64	65–74	≥ 75	Total
DIP2R	0.8	7.4	22.2	34.0	51.0	15.7	1.0	9.4	37.3	57.7	67.4	29.0
DIP2L	0.8	5.8	19.0	34.8	35.4	13.7	1.0	7.7	32.0	56.2	62.2	26.6
DIP3R	0.4	3.7	12.8	23.7	30.2	9.6	0.4	8.3	28.2	46.0	49.2	22.4
DIP3L	1.0	4.2	16.1	30.0	31.3	11.8	1.2	8.3	28.8	46.2	56.0	23.4
DIP4R	1.2	4.5	12.8	22.9	24.0	9.5	1.0	6.8	24.2	42.8	46.6	20.4
DIP4L	0.8	4.5	11.4	21.3	31.3	9.2	0.2	5.7	24.2	40.3	48.2	19.6
DIP5R	1.7	8.7	24.2	30.4	40.6	15.5	0.8	11.8	39.6	61.6	65.3	30.6
DIP5L	2.3	10.9	26.7	36.4	44.8	18.0	0.6	11.8	40.0	62.1	68.9	31.1
PIP2R	0	0.5	3.4	5.1	13.5	2.6	0	1.5	9.5	16.1	27.5	8.4
PIP2L	0	0	2.3	8.3	15.6	2.8	0	0.8	7.4	17.9	21.8	7.6
PIP3R	0	1.3	4.5	8.3	12.5	3.5	0.2	2.0	9.5	27.1	36.3	11.6
PIP3L	0.2	0	3.4	11.1	14.6	3.5	0.2	1.5	8.0	22.0	31.1	9.6
PIP4R	0	1.1	2.8	6.7	16.7	3.0	0	1.1	7.4	17.6	25.4	7.9
PIP4L	0	0.5	3.7	7.9	14.6	3.1	0	0.8	6.3	19.1	26.4	8.0
PIP5R	0	0.8	3.1	7.1	12.5	2.8	0.4	2.1	5.5	15.1	24.4	7.2
PIP5L	0.6	0.8	6.5	9.9	22.9	4.9	0.2	1.3	9.5	26.4	33.2	11.0
IP1R	0.8	3.7	16.5	27.7	35.4	11.5	0.6	4.6	20.8	43.3	52.9	19.7
IP1L	0	3.7	11.1	25.7	27.1	9.2	0.4	4.2	15.0	34.0	40.4	15.2
MCP1R	1.5	3.5	11.7	21.0	30.2	9.2	0.4	1.5	6.1	11.5	19.7	6.0
MCP1L	0.8	2.9	8.0	13.8	20.8	6.3	0	1.5	3.4	7.3	16.6	4.2
MCP2R	0.4	0.2	3.1	7.1	11.5	2.8	0.2	2.2	4.5	15.1	20.7	6.6
MCP2L	0	0	2.0	7.9	9.4	2.3	0	0.8	2.8	10.8	11.9	4.1
MCP3R	0	0.8	2.0	7.9	11.5	2.6	0	0.8	3.4	10.3	14.5	4.4
MCP3L	0	0.5	0.9	5.9	9.4	1.9	0	1.5	2.8	7.8	12.4	3.7
MCP4R	0	0.8	1.4	2.0	3.1	1.0	0	0.2	1.5	3.4	7.3	1.8
MCP4L	0.2	0.8	0.6	2.8	1.0	1.0	0	0.7	0.9	3.4	6.2	1.6
MCP5R	0	0.3	1.7	1.6	2.1	0.8	0	0.2	0	3.2	2.6	0.9
MCP5L	0.6	0.3	2.0	2.4	3.1	1.3	0.2	0.4	1.1	3.7	3.1	1.4
CMC1R	0.4	1.3	4.3	7.5	18.6	3.8	0.2	3.1	8.7	20.1	27.5	9.4
CMC1L	0.4	1.6	7.7	9.9	17.7	4.9	0.2	3.7	12.5	24.5	31.6	11.7

DIP, distal interphalangeal joint; PIP, proximal interphalangeal joint; MCP, metacarpophalangeal joint; IP, thumb interphalangeal joint; CMC, carpometacarpal joint.

hip OA (OR 1.14; 95% CI 0.82 to 1.59). Chronic neck or back pain was not associated with the prevalence of Heberden's nodes.

Mortality

A significant difference was seen between men and women for symmetrical DIP OA in its prediction of total mortality (p value for interaction = 0.001). After adjusting for age, education, physical stress at work, BMI, and smoking, the relative risk of death in women was 1.23 (95% CI 1.01 to 1.51), whereas in men the association seemed even inverse (RR 0.89, 95% CI 0.68 to 1.16). For non-symmetrical DIP OA among women the corresponding relative risk was 1.02 (95% CI 0.73 to 1.42). The presence of OA in any finger joint did not significantly predict total mortality. In men, however, OA in any finger joint significantly predicted cardiovascular deaths (table 3). No other significant association was found between OA in any finger joint and cause-specific mortality (data not shown).

The associations between finger OA and mortality were similar for the whole range of subjects with different BMIs. For total mortality in women, the p value for interaction of BMI and symmetrical DIP OA was 0.50. For cardiovascular mortality in men, the p value for interaction of BMI and OA in any finger joint was 0.75.

DISCUSSION

The results of the current study confirm that finger OA is highly prevalent in the general population. However, its impact on pain and disability is only modest. In line with previous studies, obesity and physical workload showed close associations with the risk of finger OA. Smoking seemed to

carry a protection against symmetrical DIP OA in men but not in women. In general, the patterns of risk factors were different for OA in any finger joint and for its subcategory, symmetrical DIP OA. When adjusted for the risk determinants, symmetrical DIP OA predicted mortality in women but not in men. In the men, however, OA in any finger joint significantly predicted cardiovascular mortality.

Radiology is useful in epidemiological studies for biological determinants because it reflects cartilage degradation, especially in trying to test for systemic influences. Thus, hand radiography has been claimed to be the best method for defining hand OA for epidemiological studies, and has therefore been used in most studies in this field.^{2–11 40} However, defining hand OA still leads to problems,⁴¹ because there is no absolute clinical, radiological, or pathological standard with which the epidemiology of hand OA can be compared.⁴² The Kellgren-Lawrence radiological grading system has mostly been used, even if a number of problems exist in this grading system.¹ The main difficulties include inconsistencies in the interpretation of the grading system, and the prominence given to the osteophytes at all joint sites.¹ Despite the difficulties, we used the Kellgren-Lawrence system because it is the most commonly used, which means that our results are comparable with those of other studies. When radiology is not available, clinical examination is a viable substitute.⁴¹ We looked at function and pain in the presence of Heberden's nodes and radiologically diagnosed finger OA. It seems plausible that pain and dysfunction were more prevalent in the presence of Heberden's nodes than in radiologically diagnosed finger OA.

Table 2 Odds ratios (ORs) with 95% confidence intervals (CIs) for OA of Kellgren's grades 2 to 4 in any finger joint (OA in any finger joint) and its subcategory, OA in at least two distal interphalangeal joints symmetrically (symmetrical DIP OA), according to age, sex, educational level, body mass index, history of workload, and history of smoking

Explanatory variable	No of subjects examined	OA in any finger joint			Symmetrical DIP OA		
		No of subjects with OA	OR	95% CI	No of subjects with OA	OR	95% CI
Age (years)							
		Unadjusted:					
30–44	986	60	1.00		5	1.00	
45–54	834	249	6.60	4.87 to 8.87	34	8.33	3.24 to 21.42
55–64	824	548	30.64	22.73 to 41.30	160	47.28	19.31 to 115.76
65–74	662	555	80.05	57.37 to 111.70	250	119.05	48.76 to 290.67
75–	289	258	128.45	81.50 to 202.40	130	160.42	64.65 to 398.02
Sex							
		Adjusted for age:					
Men	1560	641	1.00		134	1.00	
Women	2035	1029	1.29	1.08 to 1.53	445	2.85	2.28 to 3.57
Educational level							
		Adjusted for age, sex, body mass index, smoking and history of workload:					
<8 years	2654	1371	1.00		485	1.00	
8–12 years	654	228	1.15	0.90 to 1.47	70	1.07	0.78 to 1.48
>12 years	287	71	0.98	0.60 to 1.44	24	1.44	0.84 to 2.45
Body mass index (kg/m ²)							
		Adjusted for age, sex, educational level, history of smoking, and history of workload:					
≤20.0	141	45	0.50	0.31 to 0.83	12	0.61	0.31 to 1.20
20.0–24.9	1315	503	1.00		145	1.00	
25.0–29.9	1483	715	1.17	0.96 to 1.43	256	1.45	1.13 to 1.86
30.0–34.9	544	337	1.78	1.37 to 2.33	136	1.75	1.29 to 2.36
≥35.0	112	70	1.98	1.19 to 3.27	30	1.99	1.18 to 3.37
History of workload, men (items of physical exposures)							
		Adjusted for age, educational level, body mass index, and smoking:					
0	415	147	1.00		33	1.00	
1	274	117	1.30	0.87 to 1.96	29	1.53	0.82 to 2.84
2	398	187	1.18	0.81 to 1.72	34	0.95	0.51 to 1.76
3	311	128	1.23	0.82 to 1.84	25	1.40	0.73 to 2.70
4	118	42	1.41	0.81 to 2.46	8	1.71	0.68 to 4.33
5	44	20	1.75	0.78 to 3.91	5	2.72	0.86 to 8.58
History of workload, women (items of physical exposures)							
		Adjusted for age, educational level, body mass index, and smoking:					
0	632	270	1.00		108	1.00	
1	430	194	0.97	0.68 to 1.38	84	1.10	0.76 to 1.61
2	687	422	1.54	1.12 to 2.10	193	1.45	1.06 to 2.00
3	193	97	1.63	1.03 to 2.59	40	1.37	0.84 to 2.22
4	82	36	1.21	0.66 to 2.22	17	1.81	0.90 to 3.62
5	11	10	10.97	1.25 to 95.90	3	1.46	0.33 to 6.51
History of smoking, men							
		Adjusted for age, educational level, body mass index, and workload:					
Never smoked	393	171	1.00		49	1.00	
Ex-smoker	605	270	0.72	0.52 to 0.99	55	0.51	0.33 to 0.81
Pipe, cigars or <20 cigarettes/day	322	124	0.70	0.48 to 1.03	21	0.48	0.27 to 0.87
≥20 cigarettes/day	240	76	0.72	0.48 to 1.09	9	0.40	0.18 to 0.86
History of smoking, women							
		Adjusted for age, educational level, body mass index, and workload:					
Never smoked	1641	902	1.00		409	1.00	
Ex-smoker	187	69	0.99	0.65 to 1.52	12	0.36	0.19 to 0.69
Pipe, cigars or <20 cigarettes/day	164	47	0.77	0.48 to 1.22	21	1.32	0.75 to 2.34
≥20 cigarettes/day	43	11	0.81	0.32 to 2.04	3	0.66	0.18 to 2.45

One of the strengths in our study was that we used the population from the Mini-Finland Health Survey, which was the first national health examination survey in the world and represented the Finnish population over 30 years of age. Consequently, generalisations can certainly be made on the basis of our results. However, there is a possible minor error in estimations because the prevalence of OA has been slightly overestimated as a result of the screening procedure, whereas the prevalence of Heberden's nodes has been under-

estimated. In the analysis focusing on risk determinants of finger OA and associations between finger OA and mortality, multiple testing may have led to some findings that are due to chance alone. Thus, our results need replication in further studies.

We found the same risk factors for hand OA as reported in previous studies. One of the main results of this study was a positive linear association between hand OA and BMI. Obesity is a strong risk factor for OA, especially in the legs.^{19 22 43} The

Table 3 Relative risks (RR) of death and 95% confidence intervals (CI) in men and women by OA of Kellgren's grades 2 to 4 in any finger joint (OA in any finger joint) and its subcategory, OA in at least two distal interphalangeal joints symmetrically (symmetrical DIP OA). Adjusted by age, education, history of workload, smoking, and body mass index

Explanatory variable	Men				Women			
	No of subjects examined	Number of deaths	RR	95% CI	No of subjects examined	Number of deaths	RR	95% CI
<i>Total mortality</i>								
Symmetrical DIP OA								
No	1426	391	1.00		1590	238	1.00	
Yes	134	71	0.89	0.68 to 1.16	445	197	1.23	1.01 to 1.51
OA in any finger joint								
No	919	163	1.00		1006	78	1.00	
Yes	641	299	1.02	0.83 to 1.27	1029	357	1.17	0.87 to 1.56
<i>Cardiovascular mortality</i>								
Symmetrical DIP OA								
No	1426	216	1.00		1590	123	1.00	
Yes	134	45	0.96	0.68 to 1.36	445	113	1.25	0.95 to 1.63
OA in any finger joint								
No	919	73	1.00		1006	33	1.00	
Yes	641	188	1.42	1.05 to 1.92	1029	203	1.26	0.84 to 1.91

association has been found to be stronger in women than in men.^{18–20,44} and to be mediated through mechanical factors. However, there is evidence that mechanical factors alone cannot explain the association, because obesity has also shown a positive association with hand OA in several earlier studies.^{21–23,40–45,46} However, a negative association has also been reported in some studies.^{47–49} This study provides further evidence that being overweight does not increase the risk of OA only mechanically, as has been claimed in some previous studies.³⁰ We found a significant association between being overweight and both OA in any finger joint and its subcategory symmetrical DIP OA, supporting the view that being overweight is also a systemic risk factor for OA.

Two earlier studies have suggested that genetic factors have significance in the aetiology of symmetrical hand OA.^{51–52} However, no previous studies have focused on the difference between the sexes in the effect of physical load on the risk of hand OA. In our study the physical work stress index was associated with the risk of OA in any finger joint in women, but not in men. Also for symmetrical DIP OA, physical work stress showed an association, but the small number of cases makes it impossible to draw reliable conclusions, and moreover, our measure of the physical work stress was only approximate. One possible explanation for the difference between men and women is that women may have inherently weaker joint cartilage than men.

Smoking was associated with decreased risk of symmetrical DIP OA in men, but not in women. However, the small number of women smokers limits the reliability of conclusions here also. For OA in any finger joint, a weak negative association was also found in men, but not in women. In a previous study, no clear protective effect of smoking on hand and knee OA in women was found,⁵³ but another study reported lower rates of radiological knee OA in male and female smokers than in non-smokers.⁵⁴ It is not known whether smoking affects cartilage, bone, or both. Smoking may not be the only explanatory variable, but the protective effect of smoking might be explained by other lifestyle factors. The inverse relation between osteoporosis and OA has been reported,⁵⁵ and it is well known that smoking is a risk factor for osteoporosis.⁵⁶ Thus, the negative association between smoking and symmetrical DIP OA is in line with the inverse relationship between OA and osteoporosis.

Generalised OA is a form of OA, but the classification is controversial.²³ According to Kellgren and Moore,⁵⁷ generalised OA exists if at least three joints or a group of joints are

affected. In previous reports, the strongest associations have been found between hand OA and OA in weightbearing joints.^{11–14} However, no clear associations could be found in this study between finger OA and OA in weightbearing joints. One possible explanation for this is that hand OA may be a separate disease entity, not one form of generalised OA. On the other hand, weak associations between finger OA and generalised OA in our study can be explained by the rarity of generalised OA. Furthermore, the diagnosis of knee and hip OA in our study was only clinical. Thus, our attempt to establish systemic OA (systematically influenced cartilage degradation) might have been hampered by the absence of radiological data of knee and hip joints. In some studies, an association between hand OA and knee or hip OA has been found, owing to the small numbers of selected subjects examined and the use of radiology in diagnosing OA.^{11–12,14} It may be that symmetrical OA in the presence of Heberden's nodes in women is a more restricted definition of systemic OA. In line with this assumption, we found an association between Heberden's nodes and symmetrical DIP OA. A section of patients with nodal OA definitely have a tendency to develop systemic OA in families.

An interesting result for the association between mortality and hand OA in our study was that OA in any finger joint significantly predicted cardiovascular deaths in men. Such an association has not previously been reported. Although the mechanism remains unclear, our result suggests an effect of some metabolic factor. Even if no previous study has focused on the association between hand OA and cardiovascular mortality, there is evidence that insulin-like growth factor hormone and sex hormones have a favourable effect on the metabolism of the articular cartilage.^{58–61} However, inverse results have also been reported.^{10,62} In addition, some studies have suggested that high levels of serum lipids can accelerate the degradation of articular cartilage.^{25–27} Thus, cardiovascular diseases and OA may have joint risk factors other than BMI, but further studies are needed to confirm the association that we found between OA and cardiovascular mortality.

OA causes pain and functional impairment, and at worst it may cause disability. Therefore, it may also exert an effect on lifespan. Cerhan and colleagues found that an increasing number of joints affected by OA predict decreased survival in women.²⁴ We found a positive association between symmetrical DIP OA and mortality in women, but not in men. OA in any finger joint showed no association with mortality in either sex.

In conclusion, our results suggest that the risk factor profiles are different for OA in any finger joint and for symmetrical DIP OA, which suggests that the outcomes of our study represent separate disease entities. Obesity, however, is a strong risk determinant of both OA in any finger joint and its subcategory, symmetrical DIP OA. This indicates that being overweight also exerts a systemic influence on the risk of OA, although the mechanism remains unclear. The different mortality patterns between men and women in symmetrical DIP OA may reflect a difference between the sexes in the genetic background of hand OA.

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