EXTENDED REPORT

Socioeconomic status and the risk of developing rheumatoid arthritis: results from the Swedish EIRA study

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Objective: To study whether formal education and occupational class are associated with incidence of rheumatoid arthritis overall and with the incidence of the two major subgroups of rheumatoid arthritis—seropositive (RF+) and seronegative (RF−) disease.

Methods: 930 cases and 1126 controls participated in a population based case–control study using incident cases of rheumatoid arthritis, carried out in Sweden during the period May 1996 to June 2001. The relative risk (RR) of developing rheumatoid arthritis with 95% confidence interval (CI) was calculated for different levels of formal education compared with university degree and for different occupational classes compared with higher non-manual employees.

Results: Subjects without a university degree had an increased risk of rheumatoid arthritis compared with those with a university degree (RR = 1.4 (95% CI, 1.2 to 1.8)). For manual employees, assistant and intermediate non-manual employees together, the risk of developing rheumatoid arthritis was about 20% more than for non-manual employees. These increased risks were more pronounced for RF+ than for RF− rheumatoid arthritis and were mainly confined to women. Smoking could not of its own explain the observed associations between risk of rheumatoid arthritis in different socioeconomic groups in Sweden.

Conclusions: There was an association between high socioeconomic status and lower risk of rheumatoid arthritis in a population based investigation that was representative for the Swedish population. The study shows that as yet unexplained environmental or lifestyle factors, or both, influence the risk of rheumatoid arthritis, even in the relatively egalitarian Swedish society.

Rheumatoid arthritis is a chronic inflammatory disease of almost unknown aetiology. Though it seems to cluster in families, it is known from epidemiological studies in twins that environmental factors are likely to be important in the development of the disease. The concordance for rheumatoid arthritis is only about 12–15% in monozygotic twins.[1 2]

Socioeconomic differences in health are found in all industrialised countries where such differences have been studied. Low socioeconomic strata are disadvantaged with respect to the vast majority of diseases investigated.[3] Evidence of differences in rheumatoid arthritis incidence between social classes is of interest from a public health point of view, but it is also of value in generating hypotheses about possible association between environmental/lifestyle factors and the risk of developing this disease. A low social class has been associated with a worse clinical outcome in rheumatoid arthritis[4–10] (for a summary, see also Symmons, 2003[11]), but socioeconomic status in relation to disease incidence has been poorly investigated up to now. In two studies,[12 13] social class according to occupation was not related to the incidence of rheumatoid arthritis, while in another study[14] a relation was observed. Low formal education has been found to be associated with an increased risk of arthritis, including rheumatoid arthritis,[12 14–20] but one study presented contradictory results.[21] Overall, the results of previous studies are somewhat inconsistent, which might reflect methodological limitations. The studies were based on prevalent cases,[12 15–20] on a relatively small number of cases,[13 14 16 21] had a low response rate,[12 16] or were not restricted to cases of rheumatoid arthritis.[14 17–20]

In 1996 we initiated the so called EIRA study (Epidemiological Investigation of Rheumatoid Arthritis) in Sweden, which is a large population based case–control study using incident cases of rheumatoid arthritis. In the present report from the EIRA study, our objective was to investigate whether indicators of socioeconomic status (formal education and occupational class) are associated with the incidence of the disease, and if so, to investigate whether such an association may be explained by smoking, which is the best established environmental risk factor for rheumatoid arthritis to date. An additional aim was to examine whether formal education and occupational class are associated with the two major subgroups of rheumatoid arthritis—that is, seropositive (rheumatoid factor positive (RF+)) and seronegative (rheumatoid factor negative (RF−)) disease. This subdivision was made because it is known that environmental factors (such as smoking[12 22–25]) and key genetic factors (such as HLA-DR SE[22]) may have different effects in RF+ and RF− patients. Thus RF+ and RF− disease should be studied separately in all investigations aimed at understanding the influences of unknown risk factors on rheumatoid arthritis.

Abbreviations: ACR, American College of Rheumatology; EIRA, Epidemiological Investigation of Rheumatoid Arthritis; FoB, Folk-och bostadsräkning (Swedish census); ISCED, International Standard for Classification System of Education; NYK, Nordisk yrkesklassificering (Swedish classification system of occupations); RF, rheumatoid factor; RR, relative risk; SUN, Svensk utbildningsnomenklatur (Swedish classification system of education)

Table 1 Relative risk of developing rheumatoid factor (RF) positive rheumatoid arthritis, RF negative rheumatoid arthritis, and rheumatoid arthritis overall for subjects without a university degree compared with those with a university degree, by sex

		Ca/Co	RR*	95% CI	RR**	95% CI
Women						
RF+ RA	No university degree	340/584	1.5	1.1 to 2.0	1.6	1.1 to 2.2
	University degree†	82/204	1.0	–	1.0	–
RF− RA	No university degree	170/584	0.9	0.7 to 1.3	0.8	0.6 to 1.3
	University degree†	61/204	1.0	–	1.0	–
Total RA	No university degree	510/584	1.3	1.0 to 1.6	1.3	1.0 to 1.7
	University degree†	143/204	1.0	–	1.0	–
		Ca/Co	**RR***	**95% CI**	**RR****	**95% CI**
Men						
RF+ RA	No university degree	162/260	2.1	1.3 to 3.6	2.0	1.1 to 3.6
	University degree†	22/75	1.0	–	1.0	–
RF to RA	No university degree	80/260	2.3	1.1 to 4.7	2.6	1.2 to 5.5
	University degree†	12/75	1.0	–	1.0	–
Total RA	No university degree	242/260	2.2	1.4 to 3.4	2.2	1.3 to 3.6
	University degree†	34/75	1.0	–	1.0	to
		Ca/Co	**RR§**	**95% CI**	**RR§§**	**95% CI**
All						
RF+ RA	No university degree	502/844	1.6	1.3 to 2.1	1.7	1.2 to 2.2
	University degree†	104/279	1.0	–	1.0	–
RF− RA	No university degree	250/844	1.2	0.8 to 1.6	1.1	0.8 to 1.6
	University degree†	73/279	1.0	–	1.0	–
Total RA	No university degree	752/844	1.4	1.2 to 1.8	1.5	1.1 to 1.9
	University degree†	177/279	1.0	–	1.0	–

Values are relative risks with 95% confidence intervals.
*Relative risk adjusted for age and residential area.
**Relative risk adjusted for age, residential area, and smoking.
§Relative risk adjusted for age, residential area, and sex.
§§Relative risk adjusted for age, residential area, sex, and smoking.
†Reference group.
Ca/Co, number of exposed cases/number of exposed controls; CI, confidence interval; RF, rheumatoid factor; RR, relative risk.

METHODS

Study base

We studied the population (aged 18 to 70 years) in a geographically defined area in the middle and southern parts of Sweden. The recruitment period for cases and controls contributing to the present report was May 1996 to June 2001. The general design of the study was described in detail in the first report from the EIRA study.[23]

Case identification

All public rheumatology units in the study area, as well as almost all of the very few privately run units, reported cases to the study. A case was defined as a person in the study base who received a diagnosis of rheumatoid arthritis for the first time (newly diagnosed cases) and fulfilled the American College of Rheumatology (ACR) 1987 criteria.[26] At the beginning some centres also reported cases who did not satisfy the ACR criteria in order to allow investigation of undifferentiated arthritis, but those subjects were eventually excluded from the study. All cases were assessed and diagnosed by a rheumatologist at a participating unit. A blood sample was taken locally and rheumatoid factor was determined as positive or negative using local standard methodology. Results were reported as RF+ or RF−.

Selection of controls

When a case was identified, a control was randomly selected from the study base, taking age, sex, and residential area (county or in some occasion municipality) into consideration. The selection of controls was made by means of the national population register, which covers the entire population and is continuously updated (see also Stolt *et al*, 2003[23]). If a control refused to participate, was not traceable, or reported having rheumatoid arthritis, a new control was selected using the same principles. Controls belonging to cases who were excluded because they did not fulfil the ACR criteria remained in the study.

Data collection

Cases and controls were given the opportunity to answer an identical questionnaire containing a wide range of questions about, for instance, formal education, employment, heredity, occupational exposures, life events, drug use, and lifestyle factors. The questionnaire was given to the cases at their first visit to the rheumatology unit and sent by post to the controls. All questionnaires were supposed to be answered at home. Purpose trained persons completed, by post or telephone, questionnaires with incomplete answers. In all, 967 cases and 1357 controls (that is, all controls who were selected, including those who refused or were untraceable) were identified and of these, 930 cases (654 women and 276 men) and 1126 controls (791 women and 335 men) answered the questionnaire, giving a participation rate of 96% for cases and 83% for controls.

All cases and controls consented to the study after receiving written information, and all aspects of the study

Table 2 Relative risk of developing rheumatoid factor (RF) positive rheumatoid arthritis, RF negative rheumatoid arthritis, and rheumatoid arthritis overall for subjects with different levels of formal education compared with a university degree, by sex

	RF+ RA			RF− RA			Total RA		
	Ca/Co	RR	95% CI	Ca/Co	RR	95% CI	Ca/Co	RR	95% CI
Women									
Compulsory school	140/212	1.6	1.1 to 2.4	60/212	1.0	0.6 to 1.7	200/212	1.3	0.9 to 1.9
Vocational upper secondary school	46/69	1.8	1.1 to 3.0	29/69	1.4	0.8 to 2.5	75/69	1.6	1.0 to 2.5
Theoretical upper secondary school	49/94	1.6	0.9 to 2.6	25/94	0.9	0.5 to 1.6	74/94	1.2	0.8 to 1.8
Other education	105/209	1.3	0.9 to 1.9	56/209	0.8	0.5 to 1.2	161/209	1.1	0.8 to 1.5
University degree†	82/204	1.0	–	61/204	1.0	–	143/204	1.0	–
Men									
Compulsory school	62/95	2.1	1.1 to 4.1	28/95	1.7	0.7 to 4.1	90/95	2.0	1.1 to 3.5
Vocational upper secondary school	33/65	1.5	0.7 to 3.2	18/65	2.0	0.7 to 5.3	51/65	1.7	0.9 to 3.3
Theoretical upper secondary school	27/38	2.2	0.9 to 5.1	9/38	1.5	0.5 to 4.8	36/38	2.0	1.0 to 4.2
Other education	40/62	2.1	1.1 to 4.0	25/62	4.0	1.5 to 10.5	65/62	2.5	1.4 to 4.5
University degree†	22/75	1.0	–	12/75	1.0	–	34/75	1.0	–
All									
Compulsory school	202/307	1.7	1.2 to 2.5	88/307	1.2	0.8 to 1.8	290/307	1.5	1.1 to 2.0
Vocational upper secondary school	79/134	1.7	1.1 to 2.6	47/134	1.5	0.9 to 2.5	126/134	1.6	1.1 to 2.3
Theoretical upper secondary school	76/132	1.7	1.1 to 2.6	34/132	1.0	0.6 to 1.7	110/132	1.3	0.9 to 1.9
Other education	145/271	1.4	1.0 to 2.0	81/271	1.1	0.7 to 1.6	226/271	1.3	1.0 to 1.7
University degree†	104/279	1.0	–	73/279	1.0	–	177/279	1.0	–

†Reference group.
Ca/Co, number of exposed cases/number of exposed controls; CI, confidence interval; RF, rheumatoid factor; RR, relative risk adjusted for age and residential area, or for age, residential area, and sex (category ''All'').

were approved by the ethics committee of Karolinska Institutet.

Exposure

Socioeconomic status involves different aspects. In this report we consider formal education and occupational class as markers of socioeconomic status. Information about education and occupation was obtained from the questionnaire.

Formal education

Formal education was divided into five levels: compulsory school, vocational upper secondary school, theoretical upper secondary school, other education, and university degree. Some education programmes did not fit into any of these categories—for example, vocational training courses for those who are unemployed, or studies within military and commercial schools. Such programmes with a duration of at least one year were classified as ''other education''. All study subjects could be classified according to education except for one female case and three female controls.

The categorisation was done with guidance from Svensk utbildningsnomenklatur (SUN), which is a Swedish classification system of education. It is used by Statistics Sweden in classifying the education of the population, and is adjusted to the International Standard for Classification of Education (ISCED 97). (For a detailed description of the categorisation of formal education, please contact the first author.)

Occupational class

Cases and controls gave an extensive description of their recent and previous occupations. For each occupation lasting at least one year, information about type of employment and time period of the employment was collected. Each occupation was given an occupational class code according to the Nordisk yrkesklassificering (NYK[27]), which is a Swedish classification system of occupations adjusted to international standards. The occupational classes we used were: skilled and unskilled manual workers; assistant, intermediate, and higher non-manual employees. At the rheumatology unit, each case was given a year and a month of onset of rheumatoid arthritis. The year in which symptoms first occurred was defined as the index year and was also used for the corresponding control. In general, employment during the index year was used to classify occupational class. Those with a retirement pension received their most recent socioeconomic code, and students were not classified at all. Those who were unemployed, housewives, on sickness or disablement pension, in employment measures, or on sick leave for more than three months were classified according to the occupational class they had before they left the labour market. If they had left working life more than two years earlier than the index year they were not classified.

In all, 181 cases (132 women, 49 men) and 218 controls (163 women, 55 men) could not be classified according to occupational class, which means that an equal proportion (19%) of the cases and controls was not classified. Among these cases and controls, almost a third were on sickness or disablement pension; approximately one fifth were students, and 4% had been on sick leave for more than three months, respectively. For two cases and eight controls, data were missing.

Potential explanatory factors

There are several potential environmental and lifestyle factors that could explain the possible association between socioeconomic status and rheumatoid arthritis. Smoking is, however, the only environmental factor so far that has been unambiguously shown to be related to rheumatoid arthritis in several different studies,[12 22–25] and it was therefore considered as the only potential explanatory factor in this study. All results were adjusted for age and residential area according to the principle of control selection. In the analyses, age was categorised into 10 strata (18 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44, 45 to 49, 50 to 54, 55 to 59, 60

Table 3 Relative risk of developing rheumatoid factor (RF) positive rheumatoid arthritis, RF negative rheumatoid arthritis, and rheumatoid arthritis overall for subjects who were not higher non-manual employees compared with higher non-manual employees, by sex

		Ca/Co	RR*	95% CI	RR**	95% CI
Women						
RF+ RA	Not higher non-manual employees	298/529	1.6	1.1 to 2.5	1.6	1.0 to 2.6
	Higher non-manual employees†	35/99	1.0	–	1.0	–
RF− RA	Not higher non-manual employees	155/529	0.8	0.5 to 1.2	0.9	0.5 to 1.5
	Higher non-manual employees†	34/99	1.0	–	1.0	–
Total RA	Not higher non-manual employees	453/529	1.2	0.8 to 1.6	1.3	0.9 to 1.9
	Higher non-manual employees†	69/99	1.0	–	1.0	–
		Ca/Co	**RR***	**95% CI**	**RR****	**95% CI**
Men						
RF+ RA	Not higher non-manual employees	120/207	1.2	0.8 to 2.0	1.2	0.7 to 2.2
	Higher non-manual employees†	34/73	1.0	–	1.0	–
RF− RA	Not higher non-manual employees	53/207	1.0	0.6 to 1.9	0.9	0.5 to 1.8
	Higher non-manual employees†	20/73	1.0	–	1.0	–
Total RA	Not higher non-manual employees	173/207	1.2	0.8 to 1.8	1.1	0.7 to 1.8
	Higher non-manual employees†	54/73	1.0	–	1.0	–
		Ca/Co	**RR§**	**95% CI**	**RR§§**	**95% CI**
All						
RF+ RA	Not higher non-manual employees	418/736	1.4	1.0 to 2.0	1.5	1.0 to 2.1
	Higher non-manual employees†	69/172	1.0	–	1.0	–
RF− RA	Not higher non-manual employees	208/736	0.8	0.6 to 1.2	0.9	0.6 to 1.3
	Higher non-manual employees†	54/172	1.0	–	1.0	–
Total RA	Not higher non-manual employees	626/736	1.2	0.9 to 1.5	1.2	0.9 to 1.6
	Higher non-manual employees†	123/172	1.0	–	1.0	–

Values are relative risks with 95% confidence intervals.
*RR adjusted for age and residential area.
**RR adjusted for age, residential area, and smoking.
§RR adjusted for age, residential area, and sex.
§§RR adjusted for age, residential area, sex, and smoking.
†Reference group.
Ca/Co, number of exposed cases/number of exposed controls; CI, confidence interval; RF, rheumatoid factor; RR, relative risk.

to 64, and 65 to 70 years of age) and smoking into four (never smoked, current smokers, ex-smokers, and non-regular smokers). For the proportion of smokers among different occupational and educational groups, see the supplemental table W1 on the journal web site (www.annrheumdis.com/supplemental).

Analysis of non-response

We carried out an analysis to evaluate possible bias owing to non-response (4% and 17% of identified cases and controls, respectively, did not participate). For all identified study subjects (967 cases and 1357 controls), information on education and occupational class was collected from the census of 1990, which is managed by Statistics Sweden. The substudy was approved separately by the ethics committee of Karolinska Institutet.

Statistical analysis

Subjects with different levels of education were compared with those with a university degree, and subjects in different occupational classes were compared with higher non-manual employees. All analyses were done with regard to the incidence of seropositive rheumatoid arthritis (RF+), seronegative rheumatoid arthritis (RF−), and rheumatoid arthritis overall. Men and women were analysed separately, as well as together. Odds ratios with 95% confidence interval (CI) were calculated using the Mantel–Haenszel method (unmatched analyses) or conditional logistic regression analysis (matched analyses). Only results from the unmatched analyses are presented, as these were in close agreement with those from the matched analyses but, in general, had greater precision. Odds ratios were interpreted as relative risks (RR), as the study was population based and the controls were a random sample from the study base.[28] Estimates of relative risk (RR) were adjusted for age, residential area, and smoking. All analyses were carried out using the Statistical Analysis System (SAS), version 8.2.

RESULTS

In all, 930 cases participated in the study. Of these, 654 were women and 276 were men. Their mean age in the index year was 50 years for women and 53 years for men. The mean duration of disease at inclusion in the study was 10 months, and 65% of the female and 67% of the male cases were RF positive.

Formal education

Subjects without a university degree had an increased risk of rheumatoid arthritis compared with those with a university degree (RR for women and men together = 1.4 (95% CI, 1.2 to 1.8)) (table 1). When the cases were subdivided according to RF status at inclusion, the increased risk for individuals without a university degree was mostly associated with RF+ rheumatoid arthritis overall (RR = 1.6 (95% CI, 1.3 to 2.1)). When educational level lower than university degree was divided into compulsory school, vocational/theoretical upper secondary school, and other education, almost all of these programmes were associated with an increased risk of developing rheumatoid arthritis compared with subjects with a university degree (men and women together) (table 2). Also in this analysis, educational level appeared to have a greater impact on the risk of RF+ than RF− rheumatoid arthritis, and this impact appeared to be mainly confined to women. The subanalyses on men are, however, uncertain,

Table 4 Relative risk of developing rheumatoid factor (RF) positive rheumatoid arthritis, RF negative rheumatoid arthritis, and rheumatoid arthritis overall for subjects in different occupational classes compared with higher non-manual employees, by sex

	RF+ RA			RF− RA			Total RA		
	Ca/Co	RR	95% CI	Ca/Co	RR	95% CI	Ca/Co	RR	95% CI
Women									
Unskilled manual workers	96/160	1.7	1.0 to 2.7	51/160	0.7	0.4 to 1.3	147/160	1.2	0.8 to 1.8
Skilled manual workers	36/71	1.7	0.9 to 3.2	23/71	1.0	0.5 to 2.0	59/71	1.3	0.8 to 2.2
Assistant non-manual employees	88/139	2.2	1.3 to 3.6	36/139	0.7	0.4 to 1.2	124/139	1.4	0.9 to 2.1
Intermediate non-manual employees	78/159	1.4	0.8 to 2.4	45/159	0.8	0.5 to 1.4	123/159	1.1	0.7 to 1.7
Higher non-manual employees†	35/99	1.0	–	34/99	1.0	–	69/99	1.0	–
Men									
Unskilled manual workers	34/55	1.3	0.6 to 2.5	11/55	0.9	0.4 to 2.2	45/55	1.1	0.6 to 2.0
Skilled manual workers	46/57	1.8	0.9 to 3.3	20/57	1.1	0.5 to 2.7	66/57	1.6	0.9 to 2.8
Assistant non-manual employees	13/32	0.6	0.2 to 1.5	11/32	1.7	0.7 to 4.6	24/32	1.0	0.5 to 2.0
Intermediate non-manual employees	27/63	1.1	0.6 to 2.2	11/63	0.8	0.3 to 2.0	38/63	1.0	0.6 to 1.8
Higher non-manual employees†	34/73	1.0	–	20/73	1.0	–	54/73	1.0	–
All									
Unskilled manual workers	130/215	1.5	1.0 to 2.3	62/215	0.7	0.5 to 1.2	192/215	1.2	0.8 to 1.6
Skilled manual workers	82/128	1.7	1.1 to 2.7	43/128	1.0	0.6 to 1.8	125/128	1.4	1.0 to 2.1
Assistant non-manual employees	101/171	1.6	1.0 to 2.5	47/171	0.9	0.5 to 1.4	148/171	1.3	0.9 to 1.8
Intermediate non-manual employees	105/222	1.3	0.8 to 1.9	56/222	0.8	0.5 to 1.3	161/222	1.1	0.8 to 1.5
Higher non-manual employees†	69/172	1.0	–	54/172	1.0	–	123/172	1.0	–

†Reference group.
Ca/Co, number of exposed cases/number of exposed controls; CI, confidence interval; RF, rheumatoid factor; RR, relative risk adjusted for age and residential area or for age, residential area, and sex (category ''All'').

owing to the relatively small numbers of individuals in the subgroups, especially in the comparison group. Adjustment for smoking only marginally altered the estimated relative risks associated with educational attainment (table 1).

Occupational class

Taking women and men together, employees other than higher non-manual employees had an approximately 20% greater risk of developing rheumatoid arthritis than higher non-manual employees, but the confidence interval was wide (table 3). After dividing cases into RF+ and RF−, the influence of occupational class was mainly associated with RF+ disease, at least for women. From the relatively few observations on men, no substantial difference was observed with regard to RF status. Table 4 shows the results when the occupational classes unskilled manual workers, skilled manual workers, assistant non-manual employees, and intermediate non-manual employees were compared separately with higher non-manual employees. For both sexes together, a tendency towards increased risk was observed for all these occupational classes with respect to RF+ disease, while no increased risk of developing RF− disease was observed. Adjustment for smoking appeared to explain only a minor part of the association between occupational class and rheumatoid arthritis (table 3).

Analysis of non-response

The relative risks of rheumatoid arthritis associated with different educational levels, according to the census of 1990, were compared among responders separately, and among responders and non-responders together. The relative risks were about the same in these comparisons. The same procedure was carried out for different occupational classes and with the same result. Only minor differences were observed between the two groups.

DISCUSSION

According to the results of our study, women as well as men with a university degree or working as higher non-manual employees had a lower risk of developing rheumatoid arthritis. These effects of socioeconomic status on risk of rheumatoid arthritis were more pronounced for rheumatoid factor positive disease than for rheumatoid factor negative disease, and were entirely confined to rheumatoid factor positive disease in women.

Our study was designed as a population based case–control study with incident cases. This design might introduce differential misclassification of exposure because of recall bias. However, it is most unlikely that cases would recall the exposures of interest in the present report (formal education and occupational class) differently from controls.

Another potential methodological problem with our study is the possible introduction of selection bias. Some cases might have been unidentified, for instance cases diagnosed in primary care but never referred to a rheumatology unit. As we know that almost all cases of rheumatoid arthritis in the Swedish system are referred to rheumatology units,[29] it is unlikely that the unidentified cases in primary care would have any great impact on our results. At some participating rheumatology units, cases with symptoms lasting more than one year were not reported to the EIRA study. If socioeconomic status influences the time from disease onset to diagnosis, this might constitute a potential bias in the present study. In order to evaluate this potential bias, we carried out separate conditional logistic analyses confined to cases where the duration of disease differed. According to this analysis, disease duration had no impact on the studied associations between formal education and occupational class and the incidence of rheumatoid arthritis. Another selection bias might have been introduced if socioeconomic status had differed between responding and non-responding cases and controls. To investigate this potential bias we undertook an analysis of non-response, based on census data regarding education and occupational class, which showed that non-response had only a minor impact on our estimated relative risks.

The Swedish general welfare system provides universal access to medical care. All rheumatology units linked to the general welfare system, as well as most of the (few) private rheumatology units in the study area, reported cases to our study. It is therefore unlikely that the recognised association between high socioeconomic position and a lower incidence of rheumatoid arthritis could be explained by unequal distribution of medical care. In conclusion we consider that our estimated relative risks do not suffer from severe bias.

Previous investigations on the potential influence of socioeconomic factors on the risk of developing rheumatoid arthritis are somewhat conflicting. Thus seven studies from Norway,[12] the United Kingdom,[14] Finland,[15] and the USA[17–20] also observed an association between low formal education and an increased risk of arthritis, including rheumatoid arthritis, but a study from the USA presented conflicting results.[21] Social class according to occupation was not related to rheumatoid arthritis incidence in a study from Norway[12] and a study from the United Kingdom,[13] but in another study from the United Kingdom,[14] a relation was shown. Finally, a recent Swedish investigation[16] on prevalent cases (in a region different from that of our present study) reported a link between higher education and a low risk of rheumatoid arthritis. One possible explanation for the divergent results from these previous investigations may be methodological: these studies were either based on relatively few cases,[13 14 16 21] or used prevalent cases,[12 15–20] or were not restricted to rheumatoid arthritis alone,[14 17–20] or had a low response rate.[12 16] It is also likely that accuracy of responses may decrease with time of disease, and that studies on incident cases may thus provide more accurate results than studies on prevalent cases.

Taking these considerations into account, the results from our study on incident cases of rheumatoid arthritis add to the likelihood that socioeconomic status indeed influences the risk of developing this disease even today, and even in Western Europe, including the highly egalitarian societies in Scandinavia.[12 15 16] It is thus of great interest to identify risk factors in the environment or lifestyle that are responsible for the observed differences, but this was beyond the primary scope of our study. Explanations for social class differences in rheumatoid arthritis may be found in the social structure (for example, as variations in social cohesion between living areas) as well as in the so called lifestyle of the individual (for example whether or not they smoke). They may also be found in conditions during youth and upbringing or in conditions closer to the onset of the disease.[30] We hope to return to these questions later in the course of the EIRA project when the web of causation may be somewhat clearer.

In our current study, as well as in the Norwegian[12] and the Swedish study,[16] the interference of smoking—the major environmental risk factor identified so far—was studied. However, the observed differences could not be explained by differences in smoking habits. We also investigated whether differences in socioeconomic status had different effects with respect to RF+ *v* RF− disease and in men compared with women. Interestingly, the socioeconomic status appeared to have its major effects on RF+ disease, and we also observed some differences between women and men in this respect, although these latter investigations are less precise, mainly because of the relatively few individuals in some of the investigated groups.

So far, we do not know which individual factors are responsible, either for the overall influence of socioeconomic factors on the risk of developing rheumatoid arthritis, or for the different effects on subgroups of rheumatoid patients. In the Norwegian study[12] the association between low formal education and higher risk of rheumatoid arthritis was explained by adjusting for age, sex, marital status, body mass index, employment category, and current smoking in a multivariate model. In order to compare our results with the Norwegian study, we adjusted our results for marital status and body mass index separately, but this had only a minor impact on our estimated relative risks (data not shown). In the Swedish study,[16] adjustment for smoking and employment in high risk occupations could not explain the association between low formal education and higher risk of rheumatoid arthritis.

Conclusion

In summary, we observed that high socioeconomic status, independent of smoking habits, is associated with a lower risk of developing rheumatoid arthritis in Sweden, and also that this association may be different for seropositive and seronegative disease, and among men and women. These differences point to interesting challenges in the identification of aetiological factors responsible for the findings within this society, whether they are protective factors among those of higher socioeconomic status, or risk factors among those of lower socioeconomic status, or both. The lower risk of rheumatoid arthritis in individuals with high education and less manual work may in addition reflect fundamental but as yet unidentified factors that may have changed the overall pattern of rheumatoid arthritis in many Western societies towards a lower overall incidence and a higher age of onset of the disease.

THE EIRA GROUP

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The supplemental table W1 showing the proportion of smokers among different occupational and educational groups can be viewed on the journal web site (www.annrheumdis.com/supplemental).

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