

# Becoming a Disability Pensioner with Rheumatoid Arthritis in Norway 1971–1990

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**ABSTRACT.** *Objective.* Physically demanding occupations have been associated with becoming a disability pensioner with rheumatoid arthritis (DPRA), but not with the disease of RA. The association with becoming DPRA probably reflects that patients with RA have difficulties in maintaining employment in a physically demanding occupation. However, the attitudes of the employers concerning employment of persons with RA might vary. For example, the patient's age may influence the strength of the association between a physically demanding occupation and becoming DPRA. We assessed whether the association between the predictors and becoming DPRA was stronger for the youngest or the oldest age group.

*Methods.* The study was prospective with data on persons in Norway 30–56 years old either in the census of 1970 or 1980. All new cases of DPRA during the 2 followup periods 1971–80 and 1981–90 were identified and analyzed by logistic regression.

*Results.* For women the predictors employment, low level of education, and period (1981–90 compared to 1971–80) were more strongly associated with becoming DPRA for the youngest compared to the oldest persons, while manual work and part time work were not predictors of becoming DPRA. For men, all the predictors in the study were more strongly associated with becoming DPRA for the youngest compared to the oldest age group.

*Conclusion.* The higher risk of becoming DPRA was associated with most predictors for persons aged 30–39 years than the group aged 50–56 years. Our results appear to indicate that the consequences of having RA in the labor market are greater for the youngest age group. (J Rheumatol 2001;28:54–61)

*Key Indexing Terms:*

DISABILITY PENSION

RHEUMATOID ARTHRITIS

AGE GROUPS

MULTIVARIATE LOGISTIC REGRESSION

PROSPECTIVE STUDIES

The cause of rheumatoid arthritis (RA) is unknown, but autoimmune mechanisms and virus infection have been suggested as causal factors<sup>1,2</sup>. Possible hormonal<sup>3</sup> and genetic<sup>4,5</sup> risk factors have been identified. The disease RA has not been associated with low level of education or low socioeconomic status, i.e., manual work, in any age groups<sup>6–8</sup>.

In studies of becoming a disability pensioner with RA (DPRA) an association was found between becoming DPRA and low level of education<sup>9</sup>, occupations requiring physical capacity<sup>10–12</sup>, low number of hours worked<sup>10</sup>, and not being married<sup>10,13</sup>. The association between these factors and becoming DPRA probably reflects that one of the consequences of having RA is increased difficulty of remaining employed for some groups. RA is a progressive, disabling disorder with high levels of work disability and functional loss, where the chief aim of therapy is the delay of disability<sup>14</sup>.

DPRA in Norway in 1990 made up 3.0% of all disability pensioners 16–66 years old, 4.3% among women and 1.5% among men. In 1990 the incidence of DPRA in the age group 40–49 years old was 0.08 per thousand men and 0.49 per thousand women without a disability pension<sup>15</sup> (1991). The corresponding rates were 0.39 and 1.12, respectively, for the group aged 50–59 years and 0.93 and 1.27 per thousand for those aged 60–64 years<sup>15</sup> (1991).

The increasing incidence of DPRA with age might just reflect that the incidence of RA increases with age<sup>16</sup>. However, it might also be influenced by the fact that the strength of the association between possible predictors and becoming DPRA varies between age groups. If, for instance, it is harder for elderly people than for young people to remain employed, one would also expect the disability pensioning rate for unemployed persons to be larger among the elderly. If the association between manual work and becoming DPRA is stronger in one age group than in another, this might imply that the potential for interventions that might reduce the number of new DPRA is larger in this age group. Type of work is of special interest, as it probably is easier to make adjustments in the work environment than to influence the general education or income level. Income level has been discussed as an incentive for becoming a disability pensioner, as persons with poor income might increase their income by becoming DPRA. Economic compensation might not be of equal impor-

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tance for persons in different age groups. Young persons, for example, might in general have a lower income.

In this study, all persons 30–39, 40–49, and 50–56 years old at the start of the followup periods, 1971–80 and 1981–90, in Norway were included. We assessed if the association between the predictors and becoming DPRA was stronger for the youngest or the oldest age group. The possible predictors included were sex, marital status, time period, duration of education, employment and type of work, number of hours worked, and income for the employed persons.

## MATERIALS AND METHODS

**Subjects.** In Norway a public disability pension is granted any person between 16 and 66 years old whose working capacity is judged to be permanently reduced by at least 50% because of illness, injury, or defect. The working capacity should be assessed after the termination of medical treatment, vocational training, education, or other appropriate attempts at rehabilitation. The applicant will usually also have had one year with sickness benefits and usually at least one year of rehabilitation before a disability pension is applied for. There were no alternative schemes to the public disability pension for early retirement during the study period. All Norwegians are entitled to a public retirement pension from the age of 67 years.

The study population included the total of residents of Norway registered as 30–56 years old in the 1970 census or in the 1980 census. Data from the National Insurance Administration (NIA) identified persons who had been granted a public disability pension during the two 10-year followup periods 1971–80 and 1981–90. Persons who did not survive the year the pension was granted were not identified in the NIA data.

Persons can be granted a reduced disability pension according to degree of incapacity (50–90%). Of new DPRA 30–56 years old in 1990, 44.3% of women and 23.3% of men held a reduced disability pension (NIA). Pensioners with a reduced pension may apply for a disability pension with a larger or full degree of incapacity at a later time. All the new disability pensioners with a primary diagnosis of RA, with a reduced or a full disability pension, were included as cases. The number of subjects included in the analyses is shown in Table 1.

The upper age limit of 56 years was chosen because persons older than 56 years would become retirement pensioners during the followup period and should be censored in the analysis. Persons younger than 30 years were excluded because the proportion becoming DPRA is very low compared to the proportion in older age groups. The number of DPRA included in the study would have been larger had the upper age limit been higher. However, restricting the age span to 56 years precludes the possibility of studying risk factors that are especially important for persons close to old-age retirement.

**Measures.** A disability pension is applied for at the local insurance office, and requires a health certificate from the applicant's physician. The local insurance office then judges whether the applicant meets the criteria for being granted a disability pension<sup>17</sup>. If the local insurance office questions the diagnosis or the extent of reduced working capacity, it can ask for an examination by a specialist or can have the patient examined by a physician employed by the NIA.

The illnesses, injuries, and defects described in the health certificates are classified according to the International Classification of Diseases (ICD) by the NIA. NIA used ICD-7 (revision No. 7) during the period 1971–82, ICD-8 during the period 1983–86, and ICD-9 during the period 1987–90. The diagnoses registered according to ICD-8 have been recoded to ICD-9 codes by the NIA.

RA was identified by the codes 7220 in ICD-7 and 714 in ICD-9. The register does not hold information on the severity of the disease, the time of onset, or the treatments that have been carried out.

Age in 1970 and 1980, defined as number of years at the end of the year, was recoded into 3 groups, 30–39, 40–49, and 50–56 years old. Variables from the census included in the analyses were marital status, duration of education, income, hours worked the previous year, and occupation. Marital status was classified as never married, married, widow(er), divorced, or separated; the last 3 categories were recoded into "previously married." Duration of education was recorded as number of years of schooling. The variable "number of hours worked the previous year" was dichotomized as part-time (< 1300 hours) and full-time. Occupation, coded according to the Nordic Classification of Occupations<sup>18</sup>, was reclassified into 3 groups by type of work: manual work (both skilled and unskilled), routine nonmanual work, and professional work<sup>19</sup>. These 3 types of work have very different work environments — persons engaged in manual work lift and bend more often than persons engaged in the 2 other types of work. Persons in professional work are more free to define their working pace<sup>20</sup>. Manual work will in this study be considered to be more physically demanding than other types of work.

Included among the nonemployed were persons that claimed they were nonemployed, in addition to persons who at the censuses had not given any information on the occupation they held or the number of hours they worked.

Personal identification numbers were removed from the data before being released for research.

**Analyses.** Cumulative incidences for each of the 10 year followup periods were calculated using all registered subjects at the start of the followup period as the denominator. Pearson's chi-square tests were used to test for differences in proportions between categories of each variable in each time period. The risk attributable to manual work was calculated as:

$$\frac{(\text{cumulative incidence for manual work} - \text{cumulative incidence for routine nonmanual work})}{(\text{cumulative incidence for manual work})}^{21}$$

Logistic regression was chosen for analysis. In prospective studies the

*Table 1.* Number of persons in the population of Norway without a disability pension 30–56 years old in the census of 1970 or in the census of 1980, the proportion employed of the total population, and the total number of new disability pensioners with rheumatoid arthritis (DPRA) during the periods 1971–80 and 1981–90 in each age group and among the employed.

Age at census, yrs	Men								Women							
	Persons without Disability Pension, 1970		New DPRA, 1971–80		Persons without Disability Pension, 1980		New DPRA, 1981–90		Persons without Disability Pension, 1970		New DPRA, 1971–80		Persons without Disability Pension, 1980		New DPRA, 1981–90	
	Total	Em- ployed, %	Total	Among Em- ployed	Total	Em- ployed, %	Total	Among Em- ployed	Total	Em- ployed, %	Total	Among Em- ployed	Total	Em- ployed, %	Total	Among Em- ployed
30–39	198,612	96.7	73	67	292,118	91.8	152	124	193,115	41.7	429	149	273,170	66.7	802	486
40–49	228,080	96.5	440	398	192,881	91.4	364	307	223,269	50.2	1237	583	186,581	73.0	1282	858
50–56	158,506	96.2	614	557	138,268	91.0	702	611	160,666	51.1	1351	667	135,444	66.1	1421	930

odds ratio (OR) can be interpreted as an approximate relative risk when the events are rare (< 10%). To deal with the problem of censored data, persons dying or becoming a disability pensioner with any other diagnosis than RA were excluded from the logistic regression analyses<sup>22</sup>.

The data from each of the periods 1971–80 and 1981–90 were analyzed with an interaction term between age group and each of the other variables, one at a time. The variables sex, marital status, education, type of work, part-time/full-time work, and income were all tested for interaction with age group. In cases with significant effects of the interaction term between age group and the other variables, the analyses were recalculated for each age group separately. The data on each age group from both periods (1971–80 and 1981–90) would be collapsed into 3 different data sets with a “period” variable (0 if 1971–80 and 1 if 1981–90) and each data set would be tested for significant interaction effects with the period variable and the other predictors. The tests on interaction between age and time period had to be analyzed in 2 steps, as the subjects aged 30–46 years who were included in the 1970 census are also included in the 1980 census as 40–56 years old.

A corresponding procedure was followed for the other variables until all variables were tested for significant interaction terms with the remaining variables, and there seemed to be no need for further reanalysis.

Analyses with education entered as a continuous variable compared with analyses in which education was entered as dummy variables showed no non-linear effect of education, implying that education could be entered as a single continuous variable without loss of information.

## RESULTS

In this prospective study of all men and women without a disability pension in Norway at the onset of the study periods 1971–80 and 1981–90, nonemployed men 30 to 56 years old, regardless of age, had a higher probability of becoming DPRA than employed men during both followup periods (Table 2). In the 1980s the association between nonemployment and becoming DPRA was stronger for the youngest than the oldest men. Nonemployed women had a higher probability of becoming DPRA than employed women in the age groups 30–39 and 40–49 years, but not women aged 50–56 years (Table 2).

Results of the bivariate analyses that included only the employed persons are shown in Table 3. Low level of education and manual work were associated with becoming DPRA

for both men and women in all age groups during both followup periods. For men, low income and part-time work were also associated with DPRA in all age groups in both followup periods (Table 3). Marital status was not associated with becoming DPRA for either men or women (Table 3). The attributable risk for manual work in 1981–90 was 57% for the men aged 30–39 years, 2% for men aged 40–49 years, and 39% for men aged 50–56 years (Table 3).

In multivariate logistic regression analyses of the employed persons there were significant interactions both in the 1970s and the 1980s between age group and the variables sex, education, number of hours worked, and income; and between age group and type of work in the 1980s. The significant effect of the interaction terms implies that the effects of many predictors do vary between age groups for the employed persons. Before deciding how to present the adjusted OR, we also tested other interaction effects. There were significant interactions between sex and the variables type of work, number of hours worked, education, and income in the age groups 40–49 years and 50–56 years. Other significant interaction effects were not found. The adjusted OR were therefore presented for employed persons stratified by age group and sex.

For both men and women, the association between low level of education and part-time work and becoming DPRA was stronger for the youngest persons than for the oldest (Table 4). For men, the association between manual work and low income and becoming DPRA was also found in all age groups, but was stronger for the youngest persons (Table 4). High income was associated with becoming DPRA among women, but only in the oldest age group. Adjusting for the other variables, the effect of the time period was stronger in the youngest group than in the oldest group for both men and women, and the effect was significantly stronger for men than women.

The adjusted OR were generally closer to unity than the unadjusted (data not shown), implying that much of the apparent risk associated with one particular variable was actually related to the covariation with the other variables in the model.

However, the results of the analysis shown in Table 4 do not reveal any effect of sex and age. To obtain these effects, data from each time period have to be analyzed separately. After adjusting for type of work, number of hours worked, level of education, income, marital status, and sex, people aged 50–56 had roughly a 6 times higher risk of becoming DPRA than people 30–39 (Table 5). The effect of age was similar in the 1970s and the 1980s. Women had about a doubled risk of becoming DPRA compared with men in 1971–80, and nearly 3 times the risk in 1981–90 (Table 5).

## DISCUSSION

The higher OR of becoming DPRA for men with manual work in the youngest age group might reflect that in the older age groups the persons with manual work have already become

Table 2. Cumulative incidence of becoming disability pensioners with rheumatoid arthritis (DPRA) among employed and nonemployed men and women without a disability pension in Norway 1971–80 and 1981–90. Per thousand.

	Men		Women	
	1971–80	1981–90	1971–80	1981–90
30–39 yrs				
Nonemployed	1.17*	0.91**	2.48**	3.48**
Employed	0.46	0.35	1.85	2.67
40–49 yrs				
Nonemployed	5.19**	3.43**	5.88*	8.41**
Employed	1.81	1.74	5.20	6.30
50–56 yrs				
Nonemployed	9.52**	7.32**	8.70	10.69
Employed	3.65	4.86	8.09	10.39

Pearson’s chi-square test for difference between categories for each variable in each time period of becoming DPRA. \*p < 0.05, \*\*p < 0.001.

Table 3. Cumulative incidence of becoming disability pensioner with rheumatoid arthritis (DPRA) in 1971–80 and 1981–90 in Norway for employed men and women without a disability pension 30–39, 40–49, and 50–56 years old in 1970 and 1980 by marital status, socioeconomic group, income, part-time/full-time work, and education. Per thousand.

	30–39 Years		40–49 Years		50–56 Years	
	1971–80	1981–90	1971–80	1981–90	1971–80	1981–90
Men	0.35	0.43	1.81	1.73	3.65	4.81
Marital status						
Never married	0.38	0.37*	2.30	1.81	3.98	5.59
Married	0.34	0.40	1.73	1.74	3.64	4.77
Previously married	0.61	0.93	2.21	1.55	3.21	4.24
Type of work						
Professional	0.10**	0.13**	0.51**	0.57**	1.62**	2.47**
Routine nonmanual	0.15	0.30	1.47	2.28	2.55	3.81
Manual work	0.50	0.70	2.32	2.33	4.39	6.23
Hours worked						
Full-time	0.28**	0.34**	1.56**	1.58**	3.25**	4.63**
Part-time	1.07	1.28	4.16	3.33	6.60	6.54
Years of education						
7	0.68**	0.93**	2.65**	2.78**	4.49**	6.84**
8–12	0.26	0.51	1.41	1.72	3.16	4.41
≥ 13	0.03	0.05	0.16	0.33	1.10	0.91
Women	1.85	2.66	5.20	6.24	8.13	10.24
Marital status						
Never married	2.16	1.83	5.14	4.96	7.53	8.70
Married	1.71	2.71	5.04	6.30	8.16	10.23
Previously married	3.04	3.14	6.74	6.38	8.61	11.11
Type of work						
Professional	1.17**	1.38**	3.21**	3.15**	7.03	6.97**
Routine nonmanual	1.84	2.74	5.07	6.51	8.18	10.71
Manual work	2.39	4.46	6.01	8.33	8.36	11.56
Hours worked						
Full-time	1.58	2.10**	5.19	5.96	8.21	9.89
Part-time	2.06	3.03	5.20	6.46	8.06	10.54
Years of education						
7	2.75**	4.87**	6.77**	8.85**	8.97**	12.33*
8–12	1.79	2.99	4.20	5.80	7.44	9.61
≥ 13	0.38	0.72	2.33	2.91	5.42	4.32

Pearson's chi-square test for difference between categories for each variable in each time period of becoming DPRA.

\* $p < 0.05$ , \*\* $p < 0.001$ .

disability pensioners or have died. However, only 10% of Norwegians aged 50–59 years were disability pensioners in 1980<sup>15</sup>. The attrition bias<sup>23</sup> will be more pronounced in the oldest age group, as the number of persons excluded from the analysis (because of becoming disability pensioners with another diagnosis than RA or dying) is larger in this age group than in the younger age groups. It can be shown that the exclusion of these persons from the analysis will result in an overestimation of the OR, and that the overestimation will be somewhat larger in the oldest age group. This implies that if the results were corrected for attrition bias, the OR for the oldest age group would be closer to unity compared to those for the younger age groups, increasing the differences between the age groups found in this study.

Disability pensioners dying during the year the disability pension was granted were not included in the data from the NIA. This exclusion may have resulted in a slight underesti-

mation of the incidence of DPRA in this study. As the general mortality in the age groups included was low, and RA is not considered a fatal disease, this can hardly have influenced the results significantly. The increased unemployment from 1983 might have increased the number of applicants for disability pension<sup>24</sup>. If a large proportion of unemployed persons apply for disability pension, this might influence the description of the patient in the health certificate that is part of the application for a disability pension, as these people might have a different health status than other groups. Increased unemployment, however, may be only one aspect of an economic downturn that may influence the number of applicants for disability pension. Norway had less economic downturn than the rest of the Western world in the 1970s, because of profit from the oil found in the North Sea<sup>25</sup>. The diagnosis of RA is a serious one, and physicians would probably not use this diagnosis if the patient were not thought to have the disease. The

Table 4. Odds ratio adjusted for marital status, type of work, part-time work, level of education, and time period with 95% confidence intervals (CI) for becoming a disability pensioner with rheumatoid arthritis during 1971–80 and 1981–90 in Norway for employed men and women 30–39, 40–49, and 50–56 years old in 1970 and 1980.

	30–39 Years		40–49 Years		50–56 Years	
	OR	95% CI	OR	95% CI	OR	95% CI
<b>Men</b>						
Marital status						
Never married	1.00		1.00		1.00	
Married	1.45	0.91–2.31	1.18	0.92–1.52	1.17	0.95–1.44
Previously married	2.25	1.18–4.62	1.11	0.72–1.73	1.14	0.80–1.62
Type of work						
Professional	1.00		1.00		1.00	
Routine nonmanual	1.14	0.55–2.38	1.91	1.38–2.95	1.20	0.91–1.57
Manual work	2.01	1.12–3.61	2.07	1.46–2.95	1.59	1.26–1.99
Part-time work	2.91	2.03–4.18	2.42	1.98–2.95	1.97	1.65–2.33
Education (per year)	0.80	0.72–0.88	0.83	0.79–0.87	0.87	0.83–0.90
Income*	0.86	0.81–0.92	0.93	0.90–0.96	0.95	0.92–0.97
Age (per year)	1.13	1.08–1.20	1.14	1.11–1.17	1.13	1.10–1.17
Time period						
1970s	1.00		1.00		1.00	
1980s	4.00	2.61–6.13	1.93	1.50–2.48	2.61	2.17–3.15
<b>Women</b>						
Marital status						
Never married	1.00		1.00		1.00	
Married	0.82	0.61–1.11	0.94	0.76–1.16	1.06	0.88–1.28
Previously married	1.15	0.79–1.66	1.18	0.91–1.52	1.21	0.97–1.51
Type of work						
Professional	1.00		1.00		1.00	
Routine nonmanual	0.89	0.68–1.17	1.38	1.10–1.75	1.06	0.88–1.28
Manual work	1.13	0.83–1.54	1.24	1.01–1.53	1.08	0.87–1.33
Part-time work	1.35	1.11–1.63	0.95	0.83–1.08	1.07	0.95–1.21
Education (per year)	0.76	0.72–0.80	0.84	0.81–0.88	0.85	0.82–0.88
Income*	1.02	1.00–1.04	0.99	0.96–1.02	1.07	1.04–1.09
Age (per year)	1.10	1.06–1.13	1.09	1.07–1.12	1.05	1.02–1.08
Time period						
1970s	1.00		1.00		1.00	
1980s	1.89	1.54–2.32	1.60	1.38–1.86	1.31	1.15–1.50

\*Per 10,000 Norwegian Kroner.

American College of Rheumatology revised the criteria for the diagnosis of RA in 1987, but the differences between the 1958 and 1987 criteria are small<sup>26</sup> and are not likely to have affected our results substantially.

Disability pension is one of several public benefit schemes in the National Insurance Act. The higher OR for the younger age groups might possibly reflect that disability pension is one of few benefits available to the youngest age group. The public benefits other than disability pension that are included in the National Insurance Act are basic benefit, granted if an illness or disability involves significant extra expenses, attendance benefit, granted if an ill or disabled person needs special attention or nursing, rehabilitation benefits, occupational injury benefit, cash and medical benefits in case of sickness, and unemployment benefit<sup>27</sup>. All these benefits, which are not means-tested, are granted persons under the age of 67 insured under the national insurance scheme, which means practically all Norwegians who meet the requirements for each bene-

fit. In addition, residents of Norway may obtain Social Assistance that is means-tested and granted according to need of the individual in order to meet costs of living<sup>28</sup>. However, up to 1992 there were no benefits that were dependent upon the age of the applicant, and differences between age groups in becoming DPRA cannot result from age dependent benefits.

The data from the census of the whole population of Norway were edited by Statistics Norway. This secures a high data quality. However, although the census data were correct when recorded, occupation may have changed shortly afterwards. The patient with RA may have changed his/her occupation at some early stage of the disease in the same way as patients with other illnesses do, to avoid painful tasks<sup>29</sup> or to stay employed in spite of less physical ability<sup>30,31</sup>. Thus, the proportion of those becoming a DPRA who were registered in the census with manual work is probably an underestimation of the proportion having manual work at the onset of RA.

Table 5. Odds ratios (OR) adjusted for all the other variables in the model with 95% confidence interval (95% CI) for becoming disability pensioner with rheumatoid arthritis 1971-80 and 1981-90 in Norway among employed persons 35-56 years old.

	1971-80		1981-90	
	OR	95% CI	OR	95% CI
Men	1.00	ref	1.00	ref
Women	1.99	1.77-2.25	2.82	2.54-3.14
Age, yrs				
30-39	1.00	ref	1.00	ref
40-49	3.58	3.08-4.16	2.53	2.28-2.81
50-56	6.62	5.71-7.68	5.88	5.32-6.50
Marital status				
Never married	1.00	ref	1.00	ref
Married	0.85	0.75-0.96	1.06	0.91-1.23
Previously married	1.16	0.97-1.39	1.27	1.06-1.52
Type of work				
Professional	1.00	ref	1.00	ref
Routine nonmanual	1.09	0.91-1.30	1.25	1.10-1.42
Manual work	1.11	0.92-1.33	1.47	1.29-1.69
Part-time work	1.11	0.99-1.24	1.17	1.07-1.29
Education (per year)	0.85	0.83-0.88	0.82	0.80-0.84
Income*	0.91	0.87-0.94	1.01	0.99-1.02

\*Per 10,000 Norwegian Kroner.

Such an underestimation may be larger for younger than for older persons, as young persons probably may be more willing and have better opportunities to change occupation than older persons, implying that the differences between the age groups in this study is an underestimation.

In this study the association between DPRA and manual work remains significant after controlling for age, level of education, and income, implying that there are some factors associated with the physical or organizational work environment of the manual worker that increase the risk of becoming DPRA. The association between DPRA and manual work for men probably reflects that it is harder to remain employed with RA for a manual worker than a professional<sup>32</sup>, or that professionals' work environments can be modified more easily so that patients with RA can remain employed even with significant physical incapacity<sup>32,33</sup>.

Manual work predicted DPRA for men in all age groups, but not for women. This may reflect that type of work, as defined in this study, is a better measure of ergonomic demands for men than for women. Many typical female professional occupations, e.g., registered nurse, are physically demanding.

Low income predicted DPRA for men in all age groups after controlling for all other variables in the model, including manual work, while high income predicted DPRA for women, but only in the oldest age group.

In Norway the disability pension is calculated as a basic amount, and a supplementary pension is dependent upon the income of the applicant. Pensioners without income to give them supplementary pension are entitled to a special supplement that equals 79.33% of the basic amount for the unmarried pensioner<sup>27</sup>. For persons without or with a very low

income a full pension will mean a high compensation rate, i.e., increased income. Persons with an average income can calculate upon a compensation rate of roughly 60%, and persons with a higher income will have a lower compensation rate. The calculation of the size of the disability pension is complicated<sup>27</sup> and is not common knowledge.

A high compensation rate has been thought to increase the number of applicants for disability pension. Persons that are granted a special supplement, i.e., have a high compensation rate, have probably been granted a reduced disability pension, and this information has not been included in our study. In our study a high compensation rate might increase the number of DPRA for men, but not for women, as low level of income does not increase the risk of becoming DPRA for women. The difference in OR between the youngest and the oldest men is so large that one might question if the compensation rate is important for the oldest men. Studies from both USA<sup>34</sup> and Norway<sup>35,36</sup> also question if the compensation rate is a major incentive in becoming a disability pensioner. Other reasons for the association between low level of income and high risk of becoming DPRA should be studied.

The proportions of nonemployed men (Table 1) and men with part-time work were low, implying that full-time employment was the norm for men. Nonemployed men and men working part-time are probably highly selected towards men with poor health, and some may already have RA. Nonemployment and part-time work were of little importance for becoming DPRA for women. Moreover, persons receiving sickness or rehabilitation benefits while waiting for evaluation of the application for disability pension will remain registered as employed in the census, not nonemployed.

The larger effect of the period variable for the youngest age

group may have several explanations. It might reflect that NIA evaluated the applications more leniently in the 1980s than in the 1970s, especially those from young persons. Or it might reflect that the young persons in the 1980s had poorer health, a decreasing tolerance of pain, or greater difficulties in obtaining a job compared to older persons and applied for disability pension more readily.

The incidence of disability pension with a particular diagnosis might reflect the occurrence of the disease studied. If so, the effect of the period variable is probably underestimated as the prevalence of RA has decreased in Norway<sup>16</sup>, as it has in most of the Western world<sup>7,37-39</sup>. The large effect of the period variable, i.e., higher risk in the 1980s than in the 1970s, even after controlling for all the predictors in the study in all age groups, implies that important factors that influence the probability of becoming DPRA were not included in our analysis. Such factors might be less willingness to invest in adjustment of workplaces, increased demands on the level of physical ability of the employed, or the increased unemployment starting from 1983<sup>40</sup>.

In this analysis the assumptions concerning the biological basis, e.g., severity of the disease, in various age groups have been considered equal. However, one possible explanation of why the strength of the associations varied between age groups is that the severity of the disease varies between age groups. Traditionally, RA has been thought to progress faster for younger patients, which would explain our results, but recently it has been reported that older persons may have faster progression of disease<sup>14,41,42</sup>.

However, the large proportion of healthy persons in the youngest age group may create little acceptance in the labor market for a young patient with special needs. The higher disability rates of the youngest age group during the 1980s, when there were many unemployed young persons, may be interpreted as support for this view.

The stronger association between manual work and becoming DPRA for men in the youngest than in the oldest age group might imply that rehabilitation of younger patients with RA from manual work to routine nonmanual work might have the larger preventive effect. The attributable risk for manual work confirms this, as the attributable risk was larger for the men aged 30–39 years than men 50–56 (Table 3). However, in the total population the proportion having RA in the youngest age groups was very small; indeed, age was the strongest predictor for becoming DPRA in this study (Table 5). The effect of rehabilitation would be larger in the youngest age group, but the number of people who could avoid becoming DPRA would be much larger in the oldest age group.

The association between manual work and disability pension with a musculoskeletal disease has been thought to imply a causal relationship<sup>43</sup>. The relationship between manual work and a musculoskeletal disease is most probably not causal, as implied by this study, but points to problem areas in which poor health makes continued employment difficult.

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