

INDUSTRIAL DIFFERENCES IN DISABILITY RETIREMENT RATES IN DENMARK, 1996–2000

HARALD HANNERZ, FINN TÛCHSEN, SØREN SPANGENBERG, and KAREN ALBERTSEN

National Institute of Occupational Health
Copenhagen, Denmark

Abstract

Objectives: The objective of the study was to identify industries associated with a high risk of disability retirement and to roughly estimate the fraction of the retirements that can be attributed to a non-optimum work environment. **Materials and Methods:** All economically active people in Denmark, aged 20–54 years, in the beginning of 1996 (1 196 235 men and 1 063 058 women) were followed-up from 1996 to 2000. Gender stratified and age standardized incidence ratios (SIR) for disability retirement were calculated for each of 58 baseline industries. A Monte-Carlo simulation model was used to estimate attributable fractions. **Results:** In total, we observed 17 242 disability retirements among the men and 20 910 among the women. The attributable fraction was 38% for the women and 40% for the men. Twenty-six of the SIR-values (13 among the men and 13 among the women) were statistically significantly high. Twenty-two of the 26 groups with a high SIR had been identified by previous research as groups at high risk of circulatory disease and/or musculoskeletal disorders. Two of the remaining four groups with a high SIR were associated with hard physical work (men and women engaged in horticulture and forestry) while the other two consisted of men in female-dominated industries (child-care and cleaning). **Conclusions:** The present study identified a series of high-risk industries. It also corroborated previous findings, which state that circulatory disease and musculoskeletal disorders are major risk factors and that hard physical work is an independent risk factor of disability retirement. Further research is needed to find out why men in some stereotypically feminine industries are at high risk of disability retirement.

Key words:

Inequality in health, Work disability, Premature retirement, Cohort study, Population study

INTRODUCTION

In Denmark, disability pension may be granted to people aged 18–64 years if their work ability is permanently reduced by more than 50% due to physical or mental illness, and/or social circumstances, and all possibilities for treatment and rehabilitation are exhausted. According to the law, decisions regarding the granting of disability pensions should in addition to illness also involve other factors such as age, education, occupation and local employment opportunities [1]. Seven percent of the Danish population, aged 40–49 years, 11% of the population aged 50–54, and 14% of the population aged 55–59 received a disability pension in 2002 [2].

Each of these early retirements represents disappointed aspirations, reduced quality of life for the worker, his or her family, and reduced income for the retired person and the family, the workplace and the society at large. They are usually followed by lower respect and lower self-esteem. The distribution of early retirements seems to be dependent on industry [2.] Preventive efforts are needed, and such efforts might be more effective if broad campaigns are supplemented with campaigns directed and tailored to groups with a documented high risk [3]. The aim of the present study was to identify industries associated with a high risk of disability retirement and to

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Address reprint requests to H. Hannerz, MSc. Stat, Licentiate, National Institute of Occupational Health, Lers Parkallé 105, DK-2100 Copenhagen, Denmark (e-mail: hh@ami.dk).

roughly calculate the fraction of the retirements that can be attributed to a non-optimum work environment.

MATERIALS AND METHODS

The data material

The material consisted of data obtained through a record-linkage between two national registers – the centralized civil register and the employment classification module. The employment classification module has existed since 1975 and contains annual information on socio-economic status, occupation, and industry for every adult inhabitant of Denmark. The centralized civil register contains information on gender, addresses and dates of birth, death and migration for every person who is or has been an inhabitant of Denmark sometime between 1968 and today.

The follow-up

All economically active persons in Denmark, aged 20–54 years (1 January 1996, 1 196 235 men and 1 063 058 women) were followed in the period of 1996–2000 for the first occurrence of the socio-economic status “disability pensioner” in the employment classification module. If a disability retirement had occurred during a certain calendar year, the retirement date was set to 1 July that year. Dates of deaths, emigrations and retirements were used to calculate person years at risk for each individual.

Statistical analysis

For each gender, we used indirect standardization to adjust for five-year age groups, with all economically active people of the concerned gender, in the total population of Denmark as standard population. Age standardized incidence ratios (SIR) were calculated by industry. We used the official industrial classification of the National Institute of Occupational Health, which contains 58 different industrial groups [4]. The classification is an aggregation of the Danish Industrial Classification of All Economic Activities, 1993 [5], which is a national version of the European Industrial Classification of All Economic Activities.

By an excess fraction we mean the proportion of disability retirements that would not have occurred if the disability

retirement rate in each of the industries had been as low as that in the industry associated with the lowest risk.

It follows from the statistical distribution function for order statistics [6] that the range of the estimated risks are likely to be wider than the range of the true risks, and that the lowest estimated risk is likely to be lower than the lowest true risk. When estimating the excess fraction, it is therefore necessary to adjust for random fluctuations. To accomplish this adjustment, we used Monte Carlo simulation to find the excess fraction that corresponds with the observed variation between the industries.

The general principles of how to use computer-aided Monte Carlo simulation to estimate statistical parameters are well described by, e.g., Morgan [7] and Ross [8]. The simulations in the present study were performed by use of the statistical analysis software SAS version 8.2 on the basis of the following assumptions:

- The number of disability retirements in each industry follows a Poisson distribution.
- The industries’ true risk ratios increase geometrically with their rank order.

The observed variation was measured with Pearson’s chi-square [9].

A part of the excess fraction might be due to industrial differences in the composition of social status groups. To explore this we calculated the excess fraction both with and without standardization for social class (legislators, senior officials and managers; professionals; technicians and associate professionals; employees in a work that requires skills at a basic level; employees in elementary occupations) according to the official classification system used by Statistics Denmark.

RESULTS

In total, we observed 17 242 disability retirements among the men and 20 910 among the women. The age standardized incidence ratios ranged from 0.28 (general practitioners and dentists) to 2.18 (the fishing industry) among the men, and from 0.47 (office and administration in the transport and the wholesale sector) to 1.99 (cleaning, laundries and dry cleaners) among the women. Thirteen

of the 57 SIR-values were significantly high and 23 were significantly low among the men at a significance level of 0.05. Thirteen were significantly high and 21 were significantly low among the women. The excess fractions without social group adjustment were 0.495 (95% CI: 0.365–0.618) for the women and 0.517 (95% CI: 0.430–0.600) for the men. The respective fractions with adjustment for social group were 0.378 (95% CI: 0.280–0.479) and 0.397 (95% CI: 0.329–0.466).

Among the men, the following industries were associated with a significantly high risk of disability retirement: the fishing industry (SIR = 2.18), nursing homes and home care (SIR = 1.75), cleaning, laundries and dry cleaners (SIR = 1.71), transport of goods (SIR = 1.59), transport of passengers (SIR = 1.40), poultry slaughtering and fish products (SIR = 1.39), hotels and restaurants (SIR = 1.35), slaughterhouse industry (SIR = 1.35), finishing (SIR

= 1.33), child-care (SIR = 1.25), horticulture and forestry (SIR = 1.17), manufacture of wood and wood products (SIR = 1.12), and road contractors (SIR = 1.12).

The corresponding list for women consists of the industries: cleaning, laundries and dry cleaners (SIR = 1.99), poultry slaughtering and fish products (SIR = 1.59), textile, clothing and leather industry (SIR = 1.50), slaughterhouse industry (SIR = 1.48), hotels and restaurants (SIR = 1.46), nursing homes and home care (SIR = 1.44), agriculture (SIR = 1.38), paper, cardboard and bookbinding industries (SIR = 1.31), manufacture of bread, chocolate, tobacco, etc. (SIR = 1.29), medical equipment, toys, cameras, etc. (SIR = 1.22), horticulture and forestry (SIR = 1.22), transport of goods (SIR = 1.21), and iron and metal industries (SIR = 1.17).

A complete list of SIR-values and 95% confidence intervals by industry and gender is given in Table 1.

Table 1. Industrial standardized incidence ratios (SIR) for disability retirement with 95% confidence interval (CI) among Danish men and women 1996–2000

Industry	Men			Women		
	Cases	SIR values	95% CI	Cases	SIR values	95% CI
1	2	3	4	5	6	7
010 Metal and steelworks, and foundries	59	1.07	0.81–1.38	17	1.16	0.68–1.86
020 Manufacture of transport equipment	104	0.73	0.60–0.88	28	0.83	0.55–1.20
030 Shipyards	105	0.76	0.62–0.92	15	1.10	0.61–1.81
040 Electricity and heat supply	112	0.69	0.57–0.83	36	0.71	0.50–0.99
050 Iron and metal industries	443	0.95	0.86–1.04	235	1.17	1.03–1.33
060 Engineering industry	532	0.79	0.72–0.86	220	1.04	0.91–1.19
070 Electricity and electronics industry	139	0.60	0.51–0.71	205	0.99	0.86–1.14
080 Car industry	278	1.08	0.96–1.22	59	0.79	0.60–1.02
090 Road contractors	677	1.12	1.04–1.21	37	0.51	0.36–0.71
100 Bricklayer, joiner, and carpentry work	478	0.99	0.90–1.08	32	0.63	0.43–0.88
110 Finishing	232	1.33	1.17–1.51	34	0.77	0.53–1.07
120 Insulation and installation businesses	294	0.70	0.63–0.79	62	0.62	0.48–0.80
130 Printing works and publishing	296	1.07	0.96–1.20	181	0.92	0.79–1.06
140 Paper, cardboard and bookbinding industries	100	1.06	0.86–1.28	72	1.31	1.03–1.65
150 Wholesale trade	772	0.60	0.56–0.64	432	0.61	0.56–0.67
160 Transport of goods	1667	1.59	1.51–1.67	425	1.21	1.10–1.33
170 Transport of passengers	850	1.40	1.31–1.49	254	1.08	0.96–1.23
180 Fire service, lighthouse and salvage corps	81	0.81	0.64–1.00	27	1.22	0.80–1.77
190 Textile, clothing, and leather industry	75	0.78	0.61–0.98	378	1.50	1.35–1.66

Table 1. – contd

1	2	3	4	5	6	7
200 Manufacture of wood and wood products	381	1.12	1.02–1.24	154	1.06	0.91–1.24
210 Mineral, oil, rubber and plastic products	200	1.03	0.89–1.18	126	1.05	0.88–1.25
220 Stone-works, pottery, and glass industry	169	1.06	0.92–1.24	42	0.67	0.48–0.90
230 Medical equipment/toys/cameras/, etc.	75	0.76	0.60–0.96	158	1.22	1.05–1.43
240 Manufacture of industrial chemicals	94	0.71	0.57–0.87	70	0.85	0.66–1.07
250 Heavy raw material and semi-manufacture	76	0.89	0.70–1.12	14	0.85	0.46–1.42
260 Pharmaceutical industry	38	0.58	0.41–0.80	114	1.00	0.83–1.20
271 Office and administration (transport and wholesale)	99	0.79	0.64–0.96	35	0.47	0.33–0.65
272 Office and administration (service)	219	1.06	0.93–1.21	99	1.01	0.82–1.22
273 Finance/Public office and administration	768	0.72	0.67–0.77	1376	0.62	0.59–0.66
274 Private office and administration	489	0.43	0.39–0.47	654	0.53	0.49–0.58
281 Car dealers	120	0.66	0.55–0.79	25	0.58	0.37–0.85
282 Garage	23	0.70	0.44–1.04	36	1.06	0.74–1.47
283 Shops	295	0.91	0.81–1.01	575	0.89	0.82–0.97
290 Supermarkets, department stores, etc.	154	0.61	0.52–0.71	361	0.87	0.78–0.96
300 Sewers, water and gas supply	47	0.72	0.53–0.96	14	0.71	0.39–1.19
310 Personal care and other services	100	1.17	0.95–1.42	259	1.10	0.97–1.24
320 Cleaning, laundries, and dry cleaners	229	1.71	1.50–1.95	720	1.99	1.85–2.14
330 Telecommunication	90	0.71	0.57–0.87	90	0.81	0.65–0.99
340 Surveillance, armed forces, police, etc.	282	0.57	0.50–0.64	164	0.90	0.78–1.05
350 Hotels and restaurants	326	1.35	1.21–1.51	593	1.46	1.34–1.58
361 Photographers/film and video production	12	0.36	0.18–0.62	16	0.61	0.35–0.98
362 Entertainment, culture and sport	163	0.87	0.75–1.02	151	0.78	0.66–0.91
363 Libraries and archives	39	1.30	0.93–1.78	103	0.68	0.56–0.82
370 Slaughterhouse industry	261	1.35	1.20–1.53	113	1.48	1.23–1.78
380 Poultry slaughtering and fish products	87	1.39	1.11–1.71	149	1.59	1.35–1.87
390 Beverage industry	131	0.98	0.83–1.17	80	1.14	0.91–1.42
400 Manufacture of bread, chocolate, tobacco, etc.	127	0.93	0.78–1.10	248	1.29	1.14–1.46
410 Manufacture of dairy products	71	0.73	0.57–0.92	66	1.09	0.84–1.39
420 Agriculture	616	0.99	0.92–1.07	420	1.38	1.26–1.52
430 Horticulture and forestry	151	1.17	1.00–1.38	113	1.22	1.01–1.46
440 Hospitals	262	0.97	0.86–1.10	1198	0.78	0.74–0.83
450 Nursing homes, home care, etc.	451	1.75	1.60–1.92	3617	1.44	1.39–1.49
460 Child care, etc.	238	1.25	1.10–1.42	1552	0.87	0.83–0.91
471 General practitioners, dentists, etc.	29	0.28	0.19–0.40	165	0.48	0.41–0.56
472 Health care (not elsewhere classified)	107	0.90	0.74–1.08	371	0.75	0.67–0.83
480 Education and research	688	0.60	0.56–0.64	1550	0.71	0.68–0.75
490 Fishing	166	2.18	1.87–2.54	6	1.73	0.63–3.76
990 Unstated	2075	3.70	3.54–3.86	2564	2.19	2.11–2.28

DISCUSSION

We found large industrial inequalities regarding disability retirement incidence in Denmark, and we identified a number of high-risk industries.

The excess fractions tell us that to eliminate all of the inequalities without worsening the situation in any group, the total incidence must be reduced by at least 49% among the women and 52% among the men.

The inequalities reflect, however, the combined effect of selection into the industries and differences with regard to social group composition, occupational exposures, unemployment levels and social responsibility of the employers. If we assume that there is no selection bias and apply the principles of bench marking then the excess fractions obtained with social group adjustment (38% for the women and 40% for the men) would conservatively estimate the proportions of the cases that are attributable to a non-optimal work environment.

A high rate of disability may be an indicator of a problematic work environment. However, as mentioned in the introduction, it is not the only reason. Methodological flaws should also be taken into consideration. People were not randomly assigned but self-selected to their industries. Various types of selection mechanisms might have caused incidence differences that have nothing to do with the work situation. Another drawback is that exposure differences become diluted because people can change from one industry to another. A third drawback is that exposures in the work environment, salaries, etc. can differ between people employed in the same industry. An industry could contain subgroups at high risk even if the overall incidence is low. It has, for example, been shown that bridge and tunnel construction workers run a significantly higher risk for premature retirement than other workers in the same industry [10].

Since we included the total economically active population in the concerned age groups we obtained high statistical power. Another strength is that the study was prospective and that we used a sufficiently long follow-up period to allow for the time that may pass between the appearance of work disability and the granting of a pension.

It has been shown that circulatory and musculoskeletal disorders generally cause more disability retirements than all other somatic illnesses do jointly [11–14]. We compared the results obtained in the present study with official statistics on industrial cause-specific hospitalisation ratios in Denmark, 1994–1999 [4]. Among men, 10 of the 13 industries with significantly high disability rates posed a significantly high risk of either circulatory or musculoskeletal disorders, and eight of them put workers at significantly high risks of both disease categories. Among the women, 12 of the 13 industries posed a significantly high risk of at least one of the disease categories while seven of them manifested significantly high risks of both. A large part of the work necessary to reduce disability retirements would thus consist of measures designed to prevent circulatory disease and musculoskeletal disorders. The exceptions, i.e., the groups associated with a high risk of disability retirement, but none of the two disease categories, were: men and women engaged in horticulture and forestry, men in the child care sector, and men in the cleaning industry. The latter group was, however, associated with an increased risk for asthma. The situation in the horticulture and forestry industry corroborates earlier findings, which states that heavy physical work is a risk factor of premature retirement [15–18], and that it acts independently of prevalent disease [19].

We found a significantly high risk of disability retirement among men in childcare while women in childcare encountered a significantly low risk. Both men and women in the cleaning industry were at a high risk of disability retirement, but for men, musculoskeletal disorders or cardiovascular diseases could not explain it. Disability retirement is not granted to people who do not apply for it. Reasons for applying are not only medical. Both childcare and cleaning work are associated with relatively low societal prestige and accordingly low economic reward. To be in minority as a man in a low prestige women-dominated job might be associated with an even lower societal prestige. Hence, men in these industries might be more inclined to apply for a disability pension than men in other industries. Unemployment is another non-medical factor that might have influenced these retirement rates. If this were

the case, it would mean that men in the child-care sector have more difficulties in finding a job than women. It is held that child-care workers ought to be patient, nurturing and soft-spoken and that masculine traits, such as aggressiveness and ambitiousness, are likely to be seen as inappropriate for the role [20]. Hence, hiring discrimination might have caused a part of this gender inequality. Another part might have been caused by gender differences in educational background. Further research is needed to uncover the mechanisms behind the elevated retirement rates among men in the child-care sector.

The aim of the present study was to identify industries associated with high disability retirement rates. However, the design of the study also allowed us to identify industries associated with significantly low rates. Most of these industries have been associated with low hospitalization rates [4]. We found, however, two exceptions, which prove that it is possible for an industry to have low retirement rates in spite of high hospitalization rates for both circulatory and musculoskeletal diseases. The concerned groups were: men in the sewer, gas and water supply industry, and men in the shipyard industry. The low standardized disability pension ratio (0.72) for sewer, gas and water supply workers may be a result of the Danish social legislation, where so called flexible jobs shall contribute to a more flexible labor market. The purpose is to create jobs for persons with a limited working capacity in order to ensure an active working life for as many people as possible and to reduce the access to disability pension. The local authorities finance the disability pensions; they also administrate flexible jobs and contribute to the salary, and at the same time employ many sewer, gas and water supply workers. Thus, the local authorities have an economic interest in keeping people occupationally active, but further research is needed to determine if the low number of disability pensions is due to flexible jobs. The reason for the low standardized disability pension ratio (0.76) among Danish shipyard workers is not known.

Recently, several large-scale intervention projects were initiated after Danish surveillance systems identified a need for preventive measures or health promotion program. A new research and intervention program among

home care workers in Denmark, which is in its planning stage, and the Healthy-Bus project, which includes more than 200 local initiatives among Copenhagen bus drivers may serve as examples of such enterprises [21]. Another example is the political program "The ten most hazardous professions", which aims at reducing ill health in ten professions identified in surveillance systems maintained by the National Institute of Occupational Health, Denmark [22]. These programs will hopefully decrease future disability retirement rates in some of the high-risk industries identified by the present study.

In conclusion, we found that most of the industries with high disability retirement rates already had been identified by official statistics as high-risk industries with regard to circulatory disease or musculoskeletal disorders. We also found support for a hypothesis that heavy physical work is a risk factor for premature retirement that acts independently of prevalent disease. Moreover, we identified some areas where future research may lead to a broader understanding of the industrial inequalities in disability retirement rates.

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