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Negative health selection into physically light occupations

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SUMMARY Health selection, which transfers workers with health problems from physically heavy to physically light occupations, may be a factor contributing to excessive morbidity in the latter group. The aim of this study was to investigate whether workers who had stopped doing heavy work and moved to occupations with low physical demand are generally more ill than workers who had always done light work. The study population comprised 5436 men and 5486 women aged 25 to 74 years, who were interviewed within the scope of the Statistics Sweden Survey of Living Conditions in the years 1977 and 1979–81. For all respondents detailed recording of the occupational histories was completed. For all the diseases and functional disorders studied an increase in risk could be seen for movers. Moreover, movers who had left their heavy work most recently had the greatest risks. This association was most apparent when studying musculoskeletal disorders and impaired working capacity for men and diseases of the circulatory organs and impaired hearing for women. The findings indicate clearly that there is a negative health selection into physically light occupations, introducing a bias (especially in cross-sectional studies) that causes an apparent excess morbidity in occupations with low physical demand.

The term 'health related selection' is used widely in occupational studies, often referring to factors involved in the healthy worker effect: the selection of a relatively healthy population for employment and the survival of the healthier workers in the industry. Because individuals entering the labour force are sufficiently healthy to obtain and hold employment while the ill workers may leave the industry, prevalence of sickness and death rates of particular occupational groups are generally lower than those of the general population.[1–8] Thus health related selection causes underestimates or overestimates of occupational mortality and morbidity, introducing a bias (especially in cross-sectional studies) which tends to mask real occupational or environmental health effects.

The principal objective of the present investigation was to study morbidity and the occurrence of functional disorders among those who, at the time of data collection, worked in physically light occupations, by taking their occupational exposure histories into consideration.

The following hypotheses were investigated: (1) If the levels of occupational exposure are defined as either heavy or light according to the physical demand of work and if people move from the heavy level to the light level mainly because of impaired health, the prevalence of sickness and functional disorders at the light level would therefore be undeservedly high. (2) As musculoskeletal disorders (especially low back pain) have been strongly documented as work related health problems,[9–10] mainly associated with posture, improper lifting of objects at work or similar physical strains, the overestimation of morbidity rate at the light level would be most apparent in the study of diseases of the musculoskeletal system and connective tissue. (3) Those who have recently moved from physically strenuous occupations to lighter work are generally more ill than those who moved further in the past, assuming that the former group has a more recent experience of health problems resulting from heavy work.

Method

The study was based on data collected within the framework of the Statistics Sweden Survey of Living Conditions, which is accomplished in the form of interviews with about 8000 people every year. The subjects are chosen randomly and constitute a representative sample of the Swedish population. They are asked a great number of questions about

their living conditions (for example, housing, health, occupation, working environment, leisure time, etc). The development of these surveys as well as issues of quality control are discussed elsewhere.[11]

In the years 1977 and 1979–81 detailed recording of the occupational histories of 25 600 people was completed. All jobs that lasted at least two years were recorded, together with detailed accounts of the respondents' current working conditions. Furthermore, the respondents were asked to report the length of each employment. The occupations were coded according to the Nordic Occupational Classification (NYK), which follows the recommendation of the three-digit International Classifications (ISCO). When classifying the level of exposure at work an Occupational Classification System proposed by Alfredsson and Theorell[12] was used. Occupations in this system are classified by means of conditions in the working environment. For each demand or strain the occupations are ranked by the proportion of employees reporting that demand at work. On the basis of this classification, two exposure categories were constructed in the present study, defined according to the sum of eight characteristics describing the physical demand at work. These eight characteristics were selected by a factor analysis, where all factors had high score coefficients in the 'physical work environment' dimension. These factors were: heavy lifts daily, repetitive and one-sided working movements, unsuitable working postures, heavy shaking or vibration, daily perspiring from physical exertion, contact with dirt, deafening noise, and risk of exposure to accidents. Of the total population of 25 600, 5436 men and 5486 women fell into the low exposure category and those form the study population. They ranged in age from 25 to 74 years and at the time of data collection were all still working in physically light occupations. By taking occupational histories into consideration, it was possible to divide the subjects into those who had always been working at the light level (stable workers) and those who had moved to the light level from the heavy level (movers). Moreover, movers were subdivided according to the length of time they had been working at the light level. Thus, those called 'recent movers' had been working at the light level five years or less, and those called 'past movers' had worked more than five years at that level.

State of health was measured by means of self-reported morbidity. People were classified as 'ill' if they answered "yes" to either of the questions "Do you suffer from any long-term illness, after-effects from an accident, disability or other ailment?" or "Do you regularly take medicine for anything (else)?" If the answer is yes to either of the questions the respondent is asked to report the kind of illness he or she is suffering from as accurately as possible. Moreover, follow-up questions by which it is possible to determine the amount of pain and suffering caused by the illness are asked. The reported illnesses are coded by a central unit of Statistics Sweden. The coding system was developed and tested by consultant physicians. The symptoms are matched with the International Classification of Disease, 8th revision (ICD).

The present study deals with diseases classified as affecting (a) the musculoskeletal system and connective tissue and (b) the circulatory organs. Only diseases that afflict the respondents often/all the time, seriously or very seriously are included. In addition, reported functional disorders, that is, impaired hearing and impaired working capacity, have been studied.

The data were analysed using epidemiological programs developed by Rothman and Boice.[13] The measure of association was the relative risk ratio. The risk ratio was adjusted for age taking the theoretically least exposed category as the standard. The general approach was to treat the data as a series of 2×2 tables comparing controls and cases in different age groups in different categories, and then calculating the age adjusted relative risks for each category. Confidence limits for the risk ratio were constructed using the test-based interval estimation proposed by Miettinen,[14] which couples the point estimates of the relative risk and the Mantel-Haenszel statistic.

Results

Table 1 gives the prevalence rates and relative risks for long term illness for men and women respectively. For each sex the comparison of morbidity is made between those who had always worked in physically light occupations (stable workers) and those who, previous to their current employment at the light level, had worked in physically heavy occupations (movers). Moreover, movers are subdivided according to the length of time they spent at the light level. Using the theoretically lowest strain group (ie, stable workers) as the reference category, the relative risks are seen to rise to 1·43 for male movers and to 1·53 for female movers. Comparing those male movers who left heavy level recently with past movers, a considerable increase in risk can be seen for recent movers (SRR = 2·03). However, recent female movers seem to have the same risk for long term illness as past movers.

Tables 2 and 3 give the prevalence rates and relative risks for diseases of the musculoskeletal system and connective tissue, diseases of the circulatory organs, impaired hearing, and impaired working capacity for

Table 1 *Prevalence rate (PR) and age adjusted relative risk (SRR) for long-term illness by sex and occupational history: workers in physically light occupations*

		Occupational history			
			Movers from the heavy level		
		Stable workers	*Recent*	*Past*	*All*
Men	PR (%)	28·4	35·8	41·6	40·7
	n	3524	310	1602	1912
	SRR	1·00	2·03***	1·37***	1·43***
	90% CI	(ref.cat)	1·36–2·10	1·23–1·54	1·28–1·58
Women	PR (%)	31·4	38·2	47·9	44·6
	n	4392	372	722	1094
	SRR	1·00	1·49**	1·54**	1·53***
	90% CI	(ref.cat)	1·23–1·80	1·25–1·67	1·29–1·65

* p<0·1
** p<0·01
*** p<0·001

Table 2 *Prevalence rate (PR) and age adjusted relative risk (SRR) for different disorders by occupational history: men in physically light occupations*

		Occupational history			
			Movers from the heavy level		
Disorder		*Stable workers*	*Recent*	*Past*	*All*
Disease of the musculoskeletal system and connective tissue	PR (%)	4·57	11·34	10·72	10·81
	SRR	1·00	3·41***	2·04***	2·18***
	90% CI	ref.cat.	2·5–4·6	1·6–2·4	1·8–2·5
Disease of the circulatory organs	PR (%)	3·95	4·22	8·71	7·97
	SRR	1·00	1·58	1·48**	1·51**
	90% CI	ref.cat.	0·9–2·4	1·2–1·8	1·2–1·8
Impaired hearing	PR (%)	3·46	6·59	8·73	8·34
	SRR	1·00	2·88***	1·98***	2·05***
	90% CI	ref.cat.	1·6–3·6	1·5–2·3	1·6–2·4
Impaired working capacity	PR (%)	4·53	10·79	10·70	10·76
	SRR	1·00	3·31***	1·66***	1·80***
	90% CI	ref.cat.	2·3–4·5	1·4–2·1	1·5–2·2

* p<0·1
** p<0·01
*** p<0·001

Table 3 *Prevalence rate (PR) and age adjusted relative risk (SRR) for different disorders by occupational history: women in physically light occupations*

		Occupational history			
			Movers from the heavy level		
Disorder		*Stable workers*	*Recent*	*Past*	*All*
Disease of the musculoskeletal system and connective tissue	PR (%)	7·17	10·23	12·71	11·94
	SRR	1·00	1·62***	1·51***	1·52***
	90% CI	ref.cat.	1·2–2·2	1·1–1·7	1·2–1·7
Disease of the circulatory organs	PR (%)	4·34	6·22	9·10	8·16
	SRR	1·00	1·94**	1·45*	1·51*
	90% CI	ref.cat.	1·2–2·6	1·0–1·7	1·2–1·8
Impaired hearing	PR (%)	2·03	3·54	3·53	3·51
	SRR	1·00	1·91*	1·32	1·46*
	90% CI	ref.cat.	1·2–3·1	0·9–1·8	1·0–1·9
Impaired working capacity	PR (%)	5·06	5·71	12·31	10·05
	SRR	1·00	1·38	1·53***	1·52***
	90% CI	ref.cat.	0·9–1·9	1·3–2·1	1·2–1·9

* p<0·1
** p<0·01
*** p<0·001

both sexes separately. Table 2 shows an increase in risks for movers to 2·18 for musculoskeletal diseases, to 1·51 for diseases of the circulatory organs, to 2·05 for impaired hearing, and to 1·80 for impaired working capacity. The difference in risks between stable workers and recent movers is even more apparent, especially when analysing musculoskeletal diseases (SRR = 3·41) and impaired working capacity (SRR = 3·31).

Furthermore, female movers, according to table 3, seem to be more prone to the disorders studied compared with stable women. The strongest increase in risk is seen among recent movers, especially when studying diseases of the circulatory organs (SRR = 1·94) and impaired hearing (SRR = 1·91).

Table 4 *Overestimation ratio (OER) for different disorders in physically light occupations due to selection*

Disorder	*Men (OER)*	*Women (OER)*
Long term illness	1·15	1·09
Disease of the musculoskeletal system and connective tissue	1·48	1·13
Disease of the circulatory organs	1·35	1·17
Impaired hearing	1·49	1·24
Impaired working capacity	1·50	1·20

The ratios given in table 4 are compared with what would be observed if there was no selection into physically light occupations. Thus, due to selection, we should expect 15 to 50% higher morbidity for men (9 to 24% for women), depending on the kinds of disorders studied. The lower selection effect for women is probably due to the lower proportion of movers among female workers compared to male workers (20% and 35% respectively).

Discussion

Although many people who leave physically strenuous occupations do so for reasons unrelated to health, there are quite a few who change because they are no longer able to carry out heavy work or possibly because they consider heavy work is dangerous to their health. What happens to those who are no longer fit enough to continue in their heavy jobs? Some of them, in more serious cases, will probably leave the workforce partly or entirely and some of them will continue working in physically less strenuous occupations. These lighter occupations might therefore, especially in cross-sectional data, show an 'undeservedly' high morbidity. The aim of the present study was to investigate the possible responsibility of previous heavy work for health problems at a currently light level, and the findings confirm the initial hypotheses that 'blame' former, heavy exposure for increased morbidity at the light level. Not unexpectedly, the results indicate also that musculoskeletal disorders cause highly selective turnover among men at work with high physical demand. Men who had stopped doing heavy work reported a very high occurrence of musculoskeletal disorders. Since those are strongly associated with impaired working capacity, the occurrence of the latter disorder was also very high. Moreover, the findings that recent movers of both sexes in most cases are more affected by the disorders studied, gives support to the initial hypothesis. The after effects of health problems associated with heavy work are probably stronger among those who left the heavy level more recently, compared with past movers who have had more time for 'rehabilitation'.

The findings of the present study indicate clearly that there is a negative health selection into physically light occupations, resulting in an overestimation of illness at that level. The degree of overestimation in such occupations may, according to this study, depend on the kind of disorder studied, the proportion of mobile workers, and the proportion of male (or female) workers. The results indicate also the need for detailed recording of occupational histories in cross-sectional studies, especially when the aim of the study is to analyse morbidity in occupations with high turnover rates.

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