

Work load and individual factors affecting work disability among aging municipal employees

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TUOMI K, LUOSTARINEN T, ILMARINEN J, KLOCKARS M. Work load and individual factors affecting work disability among aging municipal employees. *Scand J Work Environ Health* 1991;17 (suppl 1):94-8. A cohort of 6165 municipal workers 44 to 58 years of age was followed during 1981-1985. The most impairing work loads were poor work postures and poor physical climate, whereas good possibilities for development at work prevented work disability. Aging particularly increased the incidence of work disability, whereas physical exercise maintained work ability. Among workers who suffered from any cardiovascular disease, a low level of muscular work and a high level of leisure-time physical exercise decreased work disability. Compared with the work ability of active workers, work disability was more linked to individual than to work load factors.

Key terms: age, disease, exercise, life satisfaction, muscular work, physical climate, smoking, work posture.

Premature medical retirement according to the municipal disability pension scheme used in Finland requires the presence of decreased work ability caused primarily by disease. The major medical causes of premature retirement (disability pension) in the age group 45-59 years are musculoskeletal, cardiovascular, and mental diseases (1). The decision for premature medical retirement also takes into consideration individual work load factors and stress reactions. We have earlier shown that there are several work load factors, such as heavy physical work, hot and cold work environments, lack of freedom, few possibilities to develop, and role conflicts at work that predict poor work ability or disability (2, 3).

The present study aimed at creating models for disability through the study of work load and individual factors. Another objective was to compare the developed models of disability among those who had left work because of work disability and those who were still actively working.

Subjects and methods

In 1981, 6257 actively working municipal employees participated in a cross-sectional questionnaire study (2). During the follow-up period of 1981-1985, 92 employees died, and 544 employees were granted a disability pension on medical grounds. The subjects were grouped into six categories according to their health in 1981 (table 1).

The dependent variable in the logistic model (4) was dichotomized into work-abled and work-disabled classes. As independent variables we used work load

and individual factors, which were dichotomized or used as indicator variables (3).

The variable scales were cut below or near the median. Only age was allowed to have three classes (44-48, 49-52, and 53-58 years). To restrict the number of independent variables in the models, we grouped the work load factors into four categories and the individual factors into three categories. The modeling was performed separately for the work load and the individual factors. Thus it was possible to diminish considerably the number of observational units (the number of observed combinations which results from the cross-tabulation of all the independent variables, ie, units). For the modeling, one variable with the smallest P-value in Pearson's chi-square test was selected from each group.

The effect of an independent variable was tested in the CATMOD procedure of SAS[®] (statistical analysis system) by Wald's chi-square test, which is based on an information matrix (5). In this study the P-value

Table 1. Health status in 1981, presence of disease in 1985, and the percentage of disability pensioners in 1985 for 6165 municipal employees who were active workers in 1981.

Health status in 1981	Presence of disease in 1985 (N)	Disability pensioners in 1985 (%)
Musculoskeletal disease		
Yes	2245	14
No	3920	6
Cardiovascular disease		
Yes	1129	16
No	5036	7
Mental disease		
Yes	270	23
Healthy	2232	4
All subjects	6165	9

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of the test was always very close to the P-value of the difference of deviances adding the variable to the model.

The modeling advanced as follows. The model of main effects was first fitted. Thereafter all of the two-factor interactions were added. The P-value of Wald's test guided the most evident removals of interactions.

The main effect was removed if its removal did not cause a significant increase in deviance at the 5 % level of significance. The level of significance was set at 10 % if there were theoretical grounds for the factor. However, if the factor had an interaction with other factors, the main effect was left in the model. In the final models, deviance and its degrees of freedom were close to each other.

The SAS® program was used for the analysis. The example, with its parameter estimates using corner-point parametrization and standard errors, was formed with the use of GLIM (generalized linear modeling) (6). The risk ratios (RR) were estimated by Wacholder's macros (7). The 95 % confidence intervals (95 % CI) of the risk ratios were calculated with the use of the standard errors of the regression coefficients. Logit models were diagnosed from the examination of the quantile quantile plots, leverage, and Cook's statistic.

Results

For the subjects with musculoskeletal diseases the work load variables for modeling work disability were work posture, possibilities for development, and physical climate of the workplace. For the work load model the deviance was 3.50 [degrees of freedom (df) = 3].

The main effect of work posture affected disability moderately, but work posture interacted with possibilities to develop at work (figure 1). The lowest cumulative incidence of work disability (5.3 %) was determined for those who had a low load for poor physical climate and work posture but high possibilities to develop at work. The highest cumulative incidence of work disability (18.8 %) was determined for the subjects who had a high load for poor physical climate and work posture and low possibilities to develop at work. The risk of work disability increased by more than threefold between these extreme groups. Figure 1 also shows that good possibilities for development at work can, when combined with good work postures, markedly decrease the risk of work disability in spite of a poor physical climate.

The logit model of individual factors for subjects with musculoskeletal diseases (deviance = 6.69, df = 7) showed that age, dissatisfaction with life, and cigarette smoking were the most clearly connected with disability.

The estimated risk ratios of the parameters and their 95 % confidence intervals are presented in table 2. The estimates differed clearly from unity.

The oldest age group, 53–58 years, had the highest rate of work disability. The risk ratio of the 53- to 58-year-olds was 2.65; in other words, according to the fitted logit this age group was about 2.5 times more probable to become disabled than the 44- to 48-year-olds.

In the present logit model the independent variables divided the data into 12 units. The number of subjects in each unit and the observed and predicted cumulative incidences of the work disability are presented in

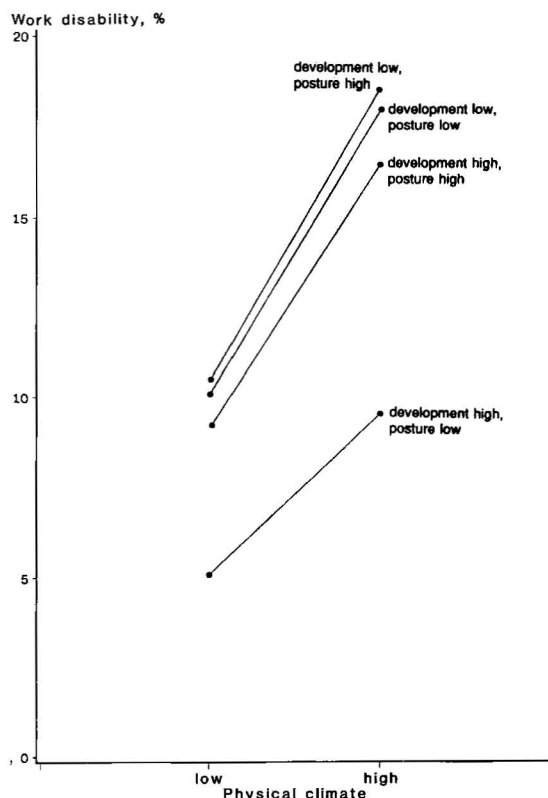


Figure 1. Fitted work disability rates — effects of work load factors on work disability among subjects with musculoskeletal diseases (N = 2245).

Table 2. Estimates of risk ratio for work disability among subjects with musculoskeletal diseases and the 95 % confidence intervals (95 % CI) of the estimates.

Parameter	Estimate of risk ratio	95 % CI
Age ^a		
49–52 years	1.60	1.14–2.24
53–58 years	2.65	1.94–3.61
Smoking ^b	1.73	1.39–2.14
Dissatisfaction ^c	1.43	1.16–1.78

^a Reference category: 44–48 years.

^b Reference category: nonsmoking.

^c Reference category: satisfied with life.

Table 3. Predicted and observed cumulative incidences of work disability (%) for the different individual factor units among the subjects with musculoskeletal diseases.

Unit	Age	Smoking	Life satisfaction	N	Disability (%)	
					Observed	Predicted
1	44—48	No	Satisfied	401	4.7	5.8
2	44—48	No	Dissatisfied	117	13.7	8.4
3	44—48	Yes	Satisfied	78	9.0	10.1
4	44—48	Yes	Dissatisfied	28	10.7	14.5
5	49—52	No	Satisfied	485	9.1	9.3
6	49—52	No	Dissatisfied	117	12.8	13.4
7	49—52	Yes	Satisfied	108	17.6	16.1
8	49—52	Yes	Dissatisfied	56	23.2	23.1
9	53—58	No	Satisfied	528	15.3	15.4
10	53—58	No	Dissatisfied	152	22.4	22.2
11	53—58	Yes	Satisfied	109	30.3	26.6
12	53—58	Yes	Dissatisfied	66	33.3	38.3

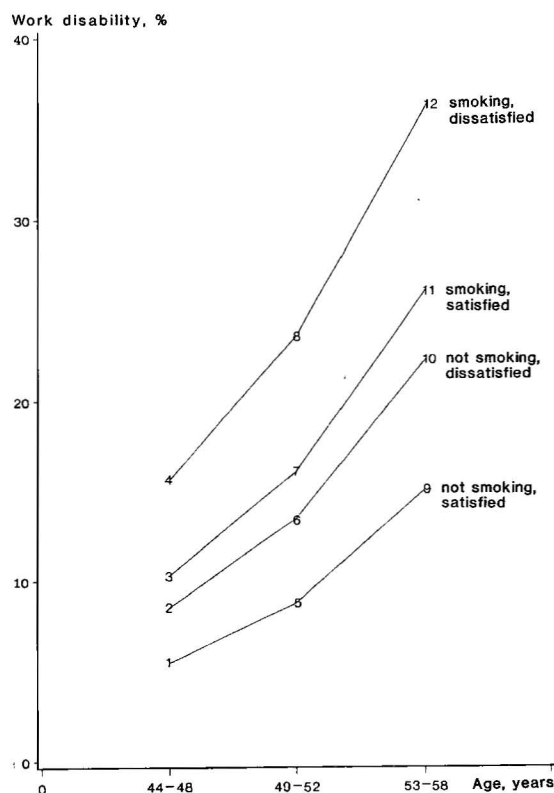


Figure 2. Fitted work disability rates — effects of individual factors on work disability among subjects with musculoskeletal diseases (N = 2245).

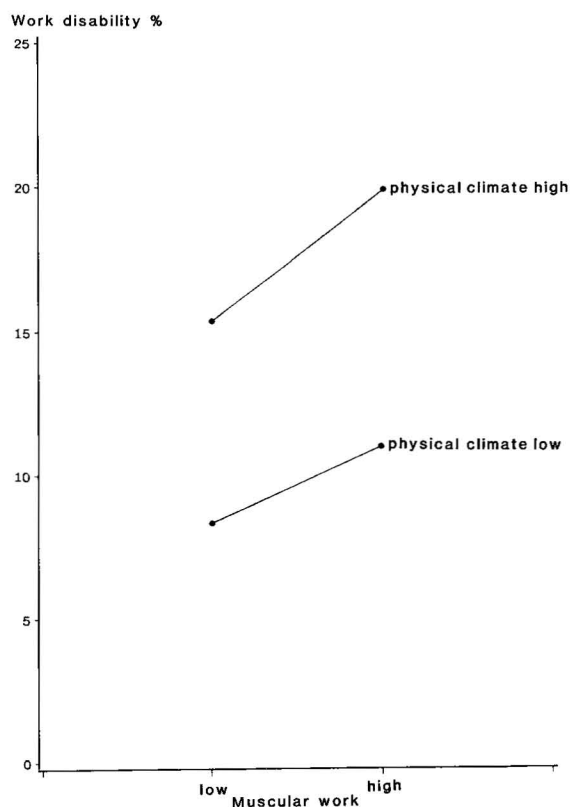


Figure 3. Fitted work disability rates — effects of work load factors on work disability among subjects with cardiovascular diseases (N = 1129).

table 3. Those who smoked and were dissatisfied with their lives, and were 53—58 years of age, had the highest disability rate (38.3 %) (figure 2). Those who did not smoke and were satisfied, and were in the age group of 44—48 years, had the lowest (5.8 %). The risk of disability was more than sixfold smaller for the latter group.

Only a few of the work load factors predicted work disability among the subjects with cardiovascular diseases. Poor physical climate had a great and muscu-

lar work a small effect on disability (deviance = 0.09, $df = 1$). This model is illustrated in figure 3. The combination of a high load of physical climate and muscular work resulted in a cumulative incidence of 20.2 % for disability, and, if these loads were low, the cumulative incidence was 8.5 %. Subjects with a high level of muscular work had a 1.31-fold risk (95 % CI 0.97—1.77) to become disabled compared with those who did little muscular work. The risk ratio for poor physical climate was 1.81 (95 % CI 1.26—2.60).

Age and physical exercise best explained the work disability of the subjects with cardiovascular diseases. The interaction between physical exercise and life satisfaction was also important. This model (deviance = 4.16, $df = 6$) is illustrated in figure 4. The cumulative incidence of disability was 40.0 % among the subjects whose physical exercise was low, who were dissatisfied with their lives, and who were 53—58 years of age. The lowest cumulative incidence of disability (4.6 %) was determined for the 44- to 48-year-old age group with frequent practice of physical exercise and life dissatisfaction. The older subjects had a more than two times (RR 2.19, 95 % CI 1.49—3.23) higher risk to become disabled to work than the younger subjects did.

Among the healthy subjects the logit-model for work load was similar to that for musculoskeletal diseases. Possibilities for development at work, work posture, and physical climate explained disability rather well. A common feature of the logit models of the work load factors was that they did not include the work organization variable. Among subjects with mental disease, role conflicts were connected with disability. However, a low level of role conflict predicted disability, but a high level did not. In addition to low role conflicts, poor physical climate predicted disability among the subjects with mental disease.

Discussion

For subjects with or without a musculoskeletal disease and with cardiovascular disease, the logit procedure produced reasonable models for both work load and individual factors. For the healthy subjects only the model of work load factors was acceptable. The modeling of work disability for all the 6165 subjects did not succeed, and there seems to be no uniform rule to explain work disability.

Almost all the models of the work load factors for the subgroups included poor possibilities to develop at work, poor work postures, and poor physical climate. For both the active workers and the prematurely medically retired subjects both the high physical demands and the poor physical environment of work impaired work ability (2, 3). Therefore it is important to minimize such work loads of all workers, but particularly those of elderly workers, to prevent premature medical retirement. Surprisingly, none of the work organizational factors predicted work disability. Among active workers lack of freedom and role conflicts have been shown to impair work ability (3), but in the present study only uninspiring work slightly predicted work disability, although not in the logit models. However, it must be stressed that no confounding factor (eg, age) was considered in the work load models. The failure to model work disability for all the subjects may be due to their heterogeneity.

The question of why muscular work reduces work ability but leisure-time physical exercise maintains it

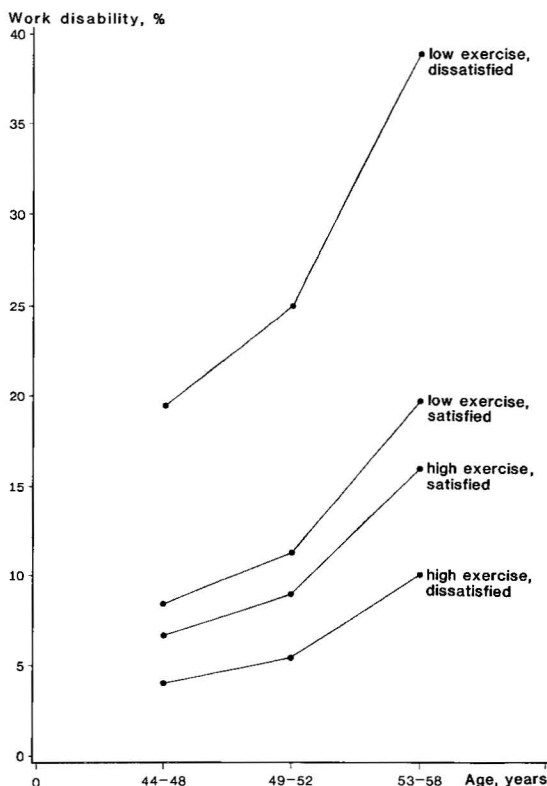


Figure 4. Fitted work disability rates — effects of individual factors on work disability among subjects with cardiovascular diseases (N = 1129).

has repeatedly appeared in the present project. It has been suggested that nowadays occupational physical load is too one-sided, too local, and too static for it to induce positive effects on health and functional capacity (8, 9). From the preventive point of view, it is important to recognize that physical exercise seems to maintain work ability. That life dissatisfaction was linked with a low disability rate among the subjects with cardiovascular disease was surprising. Possibly these people suffer from minor diseases, and they express their opinions rather freely.

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