Scand J Work Environ Health 1989;15(6):415-423

<https://doi.org/10.5271/sjweh.1836>

Issue date: Dec 1989

Predictors of sciatic pain among concrete reinforcement workers and house painters--a five-year follow-up.

by [Riihimäki H](#), [Wickström G](#), [Hanninen K](#), [Luopajarvi T](#)

Affiliation: Institute of Occupational Health, Helsinki, Finland.

This article in PubMed: www.ncbi.nlm.nih.gov/pubmed/2533392

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Predictors of sciatic pain among concrete reinforcement workers and house painters — a five-year follow-up

by Hilikka Riihimäki, MD, MSc,¹ Gustav Wickström, MD,² Kari Hänninen, MSc(Eng),³
Tuulikki Luopajarvi, MSc¹

RIIHIMÄKI H, WICKSTRÖM G, HÄNNINEN K, LUOPAJÄRVI T. Predictors of sciatic pain among concrete reinforcement workers and house painters — a five-year follow-up. *Scand J Work Environ Health* 1989;15:415-423. In a study of the association of occupation and several other determinants with the occurrence of sciatic pain, 167 concrete reinforcement workers and 161 house painters were followed for five years. Base-line data were obtained with a questionnaire, an interview on back symptoms, a clinical examination, and a radiograph of the lumbar spine. Follow-up data on back symptoms were obtained with a postal questionnaire. Concrete reinforcement work was associated with an increase in the risk of sciatic pain, in both a cross-sectional and a prospective study. Reported back accidents contributed to the risk of sciatic pain. Previous history of back symptoms was the most powerful predictor of sciatic pain prospectively. Degenerative changes were related to sciatic pain in retrospect, but prospectively this relationship was weaker. Body height and history of stress episodes showed some association with sciatic pain; abdominal muscle strength, body mass index, and smoking did not; and back muscle strength was associated only retrospectively.

Key terms: back accidents, back pain, degeneration, heavy work, radiographs, trunk muscle strength.

The accumulated epidemiologic knowledge on the relationship between low-back pain and occupational factors is based mostly on cross-sectional studies. In these studies the data on the occurrence of low-back pain and its determinants are measured at the same time and often obtained from the same source, eg, questionnaires or interviews. Such data may lead to spurious associations between the outcome and the determinants. Often the question of the temporal order in detected relationships cannot be answered, and it may not be possible to draw conclusions about causality in relationships detected from retrospective studies.

Only a few prospective studies on the occurrence of low-back pain have been published. A sample of Finnish employees in the metal industry has been followed for 10 years. Both retrospectively in the base line and in the follow-up, low-back pain was more common among blue-collar workers than among white-collar workers. Among the blue-collar workers, however, the associations between indices of physical work load and musculoskeletal morbidity were weak or nonexistent (1).

In a one-year follow-up study, low-back trouble was significantly more common among Danish forklift truck drivers than among the general population, but it was equally common in a sample of unskilled workers (2). The one-year prevalence did not differ between

the three groups in the follow-up. A positive correlation was found between the length of employment and the prevalence of low-back trouble among the truck drivers.

In a one-year follow-up of a Danish sample of the general population, occupational factors did not predict the occurrence of low-back pain (3). An 11-year follow-up of a Finnish population sample (4) revealed that blue-collar workers had a higher incidence of hospitalizations due to herniated lumbar disc or sciatica than white-collar workers did. The risk was highest among motor vehicle drivers and metal or machine workers.

Concrete reinforcement work loads the back heavily (5, 6). In 1972 we found back disorders to be common in a sample of concrete reinforcement workers, but sound conclusions about the possible effect of occupational loads could not be drawn because no reference group was included (7, 8). Thus a new study with house painters as the reference group was done in 1977. In this context, also 86 % of the formerly studied concrete reinforcement workers were followed for five years (9). During the follow-up, the lifetime prevalence of sciatic pain increased from 42 to 59 %, and that of lumbago from 32 to 36 %. The prevalence of radiographically detectable lumbar disc-space narrowing increased from 62 to 73 %, and that of spondylophytes also from 62 to 73 %.

In 1982, all the concrete reinforcement workers and house painters who had participated in the cross-sectional study in 1977 were sent a postal questionnaire on the occurrence of back symptoms during the five years of follow-up. Our objective was to learn more about the effect of heavy concrete reinforcement work

¹ Institute of Occupational Health, Helsinki, Finland.

² Turku Regional Institute of Occupational Health, Turku, Finland.

³ LEL Employment Pension Fund, Helsinki, Finland.

Reprint requests to: Dr H Riihimäki, Institute of Occupational Health, Topeliuksenkatu 41 A A, SF-00250 Helsinki, Finland.

on the back as compared with the lighter work of house painters, and also to gain knowledge about other predictors of the occurrence of back symptoms. Of the different types of back symptoms, sciatic pain has proved to be the most distinctly work-related (10, 11), and thus only this symptom was chosen as the outcome variable in our study.

Subjects and methods

Cross-sectional study in 1977

Subjects. In 1977 all active concrete reinforcement workers who were 25–54 years of age, had at least five years' experience in their current occupation, and were registered members of the regional trade union of the Uusimaa Province were enlisted in the study. About 80–90 % of Finnish skilled construction workers are unionized. The house painters were selected from the active members of the local painters' trade union of Helsinki with the use of frequency-matching according to five-year age strata. The painters also had at least five years' experience in their current occupation. Two hundred and seventeen (84 %) of the 258 concrete reinforcement workers and 202 (86 %) of the 235 house painters participated in the study. All the subjects were men.

Questionnaire. In a self-administered standardized questionnaire the workers were asked to indicate the number of years in their present occupation. The frequency of stress episodes during their lifetime was requested with a six-class question, stress being defined as a situation in which a person feels tense, restless, nervous, or distressed or has sleeping difficulties due to worries. The classes were combined, and the following three-class variable was used: (i) none or only a few stress episodes in one's lifetime, (ii) a couple of episodes in the past five years, and (iii) several episodes or continuous stress in the past five years. We also requested an estimate of the number of back accidents or sprains during one's lifetime, and a dichotomic variable (no, yes) was formed. The men were asked whether they smoked or had smoked regularly daily, and a three-class variable was used for smoking (non-smokers, ex-smokers, smokers).

Interview. Two specially trained physiotherapists carried out a standardized interview on the occurrence of the following back symptoms: "sciatic pain," defined as back pain radiating to a leg; "lumbago," defined as sudden back pain causing constrained posture; and other back pain, referred to as "nonspecific back pain." They registered the recency of the symptoms by repeating the questions for the past month, the past 12 months, and for the lifetime.

Clinical examination. A clinical examination was carried out by the two physiotherapists after they interviewed the subjects. Body weight (kg) and height (cm) were recorded. Maximal isometric abdominal and back muscle strength was measured with a calibrated dynamometer. The dynamometer consisted of a frame with a strain gauge transducer (Philips strain gauge). The measurements were recorded on a chart recorder (Goerz Minigor 502). During the measurements of abdominal muscle strength, the subject stood upright with his back against the dynamometer. He was strapped tightly to the frame at the hips and was attached to the strain gauge by a strap around his chest. He was asked to flex his trunk as hard as he could and hold the flexion for 2–3 s. The range of motion was limited to 15°. To ensure the similarity of instructions, a prerecorded tape was used. The subject was motivated to make maximal exertions twice with a rest period of 30–60 s in between. The higher value was recorded. The test was repeated in the same way for trunk extension with the subject standing facing the dynamometer. Seventeen men were not tested because they had acute back pain at the time of the study.

Due to the correlation between body weight and trunk muscle strength ($r=0.37$ for back muscles, $P<0.001$; $r=0.39$ for abdominal muscles, $P<0.001$), muscle strength relative to body weight [kp/kg; 1 kp (kilopond)=9.8 N] was used in the analyses. We formed a four-class variable for both abdominal and back muscle strength using the quartiles of the distributions of all the subjects as cut-off points and reserving a fifth class for those whose measurements were missing.

Radiographic examination. A lateral radiograph of the lumbar spine was taken of all the workers, except one concrete reinforcement worker and one house painter. The subjects stood erect for the radiograph. Their informed consent was obtained before the examination. The radiographs were read jointly by two radiologists blinded for the age and occupation of the subjects. The occurrence of disc-space narrowing, anterior and posterior spondylophytes, and end-plate sclerosis was recorded separately for each of the lumbar intervertebral spaces with a four-grade classification (no, slight, moderate, or severe change). The grading was based on visual judgment supported by a preselected set of reference films. The reliability of the classification was evaluated in a pilot study that preceded the final reading. The radiologists read 50 radiographs independently. The weighted kappa coefficients (12) varied between 0.42 and 0.85 for disc-space narrowing in different intervertebral spaces, 0.45 and 0.88 for anterior spondylophytes, 0.23 and 0.56 for posterior spondylophytes, and 0.46 and 0.80 for end-plate sclerosis. Thus the agreement between the raters was satisfactory, except for posterior spondylophytes which, on the other hand, were detected the most infrequently.

In this paper only the general occurrence of degenerative changes has been considered, irrespective of the different types of degenerative changes recorded or the location of the changes. The severity of the degenerative changes was classified according to the maximal grade of the occurrence for the three different types of changes.

Follow-up study in 1982

Subjects. In 1982 a postal follow-up questionnaire was sent to all the men who had participated in the cross-sectional study in 1977. One hundred and sixty-seven concrete reinforcement workers (77 %) and 161 house painters (80 %) responded. There were no significant differences between the respondents and nonrespondents with respect to age, earlier back symptoms, clinical findings, or radiographic findings.

For the data analysis, two sets of subjects were used. All 328 men were included in the calculations of the lifetime cumulative incidence rate (the proportion of the subjects who had had sciatic pain sometime prior to the study) in the cross-sectional phase of the study in 1977 and the five-year period prevalence rate (13) (the proportion of the subjects who had had sciatic pain during the follow-up period) in the follow-up in 1977–1982. However, only those men with no history of sciatic pain prior to the beginning of the follow-up were included when the five-year cumulative incidence rate (the proportion of the previously “healthy” subjects who had experienced sciatic pain for the first time in their life during the follow-up) was calculated. The latter group was distinctly selected with regard to several of the predictor variables considered in the analyses (table 1).

Questionnaire. The questions on back symptoms were phrased exactly as in the initial interview in 1977 in regard to the past 12 months and the past month, and the same question was repeated for the five-year follow-up period. The subjects were also asked about hospital treatments and operations due to back diseases.

Data on pensions granted to the subjects during the follow-up were obtained from the register of the LEL Employment Pension Fund, which covers all construction workers in Finland.

Statistical methods. Risk ratio (RR) was used as the measure of effect. Risk ratio estimates and their 95 % confidence interval (95 % CI) values were calculated from the regression coefficients and their standard errors obtained from logistic regression models fitted to the data with the GLIM3 program (14, 15). All the variables were in categorical form, and the age was in five-year classes. In the multivariate modeling, first a full model with the main effect terms (variables given in tables 2–4) was fitted, and then we tested the significance of their effects by excluding the terms one

Table 1. Comparison of the two sets of subjects used in the analysis of the data. Percentages of subjects with characteristics (in 1977) defined as predictor variables.

Characteristic	All subjects ^a (N = 328) (%)	“Healthy” with regard to sciatic pain ^b (N = 178) (%)
Age 45–54 years	35	26
Occupation		
Concrete reinforcement workers	52	41
House painters	48	69
Back accidents	58	45
Degeneration of the lumbar spine		
Slight	43	45
Moderate or severe	33	23
Poor back muscle strength	25	16
Poor abdominal muscle strength	24	20
Height ≥ 180 cm	20	17
Body mass index ≥ 28.0 kg/m ²	21	22
Frequent stress	29	24
Smoking		
Ex-smokers	36	34
Smokers	49	50
Lifetime cumulative incidence of back symptoms		
Lumbago or nonspecific low-back pain, no sciatic pain	37	67
Sciatic pain	46	—

^a Study group for estimation of lifetime cumulative incidence (1977) and five-year prevalence (1977–1982) of sciatic pain.

^b Study group for estimating five-year cumulative incidence (1977–1982) of sciatic pain.

at a time from the model and testing for the significance of the change in the model fit. Nonsignificant determinants were excluded from the model, after which the significance of the interactions between the remaining covariates was tested. No significant interactions were found.

Results

Lifetime cumulative incidence

Figure 1 shows the relationship of the lifetime cumulative incidence of sciatic pain in the 1977 cross-sectional phase of the study and of other back symptoms to the potential predictors considered in the study.

When age was allowed for, a statistically significant relation was found between sciatic pain and the following predictors: occupation, back accidents, degeneration of the lumbar spine, back muscle strength, and stress. Abdominal muscle strength, body mass index, and smoking were not associated with sciatic pain (table 2).

In the multivariate analysis, the predictors which had significant independent effects on the incidence of sciatic pain were back accidents (RR 1.8, 95 % CI 1.3–2.4), back muscle strength (poor versus excellent strength: RR 1.5, 95 % CI 1.2–1.9), and degenera-

Table 2. Lifetime cumulative incidence of sciatic pain in the cross-sectional phase of the study in 1977.

Predictor	Risk ratio			
	Crude ^a		Age-adjusted ^a	
Occupation (concrete reinforcement workers versus house painters)	1.4	(1.1—2.0)	1.5	(1.1—1.9)
Back accidents	2.2	(1.6—2.9)	2.0	(1.5—2.7)
Degeneration of the lumbar spine				
Slight versus none	1.4	(0.9—2.1)	1.2	(0.8—1.7)
Moderate or severe versus none	2.0	(1.3—2.9)	1.5	(1.0—2.3)
Back muscle strength (poor versus excellent) ^b	1.8	(1.4—2.3)	1.7	(1.3—2.1)
Abdominal muscle strength (poor versus excellent) ^b	1.3	(0.9—1.6)	1.0	(0.7—1.3)
Height (cm)				
170—179 versus ≤ 169	1.2	(0.8—1.7)	1.3	(0.9—1.9)
≥ 180 versus ≤ 169	1.4	(0.9—2.0)	1.7	(1.2—2.5)
Body mass index (kg/m ²)				
24.0—27.9 versus ≤ 23.9	1.0	(0.8—1.4)	0.9	(0.7—1.3)
≥ 28.0 versus ≤ 23.9	0.9	(0.7—1.4)	0.8	(0.5—1.1)
Stress ^c				
Rare versus very rare	1.2	(0.9—1.7)	1.0	(0.7—1.4)
Frequent versus very rare	1.4	(1.1—1.9)	1.3	(1.0—1.7)
Smoking				
Ex-smokers versus nonsmokers	1.0	(0.6—1.3)	1.0	(0.7—1.4)
Smokers versus nonsmokers	0.9	(0.5—1.1)	0.8	(0.6—1.2)

^a 95 % confidence interval in parentheses.^b Poor = lowest quartile, excellent = highest quartile.^c Very rare = a few episodes in the past or not at all, rare = a few episodes during the past five years, frequent = several episodes or continuous stress during the past five years.

tion of the lumbar spine (moderate or severe versus no changes: RR 1.3, 95 % CI 1.0—2.1). The effect of occupation was not significant after adjustment for these covariates.

Five-year prevalence

Sixty percent of the concrete reinforcement workers and 42 % of the house painters had experienced sciatic pain during the five-years of follow-up ($P < 0.01$). Twelve percent of the concrete reinforcement workers and 7 % of the house painters had been hospitalized due to a back problem; two concrete reinforcement workers and one painter had undergone back surgery.

After allowance for age, the five-year prevalence of sciatic pain showed a significant relationship with occupation, previous occurrence of sciatic pain, back accidents, and stress. Previous occurrence of other back symptoms and height showed borderline relationships. Degeneration of the lumbar spine and abdominal muscle strength had significant crude relationships with the five-year prevalence of sciatic pain, but they were not retained after adjustment for age (table 3).

In the multivariate analysis, the only predictors showing significant independent effects on the prevalence of sciatic pain were previous occurrence of sciatic pain (RR 3.4, 95 % CI 1.8—6.3) and previous back accidents (RR 1.2, 95 % CI 1.0—1.6).

Five-year cumulative incidence

Among the participants in the follow-up study, there were 67 concrete reinforcement workers and 96 house painters who had not reported any experience of sciatic pain in the cross-sectional interview in 1977. The five-year cumulative incidence, ie, the proportion of the men who had first experienced sciatic pain during the follow-up, was 34 % among the concrete reinforcement workers and 23 % among the house painters ($P = 0.08$, Mantel-Haenszel test).

A significant age-adjusted association with the incidence of sciatic pain was detected for occupation and earlier back accidents, and an association of borderline significance appeared for previous back symptoms (other than sciatic pain) and body mass index (table 4).

In the logistic regression modeling, adding occupation to the model after the inclusion of age significantly improved the model fit [$X^2 = 5.04$, degrees of freedom (df) 1]; correspondingly, there was improvement in the model fit when back accidents ($X^2 = 4.30$, df 1), but not when previous back symptoms ($X^2 = 2.07$, df 1) were included. Inclusion of either occupation or back accidents, in addition to age and the other term, did not improve the model fit ($X^2 = 1.79$, df 1 for back accidents; $X^2 = 2.49$, df 1 for occupation). The model with age, occupation, and earlier back accidents as main effect terms yielded a risk ratio of 1.5 (95 % CI 0.9—2.5) for the effect of occupation and 1.4 (95 % CI 0.8—2.3) for the effect of back accidents.

Figure 1. The lifetime cumulative incidence (in the cross-sectional study in 1977) of back symptoms according to the predictor variables. (^a Classes defined by the quartiles of the distributions; ^b very rare = none or a few episodes in the past, rare = a few episodes during the past five years, and frequent = several episodes or continuous stress during the past five years) (LBP = low-back pain)

Table 3. Five-year prevalence of sciatic pain in the follow-up phase of the study in 1977–1982.

Predictor	Risk ratio			
	Crude ^a		Age-adjusted ^a	
Occupation (concrete reinforcement workers versus house painters)	1.4	(1.1–1.8)	1.4	(1.1–1.8)
Previous back symptoms				
Lumbago or nonspecific low-back pain, no sciatic pain versus no symptoms	1.8	(0.9–3.6)	1.8	(0.9–3.3)
Sciatic pain versus no symptoms	4.5	(2.4–8.2)	3.9	(2.2–6.9)
Back accidents	1.9	(1.4–2.5)	1.7	(1.3–2.2)
Degeneration of the lumbar spine				
Slight versus none	1.1	(0.8–1.6)	1.0	(0.7–1.3)
Moderate or severe versus none	1.5	(1.1–2.1)	1.1	(0.8–1.6)
Back muscle strength (poor versus excellent) ^b	1.1	(0.8–1.4)	1.0	(0.7–1.3)
Abdominal muscle strength (poor versus excellent) ^b	1.3	(1.0–1.8)	1.0	(0.7–1.4)
Height (cm)				
170–179 versus ≤169	0.9	(0.7–1.3)	1.0	(0.7–1.4)
≥180 versus ≤169	1.0	(0.7–1.4)	1.3	(0.9–1.8)
Body mass index (kg/m ²)				
24.0–27.9 versus ≤23.9	1.0	(0.8–1.4)	1.0	(0.7–1.3)
≥28.0 versus ≤23.9	1.1	(0.8–1.6)	1.0	(0.7–1.3)
Stress ^c				
Rare versus very rare	1.1	(0.8–1.5)	1.0	(0.8–1.4)
Frequent versus very rare	1.5	(1.1–1.9)	1.3	(1.0–1.7)
Smoking				
Ex-smokers versus nonsmokers	1.0	(0.7–1.4)	1.0	(0.7–1.3)
Smokers versus nonsmokers	0.9	(0.7–1.3)	0.9	(0.7–1.3)

^a 95 % confidence intervals in parentheses.

^b Poor = lowest quartile, excellent = highest quartile.

^c Very rare = a few episodes in the past or not at all, rare = a few episodes during the past five years, frequent = several episodes or continuous stress during the past five years.

Turnover of the workers during the follow-up

Twenty-five percent of the 217 concrete reinforcement workers and 17 % of the 202 house painters ($P < 0.05$) had left their respective occupation at the end of the follow-up period. Thirty-one (14 %) of the concrete reinforcement workers and 27 (13 %) of the house painters were employed in another occupation. An invalidity pension had been granted to 18 (8 %) of the concrete reinforcement workers and to 6 (3 %) of the house painters ($P < 0.05$), and two concrete reinforcement workers were receiving unemployment pensions. Eleven of the concrete reinforcement workers' invalidity pensions had been granted because of a musculoskeletal disease and four because of trauma. Four of the painters' pensions had been granted because of a musculoskeletal disease, but none because of trauma. Three of the concrete reinforcement workers and one house painter had died during the follow-up period.

Discussion

Validity of the study

In Finland, concrete reinforcement workers and house painters are skilled construction workers, and they have

a similar socioeconomic status. This similarity makes the two groups comparable with regard to life-style factors which may contribute to the occurrence of low-back pain. Both occupations involve physical work and demand fairly good physical fitness of the worker. The physical load is heavier in concrete reinforcement work than in house painting however.

Not much is known about the selective factors for the workers in these two occupations, but, according to the questionnaire data of the cross-sectional study, a greater percentage of house painters than concrete reinforcement workers claimed to have had back pain before entering their occupation (10). Selection out of the occupation due to musculoskeletal diseases is greater among concrete reinforcement workers than among painters. In fact 38 % of the invalidity pensions granted to concrete reinforcement workers in 1979–1982 were due to musculoskeletal disorders, and the corresponding figure for house painters was 22 %. The percentage was 27 for the whole construction trade (unpublished data, LEL Employment Pension Fund). A similar trend was noted also in the present study, although the small numbers of subjects did not allow statistical testing.

On the basis of the aforementioned figures, it seems probable that there is a negative bias due to selection

when the two occupational groups are compared. In the follow-up the men who had left their occupation were also included. Nevertheless, with only five years of follow-up, the comparison bias in the initial setting would have also affected the prospective study. The magnitude of this effect could not be estimated.

Recall bias is a matter of concern for retrospective data on symptoms. In a six-month follow-up (questionnaire) of a general population sample, 84 % consistency was reported for answers on the lifetime experience of low-back trouble; in a 12-month follow-up 89 % consistency was found regarding radiographic examination of the lumbar spine (16). In our earlier five-year follow-up of concrete reinforcement workers (interviewed on both occasions) 19 % denied their previously reported experience of sciatic pain, and 38 % denied their experience of lumbago (9). If this recall error is similar in the two groups of our current study, it does not cause bias in their comparison.

Predictors of sciatic pain

The predictive power of several covariates on the occurrence of sciatic pain was studied with regard to three measures of occurrence. Analysis of the lifetime cumulative incidence was included in this study so that we could compare the results obtained from the com-

monly employed cross-sectional setting with those from the longitudinal approach. Indeed, some interesting differences emerged from this comparison. The recognition of the predictors for the five-year prevalence of back symptoms is relevant to occupational health screening and monitoring; this part of the study corresponds to a practical situation in which the chances of future symptoms are being judged on the basis of information from health check-ups of active workers.

Previous history of back symptoms was the most powerful predictor for the five-year prevalence of sciatic pain in the follow-up. This result is in accordance with that of several earlier studies (9, 17–19). However, a previous history of other back symptoms was not a significant predictor for the first-time events of sciatic pain after allowance for age.

Age-adjusted risk for sciatic pain was higher among the concrete reinforcement workers than among the house painters with reference to lifetime prevalence in the cross-sectional phase of the study and five-year prevalence or five-year incidence in the follow-up. It is noteworthy that a significant relationship emerged with the last item although the study group at risk was strongly selected with regard to occupation. (See table 1.) In the multivariate analyses, however, the effect of occupation was not significant. A history of

Table 4. Five-year cumulative incidence of sciatic pain in the follow-up phase of the study in 1977–1982 — subpopulation of 198 men without a history of sciatic pain in 1977.

Predictor	Risk ratio			
	Crude ^a		Age-adjusted ^a	
Occupation (concrete reinforcement workers versus house painters)	1.5	(0.9–2.5)	1.8	(1.2–2.9)
Previous back symptoms (lumbago or nonspecific low-back pain versus no symptoms)	1.8	(0.9–3.6)	1.8	(0.9–3.4)
Back accidents	1.8	(1.1–2.9)	1.6	(1.0–2.7)
Degeneration of the lumbar spine				
Slight versus none	0.8	(0.4–1.6)	0.6	(0.3–1.2)
Moderate or severe versus none	1.1	(0.6–2.2)	0.8	(0.4–1.6)
Back muscle strength (poor versus excellent) ^b	0.7	(0.3–1.5)	0.6	(0.3–1.2)
Abdominal muscle strength (poor versus excellent) ^b	1.4	(0.7–2.8)	0.9	(0.4–1.9)
Height (cm)				
170–179 versus ≤169	1.0	(0.5–1.7)	1.1	(0.6–1.9)
≥180 versus ≤169	0.5	(0.2–1.4)	0.7	(0.3–2.0)
Body mass index (kg/m ²)				
24.0–27.9 versus ≤23.9	1.6	(0.6–2.3)	1.1	(0.6–2.1)
≥28.0 versus ≤23.9	1.7	(0.9–3.4)	1.6	(0.8–3.1)
Stress ^c				
Rare versus very rare	1.1	(0.6–2.2)	1.0	(0.5–1.9)
Frequent versus very rare	1.2	(0.7–2.3)	1.2	(0.6–2.1)
Smoking				
Ex-smokers versus nonsmokers	1.0	(0.4–2.3)	1.0	(0.4–2.1)
Smokers versus nonsmokers	1.0	(0.4–2.2)	1.0	(0.5–2.0)

^a 95 % confidence intervals in parentheses.

^b Poor = lowest quartile, excellent = highest quartile.

^c Very rare = a few episodes in the past or not at all, rare = a few episodes during the past five years, frequent = several episodes or continuous stress during the past five years.

back accidents proved to be a more powerful predictor of sciatic pain than did occupation, and inclusion of the former factor into the multivariate model left the effect of occupation without significance. The accident rate, especially of accidents affecting the back, is higher for concrete reinforcement workers than for house painters (5, 6). Thus back accidents can be considered an explanatory factor for the effect of concrete reinforcement work on the occurrence of sciatic pain.

Back accidents, in order to be remembered, must have caused pain, and therefore the history of back accidents and back symptoms may partly coincide. Prospectively, however, both the history of back accidents and previous sciatic pain had independent effects on the five-year prevalence of sciatic pain. In the follow-up, the history of back accidents and the outcome variable were measured at different points in time. Thus it is less probable that the detected relationship would be affected by recall bias, as could be the case in a cross-sectional study. A history of back accidents proved to be a more powerful predictor for the first-time events of sciatic pain during the follow-up than that of other back symptoms.

No detailed information of previous back accidents was obtained in this study. Thus it was not possible to differentiate between true accidents and nonaccidental injuries. Actually, all attacks of back pain arising suddenly during work are likely to be reported as accidents. Only some of such events are true accidents, many are nonaccidental injuries, and for some no cause can be attributed (20, 21). In addition there is evidence that the prognosis of accidental and nonaccidental injuries is different (22).

There was a statistically significant crude relation of radiographically detectable degenerative changes of the lumbar spine to both the lifetime cumulative incidence (cross-section) and the five-year prevalence (follow-up) of sciatic pain. After the allowance for age, the relationships weakened considerably and lost significance with regard to the five-year prevalence. Increasing age is strongly associated with an increase in the occurrence of degenerative changes. It is plausible that the effect of age on the occurrence of sciatic pain is due a great deal to degeneration. One possible explanation for the discrepancy in the relationship between sciatic pain and degenerative changes retrospectively and prospectively would be that the first symptoms of degenerative back disease occur in an early phase of the degenerative process when the changes cannot yet be visualized in radiographs. It is also well established that not all people with degenerative changes of the lumbar spine experience symptoms.

Abdominal muscle strength did not display a significant association with the occurrence of sciatic pain either in retrospect or in the follow-up. Back muscle strength had a significant effect on the prevalence in the cross-sectional phase of the study even in the multivariate analysis, but in the follow-up no significant association was detected. These findings would indi-

cate that back morbidity affects the strength of the back muscles rather than vice versa. This result is in accordance with the finding of Leino et al (23). Some earlier studies have indicated that isometric strength testing is a poor predictor of the occurrence of low-back pain in the future (19, 24).

Body height was related to the prevalence of sciatic pain in the cross-sectional phase of our investigation. There was also some tendency towards such a relationship for the prevalence in the follow-up. In earlier studies the results on the relationship between height and back symptoms have been inconsistent. Some have found a relationship (25, 26, 27), whereas some have not (18, 28, 29). In a one-year follow-up study, body height was not of prognostic value either for the first experience or the recurrence of low-back trouble, but retrospectively an association was detected (24).

Overweight did not seem to contribute significantly to the occurrence of sciatic pain in either the cross-sectional or the follow-up phases of the study. This finding is in accordance with that of earlier reports (18, 30), but there are also studies in which a significant relationship has been found (25, 26, 31).

The frequency of stress episodes was associated with the prevalence of sciatic pain in both the cross-sectional and the follow-up phases of the study. There was also some tendency towards association with regard to the incidence. This finding concurs with the results of Leino (32). Stress may be a contributory factor in the etiology of sciatic pain, but it is also possible that people with stress are more prone to report their somatic symptoms.

We did not find any relationship between smoking and the occurrence of sciatic pain. The two studied groups were similar in their smoking habits. Smoking habits are known to vary across social classes and occupational groups (33); in general, smoking is more frequent among blue-collar workers than among white-collar workers. Thus the association between smoking and back symptoms reported by many authors (3, 34, 35) could, at least partly, reflect an occupational effect in population studies.

In conclusion, this study gave further proof that the heavy work of concrete reinforcement increases the risk of sciatic pain when compared with the less burdening work of house painting. Back accidents seem to be an important factor, but also other characteristics of concrete reinforcement work, such as awkward postures, may have a bearing on the occurrence of sciatic pain.

Acknowledgments

We thank Drs T Mattsson and A Zitting for reading the radiographs and Ms T Merisalo and Ms R Suomala for carrying out the interviews and clinical measurements.

References

1. Leino P, Hasan J, Karppi S-L. Occupational class, physical workload, and musculoskeletal morbidity in the engineering industry. *Br J Ind Med* 1988;45:672-81.
2. Brendstrup T, Biering-Sørensen F. Effect of fork-lift truck driving on low-back trouble. *Scand J Work Environ Health* 1987;13:445-52.
3. Biering-Sørensen F, Thomsen C. Medical, social and occupational history as risk indicators for low-back trouble in a general population. *Spine* 1986;11:720-5.
4. Heliövaara M. Occupation and risk of herniated lumbar intervertebral disc or sciatica leading to hospitalization. *J Chronic Dis* 1987;40:259-64.
5. Niskanen T. Accidents and minor accidents of the musculoskeletal system in heavy (concrete reinforcement work) and light (painting) construction work. *J Occup Accidents* 1985;7:17-32.
6. Wickström G, Niskanen T, Riihimäki H. Strain on the back in concrete reinforcement work. *Br J Ind Med* 1985;42:233-9.
7. Wickström G, Hänninen K, Lehtinen M, Riihimäki H. Previous back syndromes and present back symptoms in concrete reinforcement workers. *Scand J Work Environ Health* 1978;4(suppl 1):20-8.
8. Wükeri M, Nummi J, Riihimäki H, Wickström G. Radiologically detectable lumbar disc degeneration in concrete reinforcement workers. *Scand J Work Environ Health* 1978;4(suppl 1):47-53.
9. Riihimäki H, Hänninen K, Luopajarvi T, et al. Raudoittaja- ja maalaritutkimus. Osa 6: raudoittajien tuki- ja liikuntaelimestön tilan 5 vuoden seuranta [Study of the concrete reinforcement workers and house painters: part 6: the condition of the reinforcement workers' musculoskeletal system after a follow-up period of five years]. Helsinki: Institute of Occupational Health, 1981. (Työterveyslaitoksen tutkimuksia 172.) (English summary.)
10. Riihimäki H. Back pain and heavy physical work: a comparative study of concrete reinforcement workers and maintenance house painters. *Br J Ind Med* 1985;42:226-32.
11. Riihimäki H, Tola S, Videman T, Hänninen K. Low-back pain and occupation: a cross-sectional questionnaire study of men in machine operating, dynamic physical work and sedentary work. *Spine* 1989;14:204-9.
12. Fleiss JL. Statistical methods for rates and proportions. 2nd ed. New York, NY: John Wiley & Sons, 1981.
13. Last MJ, ed. A dictionary of epidemiology. 2nd ed. New York, NY: Oxford University Press, 1988.
14. Baker RJ, Nelder JA. The GLIM system — Release 3, general linear interactive modelling. Oxford: Numerical Algorithms Group, 1978.
15. Wacholder S. Binomial regression in GLIM: estimating risk ratios and risk differences. *Am J Epidemiol* 1986;123:174-84.
16. Biering-Sørensen F, Hilden J. Reproducibility of the history of low-back trouble. *Spine* 1984;9:280-6.
17. Rowe ML. Low-back pain in industry: a position paper. *J Occup Med* 1969;11:161-9.
18. Rowe ML. Low back disability in industry: updated position. *J Occup Med* 1971;13:476-8.
19. Troup JDG, Foreman TK, Baxter CE, Brown D. The perception of back pain and the role of psychophysical tests of lifting capacity. *Spine* 1987;12:645-57.
20. Manning DP, Mitchell RG, Blanchfield LP. Body movements and events contributing to accidental and nonaccidental back injuries. *Spine* 1984;9:734-9.
21. Bigos SJ, Spengler DM, Martin NA, et al. Back injuries in industry: a retrospective study II: injury factors. *Spine* 1986;11:246-51.
22. Lloyd DCEF, Troup JDG. Recurrent back pain and its prediction. *J Soc Occup Med* 1983;33:66-74.
23. Leino P, Aro S, Hasan J. Trunk muscle function and low back disorders: a ten-year follow-up study. *J Chronic Dis* 1987;40:289-96.
24. Biering-Sørensen F. Physical measurements as risk indicators for low-back trouble over a one-year period. *Spine* 1984;9:106-19.
25. Gynzelberg F. One year incidence of low back pain among male residents of Copenhagen aged 40-59. *Dan Med Bull* 1974;21:30-6.
26. Heliövaara M. Body height, obesity, and risk of herniated intervertebral disc. *Spine* 1987;12:469-72.
27. Hrubec Z, Nashold BS. Epidemiology of lumbar disc lesions in the military in World War II. *Am J Epidemiol* 1975;102:366-76.
28. Kelsey JL, Githens PB, O'Conner T, et al. Acute prolapsed lumbar intervertebral disc: an epidemiologic study with special reference to driving automobiles and cigarette smoking. *Spine* 1984;9:608-13.
29. Lloyd MH, Gauld S, Soutar CA. Epidemiologic study of back pain in miners and office workers. *Spine* 1986;11:136-40.
30. Aro S, Leino P. Overweight and musculoskeletal morbidity: a ten-year follow-up. *Int J Obes* 1985;9:267-75.
31. Penttinen J. Back pain and sciatica in Finnish farmers. Helsinki: Social Insurance Institution, 1987. (Publications of the Social Insurance Institution, Finland, ML:71.)
32. Leino P. Stress symptoms and musculoskeletal disorders in the metal industry [Abstract]. In: Arbetsmiljöinstitutet. Book of abstracts: sixth international symposium epidemiology in occupational health, Stockholm, Sweden, August 16-18, 1988. Solna (Sweden): Arbetsmiljöinstitutet, 1988:140. (Arbete och hälsa 1988;16.)
33. Asp S. Confounding by variable smoking habits in different occupational groups. *Scand J Work Environ Health* 1984;10:325-6.
34. Frymoyer JW, Pope MH, Clements JH, Wilder DG, MacPherson B, Ashikaga T. Risk factors in low back pain: an epidemiological survey. *J Bone Joint Surg* 1983;65-A:213-8.
35. Svensson H-O, Vedin A, Wilhelmsson C, Andersson GBJ. Low-back pain in relation to other diseases and cardiovascular risk factors. *Spine* 1983;8:277-85.

Received for publication: 2 June 1989