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Previous back syndromes and present back symptoms in concrete reinforcement workers

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WICKSTRÖM, G., HÄNNINEN, K., LEHTINEN, M. and RIIHIMÄKI, R. Previous back syndromes and present back symptoms in concrete reinforcement workers. *Scand. j. work environ. & health* 4 (1978): suppl. 1, 20—28. Two hundred and ninety-five male Finnish concrete reinforcement workers, aged 19—64 years and engaged in heavy physical work including prolonged stooping, were clinically examined in a cross-sectional study. A history of sciatica was reported by 42 % of the men, and a history of lumbago by 33 %. The prevalence of the reported experience of sciatica and lumbago doubled in the two decades from age 25—34 onward. Half of those with a history of sciatica had also experienced lumbago; two-thirds of those who reported a history of lumbago had also suffered from sciatica. Back symptoms during an ordinary workday were reported as follows: ache 51 %, fatigue 47 %, stiffness 41 % and sharp pain 13 %. The correlation between the four symptoms was slight. Ache ($\chi^2 = 23.5$, $p < 0.001$) and stiffness ($\chi^2 = 12.0$, $p < 0.001$) were more common in workers with a history of sciatica than in workers without a history of lumbago or sciatica. In the analysis of the results for a possible effect of reinforcement work on back morbidity, the occurrence of back symptoms and syndromes was not found to be associated with length of reinforcement work, while comparison of a history of low-back pain syndromes between reinforcement workers and computer technicians showed experience of sciatica to be somewhat more common in the reinforcement workers ($\chi^2 = 5.2$, $p < 0.05$).

Key Words: back symptom, concrete reinforcement worker, lumbago, sciatica.

Back disorders are common in working age populations and especially frequent among workers in physically heavy occupations. For several reasons the differences in back morbidity between various occupational groups are, however, difficult to establish. One main cause for these difficulties are the variations in definition of the central concepts. The International Classification of Diseases (24) must be considered an unsatisfactory instrument for epidemiologic use, as the entities employed (pain sensations, pathological mechanisms, morphological changes) do not exclude each other. Even so, there has not appeared any other generally accepted taxonomy for delineating the distribution of back diseases in the population.

In this article we have presented the prevalence of reported previous experience of the pain syndromes "lumbago" and "sciatica," and the incidence of the back symptoms "fatigue," "stiffness," "ache" and "sharp pain" during an ordinary workday of a group of skilled construction workers. We have analyzed the data for the possible influence of reinforcement work on back morbidity and have compared the anamnestic data on previous back pain syndromes to the reports of present symptoms.

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MATERIAL AND METHODS

The population of reinforcement workers included in this cross-sectional study was defined as all those workers actively engaged in reinforcement work from Uusimaa County and registered as members of the National Construction Worker's Union in December 1971. Only the workers born in 1907 or later were included, since those born earlier had already reached the retirement age of 65 years at the time of the study. As the degree of union membership is over 95 %, this definition covered virtually the whole profession in this geographic area.

The group thus defined consisted of 336 male concrete reinforcement workers. Two hundred and ninety-five (88 %) attended the examinations. Their median age was 39 years, their median age for entering reinforcement work was 25 years, and their median work experience in this occupation was 12 years (table 1).

Concrete reinforcement work involves considerable static and dynamic loads; working in stooped postures is exceptionally common (19).

One part of the investigation program, the interview on present back symptoms, was enlarged during the course of the study. Because of this expansion detailed data on present back symptoms were obtained only from the last 223 men examined (table 1). As the order of arrival at the examination was arbitrary, the results were not biased.

Forty-one workers did not attend the examinations. They had approximately the same age distribution as the workers studied. Five referred to sickness, one to work, and one to language difficulties for not taking part. Twelve addresses were unknown, and we were unable to contact the remaining 22 workers.

In a one-day investigation at the Institute of Occupational Health in Helsinki the workers were interviewed on musculoskeletal symptoms by an experienced physiotherapist immediately before a clinical orthopedic examination. The questions concerned experience of back disease and back symptoms "ever" (entire lifetime minus the last four weeks) and "during an ordinary workday" (an average workday during the last four weeks).

The questions were as follows: (a) "Have you ever had back trouble?" (b) "Have you ever had lumbago?" (c) "Have you ever had sciatica?" (d) "Consider an ordinary workday; do you experience the following back symptoms: Fatigue? Stiffness? Ache? Sharp pain? Do you feel back symptoms as you bend down or when in a stooped position or as you straighten up?"

"Back trouble" was defined as any back symptom the worker was able to recall and considered negative for his health; "lumbago," as a sudden attack of back pain not radiating into one or both legs, but causing stiffness or locked posture in the back; and "sciatica," as back pain definitely radiating into one or both legs.

Table 1. Number of workers in different age groups according to experience in concrete reinforcement work. (The numbers in parentheses represent the men who answered detailed questions on back symptoms.)

Reinforcement work experience	Age group (years)										Total	
	15—19	20—24	25—29	30—34	35—39	40—44	45—49	50—54	55—59	60—64		
0—4	1	12	8	6	5	1	0	0	0	0	33	(23)
5—9	.	2	20	23	15	12	4	1	0	0	77	(60)
10—14	.	.	4	16	19	16	8	6	3	2	74	(56)
15—19	.	.	.	1	11	18	9	5	2	1	47	(37)
20—24	.	.	.	.	2	10	12	11	5	1	41	(29)
25—29	.	.	.	.	.	0	2	3	6	2	13	(11)
30—34	.	.	.	.	.	.	0	2	2	1	5	(3)
35—39	.	.	.	.	.	.	.	0	2	2	4	(3)
40—44	.	.	.	.	.	.	.	.	0	1	1	(1)
Total	1 (1)	14 (10)	32 (25)	46 (33)	52 (44)	57 (40)	35 (27)	28 (22)	20 (14)	10 (7)	295	(223)

Duration was not taken into account in the definitions of lumbago and sciatica.

"Fatigue" was defined as a feeling of weakness or slight discomfort in the back; "stiffness," as a subjectively recognized diminished range of back movement or slowness of movement; "ache," as dull pain in the back, slow in appearance and often slow in fading away, but strong enough to be considered pain; and "sharp pain" as sudden, often strong, pain in the back.

The questions were easily understood. If necessary, they were further explained according to the previous definitions. The answers were registered as either positive or negative.

In the graphical presentation of the results the observed age-dependent proportions of the findings were smoothed by the calculation of 15-year moving age ranges for the prevalence estimates. The statistical significance of the results was evaluated by ordinary chi-square testing.

RESULTS

Previous back syndromes

Back trouble at some time in life was reported by about 80 % of the concrete reinforcement workers, sciatica by about 40 %, and lumbago by about 30 %. The prevalences rose with age. When the age group 15—34 years was compared to the age group 45—64 years, the increase was statistically significant for previous back trouble ($\chi^2 = 8.1$, $p < 0.01$), previous lumbago ($\chi^2 = 9.7$, $p < 0.01$), and previous sciatica ($\chi^2 = 18.0$, $p < 0.001$). The prevalence of a previous experience of lumbago and sciatica doubled in the two decades from age 25—34 years on (table 2).

We analyzed the relationship between lumbago and sciatica by dividing the workers into four groups: (a) those reporting neither syndrome, (b) those reporting only lumbago, (c) those reporting only sciatica, and (d) those reporting both. Half of the men were found to have experienced neither lumbago nor sciatica. Half of those reporting previous sciatica had also experienced lumbago, and two-thirds of those who reported lumbago had also had sciatica. In the comparison of the age group 15—34 years to that of 45—64 years, the prevalence of reported previous lumbago alone fell, while the prevalence of sciatica alone somewhat rose. The prevalence of reported experience of both lumbago and sciatica rose clearly ($\chi^2 = 17.4$, $p < 0.001$). Still in the age group 45—64 years one-third of the men had experienced neither lumbago nor sciatica (table 3).

Present back symptoms

Roughly half of the reinforcement workers experienced ache, fatigue, and stiffness during an ordinary workday, while much fewer felt sharp pain. When the two age groups 15—34 years and 45—64 years were compared, stiffness ($\chi^2 = 5.3$, $p < 0.05$), ache ($\chi^2 = 8.8$, $p < 0.01$), and sharp pain ($\chi^2 = 4.2$, $p < 0.05$) were reported more commonly by the elder men (table 4). Twenty-five per cent of the men did not report any of the four symptoms.

The correlation between the different back symptoms was slight. Of the 113 workers with ache, 50 % reported fatigue, 46 % stiffness, and 20 % sharp pain. Of the 104 men with fatigue, 61 % reported stiffness, 55 % ache, and 18 % sharp pain. Of the 91 men with stiffness, 69 % report-

Table 2. Prevalence (%) of reported previous experience of back disorders by age.

Reported experience of previous back disorder	Age group (years)					
	15—24 (N=15)	25—34 (N=77)	35—44 (N=109)	45—54 (N=63)	55—64 (N=30)	15—64 (N=294)
Back trouble	53	77	88	90	87	84
Lumbago	20	21	35	43	40	33
Sciatica	7	31	39	60	60	42

Table 3. Prevalence (%) of previous lumbago and/or sciatica by age.

Previous back syndrome	Age group (years)					
	15—24 (N=15)	25—34 (N=77)	35—44 (N=109)	45—54 (N=63)	55—64 (N=30)	15—64 (N=294)
Neither lumbago nor sciatica	73	60	49	32	37	48
Only lumbago	20	9	12	8	3	10
Only sciatica	7	19	17	25	23	19
Both lumbago and sciatica	0	12	23	35	37	23
Total	100	100	100	100	100	100

Table 4. Incidence (%) of back symptoms during an ordinary workday by age.

Back symptom	Age group (years)					
	15—24 (N=11)	25—34 (N=58)	35—44 (N=84)	45—54 (N=49)	55—64 (N=21)	15—64 (N=223)
Fatigue	55	40	52	47	38	47
Stiffness	18	22	49	39	48	41
Ache	36	36	52	59	71	51
Sharp pain	9	5	15	22	10	13

Table 5. Incidence (%) of back symptoms on stooping during an ordinary workday by age.

Movement or position	Age group (years)					
	15—24 (N=11)	25—34 (N=58)	35—44 (N=82)	45—54 (N=49)	55—64 (N=21)	15—64 (N=221—223)
Symptoms on bending down	9	28	44	51	62	41
Symptoms in the bent-double position	45	64	72	88	76	72
Symptoms on straightening up	55	60	62	67	67	63

ed fatigue, 57 % ache, and 20 % sharp pain. Of the 30 men with sharp pain, 77 % reported ache, 63 % fatigue, and 60 % stiffness. Even if back fatigue and stiffness correlated, the data show them to be two different symptoms; neither of them clearly related with ache. As could be expected, the rarest sensation, sharp pain, correlated the most strongly with the other symptoms.

Workers commonly reported the occurrence of symptoms when stooping during an ordinary workday. Symptoms while bending down and symptoms while in the bent-double position were more common in the 45- to 64-year-old workers than in those aged 15—34 years ($\chi^2 = 12.8$, $p < 0.001$ and $\chi^2 = 9.6$, $p < 0.01$, respectively) (table 5). Of the 161 workers who reported feeling symptoms while in a stooped position, 72 % also felt symptoms as they straightened up, and 52 % as they bent down. Of the 93 men reporting symptoms as they bent down, 90 % also reported symptoms in a stooped position, and 87 % as they straightened up.

Relation to experience in reinforcement work

The data on previous low-back pain syndromes and present back symptoms were analyzed for a possible effect of reinforcement work through comparison of workers of similar age but different lengths of experience in reinforcement work. No significant associations between length of reinforcement work and occurrence of back syndromes or symptoms could be established.

The prevalences of a reported history of lumbago or sciatica among reinforcement workers were also compared to the corresponding values of computer technicians, investigated in a cross-sectional study at the Institute by identical methods (14). An age-adjusted comparison between reinforcement workers and computer technicians showed a history of sciatica to be somewhat more common among reinforcement workers than among computer technicians ($\chi^2 = 5.2$, $p < 0.05$). A history of lumbago was also slightly more common for reinforcement workers than for the technicians, but the difference was not statistically significant (fig. 1).

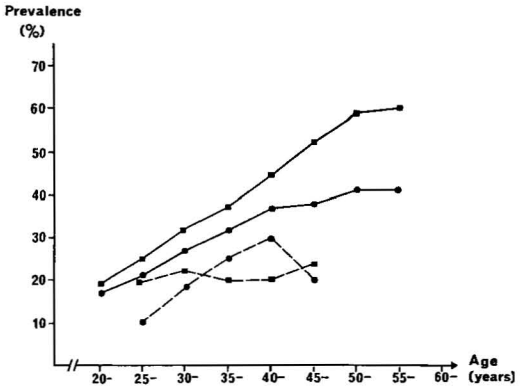

Fig. 1. Smoothed prevalence estimates for restriction of forward bending in reinforcement workers (■———■) and computer technicians (■— — —■) and for pain during forward bending in reinforcement workers (●———●) and computer technicians (●— — —●) by age.

Relation between previous back syndromes and present back symptoms

Back fatigue was reported nearly as often by workers without previous lumbago or sciatica as by those with experience of back pain syndromes. Stiffness was more frequent in workers reporting previous sciatica than in those who had had neither lumbago nor sciatica ($\chi^2 = 12.0$, $p < 0.001$). Backache was more generally reported by workers with previous sciatica as compared with those without experience of either lumbago or sciatica ($\chi^2 = 23.5$, $p < 0.001$). Sharp pain was more common in the men reporting previous sciatica than in those without ($\chi^2 = 5.4$, $p < 0.05$) (table 6).

DISCUSSION

Etiology of low-back pain

Low-back pain may be classified into four principal categories according to the neurological mechanisms behind the experience of pain in the lumbosacral region: (a) primary backache, resulting from irritation of the nociceptive nerve endings embedded in the various lumbosacral tissues; (b) secondary backache, due to disturbed

Table 6. Incidence (%) of back symptoms during an ordinary workday by previous experience of lumbago and/or sciatica.

Present back symptoms	Neither lumbago nor sciatica (N=108)	Lumbago but not sciatica (N=24)	Sciatica but not lumbago (N=45)	Both lumbago and sciatica (N=46)	Total (N=223)
Fatigue	42	54	49	52	47
Stiffness	31	33	56	54	41
Ache	35	50	69	70	51
Sharp pain	9	4	20	22	13

function higher up in the afferent nerve fibers linking the vertebral and paravertebral receptor systems with the spinal cord (e.g., nerve root compression from intervertebral disc prolapse); (c) referred backache, based on activation of nociceptive receptors in surrounding organs with innervation from the same nervous segment as the back tissues; and (d) psychosomatic backache, where the psychological disturbances constitute the dominating feature of the clinical picture (25).

The nociceptive receptors in the lumbosacral tissues consist of plexiform and freely ending arrangements of unmyelinated nerve fibers distributed throughout the skin and subcutaneous tissues, adipose tissue, fasciae and ligaments, periosteum, dura mater, the adventitia of blood vessels, and the fibrous capsules of the lumbar apophyseal and sacro-iliac joints. In human adults the intervertebral discs do not contain nerve endings and are directly related to the nociceptive receptor system only at the point where the discs are attached to the posterior longitudinal ligament through the annulus fibrosus (25).

Experimentally, pain identical to lumbago can be elicited by injection under pressure of normal saline into a degenerated lumbar disc. A similar sensation may be provoked from the intervertebral joint, while injection into interspinous ligament, musculature and dorsal fascia is experienced as local pain (3). Nachemson (12) and Rowe (18) considered most cases of low-back disorder to arise from intervertebral disc degeneration, but this view has not yet won general acceptance. The association between low-back pain and lumbar disc degeneration has been established in several studies (4, 7), but it is not very strong. This weakness is probably due to the facts that (a) low-back pain also arises from causes other than disc degeneration, (b) back pain due to lumbar disc degeneration often appears before the degenerative changes are radiologically detectable (1), and (c) the nerve impulses arising in the nociceptive receptors of the lumbosacral tissues are modulated considerably on their way to the parts of the brain where the feeling of back pain forms (25).

The influence of psychological factors on back symptoms has often been proposed (13). Psychological factors undoubtedly influence the occurrence of back pain, but many empirical studies have shown their effect to be of less importance than that of physical variables. Comparison of rheumatic pain with the stability factor derived from psychometric tests did not show any significant general association (6). Neither could any differences be found between foundry workers with and without rheumatic complaints on tests for neuroticism and extroversion (16). In an investigation of the prevalence of mental disturbance in persons on the sick list because of back disease and those of a control group, no close connection between lowback pain and psychiatric problems could be proved (21). Nonetheless, Magora (10) found an association between the incidence of back pain and a variety of psychological factors.

Quality and quantity of low-back pain

In a large survey on anamnestic back symptoms with freely worded answers to interview questions three main syndromes emerged: "lumbar insufficiency," characterized mostly by intermittent fatigue or pain in the low back; "lumbago," defined as aching pain in the low back, characteristically a sudden strong pain locking the back; and "sciatica," low-back pain definitely radiating into either leg (4).

Low-back pain is characterized by intermittency, 85 % of the patients having intermittent attacks of disabling pain every three months to three years. Each attack lasts from three to ten days (17). The exacerbations and remissions often span the active years from the late 20s to the late 50s (18).

The quality and quantity of the symptoms determine the degree of incapacity, which is generally measured in relation to performance of domestic and occupational duties, as well as need for different levels of therapy (2).

Methodological considerations

The inaccuracy of memory is a well known fact, indicated for instance by the finding that reported sickness rates are higher for the month just completed than for previous months (20). Long-term memory of pain appears to relate more to the length of time a painful experience lasts

and to the frequency with which the pain is repeated than to the intensity of the individual experience (25). Even so, we have supposed that the variables of more intensive pain used in this investigation, lumbago and sciatica, are remembered better than the less intense symptoms of fatigue, stiffness, and ache.

As the purpose of reporting back pain may influence the results, Lawrence and Aitken-Swan (8) evaluated the "proneness to remember" in the groups they investigated. In the present study of concrete reinforcement workers there was no reason to suspect that the workers interviewed would not report all the pain they had experienced and remembered at the time of the study, as the investigation was made to determine whether reinforcement work causes or contributes to back diseases. Instead a tendency to overstate the frequency and the amount of symptoms might be expected, but no sign of overestimation was observed in the clinical examination. The statements on previous back disorders could not be verified by comparison to sick leave data, however, as medical records were not available.

For several reasons, reported previous pain is not directly comparable to the amount of nerve impulses that have passed through afferent pain fibers (23), but it should, however, reasonably well reflect recognized, previous pain. The usefulness of recording reported previous pain is evident from several epidemiologic studies showing significant differences in the incidence of symptoms between different occupations (9, 22).

Evaluation of results

Differences in the incidence of sciatic pain between various occupational groups have been shown in several careful studies (8, 15, 16).

In the evaluation of the supposed effect of reinforcement work by multiple regression analysis and partial correlation analysis, Mantel's (11) chi-square test for analyzing $2 \times k$ contingency tables was used for the significance testing for single 5-year age groups and for the combined age interval. Even if the distribution in age at entering reinforcement work was comparatively wide (table 1), the "exposure period" supposed to be necessary to produce "effects" and the selection mechanisms discussed later forced us to restrict our examination of a possible occupational effect to the 111 men inside the age range of 35 to 49 years.

These analyses did not bring forward any confirmation of the hypothesis that reinforcement work increases the incidence of low-back disorders. It is thus evident that the dose-response relationship between exposure to concrete reinforcement work and the appearance of back disorders, if it exists, is not strong enough not to be concealed by other factors, e.g., hereditary constitution, physical back loads during childhood and youth, as well as other occupational exposure to back loads before entering the reinforcement profession.

A questionnaire on the occupational history of the concrete reinforcement workers covering the years before entering reinforcement work did not yield comprehensive information from all the workers studied, and reported previous occupations were found difficult to classify by degree of load on the back. Even so, general knowledge was obtained of the occupational back load prior to reinforcement work. Most of the men had been working in other building trades before entering their present occupation, primarily as concrete workers, carpenters and hod carriers. Many of them had worked about a year as helpers to the reinforcement workers immediately before entering the reinforcement guild. The majority of the reinforcement workers had also worked for more than a year in other fields, mostly in forestry and agriculture. Thus most of the concrete reinforcement workers were exposed to heavy physical work for some years before entering the reinforcement trade.

The selection of concrete reinforcement workers takes place both before entering the trade and while in it. Reinforcement work is known to be a physically demanding job, and persons with experience of low-back disorders are less likely to consider entering the trade than persons without previous spells of incapacitating back disorders. As there has been no medical preemployment examinations or other forms of organized medical selection in the Finnish construction industry up to now,

the selection before entering the trade has been almost exclusively based on the worker's own evaluation of his health and work capacity.

Concrete reinforcement work is among the most highly paid jobs in the construction industry, and an established reinforcement worker is unlikely to give up his trade unless he has no other option. According to union membership files 158 men left active reinforcement work during the eight-year period between 1964 and 1971. An attempt to use a postal questionnaire to find out the age of withdrawal and the causes for leaving reinforcement work failed because of the low rate of response. But it is known that the workers who have to leave reinforcement work before 65 years of age do so mostly because of cardiovascular or musculoskeletal, especially back, disease. The majority of the workers who have to leave reinforcement work give up active worklife to live on a disability pension, while some take up physically lighter work.

The present investigation did not include reference groups for the comparison of the results obtained for the concrete reinforcement workers. However, some anamnestic and clinical variables can be compared to data from another occupational group, the computer technicians (104 Finnish males, aged 20—54 years), examined in a cross-sectional study in exactly the same way as the reinforcement workers (14). Computer technicians work indoors. Their occupation involves less dynamic back loads than reinforcement work, but the technicians often have to work with the back in a flexed and sometimes also in a rotated position. As their occupation is quite new, there are less old workers among computer technicians than among reinforcement workers. Thus computer technicians do not constitute an ideal reference group for reinforcement workers. The enhanced occurrence of back disorders among computer technicians may "conceal" the degree of possible excessive back morbidity among reinforcement workers.

As we used the same syndromes and time periods as Hult (5), the results may be tentatively compared. Lumbago was more common among reinforcement workers than among workers in the light occupations in Hult's study, but less common than for those in heavy occupations, while sciatica was more common among reinforcement workers than in either group of Hult's study.

The appearance of back symptoms during an ordinary workday has not received much attention in the literature on occupational medicine, probably because of the difficulties in clearly defining the concept "ordinary workday." "Present low-back pain" has been found to vary from 4 to 20 % in males and females from eight different occupations (9). In our study we defined "an ordinary workday" as an average workday during the preceding four weeks, or the last four weeks at work. To evaluate the importance of different back symptoms, we asked about four different qualities. The fact that half of the workers reported experience of stiffness, fatigue, and ache during the workday reflects the degree of constant deviation from "good health" in the workers active in this profession. The symptoms of stiffness, ache, and sharp pain go together with the experience of sciatica and thus probably also with degenerative changes in the spinal tissues. Fatigue, on the other hand, may instead be connected with the state of the back muscles.

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