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Effect of psychosocial factors on low back pain in industrial workers

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Aim To test the hypothesis that workplace psychosocial factors such as demand, control, support, job satisfaction and job appreciation can predict the future onset of disabling low back pain (LBP).

Methods The present study involved a prospective cohort of 4500 Iranian industrial workers. Data were gathered by means of a self-reported questionnaire about LBP, as well as working life exposure, lifestyle factors, social exposures, co-morbidity, life events and psychosomatic complaints in 2004. All new episodes of disabling LBP resulting in medically certified sick leave during the 1-year follow-up registered by occupational health clinic inside the factory.

Results The participation rate was good (85%). A total of 744 subjects reported current LBP (point prevalence cases). A total of 52 (<2%) new episodes of disabling LBP were observed during the 1-year follow-up (incident cases). Male employees reported higher demands, lower control and lower support than female employees. Employees with high demands, low control, job strain, low job satisfaction and low job appreciation showed increased odds ratios, and these results were statistically significant.

Conclusions Few prospective studies in this field have been published, but all of them are related to industrialized countries. This prospective study suggests the aetiological role of job strain for LBP. The findings of this study indicate a substantial potential for disease prevention and health promotion at the workplace.

Key words Industrial workers; low back pain; psychosocial factors.

Introduction

Low back pain (LBP) is one of the most common occupational health problems and accounts for a large number of compensation days and disability for workers in modern industrialized societies [1–5].

Extensive research into the role of occupational risk factors in the development of LBP has been carried out [2,3,6–12]. However, there are very few conclusive findings due to some common methodological flaws. It is believed that LBP is caused by multiple factors, generally categorized into physical, psychosocial and lifestyle factors. Various physical factors have been found to be associated with pain in different regions [13]. Heavy physical work, heavy or frequent manual operations, repeated rotation of the trunk, whole-body vibration and prolonged sitting were positively associated with LBP [14,15].

Psychosocial factors at work have also been shown to play important roles in the development of LBP. Factors such as work demands, decision latitude, symptoms of stress and social support have been reported as important psychosocial factors at work [2,16,17]. However, the causal and independent contribution of the work environment on the incidence of LBP is still debated, especially with regard to psychosocial factors [2,18–20].

A number of reviews have examined the evidence for psychosocial factors at work as risk factors for back pain in recent years [9,20–25]. Hartvigsen *et al.* [20] found moderate evidence for no positive association between perception of work, organizational aspects of work and social support at work and LBP. The results of a study by Hoogendoorn *et al.* [21] showed that there was strong

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evidence for a positive effect of low social support in the workplace and low job satisfaction. Davis and Heaney [22] concluded that job satisfaction and job stress are more consistently and more strongly associated with the development of LBP than psychosocial work characteristics themselves. Vingard and Nachemson [9] found weak associations between certain psychosocial factors and LBP, but the dose and exposure time needed to give a health effect could not be concluded. Bongers *et al.* [23] concluded that there is evidence that monotonous work or poor work content and poor support by colleagues are risk factors for back pain. Burdorf and Sorock [24] concluded that job dissatisfaction and monotonous work were important factors. The results of Bernard [25] showed that there was evidence for intensified workload being a risk factor and limited evidence for low job control and job dissatisfaction.

Two comprehensive reviews on LBP [22,23] have pointed out that the majority of the studies in this field are cross-sectional in design, which severely limits the application of causal inference. This problem is further aggravated by the fact that most studies have measured both the psychosocial environment as well as the outcome by self-report questionnaire, which makes the results vulnerable to common method bias [26]. These reviews showed that studies often fail to control adequately for exposure to physical demands at the workplace.

Most epidemiological data concerning LBP are related to developed and industrialized countries, and there is little information about LBP in the general or working population in developing and low-income countries. This lack of research leaves a profound gap in what is known about LBP in a large part of the world, where the bulk of the world's working population resides [27].

Iran has a young population, half of the inhabitants being <25 years of age. During the last 20 years, the workforce in Iran has undergone major changes: from being illiterate and uneducated or with a low level of education and male dominated to being more educated or highly educated and with an increasing female participation. This transition from a developing country to a more developed state in respect of industrialization creates new situations, exposures and challenges that may affect workers' health.

We therefore proceeded to conduct a prospective study to test the hypothesis that workplace psychosocial factors such as demand, control, support, job satisfaction and job appreciation can predict the future onset of disabling LBP.

Methods

The study was a prospective cohort of Iranian industrial workers. Data were gathered by means of a self-reported questionnaire in 2004 and from register data on sickness absence in 2005.

All employees in one of the biggest car manufacturing industrial groups [Iran khodro company (IKCO)] in Iran and also in the Middle East were chosen for this study. During 2003, IKCO had $>18\,000$ full-time employees (17 300 men and 721 women) working in 14 main departments. Four thousand and five hundred of these employees were randomly selected and invited to participate in the study. Due to smaller numbers, all women working at IKCO ($n = 521$) and all managers ($n = 351$) were included.

The questionnaire used [the Musculoskeletal Intervention Center (MUSIC) inventory] was designed to measure low back and neck and shoulder pain, as well as working life exposure, lifestyle factors, social exposures, co-morbidity, life events and psychosomatic complaints [28–30]. The evolution of the questionnaire, as well as its reliability and validity, has been studied and published in Sweden [31].

A Persian version of this questionnaire prepared by standard translation and back-translation method was tested for reliability and validity. The focus group discussion method was used to detect questionnaire face and content validity. To detect questionnaire reliability, the test–retest method was used. In a test–retest study with 40 participants, the reliability coefficient was acceptable and relatively high (interclass correlation coefficient > 0.7). Results provided evidence that the Persian version of the MUSIC inventory is a reliable and valid instrument to measure musculoskeletal pain and disorders and work-related physical and psychosocial exposures as well as non-work-related factors [38].

In this study, LBP was defined as trouble (aches, pain and discomfort) in the lower back. Disabling LBP was defined as LBP that leads to sick leave for 1 day or more. The company has an annual official occupational health report from their registration system of sick leave and disease. All cases of sick leave are compulsorily registered at the occupational health clinic.

Point prevalent case was defined as a subject who reported a current episode of LBP at the baseline survey among 4500 employees in 2004, and an incident case was defined as a new episode of disabling LBP resulting in medically certified sick leave during the 1-year follow-up. The incident cases were collected between December 2004 and December 2005 with the help of the occupational health clinic registration system.

Psychosocial workplace factors were measured with reference scales on psychological demands (five items), decision latitude (six items), support (six items), job satisfaction (four items) and job appreciation (four items). Response categories for psychological demand, decision latitude and support items were on a four-point scale. Job satisfaction and job appreciation response categories were on a five-point scale. Psychological demands (range 4–20 points), decision latitude (range 4–24 points), support (range 4–24 points), job satisfaction (range 5–20 points)

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and job appreciation (range 5–20 points) scales were constructed by summing individual items. The internal consistencies of the scales were satisfactory.

We calculated job strain and iso-strain by [32] the midpoint of the respective subscales. Job strain based on the midpoint of the scale was assigned to those subjects who scored simultaneously above the midpoint on the psychological demands and below the midpoint on the decision latitude scale. If these subjects also scored below the midpoint on the total support scale, they were assigned to iso-strain based on the midpoint of the scale.

Information about physical exposures in the workplace was based on 12 questions about different physical exposures in a five-point scale and used as a control variable. At IKCO, each site has a special committee for health, safety and environment issues [Health and Safety Executive (HSE) committee]. Their members are representatives from workers, technicians and employers. The head of the committee is the director of that workplace. The committee has regular weekly meetings and for each intervention or work environment programme related to HSE, they give advice to the occupational health department.

In this project, >20 committees were involved in meetings with the research group. The committee members helped to inform all workers and others involved about the project.

Ethical approval for this study was obtained from Karolinska Institutet Ethics Committee (reference number 03-082) and the Iranian Ministry of Health, respectively.

Frequency distributions of responses and cross-tabulations of demographic factors with reported history of LBP in the last 12 months were examined. Group differences were statistically tested by chi-square test and *P*-values were derived from chi-square test, for trend and Pearson's chi-square test.

Logistic regression methods were used to analyse the association between the risk factors and the outcome variable. The analysis was performed in three stages. Initially, univariate analysis was performed to establish the association between each psychosocial risk factor and two outcomes (LBP prevalence at baseline and the incidence of disabling LBP at follow-up). Then, the basic model was controlled in the first stage for age and in the next stage for physical exposures. In the third and final stages, three psychosocial risk factors were added and logistic regression was performed for this model. Separate regressions had been done for each psychosocial factor, and for preventing multi-collinearity, we did not include components of strain in the same model. All statistics were carried out using the SPSS program.

Results

A total of 3838 completed baseline questionnaires were collected, giving an overall response rate of 85%. Baseline data are presented in Table 1.

All employees that had been serving anytime in the war between Iran and Iraq (1980–88) were excluded

Table 1. Demographic characteristics and point prevalence and incidence of disabling LBP in employees of an Iranian car manufacturing company, 2004 (n = 3174)

	Study population		LBP point prevalence		Disabling LBP 1-year incidence	
	n	%	*n*	%	*n*	%
Age group (years)						
<25	1021	35	210	21	18	1.8
26–35	1584	55	392	25	31	2
>36	281	10	77	28	2	0.7
Sex						
Male	2795	88	643	23	51	1.8
Female	379	12	101	27	1	0.3
Job type						
Manager	92	3	19	21.3	0	0
Office worker	300	9	62	20.9	2	0.7
Skilled and technician worker	621	20	127	20.7	7	1.1
Unskilled worker	1869	59	473	25.7	43	2.3
Working experience (years)						
≥1	234	8	31	13.4	1	0.4
2–5	1800	65	409	23	33	2
6–10	510	18	156	31	15	3
≥11	232	9	67	30	2	1
Education						
Diploma	59	2	513	26	44	2.2
High diploma	2319	81	69	20	6	1.7
University degree	498	17	98	20	2	0.4

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(n = 664). The reason for this was that many of them have had traumatic and other psychosocial experiences still influencing them, and earlier negative psychosocial experiences could therefore not be differentiated from workplace psychosocial factors.

The cohort of employees with complete data during the 1-year follow-up and eligible for participation in the study numbered 3174 and of these 744 subjects reported current LBP (point prevalence cases). A total of 52 (<2%) new episodes of disabling LBP were observed during the 1-year follow-up (incident cases). In this study, male employees reported higher demands, lower control and lower support than female employees. Therefore, the number suffering from strain is higher for men than for women. Results are presented in Table 2.

In a multiple logistic regression model for psychosocial factors associated with point prevalence of LBP, increased odds ratios (ORs) for men were found for high demand (OR = 1.9; 95% CI = 1.4–2.5), low control (OR = 1.9; 95% CI = 1.5–2.4) and job strain (OR = 2.1; 95% CI = 1.7–2.6). The results were controlled for age and physical exposures (sitting position, awkward working position, work with hands above shoulder or under knee level and carrying heavy objects). Also among men, low job satisfaction and low job appreciation showed an increased OR of 2.2 (95% CI = 1.7–2.8) and 1.1 (95% CI = 0.9–1.4) in LBP point prevalence, respectively. The results for women were not conclusive due to the fact that there were few cases (Table 3).

In a multiple logistic regression model for psychosocial factors associated with 1-year incidence of disabling LBP, increased OR for men were found for high demand (OR = 1.8; 95% CI = 0.7–4.9), low control (OR = 1.3; 95% CI = 0.7–2.5) and job strain (OR = 1.8; 95% CI = 0.9–3.4). The results were controlled for age and physical exposures (sitting position, awkward working position, work with hands above shoulder or under knee level and carrying heavy objects). Also among men, low job satisfaction and low job appreciation showed an increased OR of 1.8 (95% CI = 1.0–3.6) and 1.3 (95% CI = 0.6–2.7) in disabling LBP incidence, respectively. The results for women were not conclusive due to the fact that there were few cases (Table 4).

Discussion

The main findings of this study are that employees with high demands, low control, job strain, low job satisfaction and low job appreciation showed a significantly increased OR for LBP prevalence. In terms of the incidence of disabling LBP, employees with high demands, low control, job strain, low job satisfaction and low job appreciation also showed increased ORs, but these results were not statistically significant.

The participation rate for this study was good, and the prospective design was a major strength, allowing a causal interpretation of the findings [33]. Multivariate analyses

Table 2. Psychosocial exposures at work and their association with LBP in employees of an Iranian car manufacturing company, 2004 (n = 3174); males = 2795 and females = 37

Psychosocial exposure	Study population		LBP point prevalence		Disabling LBP 1-year incidence	
	Men, n (%)	Women, N (%)	Men, n (%)	Women, n (%)	Men, n (%)	Women, n (%)
Demand						
Low	592 (23)	132 (42)	81 (14)	38 (29)	7 (1.2)	1 (0.7)
High	1968 (77)	182 (58)	598 (27)	43 (24)	43 (2.2)	0 (0)
Control						
Low	1707 (65)	211 (62)	488 (29)	52 (25)	36 (2.1)	1 (0.5)
High	932 (35)	129 (38)	136 (15)	39 (30)	15 (1.6)	0 (0)
Support						
Low	1330 (51)	164 (49)	196 (15)	37 (23)	19 (1.4)	1 (0.6)
High	1296 (49)	173 (51)	428 (33)	49 (28)	31 (2.4)	0 (0)
Strain						
Yes	1278 (46)	110 (30)	410 (32)	22 (20)	32 (2.5)	0 (0)
No	1474 (54)	261 (70)	233 (16)	79 (30)	19 (1.3)	1 (0.4)
Iso-strain						
Yes	447 (16)	39 (11)	100 (22)	5 (13)	12 (2.7)	0 (0)
No	2288 (84)	330 (89)	540 (24)	96 (29)	38 (1.6)	1 (0.3)
Job satisfaction						
Low	480 (17)	61 (16)	186 (39)	18 (29)	15 (3.1)	0 (0)
High	2167 (78)	275 (74)	439 (20)	71 (26)	36 (1.6)	1 (0.4)
Job appreciation						
Low	857 (43)	95 (42)	208 (24)	27 (28)	15 (1.7)	0 (0)
High	1117 (57)	129 (58)	237 (21)	35 (27)	18 (1.6)	1 (0.8)

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Table 3. Unadjusted and adjusted OR with 95% confidence interval for psychosocial factors associated with point prevalence of LBP in employees of an Iranian car manufacturing company, 2004 (n = 3174); males = 2795 and females = 379

	Unadjusted OR (95% CI)	Model 1	Model 2	Regression Model 3
High demand				
Men	2.3 (1.8–3.0)	2.5 (2–3.1)	1.9 (1.4–2.5)	
Women	0.8 (0.4–1.3)	0.7 (0.4–1.2)	0.6 (0.3–1.1)	
Low control				
Men	2.3 (1.9–2.9)	2.5 (2.0–3.1)	1.9 (1.5–2.4)	
Women	0.8 (0.5–1.2)	0.6 (0.4–1.1)	0.6 (0.3–1.0)	
Low support				
Men	0.4 (0.3–0.4)	0.3 (0.3–0.4)	0.4 (0.3–0.5)	
Women	0.7 (0.5–1.2)	0.7 (0.4–1.2)	0.6 (0.4–1.2)	
Strain				
Men	2.5 (2.1–3.0)	2.3 (2.3–3.4)	2.1 (1.7–2.6)	1.9 (1.4–2.4)
Women	0.6 (0.3–1.0)	0.5 (0.3–0.9)	0.4 (0.2–0.7)	0.3 (0.1–0.6)
Iso-strain				
Men	0.9 (0.7–1.0)	1.0 (0.8–1.3)	0.9 (0.7–1.2)	
Women	0.4 (0.1–0.9)	0.3 (0.1–0.9)	0.3 (0.8–0.9)	
Low job satisfaction				
Men	2.5 (2.0–3.1)	2.6 (2.1–3.2)	2.2 (1.7–2.8)	1.9 (1.4–2.5)
Women	1.2 (0.7–2.2)	1.0 (0.5–1.9)	1.0 (0.5–2.2)	0.9 (0.7–1.9)
Low job appreciation				
Men	1.2 (1.0–1.5)	1.1 (0.9–1.4)	1.1 (0.9–1.4)	1.0 (0.8–1.3)
Women	1.1 (0.6–1.9)	1.1 (0.6–2.0)	1.1 (0.5–2.1)	1.2 (0.6–2.6)

Each psychosocial factor included separately. Model 1 controlled for age. Model 2 controlled for age and physical exposures. Model 3 controlled for age, physical exposure and psychosocial factors (strain, low job satisfaction and low job appreciation).

Table 4. Unadjusted and adjusted OR with 95% confidence interval for psychosocial factors associated with 1-year incidence of disabling LBP in employees of an Iranian car manufacturing company, 2004 (n = 3174)

	Unadjusted OR (95% CI)	Model 1	Model 2	Regression Model 3
	Men	Men	Men	Men
High demand	1.9 (0.8–4.2)	2.3 (1.0–5.4)	1.8 (0.7–4.9)	
Low control	1.3 (0.7–2.4)	1.5 (0.8–2.8)	1.3 (0.7–2.7)	
Low support	0.6 (0.3–1.1)	0.5 (0.3–1.0)	0.5 (0.3–0.9)	
Strain	2.0 (1.1–3.5)	2.2 (1.2–4.1)	1.8 (0.9–3.4)	1.7 (0.7–3.9)
Iso-strain	1.7 (0.9–3.2)	1.7 (0.9–3.3)	1.5 (0.7–3.0)	
Low job satisfaction	1.9 (1.0–3.5)	2.1 (1.1–3.9)	1.8 (1.0–3.5)	2.9 (1.3–6.3)
Low job appreciation	1.1 (0.5–2.2)	1.1 (0.6–2.3)	1.3 (0.6–2.7)	1.1 (0.9–1.2)

Due to few incidence cases women were excluded. Each psychosocial factor included separately. Model 1 controlled for age. Model 2 controlled for age and physical exposures. Model 3 controlled for age, physical exposure and psychosocial factors (strain, low job satisfaction and low job appreciation).

were adjusted for physical exposures, thereby overcoming a major limitation characteristic of earlier studies [22,23].

Whereas psychosocial work conditions were measured by self-report, the outcome was assessed not only by self-report but also objectively through physician's diagnoses made in the course of an accepted sickness absence certificate. By doing this, we tried to avoid bias through common method variance or the tendency to find spurious associations in studies measuring both predictors and outcome by self-report.

The absence of individual observer-based measurements of physical workload may be considered a weakness in the assessment of potential confounders. This is a typical limitation of large-scale epidemiological studies because of the high costs associated with individual standardized measurements.

Most prospective studies are limited by measuring the predictor variables only once, at the beginning of the study. Repeated measurement during the follow-up period would have allowed us to adjust for changes in the predictor variables and therefore to measure exposure more accurately. The one-time measurement might have biased the results towards an underestimation of the true size of the effect [33]. Fortunately, in the IKCO study,

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most of the employees stayed at their workplace during the follow-up period.

For the last two decades, the theoretical assumptions and empirical findings of the demand–control–support model have created controversial discussions, mostly in the field of cardiovascular research [34–35]. Results are difficult to interpret for musculoskeletal disorders due to the lack of prospective studies and insufficient control for physical workload [22,23]. Few prospective studies in this field have been published [32,37] but all of them are related to industrialized countries. Our study is one of the first studies to include this number of participants with different job titles from a developing country.

A comparison of the results of this study with recent reviews on psychosocial factors and LBP [9,20–25] showed that although there was evidence for the effect of some psychosocial work characteristics in all reviews, the results were rather heterogeneous.

The 1-year incidence of LBP observed in our study was far from that reported by other studies. However, caution must be exercised when comparing these studies, due to the differences in LBP definitions and study methods. As we defined our outcome in the article, this outcome is specific outcome based on sickness absence. Differences in social security systems, workers' compensation systems and benefits during sickness absence may explain the difference.

On the other hand, our short follow-up period (1 year) with considering the young study population would be another reason for low incidence rate.

From the prevention point of view, our findings suggest that a reduction in exposure to adverse psychosocial workplace factors may lower the risk of LBP.

This study suggests the aetiological role of job strain for LBP. Since reviews have shown that hazardous aspects of the psychosocial work environment in companies are amenable to change and that the psychosocial exposures investigated in this study may also be linked to other diseases such as the risk of cardiovascular disease, the findings of this study indicate a substantial potential for disease prevention and health promotion at the workplace.

Key points

- There are a limited number of longitudinal studies from Western countries about the aetiology of LBP. This is one of the first studies to include this number of participants with different job titles from a developing country.
- The IKCO prospective study suggests the aetiological role of job strain for LBP.
- From the prevention point of view, our findings suggest that a reduction in exposure to adverse psychosocial workplace factors may lower the risk of LBP.

Conflicts of interest

None declared.

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