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Risk factors for first-ever low back pain among workers in their first employment

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Abstract

Background Low back pain has been estimated to be the most costly ailment of people of working age. Both work characteristics and individual factors have been identified as risk factors. The first interaction between work characteristics and individual factors occurs when workers start in their first job.
Aims To investigate work-related risk factors for first-ever low back pain in young workers in their first employment.
Methods A cross-sectional analysis was performed on 278 young workers in their first employment and without a history of low back pain prior to working. Work-related physical factors, psychosocial work characteristics, individual variables and first-ever low back pain were queried by means of a questionnaire.
Results About half of the workers who developed low back pain after job start did so in the first year of employment. An increased risk was observed for (i) long periods of seated work [relative risk (RR) = 3.2, 95% confidence interval (CI) = 1.6-6.4]; (ii) more than 12 flexion or rotation movements of the trunk per hour (RR = 3.0, 95%CI = 1.4-6.4); and (iii) more than 3 years seniority in a job involving lifting more than 25 kg at least once an hour (RR = 3.7, 95%CI = 1.4-9.4). As to psychosocial work characteristics, first-ever low back pain was associated with a combination of low psychological job demands and low supervisor support.
Conclusion Work-related physical factors and psychosocial work characteristics should be considered as risk factors for first-ever low back pain. First-ever episodes of low back pain are common in the first year of employment. This may reflect a lack of work experience or training.

Keywords: cross-sectional ; first employment ; low back pain ; risk factors ; young.

INTRODUCTION

In the working population, back disorders are a major cause of sickness absence and disability, and, therefore, a significant economic burden. Both environmental characteristics and individual factors have been identified as risk factors [1]. The incidence of low back pain rises sharply in early adulthood [2] at a time when the burden of environmental factors also increases. Evidently, the first major interaction between environmental characteristics and individual factors occurs when workers start in their first job. In that context, the aim of this paper was to analyse the association between various physical and psychosocial work characteristics and the first occurrence of low back pain in young workers in their first employment.

MATERIALS AND METHODS

Subjects

This paper describes a cross-sectional analysis of the baseline measurements from the Belgian Cohort Back (BelCoBack) Study, a prospective study to identify risk factors for low back pain in occupational settings. Participants in this study were recruited among the employees of four health care institutions and two distribution companies throughout Belgium. To minimize dropout, we included only workers with a tenured position or equivalent. Furthermore, to reduce the influence of prior episodes of low back pain, participants had to be no older than 30 years at the time of intake and to have been free of episodes of low back pain of more than six consecutive days during the 12 months before intake in BelCoBack. The latter time point was taken as the endpoint for the cross-sectional analysis to exclude this 12 month episode-free period.

Of the employees who had agreed to participate and met the inclusion criteria, 972 (93%) completed the baseline questionnaire. Among these, we identified 278 workers (105 from distribution and 173 from health care) for whom the current job was the first and without a history of low back pain prior to working. In this subgroup, the

interval between job start and study endpoint ranged from 6 months to 9 years.

The study protocol was approved by the local Commission for Medical Ethics.

Data collection

The baseline questionnaire included: the work-related physical factors (al) working with the trunk in awkward postures, (a2) long periods of seated work, (a3) ability to change posture regularly, (a4) driving vehicles or machines, (a5) lifting weights >10 kg or >25 kg, (a6) pushing and pulling of loads and (a7) working schedule; the psychosocial work characteristics (b1) job control and its two subscales, i.e. skill discretion and decision latitude, (b2) social support and its two subscales, i.e. support from co-workers and from supervisors, (b3) psychological job demands and (b4) job dissatisfaction; the individual variables (c1) age at job start, (c2) gender and (c3) education; and (d) the outcome, namely the age of first-ever low back pain. The questionnaire on physical workload is reported elsewhere [3]. Data were dichotomized as indicated in Table 1. Psychosocial work characteristics were evaluated with the 43-item Job Content Questionnaire [4].

Table 1. *Descriptive statistics of categorical work-related physical factors and individual variables for workers in their first employment*

Variable	Low back pain[a]		No low back pain[b]	
	n	%	*n*	%
Sex				
Male	24	37.5	78	36.5
Female	40	62.5	136	63.5
Education				
Primary school or lower secondary	13	20.3	35	16.5
Higher secondary	22	34.4	74	34.9
Higher education, not university	28	43.8	94	44.3
Higher education, university	1	1.5	9	4.3
Working schedule				
Full-time	58	92.1	193	90.6
Part-time	5	7.9	20	9.4
Driving vehicles at least 6 h/day				
Yes	21	32.8	54	25.4
No	43	67.2	159	74.6
Flexion and/or rotation of the upper part of the body for >2 h/day				
Yes	19	29.7	51	24.1
No	45	70.3	161	75.9
More than 12 flexion and/or rotation movements of the upper part of the body per hour				
Yes	53	84.1	151	71.6
No	10	15.9	60	28.4
Ability to change posture regularly				
No	6	9.4	18	8.5
Yes	58	90.6	193	91.5
Lifting > 10 kg > 12 times an hour				
Yes	17	26.6	29	13.9
No	47	73.4	180	86.1
Lifting >25 kg at least once an hour				
Yes	17	26.6	47	22.5
No	47	73.4	162	77.5
Pushing or pulling at least once an hour				
Yes	19	29.7	59	27.8
No	45	70.3	153	72.2
Seated work for longer periods of time				
Yes	14	21.9	21	9.9
No	50	78.1	192	90.1

[a]Workers who developed a first episode of low back pain after job start.
[b]Workers who remained free of low back pain after job start.

Statistical analysis

To study the impact of work-related factors on the development of first-ever low back pain, we constructed three Cox proportional hazard models. In addition to individual variables, these considered work-related physical factors (model a), psychosocial work characteristics (model b) or both (model c). First, correlation coefficients among the independent variables were calculated to prevent the occurrence of colinearity. We then removed non-significant variables by means of a backward selection procedure until the models only contained terms that made a significant contribution. All analyses were conducted with the module PROC PHREG in the SAS package (release 8.02). Throughout, the 5% level of significance was maintained.

RESULTS

Sixty-four (23%) of the 278 workers developed a first-ever episode of low back pain between job start and study endpoint; 47% of them did so in the first year after job start. Tables 1 and 2 describe work-related factors and individual variables for the afflicted and episode-free group.

The analysis indicated that the proportional hazards assumption was violated for a single risk factor, namely lifting >25 kg at least once an hour. Indeed, the relative risks differed between the first three and later years of seniority. We extended the Cox model to account for this difference.

The single univariate analyses for the individual variables are presented in Table 3. Only the age at job start was statistically significant.

Table 4 summarizes the single univariate analyses for the work-related physical factors. Three of these proved statistically related to low back pain: (i) long periods of seated work; (ii) >12 flexion or rotation movements of the trunk per hour; and (iii) >3 years seniority in a job involving lifting >25 kg at least once an hour. Only the former two factors stayed in the model after adjustment for gender, education and the age at job start (model a). The latter was removed ($P = 0.07$). When the model was adjusted additionally for psychosocial work characteristics (model c), lifting reappeared.

Table 5 shows the single univariate analyses for the psychosocial work characteristics. We included only those characteristics or interactions of characteristics that were the most significant in single analyses to avoid the inclusion of highly correlated pairs (correlation coefficients >0.7). The interaction between psychological job demands and supervisor support was statistically associated with low back pain in both model b (adjusted for gender, education and the age at job start) and model c (additionally adjusted for work-related physical factors). This implies that the effect of job demands depends on the effect of supervisor support and vice versa. To interpret this interaction, we computed the relative risk and the 95% confidence (95%CI) interval for a job demand score of 28 (= 25th percentile) versus one of 35 (= 75th percentile) for fixed values of supervisor support (ranging from 4 to 16). Figure 1 depicts the significant relative risks from model c. For model b, the same trend was observed. Notably, for lower scores of supervisor support, the ratio of the 25th and the 75th percentile of job demands was significantly higher than 1. Furthermore, the risk of low psychological demands rose with decreasing supervisor support. We repeated the calculation for a supervisor support score of 9 (= 25th percentile) versus a score of 11 (= 75th percentile) for fixed values of job demands (ranging from 18 to 48). The significant relative risks obtained from model c are shown in Figure 2. For model b, the trend was the same. Here, the ratio of the 25th and the 75th percentile of supervisor support was significantly higher than 1 for lower scores of psychological job demands. The lower the demands, the higher the risks of low back pain due to low supervisor support.

***Table 2**. Descriptive statistics of continuous psychosocial work characteristics and individual variables for workers in their first employment*

Variable	Low back pain[a]			No low back pain[b]		
	Mean	SD	Median	Mean	SD	Median
Age at the start of employment (years)	21.6	2.0	22.0	21.5	1.8	21.0
Job control (scores between 24 and 96)	62.0	11.6	62.0	65.6	11.8	66.0
Skill discretion (scores between 12 and 48)	31.7	6.5	32.0	33.5	6.3	34.0
Decision latitude (scores between 12 and 48)	30.4	6.9	32.0	32.2	7.2	32.0
Psychological job demands (scores between 12 and 48)	32.4	5.4	32.0	33.0	5.7	32.0
Social support (scores between 8 and 32)	23.3	3.0	23.0	23.6	2.8	24.0
Supervisor support (scores between 4 and 16)	10.8	2.2	11.0	11.2	2.0	11.0
Co-worker support (scores between 4 and 16)	12.5	1.9	12.0	12.5	1.6	12.0
Job dissatisfaction (scores between 5 and 20)	10.7	3.0	11.0	10.1	2.7	10.0

[a]Workers who developed a first episode of low back pain after job start.
[b]Workers who remained free of low back pain after job start.

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Table 3. *Associations in single univariate analyses between individual variables and first-ever low back pain among workers in their first employment*

Variable	Crude RR[a]	95% CI
Age at job start (years)	1.20	(1.03; 1.39)
Sex		
Male	1.00	
Female	0.96	(0.57; 1.61)
Education		
Higher education, university	1.00	
Higher education, not university	1.75	(0.23; 13.35)
Higher secondary	1.58	(0.20; 12.18)
Primary school or lower secondary	1.71	(0.21; 13.66)

[a]RR, relative risk.

Table 4. *Associations between work-related physical factors and first-ever low back pain among workers in their first employment*

Variable			Model a[a]		Model c[b]	
	Crude RR	95% CI	Adjusted RR	95% CI	Adjusted RR	95% CI
Seated work for longer periods of time						
No	1.00		1.00		1.00	
Yes	2.58	(1.37; 4.84)	3.18	(1.65; 6.11)	3.21	(1.61; 6.40)
Lifting >25 kg at least once an hour after 3 years of seniority						
No	1.00				1.00	
Yes	3.21	(1.33; 7.74)	*		3.67	(1.43; 9.39)
Lifting >25 kg at least once an hour in the first 3 years of seniority						
No	1.00					
Yes	0.66	(0.29; 1.51)	*		*	
More than 12 flexion and/or rotation movements of the upper part of the body per hour						
No	1.00		1.00		1.00	
Yes	2.11	(1.06; 4.21)	2.74	(1.35; 5.58)	3.02	(1.43; 6.38)
Lifting > 10 kg > 12 times an hour						
No	1.00					
Yes	1.60	(0.90; 2.86)	*		*	
Working schedule						
Part-time	1.00					
Full-time	1.69	(0.67; 4.32)	*		*	
Driving vehicles at least 6 h a day						
No	1.00					
Yes	1.30	(0.76; 2.23)	*		*	
Flexion and/or rotation of the upper part of the body for 2 h/day						
No	1.00					
Yes	1.27	(0.73; 2.22)	*		*	
Ability to change posture regularly						
Yes	1.00					
No	1.23	(0.51; 2.94)	*		*	
Pushing or pulling at least once an hour						
No	1.00					
Yes	1.01	(0.58; 1.76)	*		*	

For models a and c, RRs and 95% CIs were available only for results significant at $\alpha = 0.05$. This was due to the backward selection procedure.
*Not significant at $\alpha = 0.05$.
[a]Work-related physical factors and individual variables included in the model building.
[b]Work-related physical factors, psychosocial work characteristics and individual variables included in the model building.

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Table 5. *Associations in single univariate analyses between dimensions of the Demand-Control-Support model of Karasek and Theorell and first-ever low back pain among workers in their first employment*

Variable	Crude RR[a]	95% CI
Job control	0.98	(0.96; 1.01)
Skill discretion	0.97	(0.94; 1.01)
Decision latitude	0.98	(0.94; 1.01)
Psychological job demands	0.99	(0.94; 1.03)
Social support	0.97	(0.88; 1.07)
Supervisor support	0.93	(0.82; 1.05)
Co-worker support	1.04	(0.88; 1.21)
Job dissatisfaction	1.05	(0.96; 1.15)

[a]Crude RRs indicate the change in risk for an increase of the variable with one measuring unit.

Figure 1. *Relative risk (RR) and 95% confidence interval (95% CI) for a job demand score of 28 (= 25th percentile) versus a job demand score of 35 (= 75th percentile) for fixed values of supervisor support (ranging from 4 to 16). The significant relative risks from model c are depicted. In this model, work-related physical factors, psychosocial work characteristics and individual variables were taken into account in the model building. For model b, the same trend was observed (figures not shown).*

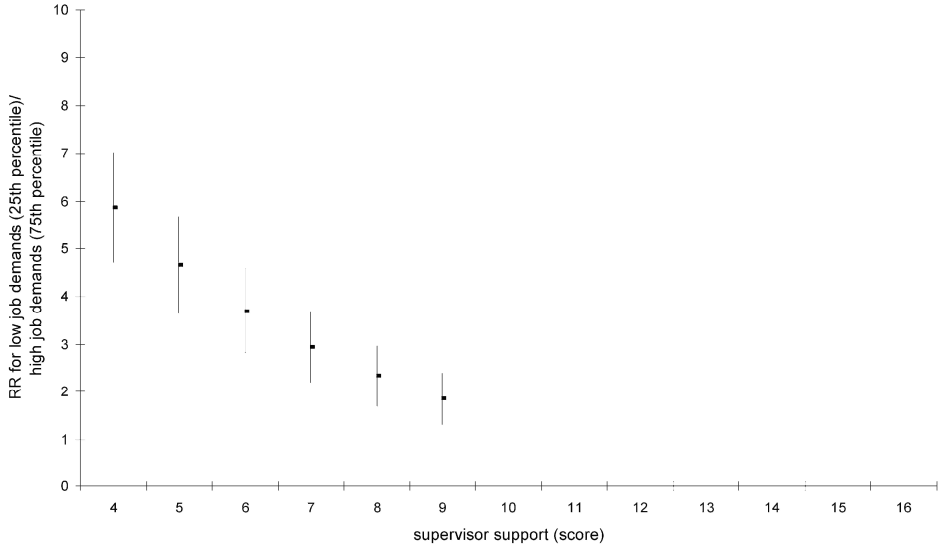
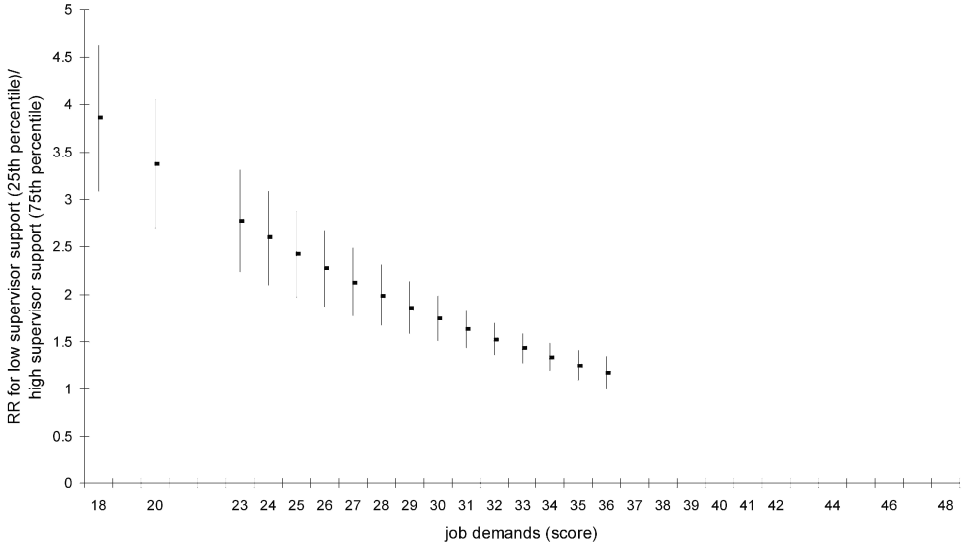


Figure 2. *Relative risk (RR) and 95% confidence interval (95% CI) for a supervisor support score of 9 (= 25th percentile) versus a supervisor support score of 11 (= 75th percentile) for fixed values of job demands (ranging from 18 to 48). The significant relative risks from model c are depicted. In this model, work-related physical factors, psychosocial work characteristics and individual variables were taken into account in the model building. For model b, the same trend was observed (figures not shown).*



DISCUSSION AND CONCLUSION

About half of the workers who developed low back pain after job start did so in the first year of employment. This may reflect a lack of work experience or training. It is well known that for work injuries, novice workers are at higher risk [5].

We observed a strong association with first-ever low back pain for seated work, flexion or rotation movements of the trunk and more than 3 years seniority in a job involving heavy lifting. In agreement, based on the compiled evidence from epidemiological studies, recent reviews identify manual materials handling and awkward trunk postures as risk factors for low back pain [6]. It must be noted, however, that in individual studies, significance of these correlations cannot always be demonstrated [7,8]. For lifting, the lag time of 3 years may reflect the importance of cumulative exposure. Given the limited age range of the participants, an effect of ageing is less plausible. As to the risk associated with seated work, the literature remains equivocal. While a negative effect of postural immobility on the nutritional status of the disc has been postulated as a likely patho-physiological mechanism [9], a recent review concluded that epidemiological studies consistently failed to demonstrate a statistically significant, positive association with low back pain [10]. In the present study, no association was observed between low back pain and driving vehicles or machines at work, which seems at odds with the consistently reported association of low back pain and whole-body vibration for tractor, truck or bus drivers [11]. However, our population exhibited very specific exposure characteristics in that they were mostly standing drivers of pallet forklifts and a limited number of sitting forklift drivers who were exposed to whole-body vibration. It must also be stressed that in the literature no clear conclusion is reached with regard to a dose-response relationship [11].

From Figures 1 and 2, it is clear that workers who perceived their work as less demanding and experienced low supervisor support were more likely to report low back pain. Low supervisor support has been cited in association with back disorders [12]. However, the finding of low psychological demands as a risk factor does not concur with the model of Karasek and Theorell [4] and former studies on back pain [13,14]. We hypothesized that it may concern young workers who feel able to cope with the psychological job demands, but are not well supported by their supervisor. The latter may be a result of the former: under the impression that these workers can handle their jobs, the supervisors may pay less attention to them and focus on those who appear to need supervision more. The combination of motivation but nevertheless low supervisor support may create a feeling of lack of respect.

The present study gives some insights to better understand the factors underlying the development of a first episode of low back pain in young adults. However, the cross-sectional nature of the analysis does not allow us to draw causal conclusions and any interpretation of the data must account for a possible healthy worker effect as no information was available for workers who had left their job prior to the study. Longitudinal studies following up workers in their first employment are thus needed in the future.

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