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Job strain, work characteristics and back pain: A study in a University hospital

Delphine S. Courvoisier [a,*], Stéphane Genevay [b], Christine Cedraschi [c], Nadia Bessire [d], Anne-Claude Griesser-Delacretaz [e], Dominique Monnin [f], Thomas V. Perneger [a]

[a] Division of Clinical Epidemiology, University Hospitals of Geneva and Faculty of Medicine, University of Geneva, Switzerland
[b] Division of Rheumatology, University Hospitals of Geneva, Switzerland
[c] Division of Clinical Pharmacology and Toxicology, Multidisciplinary Pain Center & Division of General Medical Rehabilitation, University Hospitals of Geneva, Switzerland
[d] Division of Psychiatry, University Hospitals of Geneva, Switzerland
[e] Back Pain Care Program, University Hospitals of Geneva, and Medical Directorate, University Hospital of Lausanne, Switzerland
[f] Care Services Directorate, Unit of Physiotherapy Research and Quality Assurance, University Hospitals of Geneva, Switzerland

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ABSTRACT

Objectives: The demand-control-support "job strain" model is frequently used in occupational health research. We sought to explore the relationship between job strain and back pain.

Method: Thousand two hundred and ninety-eight collaborators of a Swiss teaching hospital responded to a cross-sectional questionnaire survey that measured job strain, the occurrence of back pain as well as the characteristics and consequences of this pain.

Results: Job strain computed with both psychological and physical demands was strongly and significantly associated with various measures of back pain. These associations displayed a dose–response pattern, and remained strong even after adjustment for job characteristics and professional categories. In contrast, separate dimensions of job strain (except physical demands) and job strain computed with only psychological demands did not remain significantly associated with back pain after adjustment for other variables.

Conclusion: Our results support the findings linking back pain to job strain. Moreover, the relationship between back pain and job strain is much stronger if job strain includes both psychological and physical demands. Results of this study suggest that workplace interventions that aim to reduce job strain may help prevent back pain and may alleviate the personal, social, and economic burden attributable to back pain.

1. Introduction

Non-specific back pain is a common condition. Up to 90% of adults experience back pain at least once in their lives (Waddell, 2004; Walker et al., 2004). It is a frequent complaint in hospital settings, especially among healthcare personnel (Gonge et al., 2001; Josephson et al., 1998; Lagerström et al., 1998). Several studies have shown that non-specific back pain is related to multiple aspects of the work environment, including physical demands (e.g. awkward body position) but also psychosocial factors (Bongers et al., 1993, 2006; Burdorf and Sorock, 1997).

With respect to the psychosocial factors, systematic reviews have reached inconsistent conclusions (Hoogendoorn et al., 2000; Linton, 2001). While some studies found strong associations between psychosocial factors such as job satisfaction or social support and various measures of back pain (Ahlberg-Hulten et al., 1995; Clays et al., 2007; Ghaffari et al., 2008), others found none (Hoogendoorn et al., 2001; Leino and Hänninen, 1995; Viikari-Juntura et al., 1991). An important psychosocial risk factor of health problems in occupational settings is job strain. According to Karasek and Theorell's "job strain" model (Karasek, 1979; Karasek et al., 1998, 1982a), deleterious effects of work are due to a combination of high work-load demands and low job-decision latitude (Karasek, 1979) (demand-control model). A later version of the model also includes social support as a moderator of the effect of demand and control (Karasek et al., 1982b). Thus, strain should be a better (i.e., stronger), and a more theoretically grounded, risk factor of back and neck pain than any of its component scales. Nevertheless, even though strain is theoretically more appropriate as a risk factor of negative health outcomes, many studies (Barnekow-Bergkvist et al., 1998; Gheldof et al., 2005; Lee et al., 2008) examined the effect of demand, control and/or support on back pain separately but not of job strain as such.

* Corresponding author. Address: University Hospitals of Geneva, Division of Clinical Epidemiology, 4, rue Perret-Gentil, 1211 GE 14, Switzerland. Tel.: +41 22 3729029; fax: +41 22 3729135.
E-mail address: delphine.courvoisier@hcuge.ch (D.S. Courvoisier).

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In this study, we tested the impact of each dimension of demand, control and support as well as of job strain on several measures of back pain in the context of a hospital-based cross-sectional survey. Moreover, we examined whether the impact of job strain was confounded by work characteristics and socio-professional status.

2. Methods

2.1. Participants

After institutional (University Hospitals of Geneva) ethics approval, participants were recruited in 2006 among the staff of University hospitals of Geneva, a public teaching hospital, in Geneva, Switzerland. The questionnaires, in French language, were sent to the home addresses of 2700 randomly selected employees stratified by occupational group (450 workers in each of six groups: medical doctors, nurses, nursing assistants, technical staff, administrative staff, and other health professionals). After two reminders, 1298 persons had answered (48% response rate); the response rate was 44.2% for medical doctors, 58.4% for nurses, 37.1% for nursing assistants, 44.7% for technical staff, 43.6% for administrative staff, and 47.3% for other health professionals. The characteristics of the respondents are described in Table 1.

2.2. Questionnaires

The survey included several questionnaires measuring socio-demographic status, stress, health, back pain, job characteristics, and job strain.

Table 1
Characteristics of the sample.

	N (%)	
Socio-demographic characteristics		
Mean age category	41–50	
Sex (female)	856 (68.7)	
Profession		
Medical doctors	208 (16.0)	
Nurses	270 (20.8)	
Nursing assistants	174 (13.4)	
Other health prof.	220 (17.1)	
Technical staff	206 (15.9)	
Administrative staff	206 (15.9)	
Supervisor status	247 (20.1)	
Job characteristics (exposed often or very often)		
Working on a computer	814 (65.4)	
Carrying loads	336 (26.9)	
Handling of patients	404 (32.6)	
Position maintained for a long time	541 (43.7)	
Poorly adapted work station	254 (20.8)	
Pushing or pulling loads	315 (25.3)	
Working more than 8 h per day	446 (35.8)	
Night work	306 (24.4)	
Psychosocial factors	Mean (SD)	Reliability
Decision latitude	67.09 (15.33)	0.80
Psychological demands	53.18 (15.71)	0.88
Physical demands	38.29 (26.33)	0.77
Supervisor support	61.46 (21.36)	0.88
Coworkers support	71.33 (15.83)	0.85
Strain (only psy. demands)	43.05 (10.50)	
Strain (both demands)	39.34 (12.37)	
Back pain		
Current back pain	436 (34.0)	
Chronic back pain	453 (35.3)	
Sickness leave due to back pain	159 (12.2)	
Generalist or specialist visit	283 (23.5)	
Mean (SD) of bothersomeness	2.18 (2.44)	
Mean (SD) of pain of the worst episode	5.28 (2.26)	

2.2.1. Job content questionnaire (JCQ)

The Job Content Questionnaire is a 31-item questionnaire that can measure up to six subscales (Karasek, 1979). Response categories were presented on a 4-level Likert-type scale ('totally disagree', 'disagree', 'agree', 'totally agree'). The control dimension is called "decision latitude" (9 items). The demand dimension is called "job demands" and can be separated into psychological (9 items) and physical (5 items) demands. Finally, the support dimension (8 items) is decomposed into supervisor (4 items) and coworker (4 items) support. Based on these six subscales, several measures of job strain have been proposed (Courvoisier and Perneger, 2010; Landsbergis et al., 1994).

2.2.2. Socio-professional status

Respondents' socio-professional status was assessed by job category, supervisor status, age and gender. There were six occupational categories: medical doctor, nurse, nursing assistant, administrative staff (e.g. secretary, human resources staff), technical staff (e.g. architect, cook, cleaning staff, information technology staff), and other health professionals (e.g. chemist, psychologist, biologist, physiotherapist, social worker). Supervisor status was coded as one if the respondent was a manager and zero otherwise.

2.2.3. Job characteristics

Respondents evaluated the frequency of eight job characteristics in their work: working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 h per work day. Frequency was assessed on a 4-point scale: never, sometimes, often, and very often. The job characteristics were dichotomized by collapsing the first two and the last two categories.

2.2.4. Back pain

Several self-report measures of back pain were collected with the following questions (translated in English for this article but asked in French):

Current back pain: "Do you suffer from back pain now?" Answer was either 'yes' or 'no'. Note that all respondents answering yes to this question were considered as suffering from back pain irrespective of pain localization (i.e., lumbar, dorsal, or cervical). A sensitivity analysis showed that including respondents suffering only from neck pain changed the results only slightly (data not shown).

Chronic back pain: Based on two questions: "When did you suffer from back pain for the first time?" and "Since the first time you had back pain, how often have you suffered from back pain". Respondents were considered as suffering from chronic back pain if they have had back pain for at least 3 months and their back pains them at least a month or more frequently.

Sickness leave: "During the last year, did you go on sickness leave due to back pain?" Answer was either 'yes' or 'no'.

Doctor visit: "During the last year, for your back pain problem, did you consult a primary care physician or a specialist?" Answer was either 'yes' or 'no'.

Bothersomeness: "During the last year, did your back pain bother you in your everyday activity?" Answer was given on a visual analog scale from 0 (no bother) to 10 (worst imaginable bother).

Pain intensity: "During the last year, when you suffered from back pain, how strong was your pain during the most intense episode?" Answer was given on a visual analog scale from 0 (no pain) to 10 (worst imaginable pain).

2.3. Analyses

Based on previous research (Courvoisier and Perneger, 2010; Niedhammer, 2002) and on the demand-control model, we derived a scaled score (between 0 and 100) for each dimension of the

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questionnaire. Note that having a higher score could be positive for some dimensions (e.g., higher decision latitude) or detrimental in others (e.g., higher physical demands). We then computed a strain score by subtracting decision latitude (DL) from psychological demands (DPsy).

$$\mathrm{Dpsy} - \mathrm{DL}.$$

Support was not included in this score because a previous research has shown that its impact on adverse health event is negligible (Courvoisier and Perneger, 2010). However, since back pain probably has physical determinants in some cases, we computed a second strain score by subtracting decision latitude (DL) from the average of psychological (DPsy) and physical (Dphy) demands:

$$\frac{\mathrm{Dpsy} + \mathrm{Dphy}}{2} - \mathrm{DL}.$$

Both strain scores were transformed so that a value of zero represents no strain (high decision latitude and low psychological/physical demands) and a value of 100 represents the highest possible strain. All dimension scales were divided into four categories: from 0 to 40, from 40.1 to 60, from 60.1 to 80 and from 80.1 to 100. The first category was larger because, for several dimensions, few individuals had low scores. The strain scores were also divided into four categories (from 0 to 20, from 20.1 to 40, from 40.1 to 60 and from 60.1 to 100) because few individuals had high scores of strain.

Analyses for current back pain, chronic back pain, sickness leave, doctor visit and bothersomeness were done using the whole sample. Individuals who reported no back pain were assigned zero values for these back pain variables (e.g., no sickness leave for back pain). Analysis of the intensity of the worst episode of back pain was done only on individuals who reported at least one back pain episode. The impact of each dimension of job strain and of strain on back pain-related variables were examined using logistic regression for dichotomous outcomes. For the visual analog scale of bothersomeness, the impact of the variable was analyzed by the Jonckheere–Terpstra non-parametric test because the distribution of the outcome had an excess of zero due to individuals who did not report back pain. For the visual analog scale of pain, ANOVA was used since the distribution of the outcome variable was nearly normal. In univariate analysis, we tested the linearity of the trend over categories of job strain using chi-square test for dichotomous outcomes and ANOVA for continuous outcomes. To formally compare the predictive capacity of the subscales of the JCQ as well as the composite scale of strain, we used the relative precision method (McHorney et al., 1992). This method yields a score of 100% for the best explanatory variable and indicates, for the others variable, their percentage of explained variance (captured by the *F* statistics) relative to the best explanatory variable. Finally, we examined the impact of JCQ dimensions and strain when the analysis is adjusted for job characteristics and socio-professional status.

Table 2
Percentage or mean of back pain-related variables stratified by JCQ dimensions and strain.

Psychosocial factors		*N*	Suffer from back pain now	Chronic back pain	Sickness leave	Doctor visit	Bothersomeness in everyday activities[a]	Pain intensity of worst episode
Decision latitude	0–40	48	43.5	43.4	20.8	33.3	2.42	5.21
	40–60	369	41.2	41.0	15.2	30.4	2.62	5.58
	60–80	596	32.0	32.9	11.2	22.3	2.11	5.24
	80–100	259	27.0	31.3	7.3	13.6	1.65	4.88
Linear trend	*p*		<0.001	0.004	<0.001	<0.001	<0.001	0.008
Psychological demands	0–40	226	26.4	28.3	8.8	19.0	1.77	5.07
	40–60	654	34.2	33.5	12.7	22.9	2.10	5.25
	60–80	319	36.4	41.0	12.5	24.0	2.45	5.43
	80–100	70	44.9	50.0	14.3	33.3	2.97	5.46
Linear trend	*p*		0.003	<0.001	0.191	0.028	<0.001	0.109
Physical demands	0–40	635	28.0	31.6	7.9	17.3	1.79	4.98
	40–60	309	34.3	34.2	14.2	23.7	2.25	5.58
	60–80	161	50.9	48.1	22.4	42.1	3.25	5.59
	80–100	74	49.3	52.1	17.6	30.0	3.12	5.65
Linear trend	*p*		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Supervisor support	0–40	162	44.0	46.9	14.8	29.8	2.84	5.68
	40–60	369	34.5	35.9	13.6	24.1	2.28	5.37
	60–80	500	32.1	31.9	9.8	21.2	1.99	5.22
	80–100	219	27.2	31.3	11.4	20.3	1.79	4.87
Linear trend	*p*		0.001	0.001	0.108	0.024	<0.001	0.003
Coworkers support	0–40	25	48.0	48.0	16.0	55.6	2.68	5.94
	40–60	184	39.1	44.8	17.4	44.9	2.66	5.85
	60–80	747	32.6	33.7	11.2	29.5	2.09	5.18
	80–100	307	32.1	32.3	10.7	28.2	1.99	5.08
Linear trend	*p*		0.055	0.005	0.045	<0.001	0.008	0.002
Strain (only psychological demands	0–20	14	14.3	14.3	7.1	0.0	1.14	4.17
	20–40	480	26.5	27.5	9.0	16.9	1.69	4.97
	40–60	707	38.1	39.6	13.4	26.7	2.44	5.39
	60–100	66	48.4	50.8	18.2	33.3	3.05	6.02
Linear trend	*p*		<0.001	<0.001	0.004	<0.001	<0.001	0.004
Strain (both demands)	0–20	66	18.2	24.2	3.0	5.2	1.24	4.25
	20–40	620	26.8	28.9	9.4	17.3	1.74	5.00
	40–60	515	42.4	43.1	15.1	31.1	2.70	5.58
	60–100	61	50.8	45.0	21.3	33.3	3.07	5.95
	p		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a] Non-parametric test (Jonckheere–Terpstra test) was used for this variable.

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Table 3
Relative precision of strain and its dimensions for each outcome.

Psychosocial factors	Suffer from back pain now	Chronic back pain	Sickness leave	Doctor visit	Bothersomeness in everyday activities	Pain intensity of worst episode
Decision latitude	0.44	0.37	0.65	0.70	0.37	0.47
Psychological demands	0.20	0.46	0.00	0.04	0.22	0.11
Physical demands	0.71	0.59	0.92	0.62	0.78	0.70
Supervisor support	0.27	0.43	0.20	0.19	0.31	0.33
Coworkers support	0.06	0.13	0.16	0.23	0.09	0.31
Strain (only psy. demands)	0.66	0.90	0.37	0.56	0.64	0.58
Strain (both demands)	1.00	1.00	1.00	1.00	1.00	1.00

3. Results

3.1. Job strain and back pain prevalence

Suffering from back pain at the time of the survey was significantly associated with all strain scales except coworkers' support (Table 2). Strain and physical demands were the most informative risk factors since the difference in the prevalence of back pain between the lowest and highest category was largest (around 34% for strain with only psychological demands, 33% for strain with both demands and 21% for physical demands). For strain with psychological demands, the prevalence of current back pain was 14.3% for the lowest category and 48.4% for the highest category. By contrast, the differences in prevalence between the first and fourth category of decision latitude, psychological demands and supervisor support were all less than 20%. All strain dimensions as well as the strain scores significantly predicted suffering from chronic back pain; strain with psychological demands only, psychological demands, strain with both demands, and physical demands were the best risk factors (respectively, around 37%, 22%, 21% and 21% of difference between the prevalence in the first and in the last category).

3.2. Job strain and consequences of back pain

Only strain scores, decision latitude, physical demands and coworkers support were significantly associated with sickness leave. Strain with both demands was the best explanatory variable, with a difference between first and last category of around 18%. Decision latitude was the second best covariate (difference between first and last category: around 14%). Consulting a physician (general practitioner or specialist) was significantly associated with all scales. The best explanatory variables were the two strain scales (around 33% and 28% between first and last category), and coworkers' support (27%).

3.3. Job strain and characteristics of back pain

All scales were significantly associated with the level of bothersomeness of pain in the last year. Again, both strain scores were the best explanatory variables with a difference of 1.91 and 1.83 between the first and last category. The next best variable, as expected, was physical demands (difference of 1.33 between first and last category). Finally, the pain intensity of the worst episode was significantly associated with all scales except psychological demands. The two strain scores and the two support scores explained the most variance (difference between first and last category of 1.85 and 1.70 for strain scores and around 0.80 for both supervisor and coworkers' supports).

3.4. Relative precision of the risk factors

Table 3 presents the relative precision of each dimension of strain and strain for each outcome. Strain with both demands was, for all outcomes, the best explanatory variable according to relative precision. Indeed, the mean relative precision across all outcomes was 1.00 for strain with both demands, 0.72 for physical demands, 0.62 for strain with only psychological demands, 0.50 for decision latitude, and less than 0.40 for the other scales. Note that including support in the strain with both demands score slightly decreased the relative precision for all outcomes (data not shown).

3.5. Adjustment for job characteristics and socio-professional status

In agreement with results from Table 2, univariate analyses showed that strain with both demands was a significant risk factor of all back pain outcomes (Tables 4 and 5). Moreover, multivariate analyses which adjusted for job characteristics (working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 h per work day) and socio-professional status (age, sex, professional group and supervisor status) also showed significant associations between job strain with both demands and five of the outcomes: current back pain, chronic back pain, consulting a doctor for back pain, the intensity of bothersomeness of back pain in everyday activities, and the intensity of pain of the worst episode during the last year (Tables 4 and 5). However, most associations between back pain outcomes and separate dimensions of the JCQ (except physical demands) or strain with only psychological demands (as opposed to the job strain score with both demands) became non-significant when the analyses were adjusted for job characteristics and socio-professional status (data not shown). Physical demands remained a significant risk factor for four outcomes (current back pain, chronic back pain, consulting a doctor for back pain, and the intensity of bothersomeness of back pain in everyday activities) even after adjustment.

4. Discussion

In this study of hospital workers, job strain, computed with both psychological and physical demands, was strongly and significantly associated with various measures of back pain. These associations displayed a dose–response pattern, and remained strong even after adjustment for job characteristics and professional categories. On the contrary, the measure of job strain that only included psychological demands did not retain a significant relationship with measures of back pain. This suggests that there may be a causal pathway between job strain taking into account both physical and psychological demands and back pain in hospital workers. If the causal nature of this association was confirmed, workplace interventions that aim to reduce job strain by working on decision latitude, psychological but also physical demands, could help prevent back pain and alleviate the personal, social, and economic burden attributable to back pain.

In general, separate dimensions of the JCQ taken independently were significantly associated with most measures of back pain. However, the measure of job strain that included physical

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Table 4
Impact of job strain with both demands on back pain-related variables adjusted for job characteristics (working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 h per work day) and socio-professional status. The measure of impact is expressed in odds ratio.

Job strain	Univariate analysis CI (95%)			Adjusted for socio-professional status CI (95%)			Adjusted for job characteristics CI (95%)			Fully adjusted CI (95%)		
	OR	Low	High	OR	Low	High	OR	Low	High	OR	Low	High
Suffer from back pain now												
0–20	1*			1*			1*			1*		
20–40	1.65	0.86	3.16	1.49	0.77	2.90	1.57	0.81	3.03	1.47	0.75	2.89
40–60	3.31*	1.73	6.33	3.29*	1.66	6.52	2.67*	1.34	5.30	2.70*	1.33	5.55
60–100	4.55*	2.08	10.44	4.86*	2.03	11.63	4.27*	1.72	10.61	4.16*	1.59	10.90
Chronic back pain												
0–20	1*			1*			1*			1*		
20–40	1.27	0.71	2.30	1.25	0.68	2.29	1.25	0.68	2.28	1.23	0.66	2.27
40–60	2.37*	1.32	4.28	2.52*	1.35	4.69	2.19*	1.16	4.11	2.19*	1.14	4.21
60–100	2.56*	1.20	5.46	2.87*	1.26	6.57	3.10*	1.31	7.38	2.79*	1.11	6.99
Sickness leave												
0–20	1*			1			1			1		
20–40	3.30	0.79	13.84	2.70	0.63	11.60	2.69	0.64	11.41	2.26	0.52	9.79
40–60	5.71*	1.37	23.82	3.60	0.82	15.72	3.23	0.75	14.02	2.39	0.53	10.74
60–100	8.67*	1.87	40.23	4.56	0.91	22.78	3.67	0.70	19.11	2.27	0.41	12.75
Doctor visit												
0–20	1*			1*			1*			1*		
20–40	3.84*	1.18	12.51	3.75*	1.13	12.48	3.38	1.03	11.13	3.32	0.99	11.16
40–60	8.26*	2.55	26.83	8.02*	2.38	27.04	5.83*	1.74	19.49	5.76*	1.67	19.91
60–100	9.17*	2.52	33.38	7.59*	1.96	29.38	5.99*	1.52	23.56	4.97*	1.20	20.60

* $p < 0.05$. After the reference value indicate a significant global p-value.

Table 5
Impact of job strain with both demands on consequences of back pain adjusted for job characteristics (working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 h per work day) and socio-professional status. The measure of impact is expressed in mean difference.

Job strain	Univariate analysis			Adjusted for socio-professional status			Adjusted for job characteristics			Fully adjusted		
	Mean difference	CI (95%)		Mean difference	CI (95%)		Mean difference	CI (95%)		Mean difference	CI (95%)	
		Low	High		Low	High		Low	High		Low	High
Bothersomeness in everyday activities												
0–20	0*			0*			0*			0*		
20–40	0.50	−0.10	1.10	0.43	−0.19	1.04	0.41	−0.20	1.01	0.41	−0.22	1.02
40–60	1.45*	0.85	2.06	1.44*	0.81	2.08	1.08*	0.43	1.72	1.20*	0.53	1.87
60–100	1.82*	1.00	2.65	1.82*	0.94	2.70	1.45*	0.52	2.38	1.51*	0.53	2.48
Pain intensity of worst episode												
0–20	0*			0*			0*			0*		
20–40	0.75	−0.05	1.55	0.78	−0.04	1.59	0.80*	0.01	1.59	0.87*	0.07	1.66
40–60	1.33*	0.53	2.13	1.32*	0.49	2.15	1.41*	0.59	2.23	1.53*	0.70	2.36
60–100	1.71*	0.70	2.71	1.58*	0.49	2.66	1.78*	0.69	2.87	1.72*	0.58	2.86

* $p < 0.05$. After the reference value indicate a significant global p-value.

demands was by far the best explanatory variable of all measures of back pain. The second best explanatory variable of back pain variables was physical demands. For strain with both demands, clinically important differences were observed between the lowest and the highest category of strain. For example, while only 3% of respondents reporting low strain had taken at least one day off during the previous year due to back pain, 21% of those reporting high strain took time off work. Similarly, the difference between mean bothersomeness scores for low strain versus high strain respondents was 1.83, which represents about 75% of the standard deviation of bothersomeness, a large effect according to Cohen (1988).

Even when the analyses were adjusted for job characteristics and socio-professional category, job strain with both demands remained highly significantly associated with five of the six outcomes: current back pain, chronic back pain, doctor visit in past year, the bothersomeness in everyday activities, and the intensity of pain of the worst episode during the last year. Remarkably, job strain is a stronger explanatory variable than any job category, including that of nurses assistant. Nursing assistants are at high risk of back pain and injury (Amick et al., 1998; Boyer et al., 2009; d'Errico et al., 2007) and are regularly exposed to situations that may cause mechanical strain for the back, including lifting heavy objects or the handling of patients (Venning et al., 1987). Physical demands also remained a significant explanatory variable for several outcomes after adjustment, contrary to other dimensions of the JCQ.

The results of this study help shed light on the discrepancy in results found in previous studies of the impact of psychosocial factors on back pain (Hoogendoorn et al., 2000; Linton, 2001). Most published reviews include heterogeneous studies with different and somewhat incomplete perspectives on the subject. Some studies focused on specific job descriptions (e.g., nurses (Ahlberg-Hulten et al., 1995), or operators (Rugulies and Krause, 2005)). Some used only one health outcome, such as high blood pressure (Andersen et al., 2007; Clays et al., 2007), sickness leave (Andersen et al.,

2007) or return to work after a back pain episode (Iles et al., 2008). In addition some of the heterogeneity could be due to methodological differences. Some studies adjusted the psychological factors by non-work-related factors only (Bigos et al., 1991) while others adjusted for additional work characteristics (Leino and Hänninen, 1995). Finally, some study used measures of strain that included more physically oriented questions (e.g., Andersen et al., 2007). Since this study examined the impact of psychosocial factors on several measures of back pain with and without adjusting for work-related factors, we can propose an explanation of the discrepancy in results found in previous studies. We hypothesize that adjusting for work characteristics renders some psychosocial factors non-significant whereas other psychosocial factors (foremost a global measure of job strain that includes both psychological and physical demands) remain important. Saastamoinen et al. (2009) found a similar phenomenon with strain being less attenuated by psychosocial factors than organizational justice or family-to-work conflict.

The major strengths of this study are the use of several indicators to characterize back pain in a large sample of population reflecting several professional groups. In addition, the use of a synthetic variable (strain with psychological and physical demands) summarizing several different aspects of work place factors proves to be a powerful tool. Job strain appears in this study as a simple, easy to use concept with a considerable explanatory power. This result is congruent with other studies that examined the influence of job strain on back pain (Josephson et al., 1997; Saastamoinen et al., 2009).

However, this study has also some limitations. First, the survey was conducted in a single institution. Other work contexts may lead to different results, since the types of jobs and the nature of work might differ. Still, the generalizability of our results may be expected as large hospitals provide a great diversity of jobs and of exposure to occupational strain. Second, the response rate was less than optimal which raises the issue of selection bias. However, while selection bias may have affected the absolute levels of the measured variables, we do not see a plausible mechanism that would have caused bias in the measures of association. Third, some categories of the dimension of the JCQ and strain had few subjects since the study is a survey. Added to the fact that some outcomes are not very frequent (i.e., sickness leave and doctor visit), this may have led to inconsistencies in the dose–response pattern (e.g., sickness leave and physical demands) and to large confidence intervals for the infrequent outcomes. Finally, this survey was cross-sectional, which prevents a clear causal interpretation of the observed associations.

Despite the cross-sectional design of the survey, we believe that the results of this study suggest that there may be a causal pathway between job strain and back pain. An argument in favor of a causal relationship between strain and back pain is theoretical plausibility. Specifically, Karasek and Theorell's job strain theory that a combination of control and demands is more associated with adverse health outcomes than any specific component of strain is supported by the results of this study. Another argument is the graded, "dose–response" relationship between strain and all back pain related outcome, which is also consistent with the job strain model. If these parts of Karasek and Theorell's theory are correct, it may be that their postulate of a causal link between strain and health outcomes is also correct. Causality can also be inferred by elimination. Alternative explanations for the relationship between job strain and back pain are inverse causality (i.e. back pain causes strain), confounding (i.e. a third variable causes both back pain and strain), selection bias (i.e. individuals who did not respond to the questionnaire had no relationship between strain and back pain, or perhaps an inverse relationship), and information bias (i.e. a systematic tendency to rate both strain and back pain as frequent/high or rare/low). Inverse causality is a possible concern. However, several longitudinal studies have provided evidence that psychosocial factors predict later back pain problems (Clays et al., 2007; Rugulies and Krause, 2005). While confounding is always possible, strain was still a significant risk factor for back pain even when the analyses were adjusted for job characteristics and socio-professional status, the most likely confounders. Selection bias that would create the observed relationships does not seem probable. Finally, information bias could be a problem since all measures were obtained by self-report, which can be influenced by personality trait like a predisposition to negative/positive emotions (Watson and Pennebaker, 1989). However, information bias could probably not explain the large effect sizes found in this study; furthermore, bias would produce associations of similar magnitude for all scales, and not the diverse patterns that we observed. Thus, a causal relationship remains as a plausible explanation for our findings. Nevertheless, a causal association remains hypothetical based on a cross-sectional study and further research is needed to confirm or reject this hypothesis. Future observational studies should aim to clarify the temporal sequence between job strain and back pain, and intervention studies may explore causality by attempting to reduce strain at the workplace.

Indeed, an interesting aspect of these results is that job strain is largely determined by human activity and is therefore presumably amenable to change. Appropriate changes in the work environment – such as better task organization, greater autonomy in decisions, automation of repetitive tasks, etc. – may reduce job strain, and this in turn may prevent back pain and alleviate its personal, social and economic consequences. This perspective is obviously hypothetical in light of the available data, and this avenue would deserve further exploration, through the development of interventions that aim to reduce job strain and their subsequent testing in experimental studies.

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