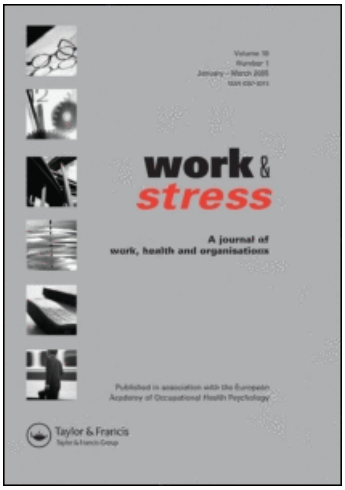

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Research Note

Are psychosocial factors associated with low-back pain among nursing personnel?

HENRIK GONGE*

Department of Occupational Medicine, University Hospital of Aarhus, Nørrebrogade 44, 8000 Aarhus C, Denmark and Institute of Psychology, University of Aarhus, Aarhus, Denmark

LONE DONBÆK JENSEN and JENS PETER BONDE

Department of Occupational Medicine, University Hospital of Aarhus, Aarhus, Denmark

Keywords: *Nursing personnel; Psychosocial factors; Stress; Low-back pain.*

The aim of this study was to investigate whether psychosocial factors at work are related to low-back pain among nursing personnel. It was conducted as a short-term follow-up study of 200 Danish female nursing personnel, providing care for the elderly. Self-reported measures of psychosocial factors such as time pressure, emotional demands of clients, control and social support were obtained by questionnaire at baseline, while stress, physical exertion and low-back pain were reported by diary records made in two, three-day periods in the subsequent 6 months. The study examines the possible influence of psychosocial factors preceding low-back pain as well as stress and physical exertion reported simultaneously with low-back pain. Only stress was associated with low-back pain (Odds Ratio (OR) = 2.3; Confidence Interval (CI) = 1.3–3.9) while neither physical exertion or any of the psychosocial factors were related to low-back pain. A possible pathway connecting emotional demands of clients to low-back pain through the mediation of stress was suggested.

1. Introduction

Female nursing personnel have a high prevalence of low-back pain compared to women in the general population (Jensen, Schibye, Hansen, Hye-Knudson, Gonge, and Lyng, 1998; Lagerström, Hansson, and Hagberg, 1998). Epidemiological studies provide some support that psychosocial factors in the work environment are in fact related to low-back pain (Bongers, Winter, Kompier, and Hildebrandt, 1993; Burdorf and Sorock, 1997; Hoogendorn, van Poppel, Bongers, Koes, and Bouter, 2000; Lagerström *et al.*, 1998), but findings are inconsistent and the impact remains to be determined. The aim of this study

*Author for correspondence. e-mail: henrik@gonge.dk

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was to investigate psychosocial factors, psychological stress and physical exertion in relation to low-back pain among nursing personnel.

A growing body of research has studied the impact of psychosocial factors on low-back pain in health care. Cross-sectional studies have suggested that factors such as stress (Bru, Svebak, Mykleton, and Gitlesen, 1997; Elovainio, and Sinervo, 1997), strain (interaction of high demands and low control) (Ahlberg-Hultén, Theorell, and Sigala, 1995; Josephson, 1998a; Josephson, Lagerström, Hagberg, and Wigaeus Hjelm, 1997), low support from superiors (Lagerström, Wenemark, Hagberg, and Wigaeus Hjelm, 1995), feeling a need to slow down (Engels, Gulden, Senden, and Hof, 1996), perception of permanent work overload (Moens, Dohogne, Jacques, and Helshoecht, 1993), time pressure and troublesome patients with dementia symptoms (Elovainio, and Sinervo, 1997) are associated with low-back pain or musculoskeletal symptoms including low-back pain. Some studies indicate that the impact of psychosocial factors gain significance in interaction with measures of physical exertion or load (Bru, Mykletun, and Svebak, 1996; Johansson, 1995; Josephson *et al.*, 1997). However, a limited number of longitudinal (Josephson, Hagberg, and Wigaeus Hjelm, 1996; Smedley, Egger, Cooper, and Coggon, 1997) and case-referent (Josephson, and Vingård, 1998b) studies including nursing personnel do not support the prediction of low-back pain by psychosocial factors.

Traditionally, studies of the impact of psychosocial factors on musculoskeletal disorders are strongly influenced by the Demand-Control (DC) model (Bongers *et al.*, 1993; Hoogendoorn *et al.*, 2000) by Karasek (Karasek, and Theorell, 1990), which also applies to research in health care (Ahlberg-Hultén *et al.*, 1995; Johansson, 1995; Josephson, 1998a; Josephson *et al.*, 1996, 1997; Lagerström *et al.*, 1995). However, conceptual limitations of the DC-model have been revealed in health care, as working with the emotional demands of suffering and sickness may imply special psychological work factors and requirements (Josephson, 1998a). In addition to the common psychosocial factors time pressure, social support and control, this study includes a measure on emotional demands of clients to reflect the context of health care.

Pathways by which psychosocial factors in the working environment may influence low-back pain indirectly include (Bongers *et al.*, 1993): (1) Psychosocial factors can intensify the exposure to physical load (hurried movements, awkward postures, decrease in pauses, etc.), which may cause low-back pain; (2) psychosocial factors can cause psychological stress which may lead to low-back pain through muscle tension or yet undiscovered physiological mechanisms. The present study uses measures of stress and physical exertion to account for these possible mediating effects.

We hypothesized that time pressure, emotional demands of clients, lack of control and lack of social support as well as perceived stress and physical exertion are associated with low-back pain.

2. Method

2.1. *Sample*

The sample consisted of female nursing personnel employed in care for the elderly in three smaller Danish municipalities. Regardless of previous low-back pain history all employees ($N=237$) received oral and written invitations to participate; 200 (84%) consented. The nursing personnel were employed in centres, where they provided home and/or residential care for the elderly including primarily nursing care but also domestic tasks. The sample mainly (88.5%) consisted of nursing personnel with short professional training—home care workers and nursing aides—but also nurses (11.5%) having wider responsibilities for the

care. The age of the participants ranged from 18 to 64 years (mean = 44.1 years, SD = 9.4 years). The seniority within care work ranged from 1 to 42 years (mean = 14.5 years, SD = 7.9 years).

2.2. *Design*

The investigation was conducted as a short-term follow-up study. At baseline, using a self-administered questionnaire we measured psychosocial factors related to the working environment and potentially confounding individual characteristics. Subsequently, within the following 6 months, stress, physical exertion and low-back pain were reported by diary questionnaires filled in by the participants during two periods approximately 3 months apart. In both periods of 3 working days, identical questions were repeated, adding up to 6 days of data. Thus, the reporting of psychosocial factors and low-back pain were separated in time, allowing follow-up analyses, while stress and physical exertion measured simultaneously with low-back pain provided data for cross-sectional analyses.

All 200 participants answered the initial questionnaire at baseline, while 173 (87%) returned one (27) or both (146) sets of diaries at follow-up. A test indicated that respondents and non-respondents did not differ with respect to psychosocial and individiual factors reported at baseline (data not shown). Due to missing values the population included in the analyses was further reduced to 153 participants.

2.3. *Measurement of predictors*

The psychosocial factors measured at baseline were *time pressure*, *emotional demands of clients*, *social support* and *control* (table 1). *Time pressure* was measured by the single item *'How often do you experience being pressed for time at work?'*. A 5-item index of *emotional demands of troublesome clients* by Kivimäki, and Lindström (1992) rated how often aspects of contact with clients had been mentally disturbing, worrying or a source of strain within the previous 6 months. *Social support* (four items) and *control* (five items) were measured by indices adopted from the Whitehall II study (North, Syme, Feeney, Head, Shipley, and Marmot, 1993).

Stress and *physical exertion* were measured as the average of each participant's responses on identical questions repeated in 6 days (or 3 days) of diary recording. The *Stress* item was worded: '*How much stress have you felt at work today?*' and scored on a Likert scale. *Physical exertion* was reported by the item '*Estimate the total physical exertion from the care work today*', rated on a Borg RPE-scale (Rating of Perceived Exertion, Borg, 1990). The *confounding variables* included in this study were age, neuroticism (Eysenck, and Eysenck, 1978), smoking, low-back pain lasting for periods of 3 months and accidents to the back (table 1). All confounding variables were reported at baseline.

The Cronbach α coefficients of the indices emotional demands, social support and control were respectively $\alpha = .76$, $\alpha = .64$ and $\alpha = .56$. The reliability of indices was thoroughly tested by Rasch item analyses (Allerup, 1987; Bashaw, 1982). Reliability of an index is indicated by a balanced response pattern among subgroups of any selected exogenic dimension that might influence item interpretation. We examined the reliability of the indices with respect to (a) municipality (the two small vs. the largest municipality), and (b) seniority (low vs. high). The tests indicated consistently, for all three indices, that employment in different municipalities did not affect item interpretation (Emotional demands $\chi^2 = 26.05$, $p > .01$ (12 d.f.), Social support $\chi^2 = 11.00$, $p > .01$ (9 d.f.), Control $\chi^2 = 16.44$, $p > .01$ (8 d.f.)) while seniority did have an affect (Emotional demands $\chi^2 = 45.41$, $p < .01$ (12 d.f.), Social support $\chi^2 = 31.76$, $p < .01$ (9 d.f.), Control $\chi^2 = 46.48$,

Table 1. Predictor and outcome variables, applied questions and response categories.

Variables	Questions
Baseline	
Time pressure: Likert scale 0 = *Rarely* to 10 = *Very often*.	How often do you experience being pressed for time at work?
Emotional demands of clients: 5 response categories: '*Very rarely or never*' to '*Very often or all the time*'.	Rate how often these factors at work have been mentally disturbing, worrying or straining within the previous 6 months: The client's level of anxiety A 'difficult' client who complains, accuses or critizises Death of clients or care of a client in the terminal phase To receive or to relate to emotions of clients or their relatives Differerent expectations in relation to the carework by clients and careworkers
Social support: 4 response categories: '*Often to Never/almost never*'.	How often do you get help and support from your immediate superior? How often is your immediate superior willing to listen to your problems? How often do you get help and support from your colleagues? How often are your colleagues willing to listen to your work-related problems?
Control: 4 response categories: '*Often*' to '*Never/almost never*'.	Do you have the possibility of learning new things through your work? Does your work demand a high level of skill or expertise? Does your work require that you take the initiative? Do you have a choice in deciding HOW you do your work? Do you have a choice in deciding WHAT you do at work?'
Smoking	Are you smoking?
Neuroticism	N-scale (23 items) from Eysenck's Personality Questionnaire.
Age	Year of birth
Low-back pain for periods of 3 months	Have you ever experienced low-back pain for 3 months continously?
Low-back accident	Have you ever injured your lower back in an accident?
Diary records (2 periods of 3 days)	
Stress: Likert scale '0 = *No stress*' to '10 = *Very high stress*'.	How much stress have you felt at work today?
Physical exertion: Modified RPE-scale* ranging from 0 to 14 with '*1 = very, very light*' to '*14 = very, very hard*'.	Estimate the total physical exertion experienced from the care work today.
Low-back Pain: Likert scale '*0 = Nothing at all*' to '*10 = Worst possible*'.	Please indicate your low-back pain right now

*RPE is the Borg Rating of Perceived Exertion (Borg 1990).

$p < .01$ (8 d.f.)). The collapse of all three indices in relation to seniority indicates: (1) Lack of index robustness; and (2) Meaning attributed to items of the indices varied according to seniority of the nursing personnel.

Further, the Rasch item analyses allowed a calibration of raw scores where 'person measurement is independent of the set of items used to measure a person and item measurement is independent of the set of persons used in the calibration' (Bashaw, 1982, p. 380).

All independent variables were dichotomized by the median to test whether they were characterized by a balanced distribution in relation to potentially confounding variables (table 2). *Time pressure*, *social support* and *physical exertion* were characterized by fairly balanced distributions. The same was the case for *control* and *emotional demands*, except for an imbalance in the tendency to neuroticism between the two levels of each variable. In relation to *stress*, imbalances were seen in respect of age, neuroticism and to some extent low-back pain periods of 3 months. Thus measures of *control*, *emotional demands* and *stress* may be confounded by neuroticism, while *stress* in addition may be affected by age and previous periods of low-back pain.

2.4. *Measurement of outcome*

Low-back pain was measured through the question '*Indicate your low-back pain right now*' followed by a Likert scale ranging from 0 to10 (table 1), which was repeated in diaries

Table 2. Distribution of individual characteristics (Mean, SD) by psychosocial factors, stress and physical exertion.

	Age* (years)	Neuroticism* (EPQ-score)	Smoking (%)	Low-back pain periods of 3 months (%)	Back accident (%)
Emotional demands					
Low ($n=93$)	44.8 (9.5)	6.2 (4.2)	65	18	16
High ($n=90$)	42.9 (9.2)	8.7 (4.3)	61	21	26
p-value	.18	.00	.59	.52	.10
Time pressure					
Low ($n=98$)	44.2 (9.4)	7.2 (4.5)	65	16	23
High ($n=100$)	44.1 (9.8)	7.5 (4.4)	57	22	22
p-value	.97	.60	.21	.24	.85
Social support					
High ($n=74$)	44.0 (10.5)	7.0 (4.0)	52	19	19
Low ($n=117$)	44.4 (9.0)	7.4 (4.6)	66	19	24
p-value	.80	.58	.06	.91	.50
Control					
High ($n=90$)	45.3 (9.5)	6.4 (3.6)	61	16	22
Low ($n=109$)	43.2 (9.5)	8.1 (4.9)	61	21	22
p-value	.12	.01	.91	.34	.91
Stress					
Low ($n=86$)	45.7 (10.4)	6.7 (3.4)	69	13	19
High ($n=87$)	42.9 (8.6)	8.1 (4.9)	58	24	21
p-value	.05	.03	.15	.06	.79
Physical exertion					
Low ($n=85$)	45.6 (9.9)	7.0 (4.2)	68	14	19
High ($n=88$)	43.0 (9.3)	7.8 (4.7)	59	23	21
p-value	.08	.24	.19	.16	.73

*p-values for the continous variables age and neuroticism calculated by t-test, all other p-values by χ^2 for categorical variables.

over two periods amounting to six days. The dependent variable for low-back pain was derived by calculating the mean score of the total 6 (or 3) days for each participant. The dependent variable ranged from 0 to 8.0 with the median being 0.7 and the mean was 1.4 (SD = 1.9).

2.5. *Data analyses*

Logistic regression was used to analyse associations between independent variables and the dependent outcome variable. Independent variables were stratified into approximately equally large tertiles described as low, medium and high.[1] Further, the dependent variable was dichotomized by the median[2] to enable logistic regression analyses. Crude and adjusted odds ratios for each of the two higher levels compared to the reference level were calculated for all the independent variables. Adjusted odds ratios for the trend through all three levels of each independent variable were also calculated. For each independent variable the greater the odds ratio of the level or the trend, the higher the odds that it was associated with a high category of the dependent variable. Adjustment of odds ratios was conducted by entering all independent variables as well as confounding variables into the analyses. Model fit was found to be acceptable by the Hosmer, and Lemeshow Goodness-of-Fit test (Cody, and Smith, 1997).

3. Results

Table 3 presents crude and adjusted odds ratios with confidence intervals for logistic regression analyses of independent variables in relation to low-back pain. Crude and adjusted odds ratios are shown for medium and high levels (or low and medium levels for social support and control) of the independent variables with the low (or high, respectively) level as reference. The total trend for each variable is indicated by an adjusted odds ratio only.

The adjusted results provide evidence for an association between stress and low-back pain. Odds ratios (OR) increase from the insignificant 1.4 for medium level of stress to the strongly significant OR of 4.7 (Confidence Interval (CI) = 1.6–14.3) for high level of stress. Equally this progression is reflected in the significant trend OR = 2.3 (CI = 1.3–3.9). Neither physical exertion nor any of the psychosocial variables such as time pressure, emotional demands, social support or control approach significance in relation to low-back pain. In additional analyses all combinations of demands due to time pressure or emotional demands in interaction with either lack of social support or control were investigated but no interactional effects were found.

4. Discussion

The main result of this study was that neither time pressure, emotional demands of clients, lack of social support nor lack of control had any effect on the reporting of low-back pain in the following 6 months. On the other hand, stress was found to be strongly associated with low-back pain, which is in accordance with a number of previous studies (Ahlberg-Hultén *et al.*, 1995; Bru *et al.*, 1997; Elovainio *et al.*, 1997; Josephson, 1998a; Josephson *et al.*, 1997). Unexpectedly, physical exertion was not associated with low-back pain, which is contrary to findings in several other studies (Ahlberg-Hultén *et al.*, 1995; Brulin, Gerdle, Granlund, Höög, Knutson, and Sundelin, 1998; Burdorf *et al.*, 1997; Josephson, 1998a).

Psychosocial factors may increase vulnerability without causing low-back pain in itself.

Table 3. Crude and adjusted risk of low-back pain by predictor variables.

		Low-back pain			
		n	Crude OR	Adjusted OR†	CI‡
Time pressure	Low	44	1.0	1.0	–
	Medium	47	1.9	1.6	(0.6–4.4)
	High	62	1.2	0.8	(0.3–2.0)
	Trend	153	–	0.8	(0.5–1.4)
Emotional demands	Low	54	1.0	1.0	–
	Medium	51	1.1	1.0	(0.4–2.7)
	High	48	1.9	1.0	(0.4–2.7)
	Trend	153	–	1.0	(0.6–1.6)
Social support	High	55	1.0	1.0	–
	Medium	63	1.4	1.7	(0.7–4.3)
	Low	35	1.8	1.5	(0.5–4.2)
	Trend	153	–	1.2	(0.7–2.0)
Control	High	59	1.0	1.0	–
	Medium	49	1.4	0.9	(0.3–2.3)
	Low	45	2.7★	1.7	(0.7–4.5)
	Trend	153	–	1.3	(0.8–2.1)
Stress	Low	47	1.0	1.0	–
	Medium	57	2.4★	1.4	(0.5–3.6)
	High	49	7.3★★	4.7★★	(1.6–14.3)
	Trend	153	–	2.3★★	(1.3–3.9)
Physical exertion	Low	43	1.0	1.0	–
	Medium	50	0.9	0.9	(0.3–2.3)
	High	60	2.0	1.2	(0.4–3.3)
	Trend	153	–	1.0	(0.6–1.7)

†Odds ratio (OR) adjusted for effects of age, neuroticism, smoking, back pain periods of 3 months, back accident and all independent variables.
‡CI = 95% confidence interval.
★$p < .05$, ★★$p < .01$.

In accordance with the pathways presented (Bongers *et al.*, 1993) the effect of psychosocial factors on low-back pain may be mediated through stress or physical exertion. In additional analyses we found that emotional demands (OR = 2.0, CI = 1.2–3.2) and time pressure (OR = 1.6, CI = 1.0–2.5) were significantly related to stress while lack of social support and control were not. Further, analyses indicated that those subjects experiencing high emotional demands actually were the same as those having the high stress scores, and to complete the chain they reported high levels of low-back pain, while such a pathway including time pressure was not supported. Evidence of these pathways was found in a study of 204 Finnish nursing personnel caring for the elderly, who indicated that troublesome patients with dementia and time pressure were related to musculoskeletal symptoms through the mediation of stress (Elovainio *et al.*, 1997). However, while our data allow us to suggest a mediational effect of stress this cannot be concluded from the data obtained due to methodological limitations.

In interpreting the results it has been assumed that the direction of the causality, if any, starts from stress leading to low-back pain, but on the other hand low-back pain could be the cause of stress (Bongers *et al.*, 1993; Josephson, 1998a).

It is a limitation of this study that the applied measure of stress was a single item that provides less valid and reliable data than a multiple-item scale might have offered. In

addition it is uncertain whether the concept of stress included in the question is appraised and reported as a stressor or a response (Jex, Beehr, and Roberts, 1992).

The credibility of this study is enhanced through the inclusion of *physical exertion*, as the effect of the psychosocial factors and stress might be overestimated otherwise (Bongers *et al.*, 1993; Hoogendoorn *et al.*, 2000; Josephson, 1998a). However, it is a problem that psychosocial factors and physical exertion often coexist in health cares e.g. transferring a patient who is old and anguished, and are often impossible to separate into distinctive physical and mental components (Josephson, 1998a; Josephson *et al.*, 1997). Strong associations between stress and physical exertion found in additional analyses indicate that the RPE-scale may reflect a mix of physical and psychological factors, possibly explaining the insignificance of physical exertion in relation to low-back pain.

The self-reported responses may be biased through negative affectivity; a tendency to report both risk factors and outcomes negatively (Watson, and Pennebaker, 1989). Although we adjusted for the effect of neuroticism as a core aspect of negative affectivity, we cannot rule out that the relation between stress and low-back pain is a result of response bias.

Cronbach's α coefficients for the indices social support ($\alpha = .64$) and control ($\alpha = .56$) were acceptable but lower than the index 'emotional demands of clients' ($\alpha = .76$), possibly reflecting better contextual relevance of the latter. In addition, the Rasch item-analyses indicated seniority of staff as a factor to be considered when testing the reliability of psychosocial measures for nursing personnel.

To conclude, we found that stress and low-back pain were strongly associated, but the direction of causality could not be established. None of the psychosocial factors predicted low-back pain as reported during the subsequent 6 months.

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Notes

1. Time pressure: low 0 to 4, medium 5 to 7, high 8 to 10. Emotional demands: low −99.00 to −0.57, medium −0.56 to 0.79, high 0.80 to 99.00. Social Support: high 99 to −19, medium −20 to −39, low −40 to −99. Control: high 99.0 to −0.4, medium −0.5 to −1.9, low −2.0 to −99.0. Stress: low 0 to 1.2, medium 1.3 to 3.0, high 3.1 to 7.3. Physical exertion: low 1 to 4.99, medium 5.0 to 6.2, high 6.3 to 10.

2. Low Back Pain: '0' = 0–0.60, '1' = 0.65–8.0.

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