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# The Impact of Psychosocial Factors on Low Back Pain

## Longitudinal Results From the Belstress Study

Els Clays, MSc,* Dirk De Bacquer, PhD,* Francoise Leynen, MD,† Marcel Kornitzer, PhD,† France Kittel, PhD,† and Guy De Backer, PhD*

**Study Design.** An epidemiological cohort study.

**Objective.** To describe the impact of psychosocial factors, both work and nonwork-related, on the prevalence of low back pain (LBP) after 6.6 years on average.

**Summary of Background Data.** There is growing consensus that psychosocial factors play a role in the development of LBP, although results are not consistent across studies.

**Methods.** Within a sample of 2556 middle-aged men and women from the Belstress study, baseline psychosocial factors were measured through self-administered questionnaires and related to prevalent cases of LBP after a mean time interval of 6.6 years through Cox regression analysis.

**Results.** After adjustment for individual and physical risks, including occasional back pain at baseline, the prevalence rate of LBP in men is significantly related to baseline low decision latitude and low social support at work, and nonsignificantly to high job strain, low wage and job satisfaction, feeling stressed at work, and feeling depressed. High job insecurity, feeling stressed at work, and feeling depressed nonsignificantly increase the relative risks for LBP in women.

**Conclusions.** Based on the results of this study, psychosocial factors (both work and nonwork-related) constitute nonnegligible risks for the development of LBP.

**Key words:** low back pain, psychosocial, work. **Spine 2007;32:262–268**

Low back pain (LBP) is a considerable health problem in most Western countries. According to the Third European Survey on Working Conditions of 2000, 33% of European workers report backache, making it one of the most prevalent work-related health problems.[1] Since most of the chronic low back disorders are believed to be multifactorial in origin, much research effort has been put in identifying different kinds of risk factors of LBP. The occurrence and development of LBP is not only ascribed to individual characteristics but also to factors from the work environment.[2,3] Several biomechanical and physical work factors such as heavy lifting, repetitive motion, non-neutral body postures and vibration, are considered as established risks for back disorders.

There is growing consensus, however, that in addition to physical work load, psychosocial work characteristics play a role in LBP.[4–7] The most common work-related psychosocial constructs in epidemiological research include factors like workload, limited control over work, job satisfaction, feeling stressed, and relationships at work. Numerous studies have emphasized the need to take into account both physical and psychosocial characteristics simultaneously in epidemiological studies on LBP.[8–13] Nevertheless, several reviews have shown that results regarding the role of psychosocial factors on LBP are not consistent across studies.[14–17] There is general agreement that some association exists, but it is difficult to draw firm conclusions due to inconclusive evidence. The inconsistency of study results is partly related to some crucial methodological issues, such as the study design, the assessment of exposure and outcome variables, and appropriate controlling for demographic and physical risk factors.[16]

The aim of this study is to describe the impact of psychosocial factors, both work- and nonwork-related, on the prevalence of LBP within a longitudinal study design. Secondly, we want to explore to what extent associations between psychosocial variables and LBP are confounded by individual and physical characteristics.

## ■ Materials and Methods

**Study Population.** The association between psychosocial factors and LBP was assessed using data from the Belstress Study (Belstress) an epidemiological cohort study about job stress and health issues.[18] A total of 2821 workers from 9 different companies or public administrations were involved in the longitudinal part of the study. Data were gathered at baseline between 1995 and 1998 and a second time in 2002–2003 after a mean time interval of 6.6 years. A participation rate of 68.5% was reached at the second phase. For the longitudinal analyses described here, workers whose job title changed during the time interval according to the first digit of the International Standard Classification of Occupations (265 subjects) were excluded.[19] This results in a study population of 2556 workers (1729 men and 827 women) aged 35–59 years at the beginning of the study. These workers are employed within 2 public administrations (55% of the sample), 6 private companies (34%), and one bank (11%).

The ethics committees of the University Hospital of Ghent and the Faculty of Medicine of the Free University of Brussels approved the Belstress study.

From the *Department of Public Health, Ghent University, University Hospital, Ghent; and †Laboratory of Epidemiology and Health Promotion, School of Public Health, Free University of Brussels, Brussels, Belgium.

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Address correspondence and reprint requests to Els Clays, MSc, Department of Public Health, Ghent University, University Hospital-Block A, De Pintelaan, 185, B-9000 Ghent, Belgium; E-mail: els.clays@UGent.be

**Data Collection.** Psychosocial factors at baseline were measured through self-administered questionnaires. Most of the work-related factors were assessed using the standardized Job Content Questionnaire based on Karasek *et al*'s[20–22] job strain model. Five items measured psychological job demands. Job control or decision latitude is composed of 2 subscales: "skill discretion" (6 items) and "decision authority" (3 items). The third dimension is social support at the workplace and also consists of 2 subscales: "supervisor support" (4 items) and "coworker support" (4 items). Reliability and validity of these scales within the Belstress study project have been demonstrated.[23] Perception of job insecurity was measured with 2 questions from the Job Content Questionnaire. In addition, the general questionnaire contains 3 items concerning job and wage satisfaction, and feeling stressed at work.

Three psychosocial factors outside the work environment were assessed through baseline questionnaires. The strength of social networks refers to a score based on 3 items regarding the number and nature of contacts with friends and family.[24] The concept of feelings of depression is composed of 11 items from the Center for Epidemiological Studies-Depression scale.[25] One question was added asking about the general satisfaction with private life.

The baseline questionnaire contains additional information on individual and physical characteristics that are treated as potential confounding variables. Data were gathered about age, educational level (low, medium, or high), living situation (alone or with partner), smoking status (current smokers *vs.* others), sector of employment (secondary, tertiary, or public sector), and physical activity outside work. Occasional back pain (yes *vs.* no) was assessed by one item from the "Current Health Index" ("Do you once in a while suffer from back pain?").[26] Five Job Content Questionnaire items regarding physical demands of the job were included: physical effort, lifting heavy loads, rapid physical activity, awkward body positions, and awkward arm positions.[22] Trained observers medically examined participants at baseline. Body mass index (BMI) was calculated as body weight (kg) divided by the square of the height (m).

At the second data collection after a mean time interval of 6.6 years, prevalent cases of LBP were identified using the standardized Nordic questionnaire.[27] Participants were classified as having LBP when they had had LBP of any kind for a total of 8 days or more during the previous 12 months.

**Statistics.** All psychosocial risk factors were dichotomized. This categorization was based on the median values of this population for the scales of job demands (12), decision latitude (27), social support at work (23), and job insecurity (3). High job strain refers to the combination of high job demands (values above the median) and low decision latitude (values below the median). Low satisfaction with the job, wage, and private life refers to being (very) dissatisfied as opposed to neutral or (very) satisfied. Participants were classified as stressed at work when they felt moderately or very stressed. A strong social network is attributed when participants have regular contacts (at least once a month) with at least 5 close friends or family members. The upper quartile of the depression scale with scores of 18 or higher is considered to suffer from depressive feelings.

Low education was defined as primary school level only and high education as high school or university. Persons who engage in heavy physical activity (resulting in sweating and elevated pulse rate) during 20 minutes or more, at least once a week, are classified as physically active. High physical job demands are identified when respondents (fully) agree with the questions regarding physical effort, lifting heavy loads, rapid physical activity, awkward body positions, and awkward arm positions at work. A BMI between 25 and 29 kg/m$^2$ is classified as overweight and a BMI of 30 kg/m$^2$ or more as obesity.[28]

Chi-square tests were carried out to explore whether cases with LBP differ from noncases in individual and physical characteristics at baseline. Cox regression analyses were conducted in order to assess the impact of baseline psychosocial factors on LBP. Subsequently, it was tested to what extent these associations are confounded by other risk factors through multivariate analyses. Individual and physical factors were included in the full model, regardless of the results of their univariate associations with the outcome variable.[29] Adjustments were made for individual and sociodemographic variables (age, BMI, educational level, sector of employment, occasional back pain, smoking status, and living situation) in the first step, and, additionally, for physical factors (physical activity, physical effort, lifting heavy loads, rapid physical activity, awkward body positions, and awkward arm positions at work) in the next step.

Analyses were performed separately for men and women. All analyses were conducted using SPSS 12.0 software (SPSS, Inc., Chicago, IL).

## ■ Results

The mean age of the sample at baseline was 43.6 years (standard deviation 5.0). The population contains 441 executives (17%), 1190 white-collar workers (47%), and 916 blue-collar workers (36%). Within the sample of 2556 workers, 1079 cases (42.2%) with LBP of any kind were identified at the second study phase. This prevalence rate of LBP is significantly higher in women as compared to men: 413 out of 827 women (49.9%) and 666 out of 1729 men (38.5%) ($P < 0.001$).

Individual and physical characteristics at baseline in cases and noncases are shown in Table 1. The prevalence of cases with LBP is higher in participants with a lower educational level, workers from the public sector, those with occasional back pain at baseline, smokers, and workers with high physical job demands. Women aged 45 years or more have more LBP than those who are younger. LBP is more frequent in men with overweight and obesity.

Crude associations between baseline psychosocial factors and the prevalence of LBP after a mean time interval of 6.6 years were assessed through Cox regression analyses (Table 2). The relative risk for LBP in men is significantly increased with 37% by baseline low decision latitude and with approximately one fifth by baseline high job strain, low social support at work, low wage satisfaction, and feeling stressed at work. A nonsignificant association is noted regarding low job satisfaction in men. Within the female population, nonsignificant associations are found with low decision latitude, high job insecurity, and feeling stressed at work. No clear associations in men or women were found with psychological job demands. Concerning psychosocial factors outside the work environment, LBP relates primarily to feelings of depression at baseline, with an increase in the relative

**Table 1. Individual and Physical Characteristics at Baseline in Cases and Noncases of LBP**

| Characteristics | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | No. Cases (n = 666) | No. Noncases (n = 1057) | $\chi^2$ | No. Cases (n = 413) | No. Noncases (n = 409) | $\chi^2$ |
| Age ≥45 y | 343 (51.5%) | 527 (49.9%) | 0.4 | 165 (40.0%) | 135 (33.0%) | 4.3* |
| Educational level | | | 31.1‡ | | | 25.6‡ |
| Low | 303 (46.0%) | 358 (34.1%) | | 185 (44.9%) | 124 (30.6%) | |
| Medium | 189 (28.7%) | 307 (29.3%) | | 157 (38.1%) | 160 (39.5%) | |
| High | 166 (25.2%) | 384 (36.6%) | | 70 (17.0%) | 121 (29.9%) | |
| Sector of employment | | | 5.2 | | | 17.9‡ |
| Secondary (manufacturing) | 210 (31.5%) | 378 (35.8%) | | 21 (5.1%) | 32 (7.8%) | |
| Tertiary (service) | 126 (18.9%) | 214 (20.2%) | | 66 (16.0%) | 108 (26.4%) | |
| Public | 330 (49.5%) | 465 (44.0%) | | 326 (78.9%) | 269 (65.8%) | |
| Living alone | 90 (13.6%) | 141 (13.5%) | 0.0 | 104 (25.3%) | 89 (21.9%) | 1.3 |
| Occasional back pain | 516 (78.5%) | 425 (40.7%) | 232.9‡ | 333 (81.2%) | 212 (52.9%) | 73.9‡ |
| Current smokers | 229 (34.7%) | 309 (29.5%) | 5.2* | 135 (33.2%) | 110 (27.5%) | 3.1 |
| BMI | | | 12.0† | | | 2.4 |
| Normal | 233 (35.1%) | 459 (43.5%) | | 248 (60.3%) | 251 (61.4%) | |
| Overweight | 339 (51.1%) | 470 (44.5%) | | 107 (26.0%) | 116 (28.4%) | |
| Obesity | 92 (13.9%) | 126 (11.9%) | | 56 (13.6%) | 42 (10.3%) | |
| Physically active outside work | 270 (43.1%) | 437 (42.8%) | 0.0 | 93 (23.7%) | 77 (19.6%) | 1.9 |
| Physical effort: high | 222 (34.0%) | 270 (26.0%) | 12.5‡ | 185 (45.6%) | 116 (29.1%) | 23.4‡ |
| Lifting heavy loads: high | 155 (23.9%) | 167 (16.1%) | 15.6‡ | 140 (34.5%) | 92 (23.0%) | 13.0‡ |
| Rapid physical activity: high | 146 (22.4%) | 173 (16.7%) | 8.4† | 133 (33.1%) | 84 (21.1%) | 14.5‡ |
| Awkward body positions: high | 132 (20.3%) | 128 (12.3%) | 19.5‡ | 87 (21.7%) | 47 (11.8%) | 13.9‡ |
| Awkward arm positions: high | 105 (16.1%) | 111 (10.7%) | 10.6† | 80 (20.1%) | 39 (9.8%) | 16.5‡ |

*$P < 0.05$.
†$P < 0.01$.
‡$P < 0.001$.

risk of 34% in men and 30% in women. In men, low satisfaction with private life also slightly increased the relative risk for LBP.

Within this study design, we could not exclude workers with LBP at baseline because the Nordic Questionnaire was not available. However, information was available regarding occasional back pain at baseline. Additional analyses within the subgroup of participants without occasional back pain at baseline show associations between crude relative risks for LBP in men with low decision latitude (relative risk 1.49; confidence interval [CI] 1.07–2.09), high job strain (relative risk 1.21; CI 0.77–1.91), low social support (relative risk 1.48; CI 1.06–2.08), low job satisfaction (relative risk 1.57; CI 0.89–2.78), low wage satisfaction (relative risk 1.56; CI 1.02–2.38), feeling stressed at work (relative risk 1.15; CI 0.82–1.62), and feeling depressed (relative risk 1.34; CI 0.88–2.03), while crude relative risks for LBP in women are associated with high job insecurity (relative risk 1.10; CI 0.70–1.74), feeling stressed at work (relative risk 1.12; CI 0.70–1.78), and feeling depressed (relative risk 1.12; CI 0.67–1.88).

**Table 2. Crude Associations Between Baseline Psychosocial Factors and Prevalent Cases of LBP in Men and Women**

| Baseline Psychosocial Factors | Men (n = 1729) | | Women (n = 827) | |
|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI |
| Work-related | | | | |
| High job demands* | 0.92 | 0.79–1.07 | 0.94 | 0.77–1.15 |
| Low decision latitude | **1.37** | 1.17–1.59 | 1.12 | 0.91–1.38 |
| High job strain† | **1.22** | 1.00–1.49 | 1.05 | 0.83–1.32 |
| Low social support | **1.23** | 1.05–1.44 | 1.08 | 0.88–1.33 |
| High job insecurity* | 0.99 | 0.85–1.16 | 1.11 | 0.92–1.35 |
| Low job satisfaction | 1.19 | 0.89–1.58 | 0.85 | 0.53–1.36 |
| Low wage satisfaction | **1.22** | 1.00–1.49 | 1.02 | 0.76–1.36 |
| Feeling stressed at work‡ | **1.19** | 1.02–1.39 | 1.18 | 0.97–1.43 |
| Nonwork-related | | | | |
| Low social network | 0.88 | 0.75–1.03 | 1.04 | 0.85–1.27 |
| Feeling depressed‡ | **1.34** | 1.12–1.60 | **1.30** | 1.06–1.58 |
| Low satisfaction with private life | 1.12 | 0.84–1.49 | 1.02 | 0.77–1.37 |

Results from Cox regression analysis. Reference categories are "high" unless stated otherwise. Significant relative risks at the 0.05 level are in bold.
*Reference category is "low."
†Reference category is "others."
‡Reference category refers to not feeling stressed or depressed.
CI indicates confidence interval; RR, relative risk.

In multivariate Cox regression analyses, individual and physical risk factors were included in the full model (Table 3). Overall, most relationships between psychosocial factors and LBP are not essentially mediated by individual or physical variables. After adjustment for individual, sociodemographic, and physical risks, the relative risk for LBP in men is significantly increased by baseline low decision latitude (relative risk 1.20) and low social support at work (relative risk 1.20). In men, a borderline significant association is found with feeling stressed at work, and nonsignificant associations with high job strain, low job and wage satisfaction, and feeling depressed. The relative risk for LBP in women is borderline significantly increased by feeling depressed, and nonsignificantly by high job insecurity and feeling stressed at work.

**Table 3. Adjusted Associations Between Baseline Psychosocial Factors and Prevalent Cases of LBP in Men and Women**

| Baseline Psychosocial Factors | RR (95% CI)§ Men (n = 1729) | RR (95% CI)§ Women (n = 827) | RR (95% CI)‖ Men (n = 1729) | RR (95% CI)‖ Women (n = 827) |
|---|---|---|---|---|
| Work-related | | | | |
| High job demands* | 1.00 (0.85–1.18) | 0.99 (0.81–1.23) | 1.00 (0.84–1.20) | 0.97 (0.78–1.21) |
| Low decision latitude | **1.22** (1.03–1.44) | 0.96 (0.76–1.20) | **1.20** (1.01–1.42) | 0.96 (0.76–1.21) |
| High job strain† | 1.13 (0.92–1.39) | 1.02 (0.80–1.29) | 1.13 (0.91–1.40) | 0.99 (0.77–1.27) |
| Low social support | **1.17** (1.00–1.38) | 1.01 (0.82–1.25) | **1.20** (1.02–1.42) | 1.00 (0.80–1.24) |
| High job insecurity* | 1.03 (0.87–1.21) | 1.09 (0.89–1.34) | 1.02 (0.86–1.21) | 1.09 (0.87–1.37) |
| Low job satisfaction | 1.11 (0.83–1.50) | 0.80 (0.49–1.31) | 1.10 (0.81–1.49) | 0.79 (0.47–1.33) |
| Low wage satisfaction | 1.15 (0.94–1.41) | 1.00 (0.74–1.35) | 1.14 (0.92–1.41) | 1.03 (0.76–1.41) |
| Feeling stressed at work‡ | **1.19** (1.01–1.39) | 1.11 (0.91–1.36) | 1.17 (0.99–1.38) | 1.09 (0.88–1.35) |
| Nonwork-related | | | | |
| Low social network | 0.90 (0.77–1.06) | 1.05 (0.86–1.30) | 0.93 (0.78–1.10) | 1.05 (0.84–1.31) |
| Feeling depressed‡ | 1.15 (0.96–1.38) | 1.18 (0.96–1.46) | 1.11 (0.91–1.34) | 1.21 (0.97–1.50) |
| Low satisfaction with private life | 1.03 (0.76–1.40) | 1.03 (0.75–1.40) | 0.99 (0.72–1.37) | 1.04 (0.75–1.44) |

Results from Cox regression analysis. Reference categories are "high" unless stated otherwise. Significant relative risks at the 0.05 level are in bold.
*Reference category is "low."
†Reference category is "others."
‡Reference category refers to not feeling stressed or depressed.
§Adjusted for age, BMI, educational level, sector of employment, occasional back pain, smoking status, and living situation.
‖Additionally adjusted for physical activity, physical effort, lifting heavy loads, rapid physical activity, awkward body positions, and awkward arm positions at work.
CI indicates confidence interval; RR, relative risk.

Significant crude associations between LBP and baseline physical job demand items were identified in men and women, with relative risk ratio's ranging from 1.24 to 1.43 (Table 4). After adjustment for individual and sociodemographic variables, nonsignificant associations are found with awkward body positions in men and awkward arm positions in women. No interaction effects were found between psychosocial factors and physical job demands in relation to LBP. Controlling for physical work factors does not reduce the strength of the associations between psychosocial factors and LBP extensively.

## ■ Discussion

The aim of this longitudinal study was to explore the impact of psychosocial risk factors on LBP. Within a sample of 2556 middle-aged men and women, psychosocial factors at baseline were related to the prevalence of cases with LBP after a mean time interval of 6.6 years. Although there is mounting support for the importance of psychosocial factors in the etiology of LBP, some recent reviews have emphasized the uncertainty of the exact relationship due to the lack of consistency in study results.[16,17]

Based on the results of this study, psychosocial factors constitute nonnegligible risks for LBP. Moreover, most associations are independent from occasional back pain at baseline, as well as from other individual and physical risk factors. Among the psychosocial work characteristics, one of the significant and independent predictors of LBP in men is baseline low social support at work. Several studies reported that the most consistent and pronounced associations with back pain were situated in the field of worksite social support.[8,9,30–33] In reviewing prospective studies on psychosocial work characteristics and LBP, Hoogendoorn *et al*[6] found strong evidence for low social support in the workplace as a risk factor. After adjustments were made for individual and physical factors, the prevalence of LBP in men was also significantly related with low decision latitude, and nonsignificantly

**Table 4. Crude and Adjusted Associations Between Baseline Physical Job Demands and Prevalent Cases of LBP in Men and Women**

| Baseline Physical Job Demands | RR (95% CI) Men (n = 1729) | RR (95% CI) Women (n = 827) | RR (95% CI)* Men (n = 1729) | RR (95% CI)* Women (n = 827) |
|---|---|---|---|---|
| Physical effort: high | **1.26** (1.07–1.48) | **1.40** (1.15–1.70) | 1.02 (0.86–1.22) | 1.14 (0.91–1.43) |
| Lifting heavy loads: high | **1.33** (1.11–1.59) | **1.30** (1.06–1.60) | 1.10 (0.90–1.34) | 1.08 (0.86–1.35) |
| Rapid physical activity: high | **1.24** (1.03–1.49) | **1.33** (1.08–1.64) | 0.99 (0.82–1.21) | 1.10 (0.87–1.39) |
| Awkward body positions: high | **1.40** (1.16–1.70) | **1.37** (1.08–1.74) | 1.16 (0.95–1.41) | 1.12 (0.86–1.44) |
| Awkward arm positions: high | **1.31** (1.06–1.62) | **1.43** (1.12–1.83) | 1.06 (0.86–1.32) | 1.21 (0.94–1.57) |

Results from Cox regression analysis. Reference categories are "low." Significant relative risks at the 0.05 level are in bold.
*Adjusted for age, BMI, educational level, occasional back pain, smoking status, and living situation.
CI indicates confidence interval; RR, relative risk.

with high job strain, low job and wage satisfaction, and feeling stressed at work. Substantial heterogeneity exists in the literature regarding the role of low job control and low job satisfaction in LBP. Although some reviews find support for a positive association between these factors and LBP,[6,7,15] others contradict this.[14,17] It has been suggested that the influence of psychosocial factors on LBP may not be solely related to work itself but also to the broader nonwork-related context; therefore, it is also important to take into account work-related perceptions such as satisfaction with work status and income and job stress in trying to understand the development of LBP.[13,34,35] In their review on psychosocial work factors and LBP, Davis and Heaney[16] suggested that the most consistent associations are not found with psychosocial work characteristics themselves but with employee responses or reactions to their work conditions. In our longitudinal study, the prevalence of LBP is both related to psychosocial work characteristics themselves (low decision latitude and low social support in men and high job insecurity in women), as to employee reactions to work conditions (low job and wage satisfaction in men and feeling stressed at work in men and women).

When assessing associations between psychosocial factors and LBP, the emphasis in most studies is on characteristics related solely to the work environment. However, psychosocial factors outside the work environment may also play an important role in the development of LBP. Conditions in leisure time such as satisfaction with social contacts can exert a long-term influence on LBP.[36] Conditions of psychological or emotional distress, including depressive feelings and anxiety, have also been related to musculoskeletal disorders and LBP.[37,38] In this study, associations were found between feeling depressed and the prevalence of LBP.

Some notable gender differences were found in our study. Overall, psychosocial work factors proved to be important with respect to LBP, but to a lesser extent in women as compared to men. Similar results were found in various other studies.[39–42] Hooftman *et al*[43] recently reviewed 14 studies regarding gender differences in the effect of risk factors on back complaints. With respect to the effect of job demands, job control, and job satisfaction, the evidence for gender differences is inconclusive due to inconsistent results. No evidence was found of a gender difference in the impact of social support at the workplace, which is not in line with the results of this study.

An important problem in many studies exploring the impact of psychosocial factors on LBP is the lack of proper adjustment for other risk factors, especially physical or biomechanical workload.[6,16] In our study, however, relationships between psychosocial factors and future LBP are not essentially confounded by individual or physical variables. This was also found in a Dutch prospective cohort study in 861 workers.[32]

The assessment of LBP in this study was not done through clinical examination but with a self-report measure, which inevitably includes some amount of subjectivity. Nevertheless, random error in the operationalization of LBP was minimized because of the use of the validated and standardized Nordic questionnaire for musculoskeletal symptoms.[27] LBP in this study was identified as having had LBP for a total of 8 days or more during the previous 12 months, which is very common. The same analyses were conducted with a more stringent definition: having had LBP for a total of 30 days or more during the previous 12 months (prevalent in 21.4% of men and 32.8% of women). This led to similar results, although some of the associations did not reach statistical significance.

Since the Nordic questionnaire was not included in the baseline questionnaire, it was not feasible to conduct prospective analyses on the subsample with no LBP at baseline. However, information was available regarding occasional back pain at baseline. With the inclusion of this variable in multivariate analyses, it is fair to assume that the largest part of LBP at baseline is controlled for. Moreover, additional analyses after exclusion of all participants with occasional back pain at baseline roughly engendered similar results regarding psychosocial factors and LBP.

A notable limitation of this study is that no information is available on possible changes in exposure to psychosocial factors between baseline and the assessment of LBP at the second study phase. This is of particular importance because of the relatively long time interval of 6.6 years on average. Participants whose job title changed during the time interval were excluded. This was done in order to rule out changes in psychosocial work factors due to objective changes in the work environment. Nevertheless, this does not mean that psychosocial or physical work characteristics may not have altered within the same job title. In addition, measuring job characteristics at only one point in time increases the risk of misclassification due to inaccuracy in assessment.[44] Consequently, the relationships found in our study are probably underestimations or at least conservative estimates of the truly existing associations between psychosocial factors and the development of LBP.

The presence of a selection bias in the population should be taken into consideration when interpreting the results. For the longitudinal results of this study, only those workers who were involved in both phases of the data collection were included. Within the 9 participating companies, a total of 8783 employees had participated in the first study phase. At the second study phase, more than half of this original population was no longer eligible due to retirement, resignation, dismissal, or decease. It concerns primarily workers from lower educational levels, lower occupations, and older age groups. Within 3 companies from the secondary or manufacturing sector, major reorganizations and restructuring measures had been carried out, as a result of which 73% of the original study sample was no longer at work there after the follow-up period. Some important reorganizations

had also taken place within 4 companies from the service sector; 47% of the population was no longer eligible for participation. Within 2 public administrations, 33% was no longer eligible, which was mostly due to natural retirements. Obviously, this results in a healthy worker effect within our population. At baseline, the "drop-out" population perceived significantly less job control. In addition, severe LBP at baseline might also be related to the "drop-out." Consequently, associations between psychosocial factors and LBP in this study are most likely underestimated.

## ■ Conclusions

Our results provide additional support to the findings linking LBP to psychosocial risk factors. Both work and nonwork-related psychosocial factors are associated with having LBP after 6.6 years on average within a sample of 2556 middle-aged men and women who remained in the same job. Moreover, the associations are independent from some important individual and physical risk factors, including occasional back pain at baseline.

### ■ Key Points

- Based on the results of this study, both work and nonwork-related psychosocial factors constitute nonnegligible risks for LBP.
- The associations between psychosocial factors and LBP are independent from some important individual and physical risk factors, including occasional back pain at baseline.
- In women, psychosocial work factors were less important with respect to LBP as compared to men.

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