Socioeconomic position and low-back pain–the role of biomechanical strains and psychosocial work factors in the GAZEL cohort.

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Sandrine Plouvier * , Annette Leclerc , Jean-François Chastang , Sébastien Bonenfant , Marcel Goldberg

[1] Santé publique et épidémiologie des déterminants professionnels et sociaux de la santé INSERM : U687 , IFR69 , Université Paris Sud - Paris XI , Université de Versailles-Saint Quentin en Yvelines , Hôpital Paul Brousse 16, av Paul Vaillant Couturier 94807 VILLEJUIF,FR

* Correspondence should be adressed to: Sandrine Plouvier <sandrine.plouvier@inserm.fr >

Abstract

Objective

To analyze the role that biomechanical strains and psychosocial work factors play in occupational class disparities in low back pain (LBP) in the GAZEL cohort.

Methods

The GAZEL cohort members were recruited in 1989 among the employees of the French national company in charge of energy, who volunteered to enrol in an annual follow-up survey. The study population comprised 1487 men who completed: - a questionnaire in 1996 on past occupational exposure to manual material handling, to bending/twisting and to driving; - another questionnaire in 1997 on psychosocial work factors; - and, in 2001, a French version of the Nordic questionnaire for LBP assessment. Associations between LBP for more than 30 days in the preceding twelve months and social position at baseline (four categories) were described with a Cox model to determine prevalence ratios (PR) for each category. Adjusted and unadjusted ratios were compared to quantify the contribution of occupational exposures.

Results

The prevalence of LBP for more than 30 days was 13.6%. Prevalence of LBP adjusted for age was significantly higher for blue collar workers and clerks than for managers. Taking into account biomechanical strains significantly reduced the socioeconomic disparities observed, while adjusting for psychosocial factors did not.

Conclusion

In this population, occupational exposures, especially biomechanical strains, play an important role in occupational class disparities for persistent or recurrent LBP.

MESH Keywords Adult ; Biomechanics ; Cohort Studies ; Female ; France ; epidemiology ; Humans ; Low Back Pain ; epidemiology ; physiopathology ; psychology ; Male ; Middle Aged ; Occupational Diseases ; epidemiology ; physiopathology ; psychology ; Recurrence ; Social Class

Author Keywords health inequalities ; social inequalities ; occupational exposure ; musculoskeletal disorder

For most health dimensions, health status is worse in lower socioeconomic groups. Such socioeconomic disparities have been described for back pain in several studies (1 –4). Many circumstances vary between groups according to socioeconomic position and may thus contribute to social inequalities in health: early life circumstances, life style, physical and psychosocial environment, employment, working conditions (5 ,6). Some occupational factors contribute to the association between socioeconomic position and self-rated health (SRH) in cross sectional studies (7 –13) and to the social gradient in the deterioration in SRH over one year (12) and five years (14). Other studies have looked at the contribution of working conditions to social inequalities in depressive symptoms, physical functioning (15), longstanding illness (11), and coronary heart disease incidence (16) for instance.

A few studies indicate that occupational factors contribute to socioeconomic disparities in musculoskeletal disorders in general. Physical and psychosocial work characteristics explained a substantial part of the relation between socioeconomic status and musculoskeletal complaints in men who graduated high school in Wisconsin (8). Physical demand at work explained a large part of occupational class disparities in musculoskeletal disorders for employees of the city of Helsinki (17). In a study of a working population in France (the Pays de la Loire study), physical occupational factors accounted for more than 50% of the disparities between manual and non-manual workers for upper limb disorders (18). In the general working population of Oslo, physical job demand and job autonomy explained a substantial portion of occupational class disparities in musculoskeletal complaints (19).

Physical exposures at work such as bending, twisting, manual material handling, and whole body vibrations are considered to be risk factors for low back pain (20 ,21); psychosocial factors at work are also reported to play a role (22 , 23). These types of factors might therefore explain at least a part of the social inequalities in low back pain. This question has not been examined in detail, and conclusions from the studies on this topic appear somewhat conflicting. In Oslo, working exposures and especially physical job demands explained a substantial portion of the absolute inequalities between occupational classes for low back pain (19). In a population-based survey in France, the association between education and low back pain was also mainly mediated by physical factors at work (24), while a study in Germany was unable to explain the relation between education and severe back pain by occupational factors (25).

Our hypothesis in this study was that low back pain is associated with socioeconomic position (SEP) and that occupational exposures are a pathway for this relation. More precisely, we sought to assess in the longitudinal Gazel cohort the relations between low back pain and socioeconomic position, measured by occupational category or class, and to analyze the contribution of biomechanical strains and psychosocial work factors to these relations.

MATERIALS AND METHODS

Population and study design

The GAZEL cohort was established in 1989. Its members were recruited among the employees of Electricité de France-Gaz de France , the French national company for the production and distribution of energy (26 ,27). At that time, the company employed approximately 150 000 people of diversified trades and socioeconomic categories, with civil-servant like status, throughout France. At baseline in 1989, the cohort included 20 624 volunteers, men then aged 40–50 years and women 35–50. In January of each year, participants receive a general questionnaire about their lifestyle, health and occupational situation. Specific themes are also explored, such as low back pain.

The study population came from the population selected for the "GAZEL-low back pain" sub-project (28), which included 4 018 cohort members, 3 377 of them men. These members were randomly selected from occupational groups in which at least 20% of workers were exposed to selected occupational strains among postures, vibrations, manual material handling and video display terminals. This sample received specific questionnaires on low back pain in 1992, 1994 and 1996. The study population comprised the men who completed the latter questionnaire and the 1996 and 2001 general questionnaires (n=2 218) and who also answered the 1997 questionnaire on psychosocial factors at work. We therefore analyzed here 1487 men (44%).

We analyzed information on SEP recorded in 1989, personal data and occupational history assessed in 1996, psychosocial factors at work in 1997, with information on low back pain self-assessed in 2001 (figure 1).

Socioeconomic position

Data on socioeconomic position at baseline (1989) came from company files and were coded according to the French national classification of occupations and socioeconomic categories (PCS) . Four categories were used: managers and higher intellectual professions, intermediate professions (technicians, foremen, supervisors, teachers, etc.), clerks, and blue-collar workers.

Low back pain

The 2001 general questionnaire collected information about low back pain with questions derived from the Nordic questionnaire for the analysis of musculoskeletal symptoms (29). Low back pain was defined by reference to a diagram of the body: "pain, discomfort or disability in this area, whether or not the pain radiates to the leg". Subjects reported the cumulative duration of low back pain during the previous twelve months (0 day, ≤ 7 days, 8–30 days, >30 days but not every day, every day). The outcome of interest in the study was low back pain that lasted more than 30 days (LBP), which is generally considered to be frequent or long-lasting (30).

Biomechanical strains

In the 1996 specific questionnaire, cohort members reported their cumulative duration of exposure during their working life to three biomechanical strains: driving a car for more than two hours/day; usually pushing, pulling or carrying heavy loads (at least once a week); bending (forward/backward) or twisting repeatedly daily or almost daily. Four answers were possible for each exposure: never, less than 10 years, 10–20 years, longer than 20 years.

Psychosocial factors at work

In the general 1997 questionnaire, psychosocial factors at work were assessed with a French version of the job content questionnaire (JCQ) (31 ,32). Respondents had to state for each item the extent to which they agreed with it (completely agree, agree, do not agree, do not agree at all), and a score was calculated for each of the three dimensions: psychological demand (9 items), decision latitude (9 items) and social support received from coworkers and superiors (8 items).

Analyses

Relations between low back pain in 2001 and SEP in 1989 were first assessed with chi-square tests. We also verified that the occupational exposures studied were distributed differently across socioeconomic groups.

Thereafter, we used Cox regression models with a constant risk period (one year) assigned to everyone to obtain a prevalence ratio (PR) of low back pain for each socioeconomic group compared with managers. Cox models were preferred to logistic regression models, because prevalence ratios are easier to interpret than odds ratios, especially for rather common diseases (33). Robust variance estimates were used to calculate the confidence intervals (34).

In accordance with previous analyses, duration of exposure was considered a quantitative variable (35). Each potential answer in the questionnaire, proposed as a category, was replaced by the value of its class center, so that the categories of never, less than 10 years, 10–20 years and more than 20 years of exposure were given the value of 0, 5, 15, and 25 years respectively. For each psychosocial scale, scores were dichotomized at the median of their distribution in the population. Age (in 1996) was forced in all the models.

In a first set of analyses, age-adjusted models were built to study the associations between LBP and SEP and between LBP and each occupational exposure separately. Only the occupational factors associated with LBP at a p-value less than 0.20 were kept for the subsequent models (A,B,C). In an initial model (model A), the age-adjusted association between LBP and SEP was further adjusted for the relevant biomechanical strains. In a second model (model B), the age-adjusted association between LBP and SEP was further adjusted for the relevant psychosocial factors. In a final model (model C), the age-adjusted association between LBP and SEP was adjusted for both the relevant biomechanical and psychosocial factors (those included in model A or B).

In each of these three models, the contribution of the occupational factors in the model (biomechanical strains, psychosocial factors, or both) to the association between LBP and SEP was estimated by comparing the PR of LBP for a defined SEP, adjusted and not adjusted for these factors, as follows (36 ,37):

$$\frac{(PR\ partly\ adjusted\ - PR\ further\ adjusted\ for\ the\ factors\ added\ in\ the\ model)}{(PR\ partly\ adjusted - 1)}$$

Confidence intervals for contribution of occupational factors were calculated by bootstrap (38).

RESULTS

Low back pain and socioeconomic position (table 1)

Intermediate grade was the most common SEP, and there were few clerks among these male cohort members. The one-year prevalence of LBP for more than 30 days was 13.6% in the overall study population. A gradient in the prevalence of LBP was observed, with the smallest prevalence for the highest socioeconomic position (p-value for trend less than 0.0001). However, prevalence was rather similar in the two first categories, managers and "intermediate".

Socioeconomic position and occupational strains (table 1)

Durations of exposure to biomechanical strains (given only for ten years or more in table 1) varied according to SEP. Globally, the higher the SEP, the higher the percentage of 'never exposed' subjects. Most managers had never been exposed to any of the biomechanical strains studied, and blue-collar workers had often been exposed to them — and for a long time. Bending/twisting and driving for a long time were also rather common for clerks. Psychosocial factors at work also differed according to the SEP. Managers reported a high level of job demand more often than the others and a low level of decision latitude less often. This latter strain concerned mainly clerks and blue-collar workers. A low level of social support was scarcer among managers than in the other groups.

Low back pain and occupational strains

The one-year prevalence of LBP increased with cumulative duration of exposure to each biomechanical strain. It was also always highest for those exposed to a more strenuous level of psychosocial factors at work.

Low back pain, socioeconomic position and occupational strains (table 2)

The first set of analyses with Cox models adjusted for age showed a significantly higher prevalence of LBP for blue-collar workers and for clerks compared with managers. LBP was significantly associated with each biomechanical strain and with a low level of decision latitude. The association with a low level of social support was on the borderline of significance.

When the association between LBP and SEP was also adjusted for biomechanical strains (model A), the PR for blue-collar workers decreased by 73% and was no longer significantly different from one. For clerks, it decreased by 45% but prevalence for clerks remained significantly higher than in managers.

When the age-adjusted association between LBP and SEP was also adjusted for the relevant psychosocial factors — decision latitude and social support (model B), the PR for blue-collar workers and clerks decreased by 11% but remained significantly different from one.

Finally, in the fully adjusted model (model C), the PR for blue-collar workers decreased by 77%, compared with the age-adjusted model, and by 74% when compared with the model adjusted for age and psychosocial factors. For clerks the correspondent figures were 51 % and 44%. The risk of LBP for these two categories compared with managers was no longer significantly increased.

Most confidence intervals for the percentages of change, given by bootstrap, were large. However, the lower limits of the confidence intervals for percentages of change associated with adjustment on biomechanical strains were 0.25 or more (depending of the models compared) for blue collar workers. For clerks the corresponding values were larger than 0.12. The confidence intervals suggested that taking into account decision latitude and social support did not change significantly the PRs.

DISCUSSION

This study, based on a longitudinal design, showed occupational class disparities for persistent or recurrent LBP among men in the GAZEL cohort. Occupational strains played an important role in these inequalities. Physical factors accounted for the greatest portion of the observed disparities, even when the role of psychosocial factors was also taken into account.

Before discussing these results, some limitations of the study must be considered. First, we could not study the relations between LBP and SEP among women because there were not enough of them. Therefore only men could be included.

The final response rate was rather low, especially because only 67% of the men who completed the 1996 and 2001 questionnaires responded to Karasek's questionnaire in 1997. Most of those who did not complete this questionnaire had already retired in 1997 and thus did not answer the questions on psychosocial factors at work. The legal age for retirement is rather low in France; in addition, in this company, those who held specific jobs classified as strenuous are allowed to retire before the legal age for retirement. Some subjects were also excluded because they answered only some questions. We chose not to use any method to substitute missing answers so that we could have a 'straight' evaluation of psychosocial factors and optimize our assessment of their contribution to the relations of interest.

A validated self-administered questionnaire was used to assess these psychosocial factors (32). Physical expsure were also self-assessed in this study (39). Moreover the assessment was retrospective, as it concerned the cumulative duration of exposure to biomechanical strains throughout the subjects' working lives. Respondents' answers appeared consistent with information they reported in earlier questionnaires. Nonetheless, we cannot rule out the possibility of recall bias. If such bias is present, it should not be differential, since the information on LPB was collected five years later, in 2001.

Classification into four main categories of socioeconomic position was based on objective information provided by the company in 1989 and not on self-assessment. However, as information on LBP and exposure at work were self reported we can not rule out the possibility of biases related to negative affectivity (19). We expect them to be minimal, as information was collected at different time points.

We chose to consider a definition of LBP independent of care seeking or sick leave, both of which are consequences that could be related per se to the occupational exposures studied. By selecting only disorders that lasted more than 30 days, we focused on LBP associated with high social and economic costs.

The data and the study design appeared appropriate to discuss hypotheses about 'pathways' for inequalities in LBP. As low back pain is rather common, statistical analyses based on Cox models were preferred to computation of odd ratios (33).

The results suggest that occupational factors play an important role in occupational class disparities in LBP. Other factors might have played a role. Obesity is more prevalent in lower socioeconomic classes and is a risk factor for LBP. Smoking is associated with LBP in some studies and is also more prevalent in less favored socioeconomic situations. In our population, smoking was not associated with LBP, and taking the body mass index into account did not change the contribution of occupational factors to the relation studied.

Psychosocial factors at work played a modest role in the relations between LBP and socioeconomic position. Each psychosocial dimension was studied separately here, but we verified that combining these dimensions did not change our findings. Most of the study population had retired by 2001 and were thus no longer exposed to these working conditions. One explanation for the limited role of psychosocial factors in our results may be that the effects of these factors do not persist several years after exposure has ceased. We nonetheless note that in the literature, evidence is limited for the specific role of these factors on low back pain ; conflicting results are observed and some studies suffer from methodological shortcomings (22 ,23). The modest role found for psychosocial factors at work in our study is therefore consistent with this literature.

Physical exposures at work played the greatest role in the relations between LBP and SEP. The contribution of these factors could also be analyzed for all the men for whom information on these exposures were available (the 2218 who completed the 1996 and 2001 questionnaires, irrespective of their participation in the 1997 questionnaire on psychosocial factors). Very similar results were observed for the relations between LBP, SEP and biomechanical factors at work, which validated our findings on biomechanical strains.

It might appear surprising that biomechanical strains had so important a role in explaining the excess risk of LBP among clerks in this population. This may be related in part to the fact that some of these clerks have also been blue-collar workers at some point in time; male clerks in this company comprise workers with disabilities, no more able to perform physically demanding tasks. Confidence intervals for percentages of change in PRs show that the results for this group are unprecise, due to the small size of the group.

Generally speaking, confidence intervals (CI) for PR changes were wide. In most similar studies, these CI are not given, mainly because there is no standard statistical procedure for calculation. It is probable that these CI are often large, especially if the samples are of limited size. The formula for RP change suggests also that this quantity could be unprecise if the denominator is close to zero, which is the case if the PR partly adjusted is close to one. Despite of a lack of precision, in this population, biomechanical strains explained a substantial part of the observed socioeconomic inequalities. The results based on the comparison between models C and B can be considered as the best measure, since they estimate the contribution of biomechanical strains in addition to psychosocial factors. However, these results were rather similar to those comparing models C and A.

For a better understanding of potential mechanisms leading to social inequalities in health, comparing models is more and more widely used (36). However, questions about causal mechanisms behind social inequalities are complex, and methods must take into account also knowledge from other fields of epidemiology.

Studies dealing with the contribution of occupational factors to socioeconomic disparities in LBP are scarce. The population we studied here could be considered specific, since it came from a single company, with a civil-servant-like status. Results appear nonetheless consistent with results collected in other populations: results on the same topic from the general population in France are in agreement with our results (24), occupational disparities for low back pain working people had experienced in the last month in Oslo are also substantially mediated by working conditions and mainly by physical demand (19).

CONCLUSION

In this study, socio-economic disparities in persistent or recurrent low back pain were mainly explained by biomechanical factors. Our findings show that reducing occupational strains, particularly biomechanical strains, could substantially help to reduce socio-economic disparities in persistent or recurrent low back pain, mainly for blue collar workers.

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Footnotes:

M GOLDBERG & A LECLERC designed and conceived the study, S PLOUVIER analysed data and wrote the article, JF CHASTANG, S BONENFANT helped for data analysis

References:

- 1 . Heistaro S , Vartiainen E , Heliövaara M , Puska P . Trends of back pain in eastern Finland, 1972–1992, in relation to socioeconomic status and behavioral risk factors . Am J Epidemiol . 1998 ; 148 : 671 - 82
- 2 . Leino-Arjas P , Hänninen K , Puska P . Socioeconomic variation in back and joint pain in Finland . Eur J Epidemiol . 1998 ; 14 : 79 - 87
- 3 . Dionne CE , Von Korff M , Koepsell TD , Deyo RA , Barlow WE , Checkoway H . Formal education and back pain: a review . J Epidemiol Community Health . 2001 ; 55 : 455 - 68
- 4 . Kaila-Kangas L , Keskimäki I , Notkola V , Mutanen P , Riihimäki H , Leino-Arjas P . How consistently distributed are the socioeconomic differences in severe back morbidity by age and gender? A population based study of hospitalisation among Finnish employees . Occup Environ Med . 2006 ; 63 : 278 - 82
- 5 . Lundberg I , Hemmingsson T , Hogstedt C . Editor: Lundberg I , Hemmingsson T , Hogstedt C . Introductory and background . Work and social inequalities in health in Europe . Samarbetsprogram mellan Arbetslivsinstitutet, LO, TCO och SACO ; 2007 ; 11 - 33
- 6 . Kistensen P . Inequalities in health social causation and the role of occupation . Scand J Work Environ Health . 2008 ; 34 : 235 - 38
- 7 . Schrijvers CT , van de Mheen HD , Stronks K , Mackenbach JP . Socioeconomic inequalities in health in the working population: the contribution of working conditions . Int J Epidemiol . 1998 ; 27 : 1011 - 8
- 8 . Warren JR , Hoonakker P , Carayon P , Brand J . Job characteristics as mediators in SES-health relationships . Soc Sci Med . 2004 ; 59 : 1367 - 78
- 9 . Borrell C , Muntaner C , Benach J , Artazcoz L . Social class and self-reported health status among men and women: what is the role of work organisation, household material standards and household labour? . Soc Sci Med . 2004 ; 58 : 1869 - 87
- 10 . Hemström O . Health inequalities by wage income in Sweden: the role of work environment . Soc Sci Med . 2005 ; 61 : 637 - 47
- 11 . Rahkonen O , Laaksonen M , Martikainen P , Roos E , Lahelma E . Job control, job demands, or social class? The impact of working conditions on the relation between social class and health . J Epidemiol Community Health . 2006 ; 60 : 50 - 4
- 12 . Niedhammer I , Leclerc A . Editor: Lundberg I , Hemmingsson T , Hogstedt C . France . Work and social inequalities in health in Europe . Samarbetsprogram mellan Arbetslivsinstitutet, LO, TCO och SACO ; 2007 ; 79 - 138
- 13 . Niedhammer I , Chastang JF , David S , Kelleher C . The contribution of occupational factors to social inequalities in health: Findings from the national French SUMER survey . Soc Sci Med . 2008 ; 67 : 1870 - 81

- 14 . Borg V , Kristensen TS . Social class and self-rated health: can the gradient be explained by differences in life style or work environment? . Soc Sci Med . 2000 ; 51 : 1019 - 30
- 15 . Stansfeld SA , Head J , Fuhrer R , Wardle J , Cattell V . Social inequalities in depressive symptoms and physical functioning in the Whitehall II study: exploring a common cause explanation . J Epidemiol Community Health . 2003 ; 57 : 361 - 7
- 16 . Marmot MG , Bosma H , Hemingway H , Brunner E , Stansfeld S . Contribution of job control and other risk factors to social variations in coronary heart disease incidence . Lancet . 1997 ; 350 : 235 - 9
- 17 . Aittomäki A , Lahelma E , Rahkonen O , Leino-Arjas P , Martikainen P . The contribution of musculoskeletal disorders and physical workload to socioeconomic inequalities in health . Eur J Public Health . 2007 ; 17 : 145 - 50
- 18 . Melchior M , Roquelaure Y , Evanoff B , Chastang JF , Ha C , Imbernon E . Why are manual workers at high risk of upper limb disorders? The role of physical work factors in a random sample of workers in France (the Pays de la Loire study) . Occup Environ Med . 2006 ; 63 : 754 - 61
- 19 . Mehlum IS , Kristensen P , Kjuus H , Wergeland E . Are occupational factors important determinants of socioeconomic inequalities in musculoskeletal pain? . Scand J Work Environ Health . 2008 ; 34 : 250 - 9
- 20 . Burdorf A , Sorock G . Positive and negative evidence of risk factors for back disorders . Scand J work Environ Health . 1997 ; 23 : 243 - 56
- 21 . Hoogendoorn WE , Bongers PM , de Vet HC , Douwes M , Kowes BW , Mediema MC . Flexion and rotation of the trunk and lifting at work are risk factors for low back pain: results of a prospective cohort study . Spine . 2000 ; 25 : 3087 - 92
- 22 . Hartvigsen J , Lings S , Leboeuf-Yde C , Bakketeig L . Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies . Occup Environ Med . 2004 ; 61 : e2 -
- 23 . Hoogendoorn WE , van Poppel MN , Bongers PM , Koes BW , Bouter LM . Systematic review of psychosocial factors at work and private life as risk factors for back pain . Spine . 2000 ; 25 : 2114 - 25
- 24 . Leclerc A , Gourmelen J , Chastang JF , Plouvier S , Niedhammer I , Lanoë JL . Level of education and back pain in France: the role of demographic, lifestyle and physical work factors . Int Arch Occup Environ Health . 2009 ; 82 : 643 - 652
- 25 . Latza U , Kohlmann T , Deck R , Raspe H . Influence of occupational factors on the relation between socioeconomic status and self-reported back pain in a population-based sample of German adults with back pain . Spine . 2000 ; 25 : 1390 - 7
- 26 . Goldberg M , Chastang JF , Leclerc A , Zins M , Bonenfant S , Bugel I . Socioeconomic, demographic, occupational, and health factors associated with participation in a long-term epidemiologic survey: a prospective study of the French GAZEL cohort and its target population . Am J Epidemiol . 2001 ; 154 : 373 - 84
- 27 . Goldberg M , Chastang JF , Zins M , Niedhammer I , Leclerc A . Health problems were the strongest predictors of attrition during the follow-up of the GAZEL cohort . J Clin Epidemiol . 2006 ; 59 : 1213 - 1221
- 28 . Tubach F , Leclerc A , Landre MF , Pietri-Taleb F . Risk factors for sick leave due to low back pain: a prospective study . J Occup Environ Med . 2002 ; 44 : 451 - 8
- 29 . Kuorinka I , Jonsson B , Kilbom A , Vinterberg H , Biering-Sørensen F , Andersson G , Jørgensen K . Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms . Appl Ergon . 1987 ; 18 : 233 - 7
- 30 . Griffith LE , Hogg-Johnson S , Cole DC , Krause N , Hayden J , Burdorf A . Low-back pain definitions in occupational studies were categorized for a meta-analysis using Delphi consensus methods . J Clin Epidemiol . 2007 ; 60 : 625 - 33
- 31 . Karazek R . Job demands, job decision latitude and mental strain: implications for job redesign . Adm Sci Quart . 1979 ; 24 : 285 - 306
- 32 . Larocque B , Brisson C , Blanchette C . Cohérence interne, validité factorielle et validité discriminante de la traduction française des échelles de demande psychologique et de latitude décisionnelle du Job Content Questionnaire de Karasek . Rev Epidemiol Sante Publique . 1998 ; 46 : 371 - 81
- 33 . Axelson O . Some recent developments in occupational epidemiology . Scand J Work, Environ Health . 1994 ; 20 : 9 - 18
- 34 . Barros AJD , Hirakata VN . Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio . BMC Medical Research Methodology . 2003 ; 3 : 21 -
- 35 . Plouvier S , Renahy E , Chastang JF , Bonenfant S , Leclerc A . Biomechanical strains and low back disorders: quantifying the effects of the number of years of exposure on various types of pain . Occup Environ Med . 2008 ; 65 : 268 - 74
- 36 . Hafeman DM , Schwartz S . Opening the black box: a motivation for the assessment of mediation . Int J Epidemiol . 2009 ; 38 : 838 - 45
- 37 . Virtanen P , Siukula A , Luukkaala T , Savinainen M , Arola H , Nygard C-H . Sick leave in four categories – do characteristics of employees and work conditions explain differences in sickness absences between workplaces? . Scand J Work, Environ Health . 2008 ; 34 : 250 - 9
- 38 . Efron B , Tibshirani RJ . An introduction to the bootstrap . New York Chapman & Hall ; 1993 ;
- 39 . Stock SR , Fernandes R , Delisle A , Vézina N . Reproducibility and validity of workers' self-reports of physical work demands . Scand J Work, Environ Health . 2005 ; 31 : 409 - 37

Figure 1

Study design

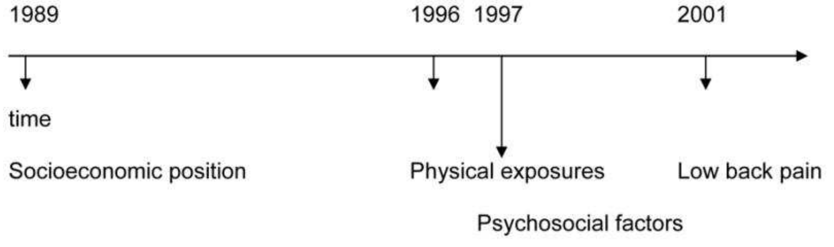

Table 1

Low back pain for more than 30 days and occupational strains according to socioeconomic position in the study population

		Study population N=1 487	Managers n=464	Intermediate n=590	Clerks n=61	Blue collar workers n=372
LBP > 30 days	n (%)	202 (13. 6)	48 (10.3)	64 (10.85)	15 (24. 6)	75 (20. 2)
Driving ≥ 10 years	n (%)	601 (40.4)	64 (13.8)	232 (39.3)	30 (49.2)	275 (73.9)
Bending/Twisting ≥ 10 years	n (%)	651 (43.8)	78 (16.8)	254 (43. 0)	40 (65.6)	279 (75. 0)
Handling loads≥ 10 years	n (%).	430 (28.9)	22 (4.7)	172 (29.1)	17 (27.9)	219 (58.9)
High psychological demand	n (%)	767 (51.6)	312 (67.2)	280 (47.5)	17 (27.9)	158 (42.5)
Low decision latitude	n (%)	866 (58.2)	160 (34.5)	387 (65.6)	49 (80.3)	270 (72.6)
Low social support	n (%)	745 (50.1)	209 (45.4)	308 (52.2)	34 (55.7)	194 (52.1)

Table 2

Prevalence Ratio of LBP for more than 30 days according to socioeconomic position (SEP), occupational strains and contribution of these strains to occupational class disparities for LBP

		PR adjusted for age*	Model A	Model B	Model C
SEP	Managers	1	1	1	1
	Intermediate	1.03 [0.72;1.48]	0.85 [0.57;1.25]	0.99 [0.68;1.43]	0.82 [0.55;1.22]
	Clerks	**2.36** [**1.41;3.95**]	**1.74** [**1.01;3.00**]	**2.20** [**1.28;3.78**]	1.66 [0.95;2.92]
	PR change (ref=age adjusted)		**0.45** [**0.16;0.98**]	0.11 [−0.11;0.45]	**0.51** [**0.17;1.11**]
	PR change (ref=model A)				0.11 [−0.33;1.23]
	PR change (ref=model B)				**0.44** [**0.12;1.11**]
	Blue collar workers	**1.92** [**1.36;2.70**]	1.25 [0.80;1.95]	**1.81** [**1.27;2.60**]	1.21 [0.77;1.90]
	PR change (ref=age adjusted)		**0.73** [**0.27;1.36**]	0.11 [−0.11;0.40]	**0.77** [**0.31;1.49**]
	PR change (ref=model A)				0.16 [−0.59;8.93]
	PR change (ref=model B)				**0.74** [**0.25;1.60**]
Driving**		**1.52** [**1.17;1.91**]	1.02 [0.75;1.37]		1.02 [0.75;1.37]
Bending/twisting**		**2.07** [**1.64;2.65**]	**1.84** [**1.32;2.55**]		**1.80** [**1.29;2.51**]
Handling loads**		**1.70** [**1.35;2.24**]	1.04 [0.74;1.46]		1.04 [0.74;1.46]
High psychological demand		1.14 [0.88;1.48]			
Low decision latitude		**1.32** [**1.01;1.73**]		1.11 [0.83;1.48]	1.09 [0.82;1.45]
Low social support		1.26 [0.98;1.64]		1.21 [0.94;1.57]	1.18 [0.91;1.53]

In brackets, 95% confidence intervals.

* PR prevalence ratio adjusted for age are issued from seven separated models, each one corresponding to one of the following variables: SEP (in four categories); driving (quantitative); bending/twisting (quantitative); handling loads (quantitative); psychological demand (two categories); decision latitude (two categories); social support (two categories)

Model A: Relations between LBP and SEP adjusted for age and biomechanical strains

Model B: Relations between LBP and SEP adjusted for age, decision latitude and social support

Model C: Relations between LBP and SEP adjusted for age, biomechanical strains, decision latitude and social support

** PR given for 20 years of exposure