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## Musculoskeletal pain in Europe: role of personal, occupational and social risk factors

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### Abstract

**Objectives**—Prevalence of musculoskeletal pain in European countries varies considerably. We analyzed data from the fifth European Working Conditions Survey (EWCS) to explore the role of personal, occupational, and social risk factors in determining the national prevalence of musculoskeletal pain.

**Methods**—During 2010, 43,816 subjects from 34 countries were interviewed. We analyzed the one-year prevalence of back and neck/upper limb pain. Personal risk factors studied were: sex; age; educational level; socio-economic status; housework or cooking; gardening and repairs; somatising tendency; job demand-control; six physical occupational exposures; and occupational group. Data on national socio-economic risk factors were obtained from eurostat and were available for 29 countries. We fitted Poisson regression models with random intercept on country.

**Results**—35,550 workers entered the main analysis. Among personal risk factors, somatising tendency was the strongest predictor of the symptoms. Major differences were observed by country with back pain more than twice as common in Portugal (63.8%) as Ireland (25.7%), and prevalence rates of neck/upper limb pain ranging from 26.6% in Ireland to 67.7% in Finland. Adjustment by personal risk factors slightly reduced the large variation of prevalence between countries. For back pain, the rates were more homogenous after adjustment for social risk factors.

**Conclusions**—Our analysis indicates substantial variation between European countries in the prevalence of back and neck/upper limb pain. This variation is unexplained by established individual risk factors. It may be attributable in part to socio-economic differences between countries, with higher prevalence where there is less poverty and more social support.

### Keywords

back pain; neck pain; upper limb pain; occupational exposures; risk factors; cross-sectional studies; population characteristics

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## Introduction

In western countries painful disorders of the back, neck and upper limb are major causes of work disability [1]. Most early studies on causes of musculoskeletal pain focused on physical exposures, such as manual material handling, repetitive movements, awkward postures, and vibrations [2]. More recently, important psychological risk factors – in particular low mood and somatising tendency – have also been demonstrated [3-6]. In addition, the role of work-related psychosocial factors has been explored [7], often using the job demand-control model proposed by Karasek [8], although with less consistent results.

It seems unlikely, however, that these personal risk factors can fully explain the variation in occurrence of musculoskeletal pain and associated disability that has been observed between countries and within countries over the time [9-11]. This raises the possibility of a contribution also from socio-economic factors operating at a population-level, such as provision of healthcare and social security, and attention to occupational health and safety.

To explore the variation in common musculoskeletal symptoms between European countries, and the extent to which it might be explained by personal risk factors, and by national socio-economic circumstances, we analysed data from the fifth European Working Conditions Survey (EWCS) and from eurostat [12, 13].

## Materials and methods

### Study population and setting

The fifth EWCS was conducted in 2010 by The European Foundation for the Improvement of Living and Working Conditions. The survey, which is carried out every 5 years, uses a harmonised approach to investigate the working conditions of employees and the self-employed across Europe. A detailed description of the methods has been published elsewhere [14]. Briefly, the survey was carried out in the 27 Member States of the European Union, and also in Norway, Republic of Macedonia, Croatia, Turkey, Albania, Kosovo, and Montenegro. A standardised questionnaire [14] was administered at interview to random samples, stratified by sex and age, of all persons aged 15 years and older (16 and older in Spain, the UK and Norway), who resided in specified regions of the participating countries, and who were thought to have been in employment during the previous week. Interviews were conducted in the respondent's home, and were completed by 43,816 subjects, giving an overall response rate of 59.6%.

### Health outcomes

Among other things, the questionnaire asked whether the participant had experienced back or neck/upper limb pain during the past year. These two outcomes were related to personal risk factors derived from the questionnaire, and also to various socio-economic risk factors defined by country.

### Personal risk factors

The personal risk factors studied were: sex; age; educational level; socio-economic status; time spent on housework or cooking; time spent on gardening and repairs; somatising tendency; job demand-control; frequency of six physical exposures at work; and occupational group.

Age was classified in five 10-year categories. A three-level variable was created for education (primary or lower; secondary; tertiary) by collapsing the seven levels of the International Standard Classification of Education [15]. The full method of the European

Socio-economic Classification [16] was used to assign subjects to three socio-economic classes (salaried, intermediate, and working class) according to their job title (classified according to the 1988 version of the International Standard Classification of Occupations (ISCO-88)), employment status (employer, self-employed, or employee) and the size of the organization in which they worked. Time spent on housework or cooking and on gardening and repairs was graded to three levels by aggregating categories from a six-level scale that had been used in the questionnaire. This aggregation was based on observed frequencies, and was carried out before associations with health outcomes were examined. Somatising tendency was graded according to how many symptoms from a total of four (stomach ache, respiratory difficulties, overall fatigue and headaches/eyestrain) the participant reported in the past year.

Classification of job demand-control was based on the model proposed by Karasek [8]. From the EWCS questionnaire, three scales were created: job demand (7 items), job skill discretion (6 items), and job decision-making authority (3 items). Job decision-latitude, representing job control, was calculated as the sum of job skill discretion and job decision-making authority, weighting for the number of items in each scale. Scores for job demand and job decision-latitude were then dichotomised about their median values, and four categories of job demand-control were defined: low strain jobs (low demand, high decision-latitude); passive jobs (low demand, low decision-latitude); active jobs (high demand, high decision-latitude); and high strain jobs (high demand, low decision-latitude). A more detailed description of the methods by which job demand-control was specified is presented in Web Appendix 1.

The occupational physical exposures analysed were frequency of: carrying or moving loads; lifting or moving people; standing; exposure to vibrations; repetitive hand or arm movements; and working with computers. The questionnaire asked about the proportion of working time that was occupied by these activities, with seven possible answers, and these were collapsed to four categories: never, sometimes (including “almost never” and “around 1/4 of the time”), often (including “around half of the time” and “around 3/4 of the time”), and always (“almost all of the time” or “all of the time”).

**National socio-economic risk factors**—Data on potentially relevant socio-economic variables defined at national level were obtained from eurostat [13], and were available for all but five countries (Albania, Croatia, former Yugoslav Republic of Macedonia, Montenegro, and Turkey). When complete information on a variable was available for 2010, this was used; otherwise, data were taken from the most recent year for which they were complete. To enhance comparability, all variables were standardised to have mean 0, standard deviation 1. The following statistics were examined:

- people at risk of poverty or social exclusion (year 2010);
- in-work at-risk-of-poverty rate (year 2010);
- gross domestic product per capita in purchasing power standards (year 2010);
- material deprivation rate (year 2010);
- distribution of income measured with Gini Index (year 2010);
- hospital beds per 100.000 inhabitants (year 2007);
- school expectancy (expected years of education over a lifetime) (year 2010);
- public expenditure on labour market policies, cat 1 (publicly funded services for job-seekers) (year 2007);

- public expenditure on labour market policies, categories 2-7 (training, supported employment and job creation) (year 2007);
- public expenditure on labour market policies, categories 8-9 (unemployment and early retirement benefits) (year 2007);
- public expenditure on education (year 2005);
- expenditure on social protection (year 2008);
- fatal accidents at work: incidence rate (year 2005);
- fatal accidents at work: trend (year 2006 compared to 1998);
- healthy life expectancy at birth (year 2010);
- self-reported unmet need for medical examination or treatment (year 2010).

A detailed description of these variables is provided in Web Appendix 2.

### Statistical analysis

Statistical analysis was carried out using Stata 11.2 SE (Stata Corp, College Station, TX, US). Associations of pain outcomes with risk factors were characterised by prevalence ratios (PRs) and associated 95% confidence intervals (95% CIs), which were estimated by fitting Poisson regression models with robust estimates of variance [17, 18]. To account for clustering within the study sample, we allowed for random effects (i.e. intercepts) by country. Supplementary analyses were carried out with random intercepts for region as well as country, to check that there was no important additional clustering by region. Subjects with missing information on one or more of the variables in an analysis were excluded from that analysis.

Multilevel methods were used to study country-level risk factors in the same models as personal risk factors [19]. In view of the large sample size, all of the personal risk factors were included in the final multivariate models. However, the number of socio-economic risk factors defined at national level was large compared with the number of countries. Therefore, to develop a suitably parsimonious model, we applied forward selection based on the Wald test, adding variables that produced a significant ( $p < 0.05$ ) improvement in fit. To avoid problems associated with co-linearity, national attributes that were strongly inter-related (a Pearson's  $r$  higher than 0.70) were never included together in the same model. A matrix setting out Pearson's correlation coefficients for pairs of country-level risk factors is presented in Web Appendix 2. Subjects from countries with missing data on socio-economic variables at national level were excluded from the analysis of country-level risk factors.

Adjusted prevalence rates by country were estimated by summing the fixed and the random effects from logistic regression models with random effects (i.e. intercepts) by country such that:  $\text{Prevalence} = 1 / (1 + \exp(-1 * (\text{linear prediction for the fixed effect} + \text{linear prediction for the random effect})))$ . Prevalence rates by occupation were estimated as average marginal effects from the fixed effects portion of the models. Coefficients of variation in prevalence rates were calculated as the ratio of standard deviation to mean.

### Results

From the original sample of 43,816 subjects, we excluded 1,926 subjects who did not confirm having been "at work" during the past week, 984 aged 65 years or older, and 191 with unknown age. We also excluded 5,931 participants with missing data on personal risk factors (principally job demand-control,  $n = 4,346$ ). Thus, 35,550 subjects (81.1% of the

original sample) entered our main analysis. A flow diagram for the study is presented in Web Figure 1.

The overall one-year prevalence of back pain in the study sample was 46.1% (95%CI 45.5–46.6), while that for neck/upper limb pain was 44.6% (95%CI 44.1–45.1). Figure 1 gives age- and sex-adjusted prevalence rates for back and neck/upper limb pain by occupation and country. The prevalence of both outcomes varied substantially between occupations, with relatively low values among teaching professionals (32.2% for back and 31.7% for neck/upper limb) and the highest rates in agricultural, fishery and related labourers (64.0% and 67.3%). Moreover, there was a high correlation (Pearson's  $r = 0.97$ ) between rates of back and neck/upper limb pain by occupation, and this applied within both manual and non-manual workers. Major differences in prevalence were also observed by country with back pain more than twice as common in Portugal (63.8%) as Ireland (25.7%), and rates of neck/upper limb pain ranging from 26.6% in Ireland to 67.7% in Finland. The correlation between back and neck/upper limb pain by country (Pearson's  $r = 0.54$ ) was less strong than that by occupation.

Table 1 summarises the associations (mutually adjusted and adjusted also for occupation) of pain in the back and neck/upper limb with personal risk factors. For both anatomical sites, the prevalence of pain increased with age, and was somewhat higher in women than in men, and with lower educational level. However, after adjustment for educational level and occupation, no association was apparent with socio-economic class. Housework or cooking for more than one hour per day was associated with both back and neck/upper limb pain (PR for both = 1.11), but no clear associations were observed with frequency of gardening and repairs. The strongest associations were with number of distressing somatic symptoms over the past year (PR for subjects reporting  $\geq 2$  v 0 symptoms = 2.43, 95%CI 2.33–2.53 for back pain, and 2.59, 95%CI 2.48–2.71 for neck/upper limb pain). The classification of subjects according to the job demand-control model suggested that active and high strain jobs (both characterised by high job demand) were a risk factor for both back and upper/limb pain. The physical occupational exposures analysed showed mostly positive associations with the two pain outcomes, the two strongest associations being between carrying or moving heavy loads and back pain, and between repetitive hand or arm movements and neck/upper limb pain. However, frequent work with computers tended to carry a lower risk of pain.

Table 2 shows risk estimates for back and neck/upper limb pain by occupational group. For both outcomes, adjustment for other personal characteristics in addition to sex and age considerably reduced the strength of observed associations. This effect was driven largely by the psychosocial and physical occupational risk factors (data not shown). Compared to teaching professionals, the highest fully adjusted PRs for back pain were observed among manual workers such as drivers and mobile-plant operators (PR = 1.36), market-oriented skilled agricultural and fishery workers (PR = 1.28), extraction and building trades workers (PR = 1.29), and agricultural, fishery and related labourers (PR = 1.28). Adjusted PRs for neck/upper limb pain were generally lower than those seen for back pain. Again, higher risks were observed among manual workers such as agricultural, fishery and related labourers (PR = 1.29), extraction and building trades workers (PR = 1.25), precision, handicraft, printing and related trades workers (PR = 1.24), and drivers and mobile-plant operators (PR = 1.22).

Table 3 shows the relation of national socio-economic risk factors to back and neck/upper limb pain, after adjustment for personal risk factors including occupation. For both anatomical sites, the prevalence of pain was lower in countries with a higher percentage of people at risk of poverty or social exclusion. Positive associations with back pain were also observed for higher expenditure on social protection, higher rate of fatal accidents at work,

and more self-reported unmet need for medical examination or treatment. Conversely, higher public expenditure on education and longer healthy life expectancy at birth were associated with a lower risk of back pain. When risk estimates were mutually adjusted, only school expectancy was positively associated with neck/upper pain.

Figure 2 summarises the distribution of one-year prevalence rates for back and neck/upper limb pain in the 28 countries with complete information on national socio-economic risk factors. For each country, we plotted the raw prevalence, and prevalence adjusted by: a) age and sex (Model A), b) all personal risk factors (Model B), and c) all personal risk factors together with significant national risk factors (Model C). For back pain, adjustment by age and sex, and by other personal risk factors produced little reduction in the large variation of crude prevalence between countries. When rates were adjusted also for national risk factors, they became more homogenous, although still varying from 39.0% (Netherlands) to 52.1% (Italy). For neck/upper limb pain, even the fully adjusted prevalence rates were quite variable (coefficient of variation = 0.156).

## Discussion

We found large variation in the one-year prevalence of back and neck/upper limb pain by occupational group and country. Differences between occupational groups were largely explained by personal risk factors (in particular, occupational determinants of musculoskeletal pain). In contrast, adjustment for personal risk factors did not reduce the variation in prevalence between countries. However, several national socio-economic variables were associated with musculoskeletal pain independently from personal risk factors. For back pain, risk factors at national level appeared to influence prevalence, which was more homogeneous after adjustment for these variables. However, only a small proportion of the international variation in neck-upper limb pain was explained in fully adjusted models.

Strengths of our study include the large sample size and substantial number of countries analysed. Also, in all countries, each stage of the survey was conducted using standardized methods [14].

Against this, the cross-sectional design limits the interpretation of findings. Reverse causation may have contributed to some of the observed associations, in particular for psychological risk factors. However, insofar as this occurred, the effect will have been to overestimate the influence of the risk factors concerned, and it would not account for the failure of adjustment for personal risk factors to explain international differences in prevalence. Another weakness is the incomplete response to the questionnaire (overall response rate 59.6%). We cannot exclude the possibility that people with musculoskeletal pain were over- or under-represented in the study sample. However, musculoskeletal pain was not the main focus of the EWCS, and it seems unlikely that selection bias alone could explain differences in symptom prevalence between countries of the magnitude that was observed.

More important is the limited quantity and quality of information that was available on individual participants. Data were collected through interviewer-administered questionnaires with no clinical measures of pain and disability. It is possible that participants were more aware of pain if it was exacerbated or made difficult by their work, and that this exaggerated associations with certain jobs and occupational activities. On the other hand, non-differential errors in the reporting of exposures may have biased risk estimates towards the null. This in turn could have caused over-estimation of the residual variation in prevalence after adjustment for personal risk factors. However, it seems unlikely to have been a major



problem since adjustment for personal risk factors caused substantial reductions in risk estimates for occupations with high rates of musculoskeletal pain, such as agricultural and construction workers (Table 2). Although the assessment of psychosocial aspects of work was not formally validated, previous studies have demonstrated the validity of Karasek's Job Content Questionnaire-like dimensions [20], and Karasek's dimensions constructed from the questionnaire used in the Fourth EWCS – which was similar to that used in the Fifth EWCS – showed good psychometric properties [21].

The EWCS questionnaire was developed in the English language and was translated into 32 languages to be used in 34 countries [22, 23], the accuracy of translation being checked by independent back-translation. The final versions of all questionnaires were then reviewed by a panel of experts. Nevertheless, it remains possible that terms such as “backache” and “pain” are understood differently in different languages and cultures. In analyses of risk factors, this would be taken into account to some extent by the assumption of a random effect of country.

The EWCS data were potentially clustered at two nested levels – region within country. In our main analysis, we fitted multilevel models with random intercept by country, but we ignored possible clustering by regions. This choice was driven by long computing times when performing the model selection for national socio-economic risk factors. However, to check for possible bias from ignoring an effect of region, we also fitted three-level models including all personal risk factors, with random intercepts for region and country. Values for prevalence ratios, associated standard errors, and random intercepts by country were almost identical to those obtained from the two-level models (data not shown). This suggests that our findings were not importantly biased from ignoring effects of region.

Findings from the analysis of individual risk factors accorded with observations in other studies [6, 10, 11, 24]. For both pain outcomes, the highest PRs were associated with report of two or more distressing somatic symptoms over the past year. A strong association between somatising tendency and musculoskeletal pain is already well established [4-6, 11]. The only unexpected finding was a negative association between working with computers and back and neck/upper limb pain. Many studies have indicated positive associations of computer use with self-reported upper limb pain [e.g. 11, 25], although there is no consistent association with specific upper limb disorders such as carpal tunnel syndrome [26; 27]. In a supplementary analysis restricted to non-manual workers (ISCO-88 major groups 1-4), the PRs for working with computers were all above 1 (data not shown), so it may be that in the full study sample, effects of using computers were negatively confounded by other occupational exposures that occur predominantly in manual work.

We did not begin our analysis with strong *a-priori* hypotheses about the role of specific national socio-economic factors. Thus, selection of variables that were included in the final models was based on statistical criteria (forward selection). Given the limited number of countries for which data were available, and the relatively large number of national socioeconomic risk factors examined, it is possible that some of the associations identified were spuriously high by chance. However, this could not account for persistent variation between countries after adjustment for such risk factors. Rather it would lead to over-adjustment

Of the associations that were observed with national socio-economic factors, most striking was the inverse relationship with poverty and social exclusion. This applied to both pain outcomes, and was present with and without adjustment for other socio-economic risk factors. It is consistent with a tendency to higher risk also in countries with greater expenditure on social protection, and with higher rates of neck and upper limb pain in

countries with longer education. It may be that through psychological mechanisms, access to social support and protection from poverty encourages the development or persistence of musculoskeletal complaints, especially if those who suffer from such disorders are less likely to lose income as a consequence. That back pain was also associated with lower healthy life expectancy and more frequent self-report of unmet need for medical examination may reflect a tendency to rate personal health worse and have greater expectations of care in countries with more social support (healthy life expectancy was calculated by a method based on life tables and self-reported general health [28]).

Back pain was also associated with higher rates of fatal accidents at work, but this emerged only after adjustment for other risk factors, and was not paralleled by a similar association with neck and upper limb pain. Thus it may be a chance finding.

Adjustment for national socio-economic variables reduced the variation between countries in prevalence of back pain (Figure 2). However, important differences remained, and for neck and upper limb pain, the effect of such adjustment was smaller. Given the potential to over-adjust because of chance associations, this suggests that there are important unidentified determinants of musculoskeletal pain that have yet to be identified. It is possible that these are related to affluence and social support, but were not adequately captured by the variables that we were able to analyse.

In conclusion, our analysis indicates substantial variation between European countries in the prevalence of back and neck/upper limb pain. This variation is unexplained by established risk factors acting at an individual level. It may be attributable in part to socio-economic differences between countries, with higher prevalence where there is less poverty and more social support. Future studies should explore this possibility further, perhaps by comparing trends over time in countries where socio-economic circumstances have changed differentially.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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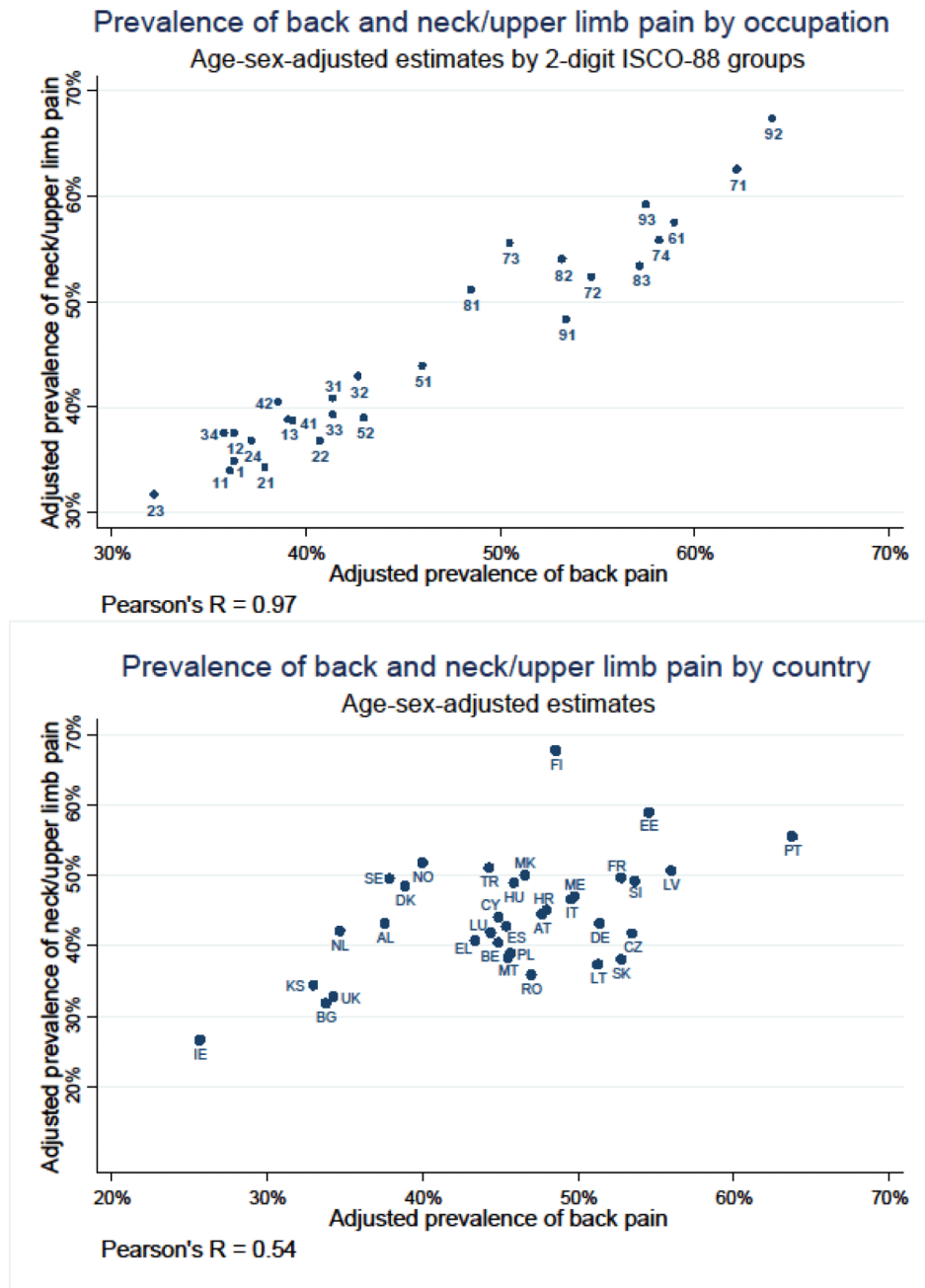


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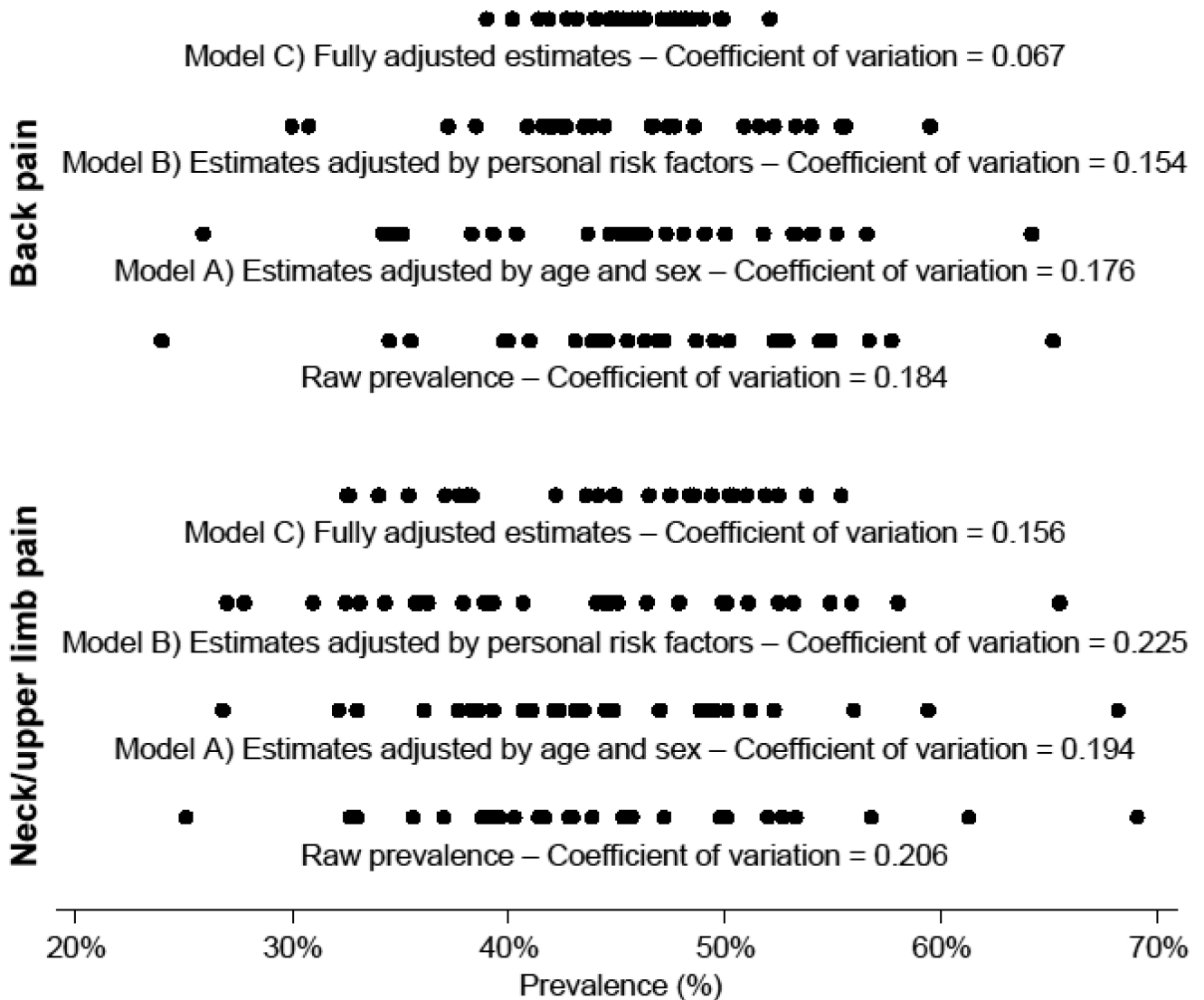
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**What is new in the paper/what are the policy implications of the paper**

- Large variation between European countries in the prevalence of back and neck/upper limb pain may be attributable in part to socio-economic differences between countries, with higher prevalence where there is less poverty and more social support.
- Future studies should explore this possibility further, perhaps by comparing trends over time in countries where socio-economic circumstances have changed differentially.



**Figure 1.** Prevalence of back and neck/upper limb pain by occupation (2-digit ISCO-88) and country. Fifth European Working Conditions Survey, 34 European countries, 2010.



**Figure 2.**

Estimated prevalence of back and neck/upper limb pain by country. Model B is adjusted for personal risk factors as presented in Tables 1 and 2. Model C is additionally adjusted for country attributes as in the stepwise regression model presented in Table 3. Fifth European Working Conditions Survey, 28 European countries, 2010.

**Table 1**

Associations between musculoskeletal pain in past year and personal characteristics. Fifth European Working Conditions Survey, 34 European countries, 2010.

Characteristic	Back pain (N = 35,476)				Neck/upper limb pain (N = 35,464)			
	Prevalence		Multivariate analysis <sup>a</sup>		Prevalence		Multivariate analysis <sup>a</sup>	
	n	%	PR	95%CI	n	%	PR	95%CI
<i>Age (years)</i>								
15 - 24	907	35.1	1.00	Ref.	881	34.1	1.00	Ref.
25 - 34	3,244	39.1	1.11	1.03–1.20	3,117	37.6	1.12	1.03–1.20
35 - 44	4,502	45.3	1.22	1.13–1.31	4,357	43.8	1.23	1.14–1.33
45 - 54	4,965	52.3	1.37	1.28–1.48	4,841	50.9	1.40	1.30–1.51
55 - 64	2,725	52.8	1.46	1.35–1.58	2,618	50.7	1.46	1.34–1.58
<i>Gender</i>								
female	8,271	48.4	1.00	Ref.	8,222	48.1	1.00	Ref.
male	8,072	43.9	0.95	0.91–0.99	7,592	41.3	0.89	0.86–0.94
<i>Highest educational level</i>								
primary	4,743	54.2	1.00	Ref.	4,501	51.4	1.00	Ref.
secondary	7,515	47.5	0.96	0.92–1.00	7,224	45.7	0.97	0.93–1.02
tertiary	4,805	37.5	0.89	0.84–0.95	4,089	37.5	0.92	0.87–0.97
<i>Socio-economic class (ESEC)</i>								
salariat	3,987	38.8	1.00	Ref.	3,945	38.4	1.00	Ref.
intermediate	4,472	45.4	1.02	0.95–1.10	4,370	44.4	1.03	0.95–1.11
working class	7,884	51.4	1.02	0.94–1.12	7,499	48.9	1.05	0.96–1.14
<i>Housework or cooking</i>								
never, occasionally	5,665	42.5	1.00	Ref.	5,324	39.9	1.00	Ref.
every day or every second day for 1 hour or less	4,935	45.7	1.07	1.02–1.11	4,859	45.0	1.07	1.03–1.12
more than one hour per day	5,743	50.6	1.11	1.05–1.16	5,631	49.6	1.11	1.06–1.17
<i>Gardening and repairs</i>								
never, occasionally	10,578	44.7	1.00	Ref.	10,141	42.8	1.00	Ref.
twice per week	3,581	48.3	1.03	0.99–1.07	3,540	47.7	1.05	1.01–1.09
everyday or every second day	2,184	49.9	1.00	0.95–1.05	2,133	48.7	1.03	0.98–1.08
<i>Number of distressing somatic symptoms in past year</i>								
0	3,605	25.8	1.00	Ref.	3,332	23.8	1.00	Ref.
1	5,207	49.8	1.83	1.76–1.91	5,014	48.0	1.91	1.82–1.99
2	7,531	68.1	2.43	2.33–2.53	7,478	67.5	2.59	2.48–2.71
<i>Job demand-control</i>								
low strain job	3,323	40.1	1.00	Ref.	3,174	38.3	1.00	Ref.
active job	4,422	47.6	1.08	1.03–1.13	4,473	48.1	1.08	1.03–1.13
passive job	4,177	42.9	0.96	0.92–1.01	3,883	39.8	0.97	0.92–1.02
high strain job	4,421	54.2	1.06	1.01–1.11	4,284	52.6	1.06	1.01–1.11
<i>Carrying or moving heavy loads</i>								
never	6,376	38.0	1.00	Ref.	6,123	36.5	1.00	Ref.



Characteristic	Back pain (N = 35,476)				Neck/upper limb pain (N = 35,464)			
	Prevalence		Multivariate analysis <sup>a</sup>		Prevalence		Multivariate analysis <sup>a</sup>	
	n	%	PR	95%CI	n	%	PR	95%CI
sometimes	5,542	48.1	1.13	1.08–1.18	5,408	46.9	1.15	1.10–1.20
often	2,137	57.7	1.23	1.16–1.30	2,058	55.6	1.25	1.18–1.33
always	2,288	66.2	1.29	1.21–1.37	2,225	64.4	1.29	1.22–1.37
<i>Lifting or moving people</i>								
never	13,457	45.6	1.00	Ref.	12,958	43.9	1.00	Ref.
sometimes	1,732	44.1	0.95	0.90–1.00	1,731	44.1	0.95	0.90–1.01
often	454	51.3	1.07	0.97–1.18	440	49.7	1.07	0.97–1.18
always	700	61.3	1.06	0.97–1.15	685	60.0	1.05	0.96–1.14
<i>Standing</i>								
never	2,429	37.8	1.00	Ref.	2,393	37.2	1.00	Ref.
sometimes	3,387	42.2	1.03	0.97–1.08	3,297	41.0	1.00	0.94–1.06
often	2,902	43.7	1.03	0.97–1.10	2,774	41.7	1.00	0.94–1.07
always	7,625	53.1	1.07	1.01–1.14	7,350	51.2	1.04	0.98–1.11
<i>Vibrations</i>								
never	9,707	41.8	1.00	Ref.	9,371	40.4	1.00	Ref.
sometimes	3,206	49.1	1.04	0.99–1.09	3,123	47.8	1.04	1.00–1.09
often	1,462	58.2	1.11	1.04–1.18	1,399	55.7	1.12	1.05–1.20
always	1,968	61.2	1.07	1.01–1.13	1,921	59.7	1.09	1.02–1.15
<i>Repetitive hand or arm movements</i>								
never	2,856	34.6	1.00	Ref.	2,559	31.0	1.00	Ref.
sometimes	3,144	40.7	1.04	0.99–1.10	3,018	39.1	1.11	1.05–1.17
often	3,129	46.9	1.12	1.06–1.18	3,031	45.4	1.21	1.15–1.28
always	7,214	56.2	1.21	1.15–1.27	7,206	56.2	1.34	1.27–1.41
<i>Working with computers</i>								
never	7,387	52.8	1.00	Ref.	7,007	50.1	1.00	Ref.
sometimes	3,273	45.7	1.00	0.95–1.05	3,135	53.8	0.96	0.92–1.01
often	1,454	38.7	0.92	0.86–0.98	1,435	38.2	0.91	0.85–0.97
always	4,229	40.0	0.95	0.90–1.00	4,237	40.1	0.94	0.89–0.99

Abbreviations: 95%CI, 95% confidence interval; ESEC, European socio-economic classification; PR, prevalence ratio; Ref., reference category.

<sup>a</sup>Estimates from multivariate Poisson regression models additionally adjusted by occupational group (2-digit ISCO-88) and with random intercept on country

Table 2

Associations between musculoskeletal pain in past year and occupational groups.Fifth European Working Conditions Survey, 34 European countries, 2010.

	Back pain (N = 35,476)										Neck/upper limb pain (N = 35,464)									
	Prevalence		Age-sex adjusted		Fully adjusted <sup>d</sup>		Prevalence		Age-sex adjusted		Fully adjusted <sup>d</sup>		Prevalence		Age-sex adjusted		Fully adjusted <sup>d</sup>			
	n	%	PR	95%CI	n	%	PR	95%CI	n	%	PR	95%CI	n	%	PR	95%CI	n	%	PR	95%CI
<b>Occupations (2-digit ISCO-88)</b>																				
1	55	32.7	1.09	1.07	51	30.2	1.05	1.04	51	30.2	1.05	1.04	51	30.2	1.05	1.04	51	30.2	1.05	1.04
11	43	37.4	1.11	1.11	43	37.4	1.07	1.06	43	37.4	1.07	1.06	43	37.4	1.07	1.06	43	37.4	1.07	1.06
12	399	36.9	1.11	1.10	417	38.6	1.15	1.14	417	38.6	1.15	1.14	417	38.6	1.15	1.14	417	38.6	1.15	1.14
13	763	39.1	1.18	1.03	755	38.6	1.19	1.02	755	38.6	1.19	1.02	755	38.6	1.19	1.02	755	38.6	1.19	1.02
21	311	35.4	1.14	1.15	282	32.2	1.05	1.03	282	32.2	1.05	1.03	282	32.2	1.05	1.03	282	32.2	1.05	1.03
22	343	42.1	1.23	1.19	322	39.5	1.14	1.08	322	39.5	1.14	1.08	322	39.5	1.14	1.08	322	39.5	1.14	1.08
23	714	35.3	1.00	1.00	722	35.7	1.00	1.00	722	35.7	1.00	1.00	722	35.7	1.00	1.00	722	35.7	1.00	1.00
24	608	39.5	1.14	1.19	601	39.1	1.14	1.16	601	39.1	1.14	1.16	601	39.1	1.14	1.16	601	39.1	1.14	1.16
31	425	40.3	1.25	1.15	411	38.9	1.24	1.12	411	38.9	1.24	1.12	411	38.9	1.24	1.12	411	38.9	1.24	1.12
32	466	47.0	1.30	1.13	472	47.6	1.31	1.13	472	47.6	1.31	1.13	472	47.6	1.31	1.13	472	47.6	1.31	1.13
33	190	43.7	1.26	1.23	189	43.4	1.21	1.19	189	43.4	1.21	1.19	189	43.4	1.21	1.19	189	43.4	1.21	1.19
34	1,060	38.3	1.10	1.08	1,107	39.9	1.16	1.12	1,107	39.9	1.16	1.12	1,107	39.9	1.16	1.12	1,107	39.9	1.16	1.12
41	1,155	42.3	1.20	1.12	1,129	41.3	1.19	1.09	1,129	41.3	1.19	1.09	1,129	41.3	1.19	1.09	1,129	41.3	1.19	1.09
42	403	40.7	1.18	1.04	417	42.1	1.24	1.06	417	42.1	1.24	1.06	417	42.1	1.24	1.06	417	42.1	1.24	1.06
51	1,726	47.0	1.38	1.13	1,665	45.4	1.33	1.06	1,665	45.4	1.33	1.06	1,665	45.4	1.33	1.06	1,665	45.4	1.33	1.06
52	1,054	43.7	1.30	1.09	954	39.5	1.20	0.97	954	39.5	1.20	0.97	954	39.5	1.20	0.97	954	39.5	1.20	0.97
61	665	56.8	1.78	1.28	655	56.0	1.75	1.20	655	56.0	1.75	1.20	655	56.0	1.75	1.20	655	56.0	1.75	1.20
71	992	59.0	1.90	1.29	955	56.8	1.95	1.25	955	56.8	1.95	1.25	955	56.8	1.95	1.25	955	56.8	1.95	1.25
72	764	52.6	1.66	1.20	700	48.1	1.61	1.11	700	48.1	1.61	1.11	700	48.1	1.61	1.11	700	48.1	1.61	1.11
73	110	51.4	1.52	1.16	118	55.1	1.68	1.24	118	55.1	1.68	1.24	118	55.1	1.68	1.24	118	55.1	1.68	1.24
74	526	60.1	1.72	1.23	490	56.0	1.68	1.13	490	56.0	1.68	1.13	490	56.0	1.68	1.13	490	56.0	1.68	1.13
81	123	50.0	1.47	1.03	125	50.8	1.56	1.04	125	50.8	1.56	1.04	125	50.8	1.56	1.04	125	50.8	1.56	1.04
82	613	53.4	1.59	1.13	612	53.3	1.63	1.09	612	53.3	1.63	1.09	612	53.3	1.63	1.09	612	53.3	1.63	1.09
83	825	55.1	1.73	1.36	731	48.8	1.64	1.22	731	48.8	1.64	1.22	731	48.8	1.64	1.22	731	48.8	1.64	1.22
91	1,389	56.7	1.57	1.19	1,262	51.5	1.45	1.05	1,262	51.5	1.45	1.05	1,262	51.5	1.45	1.05	1,262	51.5	1.45	1.05
92	157	62.3	1.92	1.28	164	65.1	2.03	1.29	164	65.1	2.03	1.29	164	65.1	2.03	1.29	164	65.1	2.03	1.29
93	464	54.1	1.74	1.17	465	54.3	1.82	1.15	465	54.3	1.82	1.15	465	54.3	1.82	1.15	465	54.3	1.82	1.15

Abbreviations: 95%CI, 95% confidence interval; PR, prevalence ratio; Ref., reference category.

<sup>d</sup>Estimates from Poisson regression models with random intercept on country and adjusted by age class, gender, socio-economic class, housework or cooking, gardening and repairs, number of distressing somatic symptoms in past year, job demand-control, carrying or moving loads, lifting or moving people, standing, vibrations, repetitive hand or arm movements, and working with computers.

Table 3

Associations between musculoskeletal pain in past year and national socio-economic risk factors. Fifth European Working Conditions Survey, 28 European countries, 2010.

Risk factors (standardised variables) <sup>b</sup>	Back pain (N = 30,064)			Neck/upper limb pain (N = 30,071)		
	Each risk factor examined separately <sup>d</sup>			Each risk factor examined separately <sup>d</sup>		
	PR	95%CI	PR	95%CI	PR	95%CI
<i>People at risk of poverty or social exclusion (%)</i>	0.96	0.92–1.01	0.86	0.82–0.91	0.90	0.85–0.94
<i>In-work at-risk-of-poverty rate (%)</i>	0.99	0.94–1.04	.	.	0.92	0.87–0.98
<i>GDP per capita (PPS)</i>	0.99	0.94–1.04	.	.	1.07	1.00–1.14
<i>Material Deprivation rate</i>	0.98	0.93–1.03	.	.	0.90	0.85–0.95
<i>Distribution of income (Gini coefficient)</i>	0.98	0.93–1.03	.	.	0.91	0.86–0.96
<i>Hospitals beds per 100,000 inhabitants</i>	1.03	0.98–1.08	.	.	0.95	0.90–1.02
<i>School expectancy (years)</i>	1.00	0.95–1.05	.	.	1.09	1.03–1.15
<i>Public expenditure on labour market policies, cat 1 (% of GDP)</i>	0.99	0.94–1.04	.	.	1.04	0.97–1.11
<i>Public expenditure on labour market policies, categories 2-7 (% of GDP)</i>	1.00	0.94–1.05	.	.	1.09	1.03–1.16
<i>Public expenditure on labour market policies, categories 8-9 (% of GDP)</i>	1.03	0.98–1.08	.	.	1.09	1.02–1.15
<i>Expenditure on social protection (% of GDP)</i>	1.01	0.96–1.06	1.06	1.02–1.10	1.10	1.04–1.17
<i>Public expenditure on education (% of GDP)</i>	0.99	0.94–1.04	0.95	0.92–0.98	1.10	1.04–1.17
<i>Fatal accidents at work – index</i>	0.99	0.94–1.04	.	.	0.97	0.91–1.04
<i>Fatal accidents at work – rate</i>	1.03	0.98–1.08	1.09	1.05–1.13	0.94	0.88–1.00
<i>Healthy life expectancy at birth: mean (years)</i>	0.94	0.90–0.98	0.94	0.91–0.97	0.99	0.93–1.06
<i>Self-reported unmet need for medical examination or treatment (%)</i>	1.00	0.95–1.05	1.08	1.04–1.13	0.95	0.89–1.01

Abbreviations: 95%CI, 95% confidence interval; PR, prevalence ratio.

<sup>a</sup> Estimates from Poisson regression models with random intercept on country and adjusted by age class, gender, socio-economic class, housework or cooking, gardening and repairs, number of distressing somatic symptoms in past year, job demand-control, carrying or moving loads, lifting or moving people, standing, vibrations, repetitive hand or arm movements, working with computers, and occupation (2-digit ISCO-88).

<sup>b</sup> Standardized variables with mean = 0 and standard deviation = 1.