ORIGINAL ARTICLE

International variation in absence from work attributed to musculoskeletal illness: findings from the CUPID study

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ABSTRACT

Objectives To quantify the variation in rates of absence due to musculoskeletal pain across 47 occupational groups (mostly nurses and office workers) from 18 countries, and to explore personal and group-level risk factors that might explain observed differences.

Methods A standardised questionnaire was used to obtain information about musculoskeletal pain, sickness absence and possible risk factors in a cross-sectional survey of 12 416 workers (92–1017 per occupational group). Additionally, group-level data on socioeconomic variables, such as sick pay and unemployment rates, were assembled by members of the study team in each country. Associations of sickness absence with risk factors were examined by Poisson regression.

Results Overall, there were more than 30-fold differences between occupational groups in the 12-month prevalence of prolonged musculoskeletal sickness absence, and even among office workers carrying out similar occupational tasks, the variation was more than tenfold. Personal risk factors included older age, lower educational level, tendency to somatise, physical loading at work and prolonged absence for non-musculoskeletal illness. However, these explained little of the variation between occupational groups. After adjustment for individual characteristics, prolonged musculoskeletal sickness absence was more frequent in groups with greater time pressure at work, lower job control and more adverse beliefs about the work-relatedness of musculoskeletal disorders.

Conclusions Musculoskeletal sickness absence might be reduced by eliminating excessive time pressures at work, maximising employees’ responsibility and control and providing flexibility of duties for those with disabling symptoms. Care should be taken not to overstate work as a cause of musculoskeletal injury.

INTRODUCTION

Absence from work because of sickness is disruptive and expensive. For example, the annual cost to the national economy of the UK has been estimated at around £15 billion.1 In most countries, the financial burden falls mainly on employers and/or the social security system, but sickness absence also impacts on the earnings of employees, and even where their income is protected, it can be damaging to their confidence and self-esteem.

While attributed ostensibly to ill health or injury, sickness absence is also influenced by the personality and attitudes of the worker,2–4 the physical and psychological demands of their job,5–13 social and cultural norms,14 15 and financial circumstances, such as availability and levels of sick pay and social security benefits.3 15–19 Some of these factors vary by country and employer, and may be amenable to modification. Thus, if there were major differences in rates of sickness absence between workforces in different countries, and especially those carrying out similar types of work, identification of the causes might provide valuable pointers to practical preventive policies.

Attempts to compare levels of sickness absence between countries have been complicated by differences in the methods by which routine national statistics are compiled.20 21 A few studies have circumvented this problem by using other, more uniform methods of data collection,4 11 20–22 and some have suggested substantial variation in rates of absence.20–22 However, their design has not allowed detailed exploration of the reasons for the observed differences.

We present here, an analysis of data on sickness absence from the CUPID (Cultural and Psychosocial Influences on Disability) study, which used standardised methods to collect information on 47 occupational groups in 18 countries.23 The study focused on disability from musculoskeletal complaints, which in many countries are the major reason given for longer-term sickness absence.24–26 The aims of our analysis were to quantify the variation in rates of absence for musculoskeletal problems between occupational groups, and to explore factors that might underlie observed differences.

METHODS

The 47 occupational groups that we studied (table 1) fell into three broad categories—nurses (including nursing assistants), office workers and ‘other workers’ (mainly manual workers who carried out repetitive tasks with their hands or arms).

Data collection was carried out during 2006–2011, by teams of local investigators in each country, who identified populations suitable for study, and recruited participants from these populations. Each participant was asked to complete a questionnaire, either at interview or by self-administration. The method of answering the questionnaire depended on considerations, such as the
The literacy of participants, their geographical dispersion and the willingness of employers to allow employee time for interviews. Only one method was used for each occupational group, except in the UK, where most questionnaires were self-administered, but random samples of each occupational group were interviewed, and in South Africa, where most nurses were interviewed, but a few answered by self-administration.

The questionnaire was originally developed in English and then translated into local languages as necessary. The accuracy of translation was checked by independent back-translation, following which, amendments were made if required. Among other things, the questionnaire asked about demographic characteristics, age at which full-time education was completed, current occupation, pain during the past 12 months in each of six anatomical regions (low back, neck, shoulder, elbow, wrist/hand and knee) as depicted in diagrams, fear-avoidance beliefs concerning low back and upper limb pain, distress from common somatic symptoms, mental health and total duration of work.

### Table 1: Occupational groups included in the CUPID study

| Country      | Occupational group                  | Response rate (%) | Number of participants analysed |
|--------------|-------------------------------------|-------------------|---------------------------------|
| Brazil (BR)  | Nurses                              | 96                | 184                             |
|              | Office workers                      | 97                | 278                             |
|              | Other workers (sugarcane cutters)   | 61                | 93                              |
| Ecuador (EC) | Nurses                              | 99                | 219                             |
|              | Office workers                      | 100               | 243                             |
|              | Other workers (flower plantation)   | 99                | 227                             |
| Colombia (CO)| Office workers                      | 89                | 92                              |
| Costa Rica (CR)| Nurses                        | 91                | 220                             |
|              | Office workers                      | 91                | 223                             |
|              | Other workers (telephone call centre)| 94                | 205                             |
| Nicaragua (NI)| Nurses                        | 100               | 282                             |
|              | Office workers                      | 100               | 285                             |
|              | Other workers (machine operators)   | 100               | 197                             |
| UK (UK)      | Nurses                              | 42                | 256                             |
|              | Office workers                      | 45                | 380                             |
|              | Other workers (mail sorters)        | 28                | 386                             |
| Spain (SP)   | Nurses                              | 96                | 667                             |
|              | Office workers                      | 98                | 438                             |
| Italy (IT)   | Nurses                              | 76                | 536                             |
|              | Other workers (assembly line)       | 52                | 136                             |
| Greece (GR)  | Nurses                              | 93                | 224                             |
|              | Office workers                      | 99                | 199                             |
|              | Other workers (postal clerks)       | 91                | 140                             |
| Estonia (EE) | Nurses                              | 48                | 370                             |
|              | Office workers                      | 53                | 202                             |
| Lebanon (LB) | Nurses                              | 96                | 184                             |
|              | Office workers                      | 86                | 172                             |
|              | Other workers (food production)     | 98                | 137                             |
| Iran (IR)    | Nurses                              | 94                | 246                             |
|              | Office workers                      | 88                | 182                             |
| Pakistan (PK)| Nurses                        | 94                | 187                             |
|              | Office workers                      | 100               | 180                             |
|              | Other workers (mail sorters)        | 96                | 222                             |
| Sri Lanka (LK)| Nurses                        | 95                | 236                             |
|              | Office workers                      | 63                | 152                             |
|              | Other workers-1 (mail sorters)      | 100               | 250                             |
|              | Other workers-2 (sewing machinists) | 86                | 151                             |
| Japan (JP)   | Nurses                              | 76                | 592                             |
|              | Office workers                      | 81                | 310                             |
|              | Other workers-1 (transportation operatives) | 86 | 1017                           |
|              | Other workers-2 (sales workers)     | 98                | 355                             |
| South Africa (SA)| Nurses                      | 90                | 247                             |
|              | Office workers                      | 83                | 229                             |
| Australia (AU)| Nurses                        | 39                | 250                             |
| New Zealand (NZ)| Nurses                     | 70                | 177                             |
|              | Office workers                      | 52                | 145                             |
|              | Other workers (mail sorters)        | 50                | 113                             |

CUPID, Cultural and Psychosocial Influences on Disability.
sickness absence in the past 12 months (0, 1–5, 6–30 and >30 days) because of pain in each of the six specified anatomical regions, and of other illness.

The questions about current occupation covered working hours, whether an average working day involved various specified physical activities, time pressures at work and job control, support, satisfaction and security. Exposure to physical loading at work was scored according to how many of five activities (lifting weights of 25 kg or more by hand, working for longer than 1 h in total with the hands above shoulder height, repeated bending and straightening of the elbow for longer than 1 h in total, use of a computer keyboard or other repeated movements of the wrist or fingers for longer than 4 h in total, and kneeling or squatting for longer than 1 h in total) were reported in an average working day. Time pressure at work was considered to be present if a participant reported either a target number of articles or tasks to be finished in the working day, or working under pressure to complete tasks by a fixed time; lack of support at work if help with difficulties was seldom or never provided by colleagues or a supervisor/manager; job dissatisfaction if overall, the participant felt dissatisfied or very dissatisfied with their employment; lack of control if there was seldom or never any choice in all of: a) how work was done, b) what was done at work, and c) work timetable and breaks; and job insecurity if the participant felt that the tenure of their employment would be ‘rather unsafe’ or ‘very unsafe’ if they were off work for 3 months with significant illness.

Questions regarding fear-avoidance beliefs were adapted from the Fear Avoidance Beliefs Questionnaire. Participants were deemed to have adverse beliefs about:

- The work-relatedness of musculoskeletal pain, if they completely agreed that either low back pain or arm pain (including pain in the shoulder or hands) is commonly caused by people’s work.
- Physical activity, if either for someone with low back pain, or for someone with arm pain, they completely agreed both that physical activity should be avoided as it might cause harm, and that rest was needed to get better.
- Prognosis, if either for someone with low back pain or for someone with arm pain, they completely agreed that neglecting such problems can cause permanent health problems, and completely disagreed that such problems usually get better within 3 months.

Questions about distress from somatic symptoms were taken from the Brief Symptom Inventory, and somatising tendency was graded according to the number of symptoms from a total of five (faintness or dizziness, pains in the heart or chest, nausea or upset stomach, trouble getting breath, and hot or cold spells) that had been at least moderately distressing in the past week. Questions on mental health were taken from the Short Form-36 (SF-36) questionnaire, and scores were grouped to approximate thirds of the distribution in the combined study sample (denoted good, intermediate or poor mental health).

Data from the questionnaires were entered into a computer by local investigators, and after checks for errors, were transmitted to the coordinating centre in Southampton for collation and analysis.

In addition to the data on individual study participants, local investigators provided standardised information about the employment and socioeconomic circumstances of the occupational groups which they had recruited. This included the local unemployment rate at the time of the survey, entitlement to sick pay in the first 3 months of absence, availability of social security support for the unemployed, financial support for ill health retirement, whether a fee was payable for primary medical care and entitlement to compensation for work-related musculoskeletal disorders.

Further details of the methods of data collection and characteristics of occupational groups have been published elsewhere.

Analysis was carried out with Stata V12.1 software, and as specified in the original protocol, was restricted to subjects aged 20–59 years who had worked in their job for at least 12 months. The main outcome analysed was prolonged sickness absence during the past 12 months because of musculoskeletal pain. This was defined to have occurred where, for at least one of the six anatomical regions listed in the questionnaire, the participant reported absence for >5 days in total during the past 12 months because of pain. We first assessed the extent to which this outcome varied by occupational group as compared with prolonged absence (>5 days in total) for other illness.

Next, we explored associations of prolonged musculoskeletal sickness absence with personal characteristics that might contribute to differences in prevalence between occupational groups. For this, we used GLLAMM (generalised linear latent and mixed models) to fit two-level random-effects Poisson regression models with robust SEs, in which individuals were clustered by occupational group. Associations were summarised by prevalence rate ratios (PRRs) with associated 95% CIs. From a final regression model including all the personal characteristics examined, we calculated the expected numbers of workers with prolonged musculoskeletal absence in each occupational group. Each individual’s relative risk of prolonged absence was derived from the modelled risk estimates for the combination of risk factors to which he/she was exposed. The individual’s probability of being a case was then calculated as the product of his/her relative risk, and a constant which was set such that the total number of expected cases for all the study subjects equalled the total number of cases observed. Finally, probabilities were summed across all individuals in an occupational group to give its expected number of cases.

The natural logarithms of these expected numbers were then used as an offset in Poisson regression analyses (with robust estimates of variance), taking the 47 occupational groups as the units of analysis, to explore the associations of prolonged musculoskeletal absence with risk factors acting at occupational group level. As well as the information on employment and socioeconomic circumstances that was provided by the local investigators, we analysed group-level risk factors that were defined by the prevalence of specified individual characteristics within each group. These prevalence rates were treated as continuous variables, and risks were estimated for 1 SD increase in each.

Next, we explored the extent to which personal and group-level risk factors might explain differences in the prevalence of prolonged musculoskeletal absence between occupational groups. For each group, we calculated the ratios of the observed prevalence of absence to that which would have been expected with no allowance for risk factors, with allowance for personal risk factors and with allowance for both personal and group-level risk factors. We then summarised the dispersions of these ratios across the 47 occupational groups by dot plots and geometric SDs (for this purpose the ratio in one occupational group with no observed cases was taken as 0.1).

Finally, to check for possible bias, we repeated analyses, excluding the five occupational groups in which the participation rate was <50% (identified in table 1).
RESULTS
Response rates among those invited to take part in the study were higher than 80% in 33 of the 47 occupational groups studied, and lower than 50% in only five groups (table 1). After elimination of subjects who did not meet the inclusion criteria that had been specified in the protocol (age 20–59 years, worked in current job for at least 12 months), and a further 317 for whom critical information was missing (eg, on sex or age), the CUPID study sample comprised a total of 12,426 participants. Further details of exclusions and the characteristics of the study sample have been reported elsewhere. For the purposes of this report, we excluded an additional 10 participants with missing information on sickness absence for musculoskeletal pain. Thus, analysis was based on 12,416 subjects (4,348 men and 8,068 women).

Figure 1 shows the 12-month prevalence of prolonged sickness absence for musculoskeletal pain and for other illness by occupational group. There was substantial variation, even between occupational groups within the same category. Thus, among office workers, the rate of prolonged absence for musculoskeletal pain ranged from 0% (95% CI 0% to 2%) in Pakistan to 13% (95% CI 9% to 18%) in South Africa, and in nurses, from 1% (95% CI 1% to 3%) in Japan to 29% (95% CI 23% to 36%) in Costa Rica. Among the other workers, the lowest prevalence of prolonged absence for musculoskeletal pain was in sales/marketing personnel in Japan (0.8%, 95% CI 0.2% to 2%), and the highest in production workers at a factory making pushchairs in Italy (34%, 95% CI 26% to 42%). Rates of prolonged absence for musculoskeletal pain tended to correlate with those for other illness (Spearman correlation coefficient=0.55), but nurses reported relatively more absence because of musculoskeletal pain than office workers.

Table 2 summarises the relationship of prolonged sickness absence for musculoskeletal pain to personal characteristics. Findings are presented from three Poisson regression models. In Model 1, which included all the risk factors other than non-musculoskeletal absence and number of painful anatomical sites, there were strong associations with exposure to physical loading, older age, somatising tendency and poor mental health. Additionally, risk was elevated in workers, with adverse beliefs about the work-relatedness of musculoskeletal pain, and tendency to be higher in those with lower levels of education. Among the psychosocial aspects of work that were examined, the strongest associations were with time pressure at work and job dissatisfaction.

Addition of prolonged absence for non-musculoskeletal illness (Model 2) had minimal impact on the risk estimates for other variables, although such absence was itself an important risk factor (PRR 1.54, 95% CI 1.22 to 1.95). When number of pain anatomical sites was also included (Model 3), many of the risk estimates were reduced. However, significant associations remained with older age, somatising tendency, poor mental health, time pressure at work, adverse beliefs about the prognosis of musculoskeletal disorders and prolonged absence in the past 12 months for non-musculoskeletal illness.

Table 3 shows associations with risk factors acting at the level of the occupational group, after allowance for all the personal characteristics that were examined in table 2. When the group-level risk factors were analysed independently (Model 4), significant associations were found with lower group prevalence of adverse beliefs about musculoskeletal pain and physical activity, and higher group prevalence of reported time-pressure at work, lack of job control, and prolonged sickness absence for non-musculoskeletal reasons. When effects were mutually adjusted in a single model that excluded only prevalence of non-musculoskeletal absence (Model 5), additional associations emerged with higher group prevalence of adverse beliefs about the work-relatedness of musculoskeletal pain, and lower group prevalence of perceived job insecurity.

With adjustment also for group prevalence of prolonged absence for non-musculoskeletal reasons (Model 6), the associations with group prevalence of low job control and of job insecurity lost their significance. However, significant associations remained with group prevalence of adverse beliefs about the work-relatedness of musculoskeletal pain (PRR for 1 SD increase in prevalence 1.22, 95% CI 1.01 to 1.47), adverse beliefs about musculoskeletal pain and physical activity (PRR 0.68, 95% CI 0.53 to 0.85), time pressure at work (PRR 1.43, 95% CI 1.24 to 1.65) and absence in the past 12 months for non-musculoskeletal reasons (PRR 1.34, 95% CI 1.16 to 1.56). Neither Model 5 nor Model 6 suggested any importantly higher risk when full sick pay was provided during the first 3 months of absence, or when compensation was available for work-related musculoskeletal disorders.

Figure 2 shows the ratios of observed to expected 12-month prevalence of prolonged absence because of musculoskeletal disorders and prolonged absence for non-musculoskeletal illness. Among the 47 occupational groups that we studied, there were more than 30-fold differences in the prevalence of prolonged
sickness absence attributed to musculoskeletal pain, and even for office workers carrying out similar occupational tasks, the variation was more than tenfold. Risk factors for such absence included older age, lower educational level, tendency to somatise, physical demands of work and prolonged sickness absence for non-musculoskeletal illness. Together, however, these

Table 2  Associations of personal characteristics with prolonged sickness absence (> 5 days in total) in past 12 months because of musculoskeletal pain

| Risk factor                                      | Number in sample | Cases† | Model 1 † | Model 2 † | Model 3 † |
|--------------------------------------------------|------------------|--------|-----------|-----------|-----------|
|                                                  | N (%)            | PRR (95% CI) | PRR (95% CI) | PRR (95% CI) |
| Sex                                              |                  |         |           |           |           |
| Male                                             | 4348             | 235 (5.4) | 1         | 1         | 1         |
| Female                                           | 8068             | 705 (8.7) | 1.17 (1.00 to 1.37) | 1.18 (1.01 to 1.38) | 1.02 (0.88 to 1.19) |
| Age (years)                                      |                  |         |           |           |           |
| 20–29                                            | 3058             | 139 (4.5) | 1         | 1         | 1         |
| 30–39                                            | 3971             | 283 (7.1) | 1.51 (1.18 to 1.94) | 1.50 (1.16 to 1.93) | 1.35 (1.06 to 1.73) |
| 40–49                                            | 3451             | 308 (8.9) | 1.74 (1.35 to 2.23) | 1.72 (1.33 to 2.23) | 1.38 (1.08 to 1.77) |
| 50–59                                            | 1936             | 210 (10.8) | 2.13 (1.72 to 2.63) | 2.08 (1.67 to 2.60) | 1.60 (1.29 to 1.98) |
| Age finished full-time education (years)          |                  |         |           |           |           |
| ≥20                                              | 7244             | 486 (6.7) | 1         | 1         | 1         |
| 17–19                                            | 3374             | 263 (7.8) | 1.18 (0.98 to 1.42) | 1.17 (0.97 to 1.41) | 1.15 (0.96 to 1.38) |
| 14–16                                            | 1269             | 130 (10.2) | 1.29 (0.99 to 1.68) | 1.27 (0.97 to 1.65) | 1.28 (1.00 to 1.65) |
| <14                                              | 470              | 57 (12.1) | 1.35 (0.90 to 2.02) | 1.33 (0.90 to 1.97) | 1.21 (0.82 to 1.78) |
| Unknown                                          | 59               | 4 (6.8) | 0.79 (0.28 to 2.19) | 0.80 (0.30 to 2.16) | 0.97 (0.36 to 2.56) |
| Number of distressing somatic symptoms in past week |                  |         |           |           |           |
| 0                                                | 7399             | 392 (5.3) | 1         | 1         | 1         |
| 1                                                | 2609             | 212 (8.1) | 1.23 (1.05 to 1.45) | 1.22 (1.04 to 1.43) | 1.09 (0.93 to 1.27) |
| 2+                                               | 2286             | 318 (13.9) | 1.69 (1.46 to 1.97) | 1.62 (1.39 to 1.89) | 1.24 (1.08 to 1.44) |
| Missing                                          | 122              | 18 (14.8) | 1.30 (0.86 to 1.97) | 1.29 (0.85 to 1.94) | 1.17 (0.76 to 1.81) |
| Mental health                                    |                  |         |           |           |           |
| Good                                             | 4700             | 295 (6.3) | 1         | 1         | 1         |
| Intermediate                                     | 3756             | 269 (7.2) | 1.14 (0.98 to 1.32) | 1.13 (0.98 to 1.31) | 1.06 (0.92 to 1.22) |
| Poor                                             | 3885             | 366 (9.4) | 1.39 (1.21 to 1.60) | 1.36 (1.19 to 1.57) | 1.19 (1.04 to 1.35) |
| Missing                                          | 75               | 10 (13.3) | 1.75 (0.83 to 3.68) | 1.85 (0.89 to 3.82) | 1.63 (0.76 to 3.52) |
| Number of physically loading activities           |                  |         |           |           |           |
| 0                                                | 874              | 35 (4.0) | 1         | 1         | 1         |
| 1                                                | 2198             | 212 (8.1) | 1.23 (1.05 to 1.45) | 1.22 (1.04 to 1.43) | 1.09 (0.93 to 1.27) |
| 2+                                               | 2286             | 318 (13.9) | 1.69 (1.46 to 1.97) | 1.62 (1.39 to 1.89) | 1.24 (1.08 to 1.44) |
| Missing                                          | 122              | 18 (14.8) | 1.30 (0.86 to 1.97) | 1.29 (0.85 to 1.94) | 1.17 (0.76 to 1.81) |
| Psychosocial aspects of work                     |                  |         |           |           |           |
| Work >50 hours per week                          | 2664             | 106 (4.0) | 1.11 (0.77 to 1.58) | 1.11 (0.78 to 1.58) | 0.99 (0.70 to 1.40) |
| Time pressure at work                            | 9341             | 785 (8.4) | 1.27 (1.06 to 1.52) | 1.27 (1.06 to 1.52) | 1.23 (1.03 to 1.46) |
| Lack of support at work                          | 3013             | 296 (9.8) | 1.08 (0.91 to 1.25) | 1.09 (0.94 to 1.25) | 1.03 (0.89 to 1.18) |
| Job dissatisfaction                              | 2535             | 223 (8.8) | 1.22 (1.05 to 1.42) | 1.22 (1.04 to 1.41) | 1.10 (0.95 to 1.27) |
| Job insecurity                                   | 2663             | 250 (9.4) | 1.06 (0.95 to 1.18) | 1.05 (0.94 to 1.17) | 1.04 (0.94 to 1.16) |
| Job insecurity                                   | 3912             | 277 (7.1) | 0.90 (0.79 to 1.03) | 0.91 (0.79 to 1.04) | 0.89 (0.78 to 1.02) |
| Adverse beliefs about musculoskeletal pain       |                  |         |           |           |           |
| Work-relatedness                                 | 4870             | 470 (9.7) | 1.24 (1.10 to 1.39) | 1.23 (1.09 to 1.38) | 1.10 (0.98 to 1.24) |
| Physical activity                                | 2576             | 219 (8.5) | 1.14 (0.97 to 1.33) | 1.13 (0.97 to 1.33) | 1.18 (1.02 to 1.37) |
| Prognosis                                        | 2079             | 240 (11.5) | 1.40 (1.19 to 1.65) | 1.38 (1.17 to 1.62) | 1.23 (1.06 to 1.44) |
| >5 days absence in past 12 months for other illness | 1226             | 194 (15.8) | 1.54 (1.22 to 1.95) | 1.43 (1.16 to 1.77) |           |
| Number of anatomical sites painful for ≥7 days in past 12 months | 7765 | 274 (3.5) | 1 | 1 | |
| 2                                                | 1530             | 138 (9.0) | 2.16 (1.78 to 2.62) |           |  |
| 3                                                | 1468             | 170 (11.6) | 2.67 (2.21 to 3.22) |           |  |
| 4                                                | 975              | 159 (16.3) | 3.40 (2.86 to 4.03) |           |  |
| 5                                                | 462              | 129 (27.9) | 4.55 (3.78 to 5.48) |           |  |
| 6                                                | 216              | 70 (32.4) | 4.98 (3.85 to 6.44) |           |  |

*Number (%) of cases among those exposed to risk factor.
†Risk estimates derived from a single Poisson regression model incorporating all variables for which results are presented.
PRR, prevalence rate ratio.
Table 3  Associations of group-level risk factors with prolonged sickness absence (>5 days in total) in past 12 months because of musculoskeletal disorders

| Risk factor                                                                 | Number of occupational groups exposed | Mean (SD) | Model 4* (95% CI) | Model 5† (95% CI) | Model 6‡ (95% CI) |
|-----------------------------------------------------------------------------|---------------------------------------|-----------|-------------------|-------------------|-------------------|
| Unemployment rate ≥10%                                                      | 12                                    | 1.05 (0.74 to 1.48) | 0.98 (0.61 to 1.57) | 1.04 (0.70 to 1.54) |
| Full sick pay in first three months absence                                 | 25                                    | 1.11 (0.80 to 1.54) | 1.07 (0.72 to 1.59) | 1.06 (0.74 to 1.52) |
| Social security for long-term unemployment                                  | 28                                    | 1.28 (0.94 to 1.75) | 0.80 (0.47 to 1.37) | 0.87 (0.48 to 1.58) |
| Financial support for ill-health retirement (sometimes or usually)          | 28                                    | 1.31 (0.90 to 1.89) | 1.33 (0.87 to 2.01) | 0.98 (0.65 to 1.46) |
| Payment for primary care (part or full)                                     | 19                                    | 0.91 (0.66 to 1.26) | 1.02 (0.65 to 1.61) | 1.09 (0.69 to 1.71) |
| Compensation for work-related musculoskeletal disorders (any)              | 38                                    | 1.27 (0.92 to 1.75) | 1.11 (0.73 to 1.70) | 1.08 (0.77 to 1.51) |
| Group prevalence (%) of adverse beliefs about work-relatedness of musculoskeletal pain | 47                                    | 0.93 (0.82 to 1.06) | 1.24 (1.04 to 1.48) | 1.22 (1.01 to 1.47) |
| Group prevalence (%) of adverse beliefs about musculoskeletal pain and physical activity | 47                                    | 0.84 (0.71 to 0.99) | 0.62 (0.48 to 0.81) | 0.68 (0.53 to 0.85) |
| Group prevalence (%) of adverse beliefs about prognosis of musculoskeletal pain | 47                                    | 1.02 (0.88 to 1.18) | 1.02 (0.85 to 1.22) | 1.03 (0.86 to 1.23) |
| Group prevalence (%) of time pressure at work§                               | 47                                    | 1.33 (1.14 to 1.56) | 1.54 (1.30 to 1.82) | 1.43 (1.24 to 1.65) |
| Group prevalence (%) of lack of support at work§                            | 47                                    | 1.03 (0.93 to 1.15) | 1.04 (0.92 to 1.17) | 1.06 (0.93 to 1.22) |
| Group prevalence (%) of job dissatisfaction§                               | 47                                    | 0.95 (0.76 to 1.20) | 1.10 (0.91 to 1.33) | 1.05 (0.84 to 1.32) |
| Group prevalence (%) of lack of job control§                              | 47                                    | 1.20 (1.03 to 1.40) | 1.28 (1.12 to 1.47) | 1.08 (0.90 to 1.28) |
| Group prevalence (%) of job insecurity§                                    | 47                                    | 0.91 (0.74 to 1.11) | 0.79 (0.67 to 0.93) | 0.94 (0.78 to 1.13) |
| Group prevalence (%) of >5 days absence in past 12 months for other illness§ | 47                                    | 1.45 (1.28 to 1.64) |                    | 1.34 (1.16 to 1.56) |

Analysis was based on 47 occupational groups.
*Each risk factor analysed independently in a separate Poisson regression model.
†Mutually adjusted risk estimates derived from a single Poisson regression model incorporating all the risk factors for which results are presented.
‡ Mean and SD of prevalence (%) across the 47 occupational groups.
§Analysed as a continuous variable. Risk estimates are for an increase of one SD.
PRR, prevalence rate ratio.
personal characteristics explained little of the disparity between occupational groups. After adjustment for personal characteristics, features of occupational groups that carried a higher risk of prolonged musculoskeletal absence included a higher prevalence of time pressure at work, and of prolonged sickness absence for non-musculoskeletal illness. However, the provision of sick pay and availability of compensation for work-related musculoskeletal disorders had no discernible impact.

Our investigation had the advantage of standardised data collection on large numbers of workers from multiple occupational groups in culturally diverse settings. Moreover, unlike previous studies, it was able to assess simultaneously risk factors operating both at the level of the individual and of the occupational group.

It is possible that some workers with serious health problems were excluded from the study because they had left employment, or were unavailable when data were collected. This may have caused rates of prolonged sickness absence to be somewhat underestimated, but it is highly unlikely that it could account for differences between occupational groups of the magnitude that were observed.

We took as our outcome >5 days sickness absence because of pain in at least one of six anatomical sites, but did not separately analyse absence ascribed to pain at specific sites. This was because while the physical activities that may precipitate, aggravate, or be made difficult by musculoskeletal pain, differ by anatomical site, psychosocial risk factors for pain at different sites are remarkably similar. Positive associations were observed with adverse beliefs about the work-relatedness and prognosis of musculoskeletal pain, and it is plausible that individuals who believe that musculoskeletal disorders are caused by work or carry a poor outlook, would be more likely to take absence when musculoskeletal symptoms occur. Similarly, adverse beliefs about harm from physical activity might deter some people from attending work, especially if their job was physically demanding.

Prolonged musculoskeletal absence was also associated with somatising tendency and poor mental health. Both these characteristics are known to be associated with, and to predict, musculoskeletal symptoms, and the substantial reductions in their risk estimates after adjustment for report of pain (Model 3, table 2) suggests that their relation to absence is explained largely by their associations with pain.

Even after allowance for other personal characteristics, prolonged musculoskeletal absence was strongly associated with individual history of prolonged absence for non-musculoskeletal reasons. This is likely to reflect, at least in part, a greater propensity of some individuals to take sickness absence, which goes beyond their demographic and occupational characteristics. Such individual differences in tendency to take sickness absence have been documented in earlier studies, and have been linked with various influences including upbringing and family situation.

When exploring determinants of musculoskeletal absence at the level of occupational groups, we considered not only the employment conditions and socioeconomic circumstances of workforces, but also a number of variables defined according to
the prevalence of exposures reported by individual workers in each occupational group. These exposures had already been examined as risk factors at individual level, but it was possible that the perceptions of individual workers and their reporting of the exposures was influenced by whether or not they had suffered from musculoskeletal pain sufficient to cause prolonged sickness absence, and this could have led to bias. A group-level measure, which took account of reports from workers both with and without pain would be less prone to such bias. Furthermore, it was possible that these risk factors contributed to differences between occupational groups in a way that exceeded their influence on which workers within an occupational group took sickness absence. For example, inclination to take sickness absence might be influenced by a culture of absence within an occupational population, as well as being related to an individual’s personal history of absence for non-musculoskeletal illness.

Among the group-level risk factors, two showed associations in Model 5 which disappeared when prevalence of prolonged non-musculoskeletal absence was added to form Model 6, suggesting that they had an effect on sickness absence in general, and not specifically from musculoskeletal disorders. These were a higher prevalence of low job control and a lower prevalence of job insecurity. Both these findings are highly plausible. Low job control may reduce workers’ scope to modify their activities in response to health problems, as well as making their job less rewarding, and has been linked with sickness absence in previous studies. More specifically, if there is a culture of absence, this might be reduced by eliminating excessive time pressures in work, maximising employees' flexibility of activities for workers who have symptoms which make their normal job unusually difficult. Also, where there is a culture of absence, this might be reduced by maximising the responsibility that is given to employees, and the control which they have over their work. The impact of such measures could usefully be investigated by intervention studies.

What this paper adds

- Earlier studies have suggested substantial international variation in rates of sickness absence, but their design has not allowed detailed exploration of the reasons for the observed differences.
- In our large international survey, personal risk factors for prolonged musculoskeletal absence included older age, lower educational level, tendency to somatise, physical loading at work and prolonged absence for non-musculoskeletal illness, but these explained little of the >30-fold variation in prevalence between occupational groups.
- After adjustment for individual characteristics, prolonged musculoskeletal absence was more frequent in groups with greater time pressure at work, lower job control and more adverse beliefs about the work-relatedness of musculoskeletal disorders.
- Our findings suggest that musculoskeletal sickness absence might be reduced by eliminating excessive time pressures in work, maximising employees’ responsibility and control, and providing flexibility of duties for those with disabling symptoms, and the impact of such measures could usefully be investigated by intervention studies.

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