Table 4 Multiple logistic regression analysis of the association between severe neck and shoulder discomfort (Katakori) and independent variables ($n = 2{,}022$)

	Adjusted Odds Ratio[a]	95 % CI		*P* Value
Male	1.00			
Female	5.74	4.07	8.09	<0.001
Age (years)				
<30	1.00			
30–39	1.25	0.92	1.69	0.15
40–49	1.14	0.81	1.63	0.45
≥50	0.69	0.43	1.09	0.11
Current smoker versus nonsmoker, ex-smoker	0.75	0.56	1.01	0.06
Overweight (BMI ≥ 25) versus normal weight	1.33	0.93	1.91	0.12
Regular exercise − versus +	1.51	1.07	2.14	0.02
VDT ≥ 4 h/day + versus −	1.08	0.81	1.43	0.60
Work with hands above shoulder ≥ 1 h/day + versus −	1.17	0.84	1.62	0.35
Driving ≥ 4 h/day + versus −	0.95	0.68	1.33	0.75
Depression (SF36 ≤ 52) + versus −	1.43	1.11	1.84	0.01
Arthritis/spinal disease + versus −	1.45	0.77	2.74	0.25
Malocclusion + versus −	1.01	0.74	1.38	0.94
High work demand (work ≥ 60 h/week)	1.30	0.96	1.76	0.08
Low job control	1.13	0.84	1.52	0.43
Low worksite support	2.62	1.79	3.83	<0.001

VDT visual display terminal

[a] Adjusted for all variables

such as posture, frequency of breaks, or fatigue may also be associated with Katakori. Notably, malocclusion was self-reported; objective assessment might have been more useful for examining its association with Katakori. A prospective study reported that physical inactivity was associated with an increased risk of chronic neck–shoulder pain [31]. Our result is consistent with that study. Increased pro-inflammatory cytokine levels in chronic pain patients and a long-term anti-inflammatory effect of physical activity have been reported [32, 33]. Moreover, exercise reduces pain in patients with fibromyalgia [34]. The effect of physical activity on the occurrence of Katakori should be examined further in future studies. The association between depression and severe Katakori is understandable if severe Katakori is a symptom of somatization, which is associated with depression [13]. Notably, Katakori was more frequently observed in women. This finding is similar to those published previously [5, 9]. We speculate this trend may be attributable to gender differences in muscle strength. Estrogen may also be involved in the pathogenesis of Katakori, although there is no scientific evidence for this assertion. Further studies will be required to explain the reason for the gender differences in the manifestation of Katakori.

This is the first study to examine the association of Katakori with somatization and work-related factors in a relatively large cohort. However, this study has some limitations. Due to its cross-sectional design, causal associations cannot be inferred. Information bias is possible as well, because the data were self-reported. Co-morbid conditions such as cervical spine diseases and/or glenohumeral joint diseases that might cause Katakori were not examined using objective measures such as radiological examinations. In the original job demand–control model, “job demand” referred to psychological job demand [20]. However, the present study used working hours as an index of job demand because the questionnaire did not contain appropriate items with which to assess the psychological demands of a given workplace. Only four occupations were analyzed in the present study, which may have limited the generalizability of our findings. In multiple regression analysis, occupation was not controlled. Instead, specific physical activities such as VDT work, working with the hands above shoulder height, and driving were controlled. The results of the present study may be applied to other occupations by controlling for physical activities rather than occupations.

In conclusion, severe Katakori may be a form of somatization. A significant association was found between Katakori and a lack of worksite support from colleagues or supervisors. Increasing social support at work may decrease the occurrence of this condition and improve workers’ well-being, but more research is needed.

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Conflict of interest None.

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CERVICAL SPINE

Prevalence of Cervical Cord Compression and Its Association With Physical Performance in a Population-Based Cohort in Japan

The Wakayama Spine Study

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Study Design. A population-based magnetic resonance imaging (MRI) study of the cervical spine.

Objective. This study was undertaken in order to investigate the prevalence of cervical cord compression (CCC) and to examine the association between CCC and physical performance measures in a population-based cohort established in Japan.

Summary of Background Data. Population-based cohort studies of the prevalence of CCC, although essential for clarification of the prevalence of slowly progressive disease and specification of the time of incidence of CCC, are not available.

Methods. This cross-sectional study was performed as a part of the Research on Osteoarthritis/osteoporosis Against Disability study, a large-scale population-based cohort study in Japan. From 1011 inhabitants who underwent MRI examinations, images of the cervical spine of 977 subjects (324 men and 653 women, mean age of 66.4 yr) were evaluated. CCC was assessed by sagittal T2-weighted MRI and was defined as spinal cord compression. The prevalence of CCC and its association with myelopathic signs (hyper-reflexia of the patellar tendon and Hoffmann and Babinski reflexes) were examined. In addition, physical performance measures (grip and release test, grip strength, 6-m walking time, step length, chair-stand time, and one-leg standing time) were tested.

Results. The prevalence of CCC was 24.4% and was significantly higher in men (29.3% in men and 21.9% in women, $P = 0.011$). The prevalence of CCC was higher with increasing age in both sexes. CCC was not significantly associated with any myelopathic signs but was significantly associated with grip and release test, 6-m walking time, step length, and chair-stand time.

Conclusion. In this MRI study, the prevalence of CCC was examined. The present results indicate that CCC correlates with physical performance measures from an early stage of the disease before myelopathic signs appear.

Key words: cervical cord compression, population-based study, MRI, physical performance. **Spine 2012;37:1892–1898**

Cervical cord compression (CCC) is a regressive and degenerative disorder. Symptoms of spinal cord compression are regarded as cervical myelopathy (CM).[1] CM sometimes can become irreversible and lead to a decrease in the performance of activities of daily living.[2–4]

Considering the regressive nature of CM, and the contemporary unprecedented rapid increase in the number of elderly people in the general population, an urgent need for the development of strategies for prevention of CM has emerged in most developed countries. Nonetheless, the prevalence of CCC, which is basic information needed for the prevention of CM, has not been well characterized. The prevalence of CCC cannot be estimated with hospital surveys, because most patients who visit hospitals have already developed a myelopathic condition. Therefore, a population-based study is essential for clarification of the prevalence of CCC. Magnetic resonance imaging (MRI) is an essential tool for diagnosis of CCC,[5,6] but no previous population-based studies of CCC using MRI have been performed. Previous studies concerning prevalence of CCC were performed with asymptomatic subjects and were not population-based studies.[7–9]

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TABLE 1. Characteristics of Men and Women Participating in This Study

	Men	Women
N	324	653
Age (yr)	67.2 ± 13.9	66.0 ± 13.4
Height (cm)	164.6 ± 7.2*	151.5 ± 7.2
Weight (kg)	64.5 ± 11.6*	53.0 ± 9.4
Body mass index (kg/m²)	23.7 ± 3.4†	23.1 ± 3.6
Physical performance measures		
Grip strength (kg)	38.0 ± 9.1*	23.9 ± 5.8
Grip and release test, number of times	24.9 ± 5.8*	22.5 ± 5.3
6-m walking time at a usual pace (s)	5.4 ± 1.5	5.8 ± 2.4
Step length at a usual pace (cm)	58.6 ± 9.2*	54.6 ± 10.1
6-m walking time at a maximal pace (s)	3.6 ± 1.1*	4.0 ± 1.6
Step length at a maximal pace (cm)	70.7 ± 10.7*	61.1 ± 11.2
Chair-stand time (s)	8.8 ± 3.4	9.0 ± 4.2
One-leg standing time (s)	35.9 ± 24.1	35.9 ± 23.6

*Significantly different from women by Student t test (*P < 0.001, †P < 0.01).*
Values are mean ± SD.

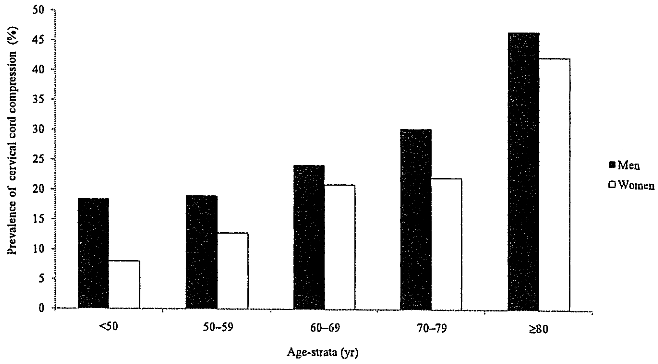

Figure 1. Prevalence of Cervical Cord Compression (≥grade 2) in sexes by age strata.

Decreases in physical performance are symptoms of CM[10,11] and can lead to a lower quality of life, especially in elderly patients.[12,13] Although CCC is commonly seen in asymptomatic subjects, it has not been clarified whether decreases in physical performance are seen in the early stages of CCC before the signs of myelopathy appear.

In this population-based study, CCC was evaluated using MRI, and the association of CCC with physical performance was examined.

MATERIALS AND METHODS

Participants

This study, was performed in a subcohort of the large-scale population-based cohort study entitled the Research on Osteoarthritis/osteoporosis Against Disability (ROAD). ROAD is a nationwide, prospective study of bone and joint diseases in population-based cohorts established in several communities in Japan. As a detailed profile of the ROAD study has already been described elsewhere,[14,15] only a brief summary is provided here. To date, a database has been created which includes baseline clinical and genetic information for 3040 inhabitants (1061 men and 1979 women) with an age range of 23 to 95 years (mean, 70.6 yr), recruited from listings of resident registrations in 3 communities: an urban region in Itabashi, Tokyo; a mountainous region in Hidakagawa, Wakayama; and a coastal region in Taiji, Wakayama. Participants completed an interviewer-administered questionnaire of 400 items that included lifestyle information, and anthropometric and physical performance measurements were taken. All study participants provided informed consent, and the study design was approved by the appropriate ethics review boards.

The second visit of the ROAD study to Hidakagawa and Taiji was performed between 2008 and 2010. From inhabitants participating in the second visit of the ROAD study, 1063 inhabitants were recruited for MRI examinations. Among those 1063 inhabitants, 52 declined the examination; therefore, 1011 inhabitants were registered in this study. Among those 1011 participants, those who had MRI-sensitive implanted devices (such as a pacemaker) and other disqualifiers were excluded. The cervical spine was scanned with MRI in 985 participants. Furthermore, 4 participants who had undergone a previous cervical operation were excluded from the analysis, and another 4 participants whose MRI interpretation was difficult because of poor image quality were also excluded. In total, MRI results were available for 977 participants (324 men and 653 women), with an age range of 21 to 97 years (mean, 67.2 yr for men and 66.0 yr for women). Anthropometric measurements included height (m), weight (kg), and body mass index (BMI) (weight [kg]/height² [m²]).

EVALUATION OF MYELOPATHIC SIGNS AND PHYSICAL PERFORMANCE

Medical information concerning neck pain, sensory disturbances, the Hoffmann reflex, the Babinski reflex, and the deep tendon reflex of the patellar tendon were gathered by an experienced orthopedic surgeon. The Hoffmann reflex was elicited with the hand in a neutral position by flicking the distal phalanx of the middle finger and observing flexion of the distal phalanx of the thumb.[16,17] The Babinski reflex was elicited by firmly sweeping from the lateral part of the sole to the base of the toes with a pointed end of a reflex hammer and observing the hallux extensor response.[18,19] Hyper-reflexia of

TABLE 2. Prevalence of Cervical Cord Compression (≥Grade 2) at Each Intervertebral Disc Level by Sex and Age

Age Strata	C2–C3	C3–C4	C4–C5	C5–C6	C6–C7	C7–Th1
Men						
Overall (N = 324)	0	5.3	12.7	18.5	11.4	0.9
<50 yr (N = 38)	0	5.3	2.6	13.2	2.6	0
50–59 yr (N = 58)	0	3.5	10.3	15.5	3.5	0
60–69 yr (N = 66)	0	1.5	9.1	15.2	15.2	1.5
70–79 yr (N = 89)	0	2.3	12.4	18.0	13.5	1.1
≥80 yr (N = 73)	0	13.7	23.3	27.4	16.4	1.4
Women						
Overall (N = 653)	0	3.5	8.1	14.9	6.0	0.2
<50 yr (N = 88)	0	0	1.1	8.0	2.3	0
50–59 yr (N = 117)	0	0	4.3	8.6	5.1	0
60–69 yr (N = 158)	0	0.6	7.0	13.9	7.6	0
70–79 yr (N = 172)	0	3.5	8.7	15.7	5.2	0.6
≥80 yr (N = 118)	0	13.6	17.8	26.3	8.5	0

Values are percentages for each intervertebral disc level.

the patellar tendon, a positive Hoffmann reflex, and a positive Babinski reflex were defined as aggravation on both sides. A myelopathic sign was defined as the presence of hyper-reflexia of the patellar tendon, the Hoffmann reflex, or the Babinski reflex.

For evaluation of physical performance, the following tests were conducted: a 10-s grip and release test (GRT), grip strength, 6-m walking time, step length, chair-stand time (CST), and one-leg standing (OLS) time. Grip strength was measured for each hand using a Toei Light handgrip dynamometer (Toei Light Co., Ltd., Saitama, Japan). To measure walking speed, the time taken to walk 6 m at a usual pace in a hallway was recorded. Similarly, the 6-m walking time at a maximal pace was measured. The time taken for 5 consecutive chair rises without the use of hands was also recorded. OLS time with each leg was measured using a stopwatch (upper limit, 60 s) and the time adopted was the mean of the times for both legs.[20–25] The participants were given a full explanation of each test but were not given any training.

Magnetic Resonance Imaging

MRI was performed on the cervical spine of each participant using a 1.5-T Excelart imaging system (Toshiba, Tokyo, Japan). All participants lay supine during the MRI, with exceptions for those participants with a rounded back, who used a triangular pillow under their heads and knees. The imaging protocol included a sagittal T2-weighted fast spin-echo pulse sequence (repetition time: 4000 ms, echo time: 120 ms, and field of view: 300 × 320 mm) and an axial T2-weighted fast spin-echo pulse sequence (repetition time: 4000 ms, echo time: 120 ms, and field of view: 180 × 180 mm).

MRI Assessment

Sagittal T2-weighted images were assessed from C2–C3 to C7–Th1. Grading of CCC was performed at each intervertebral level from C2–C3 to C7–Th1 by an orthopedic surgeon (K.N.) with experience of interpreting spinal MRI. Grading was defined as follows: grade 0 = no compression of the spinal cord but subarachnoid space remains; grade 1 = no compression of the spinal cord with subarachnoid space absent; grade 2 = compression of less than one-third of the spinal cord; grade 3 = compression of more than one-third but less than two-thirds of the spinal cord; and grade 4 = compression of more than two-thirds of the spinal cord. CCC was defined as grade 2 or more severe at the most severely affected intervertebral disc level.

To evaluate intraobserver variability, 100 randomly selected MRIs of the cervical spine were rescored by the same observer (K.N.) more than 1 month after the first reading. Furthermore, in order to evaluate interobserver variabilities, another 100 MRIs were examined and scored by a different orthopedic surgeon (H.H.) with experience interpreting spinal MRI. The intraobserver and interobserver variabilities for CCC evaluated by κ analysis were 0.78 and 0.72, respectively, and were deemed sufficient for assessment.

Statistical Analysis

Comparisons of baseline characteristics between sexes were made using the nonpaired Student t test for numerical

TABLE 3. Age, Body Mass Index, Myelopathic Signs, and Physical Performance Measures With and Without Cervical Cord Compression in the Overall Study Population

	No Compression (<Grade 2)	Compression (≥Grade 2)
Overall		
N	739	238
Age (yr)	64.7 ± 13.7	71.7 ± 11.7*
Body mass index (kg/m²)	23.2 ± 3.7	23.5 ± 3.3
Myelopathic signs and physical performance measures		
Hyper-reflexia of patellar tendon reflex, N (%)	49 (6.6)	20 (8.4)
Hoffmann reflex positive, N (%)	11 (1.5)	6 (2.5)
Babinski reflex positive, N (%)	10 (1.4)	8 (3.4)†
Grip and release test, number of times	23.7 ± 5.6	21.9 ± 5.3*
Grip strength (kg)	29.0 ± 9.6	27.2 ± 9.7†
6-m walking time at a usual pace (s)	5.5 ± 2.1	6.3 ± 2.3*
Step length at a usual pace (cm)	57.0 ± 9.0	52.8 ± 12.0*
6-m walking time at a maximal pace (s)	3.7 ± 1.3	4.4 ± 1.7*
Step length at a maximal pace (cm)	65.4 ± 11.4	60.7 ± 12.9*
Chair-stand time (s)	8.4 ± 3.4	10.3 ± 5.1*
One-leg standing time (s)	38.3 ± 23.2	28.4 ± 24.0*

Values are mean ± SD except where otherwise indicated.

*Significantly different from values of the no compression group (*P < 0.001, †P < 0.01).*

For continuous outcomes, comparison was by the Student t test. For categorical outcomes, comparison was by the χ^2 test.

variables. To evaluate the association and prevalence of CCC with age, a χ^2 test was used for each sex. Prevalence of myelopathic signs was compared between participants with and without CCC, using the χ^2 test. Measurements of physical performance, such as 6-m walking time, step length, CST, and OLS, were compared between participants with and without CCC, using the nonpaired Student *t* test. In addition, to determine the association of each physical performance with CCC, logistic regression analysis was used after overall adjustment for age, sex, and BMI. All statistical tests were performed at a significance level of 0.05 (2-sided) and were not adjusted for multiple testing. Data analyses were performed using JMP version 8 (SAS Institute Inc., Cary, NC).

RESULTS

Baseline characteristics of the 977 participants including anthropometric measurements and physical performance are shown in Table 1. There was no significant difference in age between sexes. Height, weight, and BMI were significantly higher in men than in women. Among physical performances, grip strength, GRT, 6-m walking time, and step length were significantly different between sexes ($P < 0.05$), whereas CST and OLS were not.

The prevalence of CCC in all participants was 24.4% (29.3% in men and 21.9% in women) and was significantly higher in men than in women ($P = 0.011$). As seen in Figure 1, the prevalence of CCC in men by age group for subjects aged 49 years and younger, 50–59, 60–69, 70–79, and 80 years and older was 18.4%, 19.0%, 24.2%, 30.3%, and 46.6%, respectively. Meanwhile, in women, the prevalence of CCC by age group for subjects aged 49 years and younger, 50–59, 60–69, 70–79, and 80 years and older was 8.0%, 12.8%, 20.9%, 22.1%, and 42.4%, respectively. A χ^2 test showed that the prevalence of CCC was higher with age in men and women ($P = 0.0024$ in men and $P < 0.0001$ in women). Furthermore, the prevalence of CCC of grade 3 or more was 5.9% in men and 2.6% in women. No participants had a CCC of grade 4 or more.

Table 2 shows the prevalence of CCC at each intervertebral disc level in men and women. CCC was most frequently recognized in both sexes at C5–C6, followed by C4–C5 and C6–C7. The prevalence of CCC was already higher than 10% at 50 to 59 years of age in C5–C6 in men and was higher than 10% in subjects 80 years and older at every intervertebral disc level (except for C2–C3 and C7–Th1).

Association of CCC with myelopathic signs and physical performance measures is shown in Tables 3 and 4. The prevalence of myelopathic signs, which was defined as having at least 1 myelopathic sign (including patellar tendon hyperreflexia, Hoffmann reflex, and Babinski reflex), was 3.2% in men and 16.1% in women with CCC. In men, none of the myelopathic signs were significantly different between the participants with and without CCC. Regarding physical performance measures, significant differences between the participants with and without CCC were found in GRT ($P = 0.0001$), grip strength ($P = 0.001$), 6-m walking time at a maximal pace ($P = 0.0038$), step length at a usual pace ($P = 0.0004$), step length at a maximal pace ($P = 0.001$), and OLS ($P = 0.0003$). Significant differences were not seen in the 6-m walking time at a usual pace ($P = 0.058$) or CST ($P = 0.067$). In women, the prevalence of Babinski reflex was significantly higher in participants with CCC than in those without CCC ($P = 0.019$), whereas the prevalence of hyper-reflexia of patellar tendon and Hoffman reflex was not significantly different ($P = 0.11$ and $P = 0.28$, respectively). There were significant differences between participants with and without CCC in all physical performance measures.

TABLE 4. Age, Body Mass Index, Myelopathic Signs, and Physical Performance Measures With and Without Cervical Cord Compression in Men and Women

	No Compression (<Grade 2)	Compression (≥Grade 2)
Men		
N	229	95
Age (yr)	65.5 ± 14.2	71.4 ± 12.1*
Body mass index (kg/m²)	23.8 ± 3.6	23.5 ± 3.0
Myelopathic signs and physical performance measures		
Hyper-reflexia of patellar tendon reflex, N (%)	7 (3.1)	2 (2.1)
Hoffmann reflex positive, N (%)	1 (0.4)	1 (1.1)
Babinski reflex positive, N (%)	2 (0.9)	1 (1.1)
Grip and release test, number of times	25.7 ± 6.0	22.9 ± 5.0*
Grip strength (kg)	39.1 ± 9.1	35.4 ± 8.7†
6-m walking time at a usual pace (s)	5.4 ± 1.5	5.7 ± 1.5
Step length at a usual pace (cm)	59.8 ± 8.9	55.8 ± 9.3*
6-m walking time at a maximal pace (s)	3.5 ± 1.0	3.9 ± 1.2†
Step length at a maximal pace (cm)	71.9 ± 10.1	67.6 ± 11.6†
Chair-stand time (s)	8.5 ± 3.3	9.3 ± 3.5
One-leg standing time (s)	39.0 ± 23.2	28.5 ± 24.6*
Women		
N	510	143
Age (yr)	64.3 ± 13.4	71.9 ± 11.5*
Body mass index (kg/m²)	22.9 ± 3.7	23.6 ± 3.5‡
Myelopathic signs and physical performance measures		
Hyper-reflexia of patellar tendon reflex, N (%)	42 (8.2)	18 (12.6)
Hoffmann reflex positive, N (%)	10 (2.0)	5 (3.5)
Babinski reflex positive, N (%)	8 (1.6)	7 (4.9)‡
Grip and release test, number of times	22.8 ± 5.3	21.3 ± 5.4†
Grip strength (kg)	24.5 ± 5.7	21.9 ± 5.8*
6-m walking time at a usual pace (s)	5.5 ± 2.3	6.7 ± 2.7*
Step length at a usual pace (cm)	55.7 ± 8.8	50.8 ± 13.2*
6-m walking time at a maximal pace (s)	3.8 ± 1.4	4.8 ± 1.9*
Step length at a maximal pace (cm)	62.5 ± 10.7	56.0 ± 11.7*
Chair-stand time (s)	8.4 ± 3.5	11.0 ± 5.8*

Values are mean ± SD except where otherwise indicated.

Significantly different from values of the group of no compression ($P < 0.001$, †$P < 0.01$, ‡$P < 0.05$).*

For continuous outcomes, comparison was by the Student t test. For categorical outcomes, comparison was by the χ^2 test.

In addition, multiple logistic regression analysis was performed to estimate the association of physical performance with CCC after adjustment for age, sex, and BMI (Table 5). As an overall result, GRT, step length at a usual and a maximal pace, 6-m walking time at a maximal pace, and CST were found to be significantly associated with CCC. The same logistic regression analysis was performed in participants older than 50 years, and the results remained the same.

TABLE 5. Association Between Cervical Cord Compression (≥Grade 2) and Physical Performance Measures

	OR	95% CI	P
*Overall**			
Grip and release test, N (+1SD)	0.26	0.08–0.79	0.02
Grip strength, kg (+1 SD)	0.22	0.03–1.37	0.11
6-m walking time at a usual pace, s (+1 SD)	4.88	0.81–31.1	0.09
Step length at a usual pace, cm (+1 SD)	0.04	0.03–0.45	0.01
6-m walking time at a maximal pace, s (+1 SD)	14.1	2.51–85.0	0.003
Step length at a maximal pace, cm (+1 SD)	0.13	0.03–0.46	0.002
Chair-stand time, s (+1 SD)	11.1	2.00–64.5	0.006
One-leg standing time, s (+1 SD)	0.87	0.51–1.50	0.62

**OR was calculated by multiple logistic regression analysis after adjustment for age, sex, and body mass index in the overall study population.*

OR indicates odds ratio; CI, confidence interval.

DISCUSSION

This study is the first population-based study to use MRI to clarify the prevalence of CCC and its association with myelopathic signs and physical performance measures in Japanese men and women. The prevalence of CCC was higher with increasing age in both sexes. There was no significant association between CCC and myelopathic signs. Regarding physical performance measures, GRT, step length at a usual and a maximal pace, 6-m walking time at a maximal pace, and CST were significantly associated with CCC.

Regarding the prevalence of CCC, Matsumoto *et al*[8] reported that CCC caused by disc protrusion beyond the vertebral body was found in 7.6% of all intervertebral discs using MRI in asymptomatic subjects. This study was the first to clarify the prevalence of CCC, age, and sex differences using MRI in a population-based cohort study.

Previous studies have shown that the prevalence of cervical spondylotic myelopathy was higher in men than in women.[2,26] However, as has been described earlier, and to the best of our knowledge, there have been no previous population-based studies regarding sex differences with CCC. Irvine *et al*[27] reported that the prevalence of cervical spondylosis was higher in men than in women, but the study was not population-based and diagnosis was made with x-ray films. This study is the first to clarify that the prevalence of CCC is more frequent in men than in women.

This study also used multiple logistic regression to examine the association of CCC with myelopathic signs and found that there was no significant association between CCC and hyper-reflexia of patellar tendon, Hoffman reflex, and the Babinski reflex. It is well recognized that, among the elderly, exaggerated reflexes are uncommon, whether they be caused by peripheral neuropathy or other causes. Therefore, diagnosis of early-stage CM using myelopathic signs is often difficult, especially among the elderly. In addition, the prevalence of severe CCC (> grade 3) was only 5.9% in men and 2.6% in women, and most of the participants with CCC had slight to moderate spinal compression. These findings may affect the results of this study, which found no significant association between CCC and myelopathic signs. With regard to physical performance measures, many were significantly associated with CCC in this study. The GRT, 6-m walking time at a maximal pace, and CST, all of which required agility, were significantly associated with CCC. This indicates that a decrease in agility may be observed early in the course of CM, and these kinds of physical performance measures may be useful indices for diagnosis of early-stage CM.

Limitations of the Study

There are several limitations in this study. First, although this study included more than 1000 participants, these participants may not represent the general population because they were recruited from only 2 areas of Japan. However, anthropometric measurements were compared between the participants of this study and the general Japanese population,[28] and no significant differences in BMI were found between participants in this study and the Japanese population at large in both sexes (BMI [SD] in men: 23.71 [3.41] and 23.95 [2.64], $P = 0.33$, respectively, and in women: 23.06 [3.42] and 23.50 [3.69], $P = 0.07$, respectively). In addition, the proportion of current smokers and current drinkers (those who regularly smoked or drank more than 1 drink per mo) in the general Japanese population was compared with the study population. Proportions of current smokers and drinkers in men and that of current drinkers in women were significantly higher in the general Japanese population than in the study population, and there was no significant difference in current smokers in women (male smokers, 32.6% in the Japanese population and 25.2% in study participants, $P = 0.015$; female smokers, 4.9% in the Japanese population and 4.1% in study participants, $P = 0.50$; male drinkers, 73.9% in the Japanese population and 56.8% in study participants, $P < 0.0001$; female drinkers, 28.1% in the Japanese population and 18.8% in study participants, $P < 0.0001$). These results suggest that it is likely that in this study, participants had healthier lifestyles than the general Japanese population. Second, the prevalence only applies to a portion of the Japanese population and cannot be extrapolated beyond that. Third, ossification of the posterior longitudinal ligament (OPLL) and spondylotic changes were included in CCC. There were a total of 21 participants with OPLL, which was examined by x-ray in the same population. Associations of physical performance between spondylotic changes and OPLL may be different; however, only 14 (1.4% in total) OPLL participants had CCC and therefore would not strongly affect the results of this study.

CONCLUSION

This cross-sectional population-based study revealed a high prevalence of CCC in the elderly. The prevalence of CCC was more frequent in men than in women. The highest prevalence of intervertebral lesions was at the C5–C6 level. The GRT, 6-m walking time at a maximal pace, and CST may be useful tools for diagnosis of the early stages of CM.

➢ Key Points

- ❑ This is the first study to reveal the prevalence of CCC, using a population-based study.
- ❑ The prevalence of CCC was 24.4% in this cohort.
- ❑ CCC was associated with physical performance both from an early stage of the disease and before signs of myelopathy.

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The CUPID (Cultural and Psychosocial Influences on Disability) Study: Methods of Data Collection and Characteristics of Study Sample

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Abstract

Background: The CUPID (Cultural and Psychosocial Influences on Disability) study was established to explore the hypothesis that common musculoskeletal disorders (MSDs) and associated disability are importantly influenced by culturally determined health beliefs and expectations. This paper describes the methods of data collection and various characteristics of the study sample.

Methods/Principal Findings: A standardised questionnaire covering musculoskeletal symptoms, disability and potential risk factors, was used to collect information from 47 samples of nurses, office workers, and other (mostly manual) workers in 18 countries from six continents. In addition, local investigators provided data on economic aspects of employment for each occupational group. Participation exceeded 80% in 33 of the 47 occupational groups, and after pre-specified exclusions, analysis was based on 12,426 subjects (92 to 1018 per occupational group). As expected, there was high usage of computer keyboards by office workers, while nurses had the highest prevalence of heavy manual lifting in all but one country. There was substantial heterogeneity between occupational groups in economic and psychosocial aspects of work; three- to five-fold variation in awareness of someone outside work with musculoskeletal pain; and more than ten-fold variation in the prevalence of adverse health beliefs about back and arm pain, and in awareness of terms such as "repetitive strain injury" (RSI).

Conclusions/Significance: The large differences in psychosocial risk factors (including knowledge and beliefs about MSDs) between occupational groups should allow the study hypothesis to be addressed effectively.

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Introduction

Musculoskeletal disorders of the back, neck and upper limb are a major cause of morbidity and disability with substantial economic impact, especially in western countries. In some cases symptoms arise from identifiable pathology in the spine or arm (e.g. a herniated inter-vertebral disc or peripheral nerve compression in the carpal tunnel). Most often, however, the underlying pathology is unclear, and the symptoms are classed as "non-specific".

Epidemiological research has linked the occurrence of back, neck and upper limb disorders with various physical activities in the workplace [1–4], and also with psycho-social risk factors such as low mood and job dissatisfaction [5–8]. More recently, evidence has accumulated for a causal role also of "somatising tendency" (i.e. a general tendency to report and worry about common somatic symptoms) [6,9]. Together, however, these established risk factors do not adequately explain striking temporal changes that have been observed in disability attributed to common musculoskeletal complaints. For example, in Britain rates of incapacity for work because of back problems increased more than sevenfold between 1953 and 1992 at a time when the physical demands of work were generally reducing [10]; and in Australia there was a major epidemic of disability from arm pain during the early 1980s which was not paralleled in other countries where similar technologies and working methods were employed [11].

This gap in understanding has prompted the hypothesis that the development and persistence of non-specific musculoskeletal complaints and resultant disability are importantly influenced by culturally-determined health beliefs as well as by physical activities and mental health [12]. Several observations provide support for a role of health beliefs. For example, among 178 workers carrying out repetitive tasks on an assembly line in Mumbai, India, only one of whom had ever heard of "RSI" (repetitive strain injury), the 12 month prevalence of disabling arm pain (5%) was less than one fifth of that found using the same questions among manual workers in the UK (including those who were of Indian sub-continental origin) [13]. In longitudinal studies of individuals with back and arm pain, negative beliefs about prognosis have proved predictive of their persistence [7,14]. And in Victoria, Australia, a

Table 1. Specification and recruitment of study sample.

Country/Occupational Group	Detailed description	Method of identification	Method by which baseline questionnaire completed
SOUTH AND CENTRAL AMERICA			
Brazil			
Nurses	Nurses, nursing technicians and auxiliaries at the University Hospital in Sao Paolo	Randomly sampled from a list of eligible subjects provided by managers	Self-administered (in Brazilian Portuguese)
Office workers	Computer users from an informatics centre in Curitiba	Randomly sampled from a list of eligible subjects provided by managers	Self-administered (in Brazilian Portuguese)
Other workers	Sugar cane cutters at a mill in Ribeirao Preto	Randomly sampled from a list of eligible subjects provided by managers	Interview (in Brazilian Portuguese)
Ecuador			
Nurses	Nursing staff at a Social Security hospital	Quasi-random sampling from employment records	Interview (in Spanish)
Office workers	Office workers regular using computers at the Ministry of Public Health in Quito	Quasi-random sampling from employment records	Interview (in Spanish)
Other workers	Flower plantation workers in Tabacundo and Cayambe, Pichincha	Residents of specified blocks of buildings surrounding the flower plantations	Interview (in Spanish)
Colombia			
Office workers	Office workers from the Javeriana University in Bogota	Quasi-random sampling from employment records	Self-administered by web application (In Spanish)
Costa Rica			
Nurses	Nurses, auxiliary nurses and nursing assistants from two national hospitals in San Jose	Randomly sampled from payroll records	Interview (in Spanish)
Office workers	Office workers from the Central Offices of the Costa Rican Social Security System	Randomly sampled from payroll records	Interview (in Spanish)
Other workers	Telephone call centre workers at the Duty Free Zone in San Jose	Randomly selected from payroll records	Interview (in Spanish)
Nicaragua			
Nurses	Nurses in internal medicine, surgery, orthopaedics, gynaecology and paediatrics from two hospitals	Randomly sampled from payroll records	Self-administered (in Spanish)
Office workers	Secretaries and accountants with high computer use at Ministry of Labor and Nicaraguan Institute of Social Security	Randomly sampled from payroll records	Interview (in Spanish)
Other workers	Machine operators from two textile manufacturing companies	Sample identified from worker members of the Maria Elena Cuadra Movement	Interview (in Spanish)
EUROPE			
UK			
Nurses	Nurses from specified wards at Southampton University Hospitals NHS Trust	From employment records	Interview for random subsample; remainder by self-administered questionnaire
Office workers	Full-time clerical workers from three departments at Houses of Parliament, London	From employment records	Interview for random subsample; remainder by self-administered questionnaire
Other workers	Mail sorters from three Royal Mail centres in the London area	From employment records	Interview for random subsample; remainder by self-administered questionnaire
Spain			
Nurses	All nurses and nursing assistants employed for at least one year at specified units of four hospitals in Barcelona.	From employment records	Interview (in Spanish)
Office workers	All office workers from employed for at least one year at specified units in four hospitals and one University (UPF) in Barcelona.	From employment records	Interview (in Spanish)

Table 1. Cont.

Country/Occupational Group	Detailed description	Method of identification	Method by which baseline questionnaire completed
Italy			
Nurses	Nurses and nursing assistants at three hospitals in Milan and Varese	From employment records	Self-administered (in Italian)
Other workers	Production workers at a factory making pushchairs	From employment records	Self-administered (in Italian)
Greece			
Nurses	Nurses at Heraklion University Hospital	Randomly sampled from employment records	Interview (in Greek)
Office workers	Office workers at Heraklion University who were registered as computer users	From employment records	Interview (in Greek)
Other workers	Postal clerks from the central post offices of the four prefectures of Crete	From employment records	Interview (in Greek)
Estonia			
Nurses	Nursing staff (nurses, technicians and auxiliaries) at the University Hospital in Tartu and at 31 institutions providing social care	Randomly sampled from lists provided by management	Self-administered (in Estonian or Russian)
Office workers	Secretaries and office workers in specified departments at the University of Tartu	Randomly sampled from lists provided by management	Self-administered (in Estonian or Russian)
ASIA			
Lebanon			
Nurses	Registered nurses at two hospitals	From employment records	Interview (in Lebanese Arabic)
Office workers	Office workers at an academic institution	From employment records	Interview (in Lebanese Arabic)
Other workers	Production workers at a food manufacturer	From employment records	Interview (in Lebanese Arabic)
Iran			
Nurses	Nurses at three university hospitals in Shahroud	Through a nominated manager at each organisation	Self-administered (in Farsi)
Office workers	Office workers at three university hospitals in Shahroud and at four universities in Shahroud (Shahroud University of Medical Sciences, Shahroud University of Technology, Quran Sciences University and Shahroud Azad University)	Through a nominated manager at each organisation	Self-administered (in Farsi)
Pakistan			
Nurses	Nurses in in-patient services at Aga Khan University Hospital, Karachi	From employment records	Interview (in Urdu)
Office workers	Full-time hospital receptionists at Aga Khan University Hospital, Karachi	From employment records	Interview (in Urdu)
Other workers	Postal workers from Pakistan Post at two sorting offices in Karachi	Convenience sample of workers from three shifts	Interview (in Urdu)
Sri Lanka			
Nurses	Nursing officers at two tertiary care hospitals in Colombo	Randomly sampled from employment records	Interview (in Sinhalese)
Office workers	Computer operators from six companies in Colombo	Randomly sampled from employment records	Interview (in Sinhalese)
Other workers (1)	Postal workers at the Central Mail Exchange in Colombo	Randomly sampled from employment records	Interview (in Sinhalese)
Other workers (2)	Sewing machinists at two garment factories in Colombo District	Randomly sampled from employment records	Interview (in Sinhalese)
Japan			
Nurses	Nurses at Tokyo University Hospital	Through a nominated manager	Self-administered (in Japanese)
Office workers	Administrative and clerical workers at Tokyo University Hospital and at four pharmaceutical companies and a private trading company	Through a nominated manager at each organisation	Self-administered (in Japanese)
Other workers (1)	Transportation operatives (mainly lorry drivers and loaders) at two companies transporting baggage and mail	Through a nominated manager at each organisation	Self-administered (in Japanese)
Other workers (2)	Sales/marketing personnel at six pharmaceutical companies	Through a nominated manager at each organisation	Self-administered (in Japanese)

Table 1. Cont.

Country/Occupational Group	Detailed description	Method of identification	Method by which baseline questionnaire completed
AFRICA			
South Africa			
Nurses	Nurses at two academic hospitals in Gauteng	From nurses who were at work when wards were visited	Mostly interview with a few self-administered (all in English)
Office workers	Bank workers at a call centre	From lists of workers provided by the employer	Interview (in English)
AUSTRALASIA			
Australia			
Nurses	Nurses at AlfredHealth (The Alfred, Caulfield Hospital and Sandringham Hospital), Melbourne	From employment records	Self-administered
New Zealand			
Nurses	Nurses (Registered, Enrolled or nurse practitioners) on the Nursing Council of New Zealand register	Randomly selected from all nurses holding a current practising certificate	Self-administered
Office workers	People on the 2005 New Zealand electoral roll in jobs likely to involve use of computers in offices	Randomly selected from those on electoral roll with relevant jobs	Self-administered
Other workers	Mail sorters at New Zealand Post	Randomly selected from an employee database	Self-administered

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community-based intervention aimed at modifying people's beliefs and expectations about back pain was followed by a reduction in morbidity that was not paralleled in a control state [15].

This is not to say that common musculoskeletal symptoms never arise from traumatic injury to tissues. For the most part, however, such injuries would be expected to heal spontaneously over a period of days or weeks, as in other parts of the body. The influence of health beliefs, low mood and somatising tendency is likely to be more on the persistence of symptoms and levels of associated disability than on the occurrence of acute and transient symptoms.

If the hypothesised role of health beliefs were correct, it would have important practical implications. There might be scope for interventions aimed at modifying beliefs and expectations, along the lines of the successful campaign on back pain in Victoria, Australia [15]. More importantly, however, there would be a need for wider review of strategies aimed at preventing work-related musculoskeletal disorders. Currently, preventive efforts focus largely on reduction of physical stresses to the back and arm so as to minimise the risk of injury and maximise opportunities for continued employment in those who have developed symptoms. However, this approach may reinforce beliefs that even quite minor physical stresses (e.g. from use of a computer keyboard) can be seriously hazardous, and might thereby increase workers' vulnerability to long-term symptoms and disability.

The CUPID (Cultural and Psychosocial Influences on Disability) study was designed to explore further the impact of cultural and psychosocial influences on musculoskeletal symptoms and associated disability. It aims to compare the prevalence of symptoms and disability in workers who are carrying out jobs with similar physical demands, but in a range of cultural environments, and to explore risk factors for the incidence and persistence of symptoms and disability in these varying cultural environments. We here describe the methods by which participants have been recruited and data collected, summarise various characteristics of the study sample, and discuss strengths and limitations of the study method.

Methods

Ethical Approval

Ethical approval for the study was provided by the relevant research ethics committee or institutional review board in each participating country (Appendix S1). Written informed consent was obtained from all participants with the following exceptions. For self-administered questionnaires in the UK and Iran, information about the study was provided, and consent to the baseline survey was deemed to be implicit in the return of a completed questionnaire. In Lebanon, according to local practice, oral informed consent was obtained from all participants before interview, and this was recorded on a form signed and dated by the interviewer. In all cases, the method of obtaining consent was approved by the relevant research ethics committee.

Overview

The study focuses on 47 occupational groups from 18 countries (1–4 groups per country), from which information has been collected by means of an initial baseline questionnaire, followed by a further, shorter questionnaire after an interval of 12 months. Data collection in each country was led by a local investigator, who forwarded anonymised computerised data files to a team at the University of Southampton for collation and analysis (several earlier papers have described analyses based, all or in part, on components of the study in individual countries [16–22]). Local investigators also provided background information on the socio-economic circumstances of their study cohorts – for example, on levels of unemployment in the local community and eligibility for sick pay and compensation for occupational injuries.

Identification and Recruitment of Participants

Local investigators were asked to recruit samples of nurses, office workers who regularly used a computer keyboard and/or mouse, and workers who carried out repetitive manual tasks with their arms or hands. Postal workers sorting mail were identified in advance as a group of manual workers who might be suitable for study, but other sources of manual workers were allowed at the

Table 2. Response to baseline questionnaire.

Country/Occupational Group	Number of subjects approached	Number (%) participated	Number of responders excluded	Number of subjects analysed
Brazil				
Nurses	200	192 (96%)	7	185
Office workers	300	292 (97%)	11	281
Other workers	300	182 (61%)	89	93
Ecuador				
Nurses	252	250 (99%)	31	219
Office workers	250	250 (100%)	7	243
Other workers	282	279 (99%)	52	227
Colombia				
Office workers	114	102 (89%)	10	92
Costa Rica				
Nurses	275	249 (91%)	29	220
Office workers	275	249 (91%)	26	223
Other workers	252	237 (94%)	32	205
Nicaragua				
Nurses	300	300 (100%)	18	282
Office workers	300	300 (100%)	15	285
Other workers	300	300 (100%)	103	197
UK				
Nurses	690	290 (42%)	33	257
Office workers	1051	476 (45%)	96	380
Other workers	1569	442 (28%)	56	386
Spain				
Nurses	716	687 (96%)	20	667
Office workers	483	471 (98%)	33	438
Italy				
Nurses	766	585 (76%)	49	536
Other workers	290	151 (52%)	12	139
Greece				
Nurses	240	224 (93%)	0	224
Office workers	202	200 (99%)	1	199
Other workers	154	140 (91%)	0	140
Estonia				
Nurses	876	423 (48%)	52	371
Office workers	415	220 (53%)	18	202
Lebanon				
Nurses	193	186 (96%)	2	184
Office workers	220	190 (86%)	18	172
Other workers	172	168 (98%)	31	137
Iran				
Nurses	263	248 (94%)	2	246
Office workers	213	187 (88%)	5	182
Pakistan				
Nurses	250	235 (94%)	48	187
Office workers	216	216 (100%)	36	180
Other workers	235	225 (96%)	3	222
Sri Lanka				
Nurses	250	237 (95%)	1	236
Office workers	250	157 (63%)	5	152

Table 2. Cont.

Country/Occupational Group	Number of subjects approached	Number (%) participated	Number of responders excluded	Number of subjects analysed
Other workers (1)	250	250 (100%)	0	250
Other workers (2)	250	214 (86%)	63	151
Japan				
Nurses	1074	814 (76%)	222	592
Office workers	425	346 (81%)	36	310
Other workers (1)	1308	1119 (86%)	101	1018
Other workers (2)	380	372 (98%)	17	355
South Africa				
Nurses	280	252 (90%)	5	247
Office workers	285	236 (83%)	7	229
Australia				
Nurses	2878	1119 (39%)	869 (excluded because only a random subset of participants was analysed)	250
New Zealand				
Nurses	260	181 (70%)	4	177
Office workers	280	146 (52%)	1	145
Other workers	230	116 (50%)	3	113

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discretion of the local investigator. In one country (Japan), a group of sales and marketing workers was also recruited, and in the presentation and discussion of results, three main categories of occupation are distinguished – nurses, office workers, and "other workers", the last including the sales and marketing group as well as various manual occupations.

The aim was to restrict the international analysis to workers aged 20–59 years, who had been in their current job for at least 12 months. However, local investigators were free to recruit and carry out local analyses without these restrictions. Initial power calculations indicated that a sample size of 200 workers per occupational group would be more than adequate to detect differences between countries in the prevalence of symptoms and disability of the magnitude that was anticipated, and also for analysis of important risk factors for the incidence and persistence of pain at different anatomical sites in the longitudinal follow-up.

Table 1 describes the occupational groups that were selected for study, and the methods by which participants were identified and the baseline questionnaire administered. In most cases, potentially eligible subjects were identified from employers' records, sometimes with random sampling to achieve the desired sample size. Some occupational groups provided information at interview, and others by self-completion of questionnaires. In one country (UK), most questionnaires were self-completed, but random sub-samples of each occupational group were instead interviewed.

At the time of answering the baseline questionnaire, participants were asked whether they were willing to be re-contacted in the future, and those who agreed were asked (or will be asked) to complete a follow-up questionnaire after an interval of 12 months. In most cases, subjects have been followed up through their place of work, but where this was not possible (e.g. because they had left their original employer), they have been contacted at their home address. In each occupational group, follow-up questionnaires have been completed by the same method (interview or self-administration) as the baseline questionnaire.

Questionnaires

The baseline questionnaire (Appendix S2) asked about demographic characteristics; education; height; smoking habits; current occupation; pain in different anatomical regions and associated disability for tasks of daily living; awareness of others with musculoskeletal pain; fear-avoidance beliefs concerning upper limb and low back pain; awareness of repetitive strain injury (RSI) or similar terms; distress from common somatic symptoms; mental health; and sickness absence in the past 12 months because of musculoskeletal problems and other types of illness.

The questions about current occupation covered working hours, whether the job involved each of a specified list of physical tasks, and psychosocial aspects of employment such as time pressures and targets, control over work organisation, support, satisfaction and job security. The questions about pain and disability focused on six anatomical regions (low back, neck, shoulder, elbow, wrist/hand and knee) delineated in diagrams, and were similar in wording to questions that had been used successfully in earlier studies, both by self-administration [9,23,24] and at interview [13]. The questions on fear-avoidance beliefs were adapted from the Fear Avoidance Beliefs Questionnaire [25]. Questions about distress from somatic symptoms were taken from the Brief Symptom Inventory (BSI) [26], and were chosen to provide a measure of the subject's tendency to somatise. Questions on mental health were taken from the Short Form-36 (SF-36) questionnaire [27].

The follow-up questionnaire (Appendix S3) asked about: any change of job since baseline and the reasons; recent pain in different anatomical regions and associated disability for tasks of daily living; distress from common somatic symptoms; mental health; and sickness absence in the past 12 months for musculoskeletal and other reasons. Where possible, the wording of questions was identical to that used in the baseline questionnaire.

Table 3. Economic aspects of employment.

Country/ Occupational Group	Local unemployment rate (%)	Social security provision for unemployed	Sick pay in first three months absence	Compensation for work-related musculoskeletal disorders	Special financial support for ill-health retirement
Brazil					
Nurses	5–9	No	Full for 7 days, but not up to 3 months	Sometimes	No
Office workers	<5	No	Yes	Usually	Usually
Other workers	≥15	Yes	Partial from outset	Usually	No
Ecuador					
Nurses	<5	No	Full for 7 days, but not up to 3 months	No	No
Office workers	5–9	No	Full for 7 days, but not up to 3 months	No	No
Other workers	<5	No	Full for 7 days, but not up to 3 months	No	No
Colombia					
Office workers	5–9	No	Yes	Usually	Sometimes
Costa Rica					
Nurses	<5	Up to 3 months	Yes	Usually	Usually
Office workers	<5	Up to 3 months	Yes	Usually	Usually
Other workers	<5	Up to 3 months	Yes	Usually	Usually
Nicaragua					
Nurses	10–14	No	Yes	Usually	No
Office workers	10–14	No	Yes	Usually	No
Other workers	10–14	No	Yes	Usually	No
UK					
Nurses	<5	Yes	Yes	Sometimes	Usually
Office workers	<5	Yes	Yes	Sometimes	Usually
Other workers	5–9	Yes	Yes	Sometimes	Usually
Spain					
Nurses	5–9	Yes	Yes	Usually	Sometimes
Office workers	5–9	Yes	Yes	Usually	Sometimes
Italy					
Nurses	5–9	Yes	Yes	Sometimes	No
Other workers	5–9	Yes	Yes	Sometimes	No
Greece					
Nurses	5–9	Long-term only	Some workers	No	Sometimes
Office workers	5–9	Long-term only	Yes	No	Sometimes
Other workers	5–9	Long-term only	Yes	No	Sometimes
Estonia					
Nurses	10–14	Yes	Full from 4 days	Usually	Sometimes
Office workers	10–14	Yes	Full from 4 days	Usually	Sometimes
Lebanon					
Nurses	<5	No	Full for 7 days, but not up to 3 months	Sometimes	Usually
Office workers	5–9	No	Full for 7 days, but not up to 3 months	Usually	Sometimes
Other workers	5–9	No	Full for 7 days for some workers, but not up to 3 months	Sometimes	Sometimes
Iran					
Nurses	<5	Most workers	Yes	Sometimes	Sometimes
Office workers	5–9	Most workers	Yes	Sometimes	Sometimes

Table 3. Cont.

Country/ Occupational Group	Local unemployment rate (%)	Social security provision for unemployed	Sick pay in first three months absence	Compensation for work-related musculoskeletal disorders	Special financial support for ill-health retirement
Pakistan					
Nurses	<5	No	Full for 7 days, but not up to 3 months	No	No
Office workers	5–9	No	Full for 7 days, but not up to 3 months	No	No
Other workers	5–9	No	Full for 7 days, but not up to 3 months	No	No

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Both the baseline and follow-up questionnaires were compiled first in English. If necessary, they were then translated into local languages, and the accuracy of the translation was checked by independent back-translation to English. Where this revealed errors, appropriate corrections were made. In addition, in some countries, translated questionnaires were piloted in samples of workers who were not included in the main study, and where this revealed difficulties in understanding, further amendments were made.

Local investigators were at liberty to add to the "core" questions of the international study, and a few (e.g. in Italy, Greece, Iran, Japan, South Africa, Australia and New Zealand) took up this option. However, in doing so, they were asked where possible to place the supplementary questions after the core questions, so as to minimise the chance that they would alter the ways in which participants answered the core questions.

Group-level Socio-economic Information

As well as individual data on study participants, local investigators also provided standardised information about the socio-economic circumstances of the occupational groups which they had recruited. This included the local unemployment rate at the time of the survey, availability of social security support for the unemployed, entitlement to sick pay in the first three months of absence, entitlement to compensation for work-related musculoskeletal disorders, special financial support for ill-health retirement, fees paid for healthcare, and access to an occupational health service.

Results

Response to Baseline Questionnaire

The response to the baseline questionnaire is summarised in Table 2. Participation rates among those invited to take part in the study were greater than 80% in 33 of the 47 occupational groups, ranging from 28% in UK other workers and 39% in Australian nurses to 100% in six occupational groups from Ecuador, Nicaragua, Pakistan and Sri Lanka. However, 2,279 participants were excluded from the international analysis because they fell outside the specified age range (310), had missing data (317), had not worked in their current job for as long as 12 months (783), or (in the case of Australian nurses) were excluded by random sampling (869). After these exclusions, a total of 12,426 workers were available for analysis, with between 92 and 1018 in each occupational group.

Circumstances of Occupational Groups

Table 3 summarises various economic aspects of employment for the occupational groups studied. The local rate of unemployment ranged from <5% in 16 occupational groups to ≥15% in seven. Members of 28 groups would be eligible for social security provision if they became unemployed, although in the three groups from Costa Rica this would be limited to the first three months without a job. Almost all participants could receive some form of sick pay during the first three months of absence from work, but in 22 groups this would not compensate fully for all loss of earnings over that period. Some form of financial compensation for work-related musculoskeletal disorders was available to 40 occupational groups, but 19 groups were ineligible for any special financial support in the event of ill-health retirement.

Table 4 describes the access of participants to different sources of healthcare. Most participants had free access to doctors in primary care and hospitals, but fees were more often required for consultation of other health practitioners. All but nine occupational groups were covered by an occupational health service.

Characteristics of Participants

Table 5 gives information about the demographic characteristics of participants and their hours of work. In all countries, nurses were predominantly female, and in 18 occupational groups more than 90% of subjects were from one sex. Most groups had a broad distribution of ages, but in a few groups, younger (<30 years) or older (≥50 years) workers were less well represented. Levels of education were generally high in nurses and office workers, but lower in many groups of "other workers". Most subjects had been in their current job for longer than five years, and most worked between 30 and 49 hours per week. However, in Pakistan, Sri Lanka and Japan, the prevalence of longer working hours (>50 hours per week) was high relative to other countries.

Table 6 shows the prevalence of different physical tasks by occupational group. As would be expected, a high proportion of office workers (>80% in all but one group) reported using a computer keyboard for longer than four hours per day, while manual lifting of weights ≥25 kg in an average working day was most common in nurses. Patterns of physical activity among the "other workers" were more variable, but several such groups reported a relatively high prevalence of work with the hands above shoulder height.

Table 7 summarises reported psychosocial aspects of work. Time pressure was common in most occupational groups, but the prevalence of financial incentives to productivity was much more variable. Personal autonomy at work was lowest among "other workers". Most subjects were satisfied with their jobs, but job

Table 4. Access to healthcare for musculoskeletal disorders.

Country/Occupational Group	Primary care doctor	Hospital doctor	Other practitioner	Occupational health service
Brazil				
Nurses	Full fee	Full fee	Full fee	Through employer and external
Office workers	Small fee	Small fee	Small fee	Through employer and external
Other workers	Free/insured	Free/insured	Free/insured	Through employer
Ecuador				
Nurses	Full fee	Full fee	Full fee	Through employer or external
Office workers	Full fee	Full fee	Full fee	External
Other workers	Full fee	Full fee	Full fee	Through employer or external
Colombia				
Office workers	Free/insured	Small fee	Small fee	External
Costa Rica				
Nurses	Free/insured	Free/insured	Free/insured	Through employer and external
Office workers	Free/insured	Free/insured	Free/insured	Through employer and external
Other workers	Free/insured	Free/insured	Free/insured	Through employer and external
Nicaragua				
Nurses	Free/insured	Free/insured	Free/insured	External
Office workers	Free/insured	Free/insured	Free/insured	External
Other workers	Free/insured	Free/insured	Free/insured	External
UK				
Nurses	Free/insured	Free/insured	Full fee	Through employer
Office workers	Free/insured	Free/insured	Full fee	Through employer
Other workers	Free/insured	Free/insured	Full fee	Through employer
Spain				
Nurses	Free/insured	Free/insured	Free/insured	Through employer
Office workers	Free/insured	Free/insured	Free/insured	Through employer
Italy				
Nurses	Free/insured	Small fee	Full fee	Through employer
Other workers	Free/insured	Small fee	Full fee	Through employer
Greece				
Nurses	Free/insured	Free/Insured	Varies	No
Office workers	Free/insured	Free/Insured	Varies	No
Other workers	Free/insured	Free/insured	Varies	Through employer
Estonia				
Nurses	Free/insured	Small fee	Free/insured	Through employer and external
Office workers	Free/insured	Small fee	Free/insured	Through employer and external
Lebanon				
Nurses	Full fee	Full fee	Full fee	Through employer
Office workers	Small fee	Small fee	Small fee	Through employer
Other workers	Small fee	Small fee	Small fee	Through employer
Iran				
Nurses	Free/insured or small fee	Free/insured or small fee	Free/insured or small fee	Some participants
Office workers	Free/insured or small fee	Free/insured or small fee	Free/insured or small fee	Some participants
Pakistan				
Nurses	Free/through employer with a cap	Free/through employer with a cap	Full fee	No
Office workers	Free/through employer with a cap	Free/through employer with a cap	Full fee	No
Other workers	Free/through employer	Free/through employer	Full fee	No

Table 4. Cont.

Country/Occupational Group	Primary care doctor	Hospital doctor	Other practitioner	Occupational health service
Sri Lanka				
Nurses	Free/insured	Free/insured	Free/insured	No
Office workers	Free/insured	Free/insured	Free/insured	No
Other workers (1)	Free/insured	Free/insured	Free/insured	No
Other workers (2)	Free/insured	Free/insured	Free/insured	No
Japan				
Nurses	Free/insured	Free/insured	Free/insured	Through employer and external
Office workers	Free/insured	Free/insured	Free/insured	Through employer and external
Other workers (1)	Free/insured	Free/insured	Free/insured	Through employer and external
Other workers (2)	Free/insured	Free/insured	Free/insured	Through employer and external
South Africa				
Nurses	Full fee	Small fee	Full fee	Yes
Office workers	Full fee	Small fee	Full fee	Yes
Australia				
Nurses	Small fee	Small fee	Full fee	Through employer and external
New Zealand				
Nurses	Small fee	Free/insured	Payment varies	External and possibly through employer
Office workers	Small fee	Free/insured	Payment varies	External and possibly through employer
Other workers	Small fee	Free/insured	Payment varies	Through employer and external

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dissatisfaction was notably high in Italy, Japan and South Africa. The prevalence of perceived job insecurity ranged from 1.6% in Sri Lankan postal workers to 90.3% in Brazilian sugar cane cutters.

Table 8 shows the proportions of participants who were aware of a term such as "repetitive strain injury" ("RSI"), "work-related upper limb disorder" ("WRULD") or "cumulative trauma syndrome" ("CTS"), and also the proportions who knew someone else outside work, who had experienced musculoskeletal pain in the past 12 months. Awareness of RSI and similar terms varied widely – from 0.0% in Brazilian sugar cane cutters and 7.0% in South African office workers to 94.6% in Brazilian nurses and 95.9% in New Zealand office workers. There were also marked differences in knowledge of others with musculoskeletal complaints. For example, among food production workers in Lebanon, only 16.1% knew someone outside work with upper limb pain, whereas in telephone call centre workers in Costa Rica, the proportion was 65.9%.

Table 9 presents the prevalence of potentially adverse health beliefs about back and arm pain by occupational group. These again varied substantially (more than tenfold) between occupational groups. For example, 78.6% of Greek postal workers and 77.7% of Lebanese nurses believed that low back pain is commonly caused by people's work, as compared with only 4.0% of Sri Lankan postal workers and no Brazilian sugar cane cutters; and 31.4% of Brazilian nurses and 31.0% of Brazilian office workers had pessimistic views about the prognosis of arm pain, as compared with 1.6% of nurses and office workers in Iran and 0.0% of Brazilian sugar cane cutters.

Table 10 compares the characteristics of participants in the UK who answered the questionnaire at interview and by self-administration. Among the nurses and especially the "other workers", participation rates were higher among those invited to interview, whereas in the office workers they were slightly lower. However, there were no consistent differences in the prevalence of reported occupational activities and musculoskeletal pain according to the method of data collection.

Discussion

The CUPID study has generated substantial information which will be the subject of multiple reports. A particular strength is its use of standardised questions to collect information from participants in many different countries and cultural settings. This should provide valuable insights into the determinants of common musculoskeletal illness and associated disability, and particularly the extent of differences between countries.

The occupational groups were chosen for study with the aim that the prevalence of relevant physical tasks should differ between the three broad categories (nurses, office workers and "other workers"), but that within each of these categories, it should be broadly similar across countries. For nurses and office workers this objective was fairly well achieved, although inevitably there was some heterogeneity. For example, in some countries, nurses routinely lift and move patients, whereas in others such tasks may normally be undertaken by care assistants or patients' family members. For "other workers", there was more variation in occupational activities, reflecting the greater diversity of groups selected for study. Nevertheless, the mix of activities tended to differ from that of nurses and office workers, with a relatively high prevalence of work with the arms elevated; and apart from sales personnel in Japan, all groups of "other workers" had a high prevalence of work involving prolonged repetitive movement of the wrists or hands.

The international analysis of data is restricted to subjects aged 20–59 years at baseline, who had held their current job for at least