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# Prevalence of Musculoskeletal Disorders at Workplaces in the People's Republic of China

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This paper presents 2 musculoskeletal disorders questionnaire surveys in 10 different Chinese occupational groups. Data collected from 1,603 workers using a modified Nordic musculoskeletal disorders symptom questionnaire showed that the 12-month prevalence of musculoskeletal disorders, particularly in the low back and shoulder-neck regions, was high at many Chinese workplaces. Significant differences existed between occupational groups. Assembly workers usually had higher neck-shoulder complaints compared to workers in most other occupations. However, the nature of assembly seemed also to influence the prevalence rate. Workers at a cassette recorder and a TV set assembly plant appeared to have more neck complaints compared with a group of thermos flask assemblers.

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ergonomics    epidemiology    cross-sectional study    low back pain  
shoulder-neck disorders    developing countries    assembly worker

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## 1. INTRODUCTION

Work-related musculoskeletal disorders are a major concern of workers, unions, employers, and governmental organizations in many industrialized countries due to the high prevalence and enormous cost associated with these disorders. According to Official Statistics of Sweden (1995) musculoskeletal disorders constitute about 74% of all reported occupational diseases. Intervention programs to alleviate work-related musculoskeletal disorders are given priority by many companies and related authorities. A number of industrialized countries (e.g., Sweden, USA, and Canada) have developed or are developing ergonomic regulations to reduce risk factors of work-related musculoskeletal disorders in workplaces. As a basis for setting ergonomic intervention programs and ergonomic regulations, epidemiological data concerning the prevalence of musculoskeletal disorders are essential. In many industrialized countries such information has become available through national occupational safety and health surveillance systems, worker's compensation registers, and individual epidemiological studies. But **the** corresponding information for most industrially developing countries is rare. This makes it difficult to quantify the problem in those countries, and necessary ergonomic intervention may not be initiated in the workplaces to alleviate causes of work-related musculoskeletal disorders.

China as the largest developing country in the world with an economically active population of 567 million (International Labour Office [ILO], 1993) has rapidly expanded its industrial activities during the recent years. Many activities have been associated with the importation of machinery, production systems, and management methods from industrialized countries. The health impact of industrialization and the modernization of technology and industrial management have challenged the Chinese occupational health and safety professionals to put more emphasis on improving working conditions. To accumulate and analyze the statistics of occupational diseases, a nationwide system hosted at the Chinese Academy of Preventive Medicine has been operative since 1986 (He, 1991). However, work-related musculoskeletal disorders were not included in the official list of the 102 prescribed occupational diseases.

The main purpose of the present study is to obtain information about musculoskeletal disorders (discomfort and pain) in the Chinese workplaces through two surveys. The first survey quantifies the prevalence of musculoskeletal disorders in some Chinese workplaces in order to provide a basis for further investigation of risk factors and further to facilitate the formulation of ergonomic intervention programs that might be incorporated into the Chinese industrial development process. As assembly workers were identified as a high risk group, a second survey was then carried out to further investigate musculoskeletal disorders at three assembly workplaces producing different products.

## 2. MATERIAL AND METHODS

Two questionnaire surveys were carried out in the Hubei province of the People's Republic of China.

### 2.1. Study Base

#### 2.1.1. *First survey*

The Ministry of Labor of the Hubei Province (MOL) was contacted and acted as a coordinator in this survey. The MOL helped to distribute the questionnaires in 13 different workplaces through occupational health and safety personnel at the local workplaces. The exact number of employees at these workplaces was unknown, but was estimated ranging between about 100 (primary school) to several thousands (iron and steel plants). Depending on the size of the working populations, about 50 to 400 questionnaires were randomly distributed at each workplace. Totally 2,000 questionnaires were distributed randomly among workers in these workplaces. Totally 1,405 (70%) questionnaires were collected. Groups with insufficient participant numbers were excluded from the study base. Participants with inadequately completed questionnaires or with distinctly different job titles as compared with the majority of the corresponding groups were also excluded. Therefore, the final study base for the first survey included 10 occupational groups with a total of 1,296 participants (Table 1).

TABLE 1. Participant Distribution and Background Data (Range in Parentheses)

Workplace	Job Category	Number of Participants		Age (years)		Job Seniority (years)	
		Total	Male/Female	Male	Female	Male	Female
<b>1st survey</b>							
Train car manufacturing	machine tools operators	82	69/13	33 (18-54)	33 (20-40)	9.2 (0.5-32.6)	9.2 (1.6-20.0)
Computer center	computer operators, programmers, system administrators, and hardware technicians	68	36/32	29 (19-42)	26 (18-47)	5.2 (0.5-25.0)	4.4 (1.0-10.0)
Construction company	bricklayers, carpenters, and other type construction workers	103	—/—	39 (21-56)	—	16.4 (1.0-31.1)	—
Electronic assembly plant	assembly line workers	220	59/161	30 (20-51)	30 (16-50)	7.9 (0.2-30.3)	8.1 (0.1-25.0)
Garment factory	sewing machine operators	216	—/216	—	21 (16-34)	—	1.7 (0.1-10.2)
Iron and steel plant	various metal processors	365	355/10	34 (18-60)	31 (21-41)	10.6 (0.7-30.6)	6.5 (0.8-16.6)
Paint factory	mixers, crushers, filter, and separator operators	65	31/34	29 (15-64)	32 (18-49)	5.2 (0.1-35.0)	7.1 (0.2-30.0)
Taxi company	taxi drivers	53	53/—	34 (21-48)	—	12.5 (1.9-30.0)	—
Primary school	school teachers	32	—/32	—	38 (19-54)	—	18.1 (0.6-32.0)
Textile company	spinners and weavers	92	—/92	—	34 (20-50)	—	9.9 (0.7-31.0)
Total:		1296	706/590				
<b>2nd survey</b>							
Thermos flask assembly	thermos flask assemblers	97	28/69	27 (17-50)	29 (17-53)	3.8 (0.2-21.0)	5.5 (0.2-15.0)
Cassette recorder assembly	radio recorder assemblers	67	13/54	22 (19-30)	25 (18-38)	2.3 (0.1-8.0)	3.8 (0.1-15.0)
TV set assembly	TV set assemblers	143	57/86	22 (18-31)	23 (17-37)	1.6 (0.1-10.0)	1.7 (0.1-11.4)
Total:		307	98/209				

The train car manufacturing group was used as a reference group. In this group, only workers with job titles of machine tool operators were included. The other nine occupational groups were study groups.

### 2.1.2. *Second survey*

This survey was conducted in three different assembly workplaces. The exact number of employees in these workplaces at the survey time was unknown, but was around 200 to 300 at each of the workplaces. Company occupational health and safety personnel was contacted and helped in distribution of the questionnaires. A total of 307 assembly workers were randomly selected from these workplaces (Table 1). Only assembly line workers were included in this survey.

Both electronic assemblies (cassette recorder assembly and TV set assembly) used non-machine paced lines in their production, whereas the thermos flask assembly used machine paced lines. The electronic assemblies appeared to have higher precision demands than the thermos flask assembly did, whereas the latter had more forceful demands than the former because of different products. Assembly cycles were shorter at the thermos assembly compared with the electronic assembly. Further details concerning the three assembly workplaces are given by Bao (1992).

Comparisons are made between the electronic assembly groups (cassette recorder and TV set) and the thermos flask assembly to investigate differences in prevalence of musculoskeletal complaints between groups of assembly line workers.

## 2.2. Questionnaires

### 2.2.1. *First survey*

The general standardized Nordic questionnaire for the analysis of musculoskeletal symptoms (the English version; Kuorinka et al., 1987) was translated into Chinese by the first author of this paper and distributed by health and safety personnel in the workplaces. Questions were asked about musculoskeletal pain and discomfort by body parts (neck, shoulders, elbow, wrists/hands, upper back, low back, hips/thighs, knees, and ankles/feet):

- 1) since the worker started the present job,

- 2) in the last 12 months, and
- 3) in the last 7 days.

Questions were also asked whether the pain or discomfort prevented the participants from doing their normal work, or caused them to visit a doctor or take sick leave. Additional questions were asked concerning age, gender, present and previous job titles, length of employment at the present job (job seniority), and physical activities during leisure time.

### 2.2.2. *Second survey*

The participants were interviewed by trained Chinese occupational health personnel. Questions on both the general and the detailed standardized Nordic questionnaires for the analysis of musculoskeletal symptoms (based on the English version; Kuorinka et al., 1987) were asked in Chinese by the interviewer. In addition to the questions asked in the first survey, further questions were asked such as the duration of having pain or discomfort, or being prevented from doing normal work in the previous 12 months due to the pain or discomfort in the neck, shoulder and low back, as well as whether the pain or discomfort occurred in the right, left, or both shoulders.

## 2.3. Data Analysis and Statistics

### 2.3.1. *First survey*

The 12-month prevalence rates concerning complaints from the different body parts were computed. Male and female study groups were compared separately with the male and female reference groups. Within the same occupation group, comparisons between male and female groups were also made where applicable. Rate ratios were calculated after age and job seniority standardization (Hernberg, 1991).

### 2.3.2. *Second survey*

In addition to the analyses made in the first survey, duration of complaints during the last 12 months, and frequency of visiting a doctor due to the pain or discomfort were calculated as well.



### 3. RESULTS

#### 3.1. First Survey

The results showed that, in general, prevalence of musculoskeletal disorders, especially in the low back and shoulder-neck regions, was high among many Chinese occupational groups. Significant differences concerning the 12-month prevalence existed between the different occupational groups. For example, low back complaints were usually around 66 to 76% among the electronic assembly and construction workers, whereas only about 3 to 19% among workers in the computer center. The garment workers had significantly more low back complaints as compared with the reference group after the age and job seniority standardization (Table 2), although they did not show a high crude prevalence rate. Shoulder-neck complaints were usually around 40 to 60% among electronic assembly workers and primary school teachers, but often less than 30% among the other nine occupational groups. Knee complaints were reported by about 40 to 82% of the textile and construction workers as well as the primary school teachers, but were less common among the other occupational groups.

The female assembly workers at the electronic assembly plant showed higher prevalence rates of complaints in the neck, shoulder, and upper extremities than the male assembly workers. However, no such differences were found in the other nine occupational groups. Female workers at the paint factory had less knee complaints as compared to their male colleagues (Table 3).

#### 3.2. Second Survey

The low back and shoulder-neck again were the areas with the highest complaint rates among the three assembly groups (around 40 to 70% depending on assembly workplace and gender, Table 2).

The prevalence rates appear to vary according to different types of assembly. Assembly workers at the cassette recorder and TV set assembly plants seemed to have more neck complaints compared with the thermos flask assemblers, although it was not statistically significant for the male TV set assemblers. Male cassette recorder assemblers and male TV set assemblers had higher prevalence of low back complaints as compared with the male thermos flask assemblers. The male TV set assemblers had more

**TABLE 2. Musculoskeletal Complaints During the Last 12 Months (Crude Prevalence Rate in Percentage, Rate Ratio in Parentheses and its 95% Confidence Interval in Square Brackets, Comparisons Made Between Each Study Group and the Reference Group (Male and Female Separately) in Each Survey After Age and Job Seniority Standardization)**

Workplace	Gender	Neck	Shoulders	Elbows	Wrist/ Hands	Upper Back	Low Back	Hips/ Thighs	Knees	Ankles/ Feet
Train car manufacturing (reference group)	Male	14.5	13.0	7.2	21.7	17.4	42.0	4.3	15.9	7.2
	Female	23.1	23.1	7.7	23.1	23.1	30.8	15.4	30.8	30.8
Computer center	Male	2.8 (0.15)	0.0 NA	0.0 NA	0.0 NA	0.0 NA	2.8 (0.07)	0.0 NA	0.0 NA	0.0 NA
	Female	6.3 (0.75)	0.0 NA	0.0 NA	0.0 NA	0.0 NA	18.8 (1.69)	0.0 NA	6.3 (0.56)	0.0 NA
Construction company	Male	18.4 (1.44)	20.4 (1.95)	17.5 (3.46)	22.3 (1.32)	12.6 (0.81)	75.7 (1.67)	10.7 (2.28)	40.8 (2.32)	9.7 (1.79)
	Female	10.1 (0.76-2.74)	10.0 (1.00-3.78)	14.6 (8.22)	7.6 (2.31)	1.6 (0.41-1.59)	10.7 (1.33-2.10)	10.7 (0.84-6.22)	40.8 (1.48-3.64)	9.7 (0.67-4.79)
Electronic assembly	Male	45.8 (3.27)	33.9 (2.59)	18.6 (2.98)	32.2 (1.29)	40.7 (2.33)	66.1 (1.68)	28.8 (10.31)	27.1 (1.82)	20.3 (2.61)
	Female	62.1 (4.17)	54.0 (1.78)	29.8 (1.45)	44.7 (1.47)	46.0 (3.08)	68.9 (3.47)	29.2 (2.94)	34.8 (1.75)	19.3 (0.54)
Garment factory	Male	1.9 (6.00)	1.9 (0.54)	0.9 (0.29)	1.9 (0.54)	0.9 (3.00)	7.4 (18.00)	1.9 (9.00)	5.1 (12.38)	0.5 (0.13)
	Female	1.9 (0.62-57.86)	1.9 (0.16-1.75)	0.9 (0.07-1.23)	1.9 (0.16-1.75)	0.9 (0.22-41.71)	7.4 (3.97-81.65)	1.9 (0.71-114.49)	5.1 (2.35-65.09)	0.5 (0.02-0.75)
Iron and steel plant	Male	5.4 (0.39)	12.7 (1.04)	7.6 (1.22)	9.3 (0.46)	6.2 (0.38)	50.7 (1.20)	7.6 (1.85)	28.5 (1.78)	3.1 (0.46)
	Female	0.0 NA	0.0 NA	10.0 (0.50)	0.0 NA	0.0 NA	20.0 (1.13)	0.0 NA	10.0 (0.56)	0.0 NA

TABLE 2. (continued) Musculoskeletal Complaints During the Last 12 Months (Crude Prevalence Rate in Percentage, Rate Ratio in Parentheses and its 95% Confidence Interval in Square Brackets, Comparisons Made Between Each Study Group and the Reference Group (Male and Female Separately) in Each Survey After Age and Job Seniority Standardization)

Workplace	Gender	Neck	Shoulders	Elbows	Wrists/ Hands	Upper Back	Low Back	Hips/ Thighs	Knees	Ankles/ Feet
Paint factory	Male	19.4 (1.07) [0.38-3.03]	22.6 (1.28) [0.47-3.50]	12.9 (0.95) [0.26-3.43]	32.3 (1.03) [0.49-2.14]	6.5 (0.27) [0.07-1.07]	38.7 (0.87) [0.48-1.58]	0.0 NA NA	22.6 (1.33) [0.48-3.70]	6.5 (0.67) [0.12-3.76]
	Female	20.6 (1.24) [0.45-3.37]	29.4 (1.21) [0.55-2.67]	14.7 (1.11) [0.34-3.65]	26.5 (1.09) [0.47-2.47]	5.9 (0.35) [0.08-1.52]	58.8 (2.65) [1.42-4.95]	11.8 (1.06) [0.28-4.02]	8.8 (0.40) [0.12-1.31]	8.8 (0.30) [0.10-0.88]
Taxi company	Male	17.0 (1.28) [0.51-3.18]	13.2 (1.19) [0.43-3.35]	3.8 (0.68) [0.12-3.94]	3.8 (0.23) [0.06-0.87]	13.2 (0.85) [0.33-2.17]	32.1 (0.73) [0.44-1.19]	11.3 (2.40) [0.61-9.50]	7.5 (0.45) [0.15-1.31]	3.8 (0.65) [0.12-3.68]
Primary school	Female	40.6 (1.63) [0.79-3.34]	37.5 (1.64) [0.76-3.52]	12.5 (2.00) [0.41-9.87]	15.6 (0.68) [0.25-1.90]	31.3 (1.25) [0.57-2.76]	59.4 (1.78) [1.03-3.07]	18.8 (1.13) [0.39-3.27]	40.6 (1.22) [0.64-2.33]	28.1 (0.90) [0.42-1.93]
Textile company	Female	18.5 (1.09) [0.58-2.03]	19.6 (0.60) [0.37-0.99]	2.2 (0.10) [0.03-0.31]	12.0 (0.37) [0.20-0.66]	6.5 (0.38) [0.16-0.90]	68.5 (3.02) [2.13-4.27]	13.0 (1.15) [0.53-2.50]	81.5 (3.59) [2.62-4.92]	33.7 (0.88) [0.60-1.30]
<b>2nd survey</b>										
Thermos flask assembly [reference group]	Male	7.1	32.1	3.6	14.3	10.7	28.6	10.7	3.6	7.1
	Female	17.4	63.8	8.7	21.7	13.0	59.4	4.3	11.6	5.8
Cassette recorder assembly	Male	53.8 (7.58) [1.59-36.23]	38.5 (1.96) [0.55-6.99]	23.1 NA NA	0.0 NA NA	23.1 (6.50) [0.51-83.51]	46.2 (6.50) [1.23-34.22]	0.0 NA NA	15.4 (1.71) [0.20-14.80]	7.7 (1.08) [0.07-17.38]
	Female	46.3 (3.05) [1.63-5.71]	64.8 (0.97) [0.74-1.28]	13.0 (1.49) [0.49-4.48]	22.2 (0.99) [0.49-2.00]	24.1 (1.55) [0.72-3.37]	68.5 (1.20) [0.89-1.60]	5.6 (0.91) [0.20-4.19]	3.7 (0.31) [0.07-1.33]	5.6 (0.57) [0.15-2.21]
TV set assembly	Male	24.6 (1.98) [0.89-4.42]	49.1 (2.16) [1.29-3.63]	7.0 NA NA	28.1 (2.27) [1.05-4.93]	14.0 (2.07) [0.67-6.39]	42.1 (3.10) [1.61-5.97]	1.8 (0.27) [0.04-2.04]	1.8 (0.60) [0.05-6.84]	3.5 (0.28) [0.07-1.16]
	Female	33.7 (2.92) [1.59-5.36]	54.7 (0.85) [0.66-1.08]	17.4 (5.35) [1.82-15.75]	26.7 (1.36) [0.78-2.35]	22.1 (1.31) [0.71-2.42]	44.2 (0.88) [0.64-1.21]	2.3 (0.30) [0.07-1.27]	4.7 (0.46) [0.15-1.40]	8.1 (0.56) [0.24-1.33]

Notes. NA—data not available.

TABLE 3. Comparison of Prevalence Rates Between Female and Male Participants (Data Show the Rate Ratio Between Female and Male After Age and Job Seniority Standardizations, With 95% Confidence Interval in Parentheses)

Workplace	Neck	Shoulders	Elbows	Wrists/Hands	Upper		Low		Hips/Thighs	Knees	Ankles/Feet
					Back	Back					
<b>1st survey</b>											
Train car manufacturing	1.74 (0.32-9.57)	2.01 (0.34-11.95)	1.19 (0.07-20.4)	0.95 (0.23-3.90)	1.22 (0.27-5.62)	0.65 (0.24-1.76)	3.31 (0.24-45.6)	1.63 (0.41-6.57)	5.03 (0.69-36.92)		
Computer center	1.41 (0.17-11.53)	NA	NA	NA	NA	4.24 (0.86-20.83)	NA	NA	NA		
Electronic assembly	1.35 (1.10-1.65)	1.67 (1.29-2.16)	1.82 (1.21-2.74)	1.40 (1.06-1.85)	1.22 (0.94-1.58)	1.10 (0.94-1.29)	1.06 (0.75-1.50)	1.34 (0.96-1.88)	0.97 (0.62-1.52)		
Iron and steel plant	NA	NA	1.32	NA	NA	0.42	NA	0.38	NA		
Paint factory	1.01 (0.39-2.59)	1.08 (0.50-2.30)	0.55 (0.21-1.43)	0.75 (0.36-1.54)	0.60 (0.11-3.21)	1.30 (0.82-2.06)	NA	0.26 (0.09-0.73)	0.86 (0.20-3.75)		
<b>2nd survey</b>											
Thermos flask assembly	7.09 (1.91-26.36)	1.78 (1.26-2.52)	3.00 (0.68-13.22)	1.05 (0.55-1.99)	1.06 (0.44-2.55)	1.95 (1.32-2.86)	0.45 (0.12-1.62)	1.66 (0.57-4.82)	2.36 (0.43-13.11)		
Cassette recorder assembly	1.03 (0.68-1.55)	2.07 (1.37-3.12)	0.66 (0.28-1.58)	NA	1.23 (0.60-2.52)	1.84 (1.27-2.66)	NA	0.29 (0.07-1.21)	0.81 (0.18-3.54)		
TV set assembly	1.48 (0.91-2.41)	1.21 (0.89-1.63)	2.74 (1.13-6.62)	0.89 (0.55-1.43)	1.67 (0.86-3.25)	1.03 (0.73-1.45)	1.33 (0.16-10.83)	2.92 (0.47-18.15)	2.56 (0.69-9.49)		

Notes. NA—data not available.

complaints in their shoulders and wrists/hands than the male thermos flask assemblers, whereas the female TV set assemblers had more elbow complaints than the female thermos flask assemblers (Table 2).

Gender differences were also shown in the second survey. Females at the thermos flask assembly had more neck, shoulder, and low back complaints than the males. Female cassette recorder assemblers more commonly reported shoulder and low back complaints than male cassette recorder assemblers. In the TV set assembly plant, females had more elbow complaints than their male colleagues (Table 3).

Shoulder complaints generally occurred in both shoulders or the right shoulder only (about 89-100 % of the cases, Table 4). It was seldom that shoulder trouble arose from the left shoulder only.

**TABLE 4. Location of Shoulder Complaint (Percentage of Total Complaints)**

Complaint	Thermos Flask Assembly		Cassette Radio Assembly		TV Set Assembly	
	Male	Female	Male	Female	Male	Female
Only right shoulder	22	57	60	46	43	53
Only left shoulder	0	9	0	3	11	0
Both shoulders	78	34	40	51	46	47

Low back problems in 45% of the cases lasted for 1-7 days, in 11% for 8-30 days, and in 44% for longer than 30 days. Neck problems in 61% of the cases lasted for 1-7 days, in 27% for 8-30 days, and in 13% for longer than 30 days. Shoulder discomfort in 43% of the cases lasted for 1-7 days, in 12% for 8-30 days, and in 45% for longer than 30 days. In spite of the high prevalence and long duration of these problems, only a few of those reporting complaints sought medical treatment during the previous 12 months (Table 5).

**TABLE 5. Seeing a Doctor, Physiotherapist, or Other Such Person Because of Complaints on the Low Back, Neck, and Shoulder Regions (Percentage of Those who Had Complaints in the Last 12 Months)**

Complaint	Thermos Flask Assembly		Cassette Radio Assembly		TV Set Assembly	
	Male	Female	Male	Female	Male	Female
Low back	37.5	22.0	33.3	32.4	20.8	36.8
Neck	0.0	16.7	0.0	28.0	21.4	34.5
Shoulders	11.1	27.3	0.0	5.7	25.0	29.8

## 4. DISCUSSION

The present investigation illustrates that musculoskeletal disorders seem to be a widespread occupational problem in many Chinese workplaces today. The following discussion will focus first on some methodological issues, which may have implications for our findings. The findings concerning musculoskeletal disorders at the Chinese workplaces will then be discussed.

### 4.1. Methodological Consideration

It is difficult to find an occupational group that is "symptom-free" in the research of musculoskeletal disorders, as it is possible in some other types of health research. This study used an approach to select an occupational group that was neither dominated by tasks with static physical exposure nor involved mainly heavy material handling activities, as a reference group in the comparisons. The train car manufacturing group was considered to have such characteristics and selected as the reference group in the first survey. The thermos flask assembly group was selected as the reference group in the second survey. Possible differences in occurrence of musculoskeletal complaints between operators at the three lines may be associated with corresponding organizational and technology differences. All the comparisons only show the risk levels relative to the reference groups, although the jobs of the reference groups may also involve risky mechanical exposures.

The sample population was selected mainly from the sectors of manufacturing, transportation, construction, and education. The selection therefore considered occupational groups of heavy and light tasks, as well as male and female dominated occupations. Employees in these sectors represent about 70% of the jobs in the state-owned enterprises in China during 1989 (ILO, 1993). However, this selection did not consider those workers employed in the sectors such as agriculture, mining, energy, business, and trade, which employ about 30% of the employees of the state-owned enterprises (ILO, 1993).

A questionnaire method rather than clinical examination is usually preferred in epidemiological studies of musculoskeletal disorders (e.g., Andersen & Gaardboe, 1993; Ohlsson, 1995; Toomingas, Németh, Hagberg, & Stockholm Music 1 Study Group, 1991; Tömer et al., 1988; Vihma, 1982). This is because it is usually easy and cheap to apply to large populations. However, this method provides less detailed information concerning the type of disorders, and does not offer diagnostic conclusions.

To compare results from different studies, it is necessary to use a standardized questionnaire. The Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms (Kuorinka et al., 1987) were used in this investigation. However, there are probably significant limitations in applying a questionnaire that has been standardized in one country to elucidate apparently similar problems arising in another country. Large cultural and social differences between countries and their consequent effect upon individuals living in them may make it inappropriate to compare results other than superficially (Diderichsen, 1990; Kuorinka et al., 1987; Malker & Malker, 1991; Sinclair, 1990). For example, due to the low awareness of work-related musculoskeletal disorders in the Chinese society (see the last paragraph of the discussion section), our participants may give lower reporting as compared with studies using Swedish participants.

The way the questions are asked could also influence the reported prevalence rates (Brattberg, Thorslund, & Wikman, 1989). Although the possible confounding factors have been minimized through translating the questionnaires by one of the authors, who is a native Chinese speaker, a test-retest reliability study may provide more scientific basis to increase the validity of such between country comparisons.

#### 4.2. Prevalence of Musculoskeletal Disorders and Possible Relations to Occupational Mechanical Exposures

The present survey showed that musculoskeletal disorders were prevalent in many Chinese workplaces. Supporting these are two recent cross-sectional epidemiological studies carried out by Chinese researchers (Fan et al., 1995; Li & Lu, 1994), which show that there is high prevalence of complaints in the shoulder-neck and low back areas among Chinese automobile assemblers, computer operators, and postmen. However, little attention to the issue of work-related musculoskeletal disorders appears to be paid by the Chinese occupational health and safety specialists. This may be because work-related musculoskeletal disorders are not yet on the Chinese official occupational disease list, and consequently this is not an issue in the labor inspector's routines. In many workplaces, the management did not seem yet to acknowledge the relationship between workplace factors and musculoskeletal disorders (personal communications with the management at some Chinese workplaces). Furthermore, individual workers may not relate their musculoskeletal problems to their workplace.

The present study showed that low back complaints were common (Table 2) among occupations where prolonged sitting or standing may be required (e.g., assembly work, garment making, primary school, and textile factory) and occupations where heavy material handling or lifting may be demanded (e.g., construction, iron and steel plant, paint manufacturing). This agrees with previous identified work-related risk factors of low back disorders (cf. Hildebrandt, 1987; Jayson, 1980; Riihimäki, 1991; Troup, 1984).

Shoulder-neck complaints were common among the Chinese assemblers (Table 2). This agrees with previous investigations of assembly workers including Swedish studies (e.g., Bovim, Schrader, & Scand, 1994; Christensen, 1986; Maeda, 1977; Ohlsson, Attewell, & Skerfving, 1989; Wiker, Chaffin, & Langolf, 1990; Ydreborg & Sandström, 1988).

The present investigation showed that the neck complaints were more common in the cassette recorder and the TV set assemblies compared with the thermos flask assembly (Table 2). The differences may be caused by the differences in the nature of work tasks, work organization, and technology used in these assembly places. Less efficient assembly line balancing at the thermos flask assembly line compared with the two electronic assembly lines may be one factor that is related to the prevalence of musculoskeletal complaints (Bao, Winkel, Mathiassen, & Shahnava, 1997). Another possible explanation of this difference is that the electronic assembly tasks may have higher precision demands compared with the thermos assembly tasks. This may result in increased mechanical exposure to the neck region (Winkel & Westgaard, 1992). The nature of the assembly tasks and workstation ergonomic design features including tool weight and design of tools may also partially explain the differences in shoulder-neck complaints between the assembly groups. The results show that in this case a job title offers a poor estimate of exposure.

The high occurrence of knee complaints among the Chinese textile workers (Table 2) may be explained by working conditions due to the technology and work organization used in the textile plant. According to our experience, each of the Chinese textile workers usually operates several machines during the shift. Consequently they walk between the machines frequently resulting in development of complaints and discomfort in the feet, knees, and low back during the working day (Hansen, Winkel, & Jørgensen, 1998; Winkel, 1982). Furthermore, some of the old type Chinese textile (weaving) machines require the operator to push a lever frequently with the knee during operation (observation of one of the co-authors), with the result that an extra load is frequently applied to it.



It has been reported that females have higher prevalence of shoulder-neck complaints than males (e.g., Berg, Karlsson, Axelson, Björkqvist, & Bjerre-Kiely, 1995; Statistics Sweden, 1990). However, the present results did not show such tendency among most occupational groups except the assembly groups where the female assembly workers reported shoulder-neck complaints more often than the male workers (Table 3). This gender effects in the assembly groups may be due to differences in working conditions attributable to gender-based job assignment (Mergler, Brabant, Vézina, & Messing, 1987).

The low prevalence rates of complaints among the sewing machine operators were not expected. It may be due to the young age of the operators (average 21 years old) and low job seniority (average 1.7 years). It has been reported that the prevalence of musculoskeletal pain is increased by age (Andersson, Ejlertsson, Leden, & Rosenber, 1993).

Our results show that in spite of the high prevalence of musculoskeletal complaints, Chinese workers rarely seek medical treatment to reduce their pain. Similar findings are also reported in other studies (Hasvold & Johnsen, 1993). Cultural differences and general awareness of musculoskeletal disorders may be partially responsible for this.

## 5. CONCLUSIONS

1. The prevalence of musculoskeletal disorders, especially in the low back and shoulder-neck regions, were high in many of the investigated Chinese workplaces.
2. Large differences concerning 12-month prevalence existed between different Chinese occupational groups.
3. Assembly workers comprised of a high risk group for shoulder-neck disorders.
4. The prevalence of musculoskeletal complaints differed considerably between the three investigated groups of assembly line workers. This may be explained by organizational as well as technical differences between the lines.
5. Female assembly workers had significantly higher prevalence of shoulder-neck complaints compared with male assembly workers. However, this gender difference was not apparent in the other nine occupation groups.

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