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Gender differences in upper extremity musculoskeletal complaints in the working population

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Abstract Objectives: This study analysed the association between gender and upper extremity musculoskeletal complaints, among the general working population and in various occupational groups. The hypothesis was tested whether the higher risk for women in the general working population for these complaints could partly be explained by differences in the distribution of men and women in occupations with different risks for the onset of upper extremity musculoskeletal complaints. Methods: The data for this study came from cross-sectional questionnaire data from 16,874 employees categorised in 21 different occupational classes. Associations between gender and complaints of the upper extremities were analysed for the total study sample and for each occupational class separately. An adjustment was made for the variable 'occupational class' in the final model in order to study the impact of occupational gender segregation on gender differences in upper extremity complaints in the working population. Results: In the total study sample, significantly higher risks of complaints of the neck, shoulder, elbow, and wrist among the women were observed. Within many occupational classes, women reported significantly higher risks than did men, in particular for complaints of the neck and shoulder. Adjustment for occupational class showed increased risks for female workers for complaints of the neck, shoulder, elbow, and wrist, hence, rejecting our hypothesis on occupational gender segregation as an explanation for the higher risks for upper extremity complaints among women in the general working population. Conclusions: This study confirmed the presence of gender differences in upper extremity musculoskeletal complaints among the working population and in many occupational classes, with female workers having the higher risk. The results, however, do not lend support to a differential occupational exposure theory as an explanation for the higher risks for these complaints among women in the general working population. Careful consideration of gender influence in ergonomic epidemiological studies is recommended.

Key words Gender · Occupational exposure · Musculoskeletal complaints · Upper extremities · Questionnaire study

Introduction

During the past decade, upper extremity musculoskeletal disorders (UEMSD) have become one of the most significant and costly health problems among the working population world-wide (Feuerstein et al. 1998; Muggleton et al. 1999; Silverstein et al. 1998). Alternative terms for these disorders are: repetitive strain injuries (RSI), cumulative trauma disorders (CTD), and occupational cervicobrachial disorders (OCD) (Rosecrance and Cook 1998). Several extensive reviews have been published lately on the epidemiological evidence of work-related risk factors in the development of these types of disorder (Bernard 1997; Derebery 1998; Muggleton et al. 1999, Rosecrance and Cook 1998; Sluiter et al. 2000; Viikari-Juntura and Silverstein 1999; Winkel and Westgaard 1992). Most of the papers concluded that occupational exposure to factors such as highly repetitive work tasks, excessive forces, awkward working postures, and hand-arm vibration are associated with the onset of UEMSD.

The individual factor of gender has frequently been treated as a potential confounder or effect modifier in ergonomic epidemiological studies (Bernard 1997). Over the past years, elevated risks of complaints of the upper extremities among female workers have been reported in
various occupational groups, e.g. among car assembly workers (Zetterberg and Öfverholm 1999), newspaper employees (Bernard et al. 1994), salespeople (Skov et al. 1996), fish industry workers (Chiang et al. 1993; Nordander et al. 1999), and office workers (Bergqvist et al. 1995). In large-scale studies of the general working population in different countries, the higher risk for women of the onset of these types of complaint have also been consistently observed (De Zwart et al. 1997a; Ekberg et al. 1995; Feuerstein et al. 1998; Franklin et al. 1991; Linton 1990; Tanaka et al. 1995). The explanations for these gender differences, however, are still poorly understood.

Recently, Kilborn and Messing (1998) discussed potential reasons for the higher musculoskeletal morbidity rates among female workers. The first explanation that was hypothesised were the biological differences between sexes in, e.g. body size, muscular capacity, aerobic capacity, and hormonal conditions, thought to make women more susceptible to the onset of musculoskeletal disorders. Secondly, outside of work, female workers may be more often exposed to risk factors for these types of disorder during household and child care activities than are men. Thirdly, gender-related differences may be related to information bias, as women may be more likely to express or report health problems. Fourthly, within the same occupation, the assigned tasks between both sexes may differ, as well as the psychosocial work environment. Furthermore, work stations and applied tools at the work place may be inappropriate for women, as most of them have been designed on the basis of anthropometric data for men. Finally, women and men may be segregated into different jobs with different working conditions and thus consequently are exposed to different occupational risk factors.

This last-named differential occupational exposure theory has often been mentioned as one of the most plausible explanations for gender differences in health statistics among the general working population. Consistent evidence for this hypothesis concerning gender differences in musculoskeletal complaints, however, is still lacking.

The objectives of this study are twofold: firstly, to analyse the association between gender and upper extremity musculoskeletal complaints among the general working population and in various occupational groups. Secondly, to test the hypothesis whether the higher risk in women in the general working population for these types of complaint can be explained partly by differences in the distribution of male and female workers in occupations with different risks for the onset of upper extremity musculoskeletal complaints.

**Methods**

**Subjects**

The data for this study on complaints of the upper extremities came from cross-sectional questionnaire data on working conditions and health, from a database concerning 48,690 active male and female workers from the Netherlands. All questionnaires were gathered by a regional occupational health service (OHS) in the eastern part of the country between 1982 and 1993, as part of periodic occupational health surveys (POHS). For almost three decades, employees in the Netherlands have been invited by their OHS to participate in a POHS with intervals of approximately 4 years. The surveys are carried out company-wide on a voluntary basis. Reported participation rates vary around 70-90% (Weel et al. 2000). A POHS consists of a standardised physical examination and a self-administered questionnaire. The survey primarily aims at identification of adverse working conditions and work-related diseases (Weel et al. 2000).

In case workers participated more than once in a POHS between 1982 and 1993, data from only the first questionnaire were used. Excluded from analyses were all employees: serving in the armed forces (n = 1,325), those with a mental or physical disability, working in sheltered workplaces (n = 2,861), those with ages deviating from the range 15–64 years (n = 18), and those with missing values on any of the items included in the analyses (n = 433). In the remaining group of 44,053 subjects, occupational classes were constructed by grouping workers by their occupational titles in order to increase statistical power. This grouping procedure was based on the Dutch classification of occupations. This national classification system is derived from the international standard classification of occupations in which occupations with similar work demands are grouped into occupational classes (ILO 1969). Because of statistical considerations, we selected for the final analysis data from occupational classes that had a minimum number of 50 subjects in each gender group. In total, 16,874 subjects were selected of whom 66.9% were men and 33.1% were women. Mean age of the men was 38.0 years (range 17–64) and of the women was 32.9 years (range 16–64). The sample included employees from 21 occupational classes representing a broad variation in work tasks and work demands (see Table 1).

**Questionnaire data**

The self-administered questionnaire, that has been used for almost three decades in POHS (Weel et al. 2000) and in several epidemiological studies (Broersen et al. 1996; De Zwart et al. 1997a, b, 1997c), included 55 items about subjective work demands and working conditions and 117 items about subjective health complaints. For the analysis, data were selected from questions referring to current job title, age, gender, civil status, and finally complaints of the upper extremities. Subjective complaints of the upper extremities were estimated through the questions: (1) Do you regularly have pain or stiffness in the neck? (yes/no); (2) Do you regularly have pain or stiffness in the shoulder? (yes/no); (3) Do you regularly have pain or stiffness in the elbow? (yes/no); and (4) Do you regularly have pain or stiffness in the wrist? (yes/no).

**Data analysis**

Cox’s proportional hazards regression analyses with a constant risk period were performed for the estimation of crude and adjusted prevalence ratios and 95% confidence intervals as effect measures of the association between gender and complaints of the upper extremities (Breslow 1974; Thompson et al. 1998). Men were selected as reference population. Demographic confounders age (four groups ≤29, 30–39, 40–49, 50 years) and civil status (two groups: single, and married/living together) were included in the adjusted analyses, regardless of the level of significance. Moreover, we performed descriptive analyses of the prevalences of complaints to identify high and low risk occupations by gender.

To study the impact of differences in gender distribution in occupational classes on the association between gender and upper extremity complaints in the general working population, we added the variable ‘occupational class’ as a confounder to a model in which age and civil status were already included. This was done for