

Ergonomic Conditions and Health at Gender Segregated Workplaces

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Abstract: *Purpose:* To investigate working conditions and health at gender segregated (most women, $\geq 60\%$ women or most men, $\geq 60\%$ men) workplaces with a focus on associations of ergonomic exposures with musculoskeletal disorders.

Methods: A comprehensive questionnaire was randomly sent to 10 000 inhabitants in three municipalities in the middle of Sweden. The response rate was 50% (4965 men and women). Organisational, physical and psychosocial working conditions and the musculoskeletal symptom panorama as well as general health and psychological well-being were compared between men and women in the gender segregated workplaces.

Results: There were significant differences in working conditions between men and women both in female and male dominated workplaces. Most differences concerned physical work environment factors at both workplaces. However, the level of low control and strain were more prevalent among women in male dominated workplaces. A significantly greater share of women, compared to men, reported symptoms in all body parts except in low back and knees at both workplaces. Good general health was reported by 80% of both men and women but men in male dominated workplaces perceived significantly better psychological well-being than the others.

Conclusions: Women and men in this region performed different work tasks and a greater share of women than men reported musculoskeletal symptoms. This was the fact also when working in the same type of segregated workplaces.

Keywords: Gender segregated, musculoskeletal symptoms, organisation, work environment.

INTRODUCTION

Heavy physical load at work is a potential risk factor for many different diseases, such as cardiovascular and musculoskeletal diseases [1-3]. Psychosocial job strain is often associated with musculoskeletal symptoms [4-8]. Environments with high chemical-physical exposures are often found in combination with heavy physical workload and an association with musculoskeletal symptoms is obvious [9-11].

Literature reviews indicate that women in general report less musculoskeletal well-being than men [12]. One reason could be the gender segregated labour market. Men and women work in different sectors – or more precisely, with different work tasks. So far, most attention has been focussed on occupational risk factors such as physically heavy and demanding exposures like manual materials handling, dust and noise, i.e. environments typical for male workers. This type of exposures often put more emphasis on whole-body exertions and energy expenditure than on local, repetitive stress to the upper extremities. Job requiring high static loading of the neck and shoulders, with repetitive use of small muscle groups, involve a high risk of upper extremity disorders. During dynamic low-load manual work, the higher the speed of motion and/or the higher the precision demands are the more increased muscle forces relative to capacity are needed [13, 14].

The physical demands of female-intensive jobs are often perceived by those not performing the jobs to be less strenuous than the jobs typically performed by men. Women and men working in the same factories, with the same job titles did not always perform tasks with the same physical requirements or work organisation [15]. Women performed more repetitive work on average, whereas men were less likely to sit for prolonged periods, compared to women. Exposures relevant to the occurrence of musculoskeletal disorders include both physical workload and the organisation of work in general [15]. There is scientific evidence of cause-and-effect relationships between repetitive motion, forceful work, and postural stress for disorders of the back and upper extremities [13]. The risk is particularly high when two or more of these features are simultaneous and exert synergistic effects [13].

Being a female is often described as a "risk factor" for many musculoskeletal disorders because prevalence in the general population and in large groups of employees has reported to be twice as high among women compared to men [16, 17]. As Punnett and Herbert [15] point out, it is essential to distinguish between genders differences in *crude prevalence or risk* and differences in *the effects of occupational exposures* on musculoskeletal outcome. The associations of musculoskeletal disorders with gender and occupational ergonomic exposures should be assessed separately in order to determine whether women are at increased risk when exposed to the same ergonomic stresses as men.

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OBJECTIVE

The aim of this study was to investigate the associations of ergonomic exposures with musculoskeletal disorders and more specifically to see how differences between men and women in terms of working conditions, musculoskeletal symptoms, general health and psychological well-being were related to workplaces segregated by gender.

What were the differences between men and women, at workplaces, dominated by men and women, respectively?

What were the differences among men and among women at the gender segregated workplaces?

These research questions were the focus of this study.

MATERIAL AND METHODS

Region and Study Context

The Norrköping region and the neighbouring municipalities of Finspång and Söderköping were selected as the study region. This is rather a well demarcated region in Sweden with a flow of labour between these municipalities, although each municipality has its own economic structure and social and cultural context. There are also a number of gender segregated workplaces suited for this research project. We were also met by a positive attitude from politicians and decision makers to development of equal opportunities and to cooperation between practice and research. Introductory conferences were held early in order to identify questions and problems with respect to working conditions at the segregated workplaces with a focus on the ergonomic conditions to promote the development and change on local and regional level within the municipalities.

Norrköping has traditionally been a pronounced trading- and industrial city dominated by textile-, paper- and manufacturing

industry, but has developed the business sector. The University of Linköping has a Campus Norrköping which has improved the development positively with growth for knowledge based and technical qualified businesses. Norrköping has approximately 122 000 inhabitants. *Finspång* has a long tradition as an industrial community. Occupations within the industry are as high as 46 percent. The labor market is highly gender segregated. Within the industry, 65 percent of the men and 20 percent of the women are occupied. Women are mostly occupied within the health sector, 40 percent where only 4 percent of the men are found. The number of inhabitants has steadily decreased and is now about 22 000. Young people move out and there is a lack of a qualified engineers and workers. *Söderköping* is a smaller municipal, 14 000 inhabitants. Small businesses are common.

Study Population

A questionnaire was sent to a randomly selected group of 10 000 persons, aged 18-64 years living in the region. The response rate was 50% (4965 men and women). They were asked about the distribution of gender at their workplace. Those working at gender segregated workplaces (most women, $\geq 60\%$ women or most men, $\geq 60\%$ men) constituted the study group. Twenty percent of the men and 25 % of the women, who had answered the questionnaire, did not fulfil the criteria for the analysis in the present study (no paid jobs, on sick-leave >3 months, students, etc) and were excluded. Data of respondents is shown in Table 1.

We used a modified classification system developed by Kohn and Schooler [18], where occupations were categorised in three groups: In the "people" category are occupations where the person mainly work with people - for example nurse, dentist, teacher or cashier. In the "things" category the person mainly works with objects - for example construction worker, cleaner or cook. In the "data" category,

Table 1. Characteristics of Respondents with and without Paid Jobs

	Men			Women		
	n	%	Mean Age	n	%	Mean Age
Respondents without paid jobs, on sick-leave >3 months, students, etc.	456	20	-	684	25	-
Workplaces with most women ($\geq 60\%$)	227	10	40 (18-62)	1487	54	43 (18-62)
Workplaces with about the same distribution of men and women (40-60%)	300	14	41 (18-62)	307	11	39 (18-62)
Workplaces with most men ($\geq 60\%$)	1236	56	42 (18-62)	268	10	40 (18-62)
Total	2219	100	-	2746	100	-

Table 2. Gender Segregated Workplaces and Relative Frequency of Men and Women Working with "People", "Thing" and "Data"

	Men				Women			
	n	People	Thing	Data	n	People	Thing	Data
		%	%	%		%	%	%
Most Women								
($\geq 60\%$)	227	52	28	20	1487	70	16	14
Most Men								
($\geq 60\%$)	1236	5	78	17	268	10	69	21

data formed the main object - for example journalist, secretary, computer operator or engineer (Table 2).

In female dominated workplaces both men and women worked predominantly in the "people" category; 52% of the men and 70% of the women. In male dominated workplaces both men and women worked predominantly in the "data" category; 78% of the men and 69% of the women.

METHODS

Questionnaire

A comprehensive questionnaire was sent to the participants. Standardised, reliable and valid questions were used [19], which made it possible to compare with other relevant studies in the area. The questionnaire included a wide range of questions on health and physical and psychosocial risk factors at work as well as on background data, employment/unemployment, physical and chemical and psychosocial working conditions, work organisation, general health, musculoskeletal symptoms and psychological well-being.

Questions on *work organisation* included employer, gender distribution, work hours, negative changes in working conditions during the last 12 months, negative expectation of the future and work flexibility, in total eighteen questions with 3 – 8 answer alternatives.

Questions on *physical work exposure* were focussed on known risk factors for developing musculoskeletal symptoms. Exposure questions on duration in different work postures and manual materials handling were measured on a scale from 0 to 10 or by selecting one of five alternatives: not at all, 1-3 days/month, 1 day/week, 2-4 days/ week, every day.

Questions on *psychosocial work exposure* were derived from the demand-control-social support model [20].

A single question measuring *general health* was derived from the SF36 questionnaire [21, 22]: How would you rate your health in general at present? Five response alternatives were given: excellent, very good, good, fair and poor. Those given the response alternative excellent, very good and good were included in the analysis.

Questions measuring *musculoskeletal symptoms* were derived from the Nordic Questionnaire [23]. Nine different body parts were illustrated by a figure and those who marked any symptoms during the last three months were included in the analysis.

Questions measuring *general psychological well-being* were derived from the SF36 questionnaire [21, 22]. Answers to nine questions were reported on a six-graded scale about feelings during the last four weeks. The scale ranged from "all the time" to "not at all during this time period". An index of the nine questions was created and ranged from 9 to 54.

Data Analysis

Cross tables were used to calculate relative frequency of women and men at the gender segregated workplaces exposed to physical, psychosocial and organisational risk factors at work. Questions with more than two response alternatives were dichotomised at the 75th percentile. Only

those with high exposures ($\geq 75^{\text{th}}$ percentile) were included in the analysis.

Logistic regression analysis was conducted to calculate odds ratios (OR) and 95% confidence intervals, OR (95% CI), for risk indicators of musculoskeletal symptoms associated with exposures at gender segregated workplaces. Men in female dominated workplaces were used as a reference group (OR=1). Gender and segregated workplaces were included in the same model.

Relative frequencies of women and men at the segregated workplaces were compared regarding organisational working condition, psychosocial exposures and physical exposures as well as general health, psychological well-being and musculoskeletal symptoms. The difference between men and women (M-W) and among men and among women in prevalence of symptoms and exposures was expressed in difference between proportions with 95% confidence intervals [24]. Differences were statistically significant when $CI > 1$ or $CI < -1$.

All statistical analyses were performed with the SPSS program

RESULTS

Did the Working Conditions Differ Significantly Between Men and Women in Female and Male Dominated Workplaces?

There were differences in working conditions between men and women both in female and male dominated workplaces (Table 3). Two organisational factors (part-time work and negative expectation of the future) differed between men and women (more prevalent among women) in female dominated workplaces (Table 3). Five organisational factors differed between men and women in male dominated workplaces (Table 3). Two psychosocial work environment factors (low control and strain) differed and were more prevalent among women in male dominated workplaces. As many as eleven physical work environment factors differed between men and women in female dominated workplaces and there were higher frequency of women in five of these factors; stationary standing posture, moving around at work, manual materials handling in the two lowest weight classes and high physical exertion experienced at ordinary work. In male dominated workplaces, there was a higher frequency of women in four factors (sedentary work, computer usage, VDU-screen usage and repetitive hand/finger tasks) while men were more frequent in 11 factors (Table 3).

The following differences showed to be significant in the analysed data among men and among women in gender segregated workplaces (Table 4):

- Both men and women in female dominated workplaces showed higher frequencies of part-time work, while both men and women in male dominated workplaces showed higher frequencies of salaries only by piecework.
- More men in female dominated workplaces perceived high work demands compared to men in male dominated workplaces.
- More women in male dominated workplaces perceived low control and low support from

Table 3. Significant Differences in Working Conditions Between Men and Women in Female and Male Dominated Workplaces. The Relative Frequency (%) of Men and Women, Differences with 95% Confidence Interval (CI). Grey Area Indicates Significant Differences

Working Conditions	Most Women (≥60%)		Most Men (≥60%)			
	Men N=227	Women N=1487	Men/Women Difference	Men N=1236	Women N=268	Men/Women Difference
Organisation	%	%	% (CI)	%	%	% (CI)
No possibility to stay home for shorter illness	59	59	0 (-7-7)	58	65	-7 (-13--1)
Part-time work ≤ 30 hours/week	14	35	-21 (-26--16)	5	18	-13 (-18--8)
Salary only by piecework	8	8	0 (-4-4)	26	13	13 (8-18)
Inconvenient working hours	7	9	-2 (-6-2)	13	8	5 (1-9)
Unsafe employment	19	19	0 (-6-6)	19	25	-6 (-11--0.1)
Negative expectation of the future	22	29	-7 (-13--1)	20	25	-5 (-10-5)
Psychosocial work environment						
Low control (decision latitude)	23	27	-4 (-10-2)	26	35	-9 (-16--3)
Strain (high demands and low control)	9	10	-1 (-3 -5)	8	13	-5 (-1 - -9)
Physical work environment						
Sedentary work	35	23	12 (5-18)	29	51	-22 (-29--16)
Computer usage	39	30	9 (2-16)	35	60	-25 (-32--19)
VDU-screen usage	32	26	6 (-0.3-13)	28	55	-27 (-33--20)
Stationary (standing) posture	20	27	-7 (-13 --2)	12	13	-1 (-6-3)
Moving around at work	26	36	-10 (-16--4)	33	19	14 (9-19)
Bounded sitting at work	35	24	11 (4-17)	28	34	-6 (-12-0.2)
Working on vibrating surface	7	3	4 (1-7)	37	16	21 (16-26)
Working with vibrating tools	14	6	8 (3-13)	46	13	33 (28-38)
Precision work	14	8	6 (1-11)	20	9	11 (7-15)
Working with hands above shoulders	17	22	-5 (-10-0.5)	35	16	19 (14-24)
Working with hands below knee levels	16	19	-3 (-8-2)	36	15	21 (16-26)
Repetitive hand/finger tasks	29	31	-2 (-8-4)	30	56	-26 (-32--20)
Manual material handling, 1-5 kg	39	49	-10 (-17--3)	51	41	10 (3-16)
Manual material handling, 5-15 kg	26	34	-8 (-14--2)	48	22	26 (20-32)
Manual material handling, above 15 kg	27	33	-6 (-1-0.1)	45	17	28 (22-33)
High physical exertion experienced at ordinary work	16	34	-18 (-24--13)	31	19	12 (7-17)

colleagues compared to women in female dominated workplaces.

- Two physical work environment factors with high exposures had more men in female dominated workplaces compared to men in male dominated workplaces (stationary standing posture and bounded sitting).
- Twelve other physical work environment factors with high exposures had more men in male dominated workplaces compared to men in female dominated workplaces.
- Among women, there was a more even distribution of work environment factors in differences between

female (eight factors) and male (seven factors) dominated workplaces (Table 4).

Did the Musculoskeletal Symptom Panorama Differ in Men and Women in Female and Male Dominated Workplaces?

Self-reported musculoskeletal symptoms differed between men and women in the gender segregated groups. A higher frequency of women, compared to men, reported symptoms in all body parts except in low back and knees in female dominated workplaces (Table 5). In male dominated workplaces, the picture was similar. More men; however, reported symptoms in knees (Table 5).

Differences in symptom reports among men in female and male dominated workplaces and women in female and

Table 4. Significant Differences in Working Conditions Between Men in Male Dominated Workplaces and Men in Female Dominated Workplaces As Well As Women in Female Dominated Workplaces and Women in Male Dominated Workplaces. The Relative Frequency (%) of Men and Women, Differences with 95% Confidence Interval (CI). Grey Area Indicates Significant Differences

Working Conditions	Men ≥60% Women N=227	Men ≥60% Men N=1236	Men/Men Difference	Women ≥60% Women N=1487	Women ≥60% Men N=268	Women/Women Difference
Organisation	%	%	% (CI)	%	%	% (CI)
No possibility to adjust work tasks to the form of the day	12	17	-5 (-10—0.4)	13	17	-4 (-9-1)
Part-time work ≤ 30 hours/week	14	5	9 (4-14)	35	18	17 (12-22)
Salary only by achievement	8	26	-18 (-22—14)	8	13	-5 (-9—0.7)
Inconvenient working hours	7	13	-6 (-10—2)	9	8	1 (-2-5)
Unsafe employment	19	19	0 (-6-6)	19	25	-6 (-11—0.1)
Psychosocial work environment						
High demands	41	30	11 (4-18)	37	32	5 (-1-11)
Low control	24	26	-2 (-9-4)	26	35	-9 (-14--1)
Low support from colleagues	26	30	-4 (-10-2)	20	29	-8 (-14--2)
Physical work environment						
Sedentary work	35	29	6 (-1-13)	23	51	-28 (-35--22)
Computer usage	39	35	4 (-3-11)	30	60	-30 (-36--24)
VDU-screen usage	32	28	4 (-2-11)	26	55	-29 (-35--23)
Stationary (standing) posture	20	12	8 (2-13)	27	13	14 (9-19)
Moving around at work	26	33	-7 (-13--1)	36	19	17 (12-22)
Bounded sitting at work	35	28	7 (0.1-14)	24	34	-10 (-16--4)
Working on vibrating surface	7	37	-30 (-34--26)	3	16	-13 (-18--9)
Working with vibrating tools	14	46	-32 (-37--27)	6	13	-7 (-11--3)
Precision work	14	20	-6 (-11--0.8)	8	9	-1 (-5-3)
Working with hands above shoulders	17	35	-18 (-23--12)	22	16	6 (1-11)
Working with hands below knee levels	16	36	-20 (-26--15)	19	15	1 (-4-6)
Bending/twisting posture	47	58	-11 (-18--4)	54	52	2 (-4-9)
Repetitive hand/finger tasks	29	30	-1 (-7-6)	31	56	-25 (-31--19)
Manual material handling, 1-5 kg	39	51	-12 (-19--5)	49	41	8 (2-14)
Manual material handling, 5-15 kg	26	48	-22 (-28--16)	34	22	12 (7-18)
Manual material handling, above 15 kg	27	45	-18 (-25--12)	33	17	16 (11-21)
High physical exertion experienced at ordinary work	16	31	-15 (-21--10)	34	19	15 (10-20)

male dominated workplaces were less than between men and women in female and male dominated workplaces (Table 6). More men in male dominated workplaces reported symptoms in elbows, knees and feet/ankles than men in female dominated workplaces. More females in female dominated workplaces reported symptoms in hands/wrists (Table 6).

Associations of musculoskeletal health split on gender and segregated workplaces with men in female dominated workplaces as reference group (OR=1) was calculated (Table 7).

Did the General Health and Psychological Well-Being Differ Between Men and Women in Female and Male Dominated Workplaces?

No significant difference in general health was noted between men and women in female and male dominated workplaces. Excellent, very good or good general health was reported by 80% of the men in female dominated workplaces and by 77% of the women. In male dominated workplaces the frequencies were 83 and 81% respectively (Table 8).

The mean values of psychological well-being were 39.6 and 39.4 for men and women in female dominated workplaces and 42.2 and 39.3 for men and women in male dominated workplaces. Men in male dominated workplaces

Table 5. Significant Differences in Musculoskeletal Symptoms Reported by Men and Women in Female and Male Dominated Workplaces and Differences Between Men and Women with 95% Confidence Interval (CI). Grey Area Indicates Significant Differences

	Most Women ($\geq 60\%$)			Most Men ($\geq 60\%$)		
	Men N=227	Women N=1487	Men/Women Difference	Men N=1236	Women N=268	Men/Women Difference
Body part	%	%	% (CI)	%	%	% (CI)
Any symptom	67	82	-15 (-22--9)	73	81	-8 (-13--3)
Neck	47	58	-11 (-19--2)	42	61	-19(-26--11)
Shoulders	27	42	-15 (-23--8)	26	45	-19(-27--12)
Elbows	2	7	-5 (-7--2)	6	7	-1 (-3-3)
Hands/wrists	7	18	-12 (-16--7)	10	13	-3 (-8-2)
Upper back	17	24	-7 (-14--1)	15	22	-7 (-13--1)
Hips	11	24	-12 (-18--7)	14	25	-11 (-17--5)
Knees	25	27	-2 (-10-5)	38	25	13 (7-20)
Feet/ankles	11	22	-10 (-16--4)	21	21	-0.03 (-4-8)

Table 6. Significant Differences in Musculoskeletal Symptoms Between Men in Male Dominated Workplaces and Men in Female Dominated Workplaces As Well As Women in Female Dominated Workplaces and Women in Male Dominated Workplaces. The Relative Frequency (%) of Men and Women, Differences with 95% Confidence Interval (CI). Grey Area Indicates Significant Differences

	Men $\geq 60\%$ Women N=227	Men $\geq 60\%$ Men N=1236	Men/Men Difference	Women $\geq 60\%$ Women N=1487	Women $\geq 60\%$ Men N=268	Women/Women Difference
Body part	%	%	% (CI)	%	%	% (CI)
Elbows	2	6	-4 (-6--1)	7	7	1 (-2-4)
Hands/wrists	7	10	-3 (-8-1)	18	13	6 (0.7-11)
Knees	25	38	-13 (-21--6)	27	25	2 (-4-9)
Feet/ankles	11	21	-9 (-15--3)	22	21	1 (-5-7)

were found to have the best psychological well-being. When calculating the relative frequency for men and women in female- and male dominated workplaces with well-being representing at least "a lot of the time" in the index we found; 65% of the men and 67% of the women in female dominated workplaces and 80% of the men and 63% of the women in male dominated workplaces. Men in male dominated workplaces experienced significantly better psychological well-being than their female counterparts as well as men and women in female dominated workplaces (Table 8).

DISCUSSION

Women, compared to men, had higher prevalence in two organisational factors; part-time work and negative expectation of the future and eleven physical environment factors, which concerned working postures, movements, and materials handling in female dominated workplaces. Women, compared to men, also had higher prevalence in three organisational factors and two psychosocial factors; low control and high strain in male dominated workplaces. Today, part-time work is still prevalent in female dominated

work together with negative expectations for future development in work. We consider it possible that the women in this study want to work full time but not having the opportunity to do so. Hence, their negative expectations may be ascribed to low decision latitude, lack of social support and high psychosocial job demands. This has earlier been shown to characterize female repetitive manual jobs [15]. Our results confirm that men and women perceive different ergonomic workload. It has been shown that women working in high-intensive jobs with high static loading of the upper extremity, repetitive movements and high precision demands are having a high risk for musculoskeletal disorders [13, 14]. However, women and men in this study with the same job titles did not necessarily work with tasks with the same physical requirements or work organisation. The fact that the women perceived lower control and higher strain compared to men in male dominated workplaces can be ascribed to the fact that they may perform more repetitive work compared to the men, which also has been confirmed in earlier research [15]. Women may also have work tasks with higher physical workload [15]. So, the gender differences in male dominated

Table 7. Odds Ratios (OR) and 95% Confidence Interval (CI) of Self-Reported Musculoskeletal Symptoms in Men and Women in Gender Segregated Workplaces with Men in Female Dominated Workplaces as Reference Group. Grey Area Indicates Significant Differences of Symptoms

Body part	Men				Women			
	Most Women		Most Men		Most Women		Most Men	
	OR	CI	OR	CI	OR	CI	OR	CI
Any symptom	1	-	1.3	0.97-1.78	2.3	1.70-3.13	2.0	1.35-3.07
Neck	1	-	0.8	0.59-1.18	1.5	1.10-2.17	1.8	1.17-2.71
Shoulders	1	-	0.9	0.64-1.39	2.0	1.36-2.89	2.2	1.42-3.48
Elbows	1	-	3.1	0.95-9.85	4.3	1.34-13.6	3.5	0.97-12.4
Hands/wrists	1	-	1.6	0.79-3.07	3.2	1.63-6.08	2.0	0.96-4.35
Upper back	1	-	0.9	0.54-1.35	1.5	0.99-2.40	1.4	0.80-2.31
Low back	1	-	1.0	0.73-1.45	1.2	0.83-1.63	1.0	0.69-1.59
Hips	1	-	1.2	0.71-2.04	2.4	1.44-3.98	2.4	1.36-4.36
Knees	1	-	1.9	1.26-2.76	1.1	0.76-1.66	1.0	0.61-1.59
Feet/ankles	1	-	2.0	1.17-3.29	2.1	1.24-3.43	2.0	1.09-3.55

Table 8. Well-Being Reported by Men in Female and Male Dominated Workplaces and Women in Female and Male Dominated Workplaces as Well as Between Men and Women in Female and Male Dominated Workplaces. The Relative Frequency (%) of Men and Women, Respectively, and Differences with 95% Confidence Interval (CI). Grey Area Indicates Significant Differences of General Health and Psychological Well-Being

	Men ≥60% Women N=227	Men ≥60% Men N=1236	Men/Men Difference	Women ≥60% Women N=1487	Women ≥60% Men N=268	Women/Women Difference
	%	%	%(CI)	%	%	%(CI)
General Health	80	83	-3 (-8-3)	77	81	-4 (-9-1)
Psychological well-being	65	80	-15 (-21-8)	67	63	-4 (-2-10)

	Most Women (≥60%)			Most Men (≥60%)		
	Men N=227	Women N=1487	Men/Women Difference	Men N=1236	Women N=268	Men/Women Difference
	%	%	%(CI)	%	%	%(CI)
General Health	80	77	3 (-2-9)	83	81	2 (-3-7)
Psychological well-being	65	67	-2 (-8-5)	80	63	17 (11-23)

workplaces may be ascribed to a higher level of repetitive movements, physical strain, and postural stress among the women, which in earlier studies have been confirmed to have harmful effects when combined [13]. A higher frequency of musculoskeletal symptoms was shown among women compared to men, in most body parts, at both female and male dominated workplaces. This was the fact also when working in the same type of segregated workplace. It is reasonable to believe that the result concerning musculoskeletal symptoms could be understood according to differences in work tasks and level of repetitive work.

Concerning physical working conditions, the results show gender differences in *crude prevalence or risk*. However, it is not clear if there are real differences in the

effects of occupational exposures on the musculoskeletal outcome. We believe that the real exposures may differ even in the same work position between women and men. In future studies, exposure differences in work performed by women and men respectively should be further explored from a gender perspective. According to the results in this study, tailored interventions for women at these workplaces according to their occupational exposure patterns are needed. Different tailored interventions may be needed. Women with high physical strain may benefit from a greater variety in work and less repetitive work tasks, women with high psychosocial strain may need interventions focusing how to obtain flexibility and increased job control.

We suggest that the results from this study, concerning all relevant ergonomic, psychosocial and organisational factors, should be considered when planning future tailored interventions, particularly for women. By doing so, the high risk for women, to develop musculoskeletal disorders can be reduced. We consider this as a policy recommendation, which is also important from a gender perspective.

In addition, we recommend further health promoting work at these workplaces to maintain the level of general health. Earlier research has shown that health promoting interventions can maintain work ability and build up worker strengths, competencies and resources [25, 26]. We consider health promoting activities as a policy recommendation which can further increase the workers job satisfaction and well-being.

This study shows good general health reported by about 80% of both men and women in all workplaces studied. Psychological well-being differed most in male dominated workplaces, where the men (80%) reported the best well-being. Hence, the work organisation can be characterised as a healthy work organisation. However, from a total working environment perspective the results seem a bit contradictory as this study shows gender differences in crude prevalence of ergonomic risks but at the same time a good general health and fairly good psychological well-being, especially among men in male dominated workplaces.

Methodological Considerations

Dropout analysis showed that non-respondents were not randomly distributed. More elderly than young, more women than men, more high-educated than low-educated and more ethnic Swedes than immigrants responded to the questionnaire. With the support of statistical expertise, using the method RHG, Response Homogeneity Group [27], weights for sub-groups were created in order to compensate for the uneven response rate. These created weights were used in the analyses, but since they did not change the results in this study in any significant way they are not presented.

A comprehensive questionnaire with standardised, reliable and valid questions was used [19]. The questions with more than two response alternatives were dichotomised at the 75th percentile and compared men and women only with those who had high exposures ($\geq 75^{\text{th}}$ percentile).

Logistic regression analysis was conducted to calculate odds ratios (OR) and 95% confidence intervals, OR (95% CI), for risk indicators of musculoskeletal symptoms associated with exposures at gender segregated workplaces. This method is frequently used within occupational medicine.

The difference between men and women in prevalence of symptoms and exposures was expressed in difference between proportions with 95% confidence intervals according to Gardner & Altman [24]. Differences were statistically significant when $CI > 1$ or $CI < -1$.

CONCLUDING REMARKS

Women and men perform different work tasks and have different working conditions in gender segregated work places. Gender differences in crude prevalence of ergonomic risks were shown and will be used for the development of

work and health promoting activities at these workplaces. At the same time a good general health and fairly good psychological well-being, especially among men in male dominated workplaces, were shown.

We recommend tailored interventions for women according to their occupational exposure patterns.

In addition, programs that emphasise the ergonomic design of workstations, equipment, tools, and work organisation to fit the capabilities and limitations of the human worker are needed.

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CONFLICT OF INTEREST

Declared none.

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