Psychology, 2014, 5, 896-907
Published Online June 2014 in SciRes. http://www.scirp.org/journal/psych
http://dx.doi.org/10.4236/psych.2014.58101

Scientific Research

Do Sex Differences in the Association between Work Exposure and Health in the Manufacturing Industry Depend on Work Context? Results from the WOLF-Study

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Received 16 April 2014; revised 13 May 2014; accepted 4 June 2014

Abstract

The aim of this study is to investigate the associations between work exposure such as psychosocial work factors and work posture, and health in men and women with the same type of occupation in the manufacturing industry. Two follow-ups with a follow-up rate of 67% from the WOrk, Lipids and Fibrinogen (WOLF) cohort from the Northern Sweden were used. The database included 1589 men and 286 women, which is representative of the proportions between men and women in the Swedish manufacturing industry. To be able to understand the importance of work context, the participants were categorized according to work tasks (working with things or symbols). Logistic regression was used for interaction analyses between sex and psychosocial work factors (such as demand, control, social support, role conflict, and work-family conflict) as well as physical work factors (such as work posture), and health outcomes (work overcommitment, fatigue, and neck and back pain). The results showed contextually different patterns of sex different associations between psychosocial work factors and health outcomes. For instance, women were at larger risk of ill-health (in the form of work overcommitment) when working with things, whereas men were at larger risk of both work overcommitment and fatigue when working with symbols. Women working with symbols had a larger risk of neck and back pain due to work-family conflict. The health outcome that was most sensitive to the sex different associations was work overcommitment. In conclusion, the work context matters for sex differences in the association between psychosocial work factors and health and since work overcommitment is a predictor of disease, it should be of interest for the Occupational Health Services and personnel departments to survey.

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How to cite this paper: Nordin, M., & Bolin, M. (2014). Do Sex Differences in the Association between Work Exposure and Health in the Manufacturing Industry Depend on Work Context? Results from the WOLF-Study. *Psychology, 5,* 896-907.
http://dx.doi.org/10.4236/psych.2014.58101

Keywords

Psychosocial Work Factors, Work Overcommitment, Fatigue, Pain, Gender

1. Introduction

Men and women differ in many aspects such as lifestyle, work exposure, and health. One of the reasons for this difference in Sweden is that the Swedish labor market is highly gender segregated both vertically and horizontally. Women work foremost in the service sector with responsibilities for caring and teaching, whereas men are mostly found within the private industries and in higher managerial positions (Statistics Sweden, 2012; Melkas & Anker, 2001). Consequently, men and women are exposed to different work-related factors (Messing, Punnett, Bond, Alexandersson, Pyle, Zahm et al., 2003; Bekker, Rutte, & van Rijswijk, 2009). Women report being more frequently on sick-leave (Statistics Sweden, 2014), they report having more troubles sleeping (Johnsson, 2006), being more tired, and they report more burnout (Norlund, Reuterwall, Höög, Lindahl, Janlert, & Slunga Birgander, 2010) than men. Whether these differences are due to biological or contextual reasons is hard, if not impossible, to disentangle. However, in order to understand this controversy better, studying the relationship between work exposure and health in the same type of industry and the same type of occupation is important. Therefore, this study aims at investigating the associations between work exposure, such as psychosocial work factors and work posture, and health in men and women with the same type of occupation working in the same type of industry; in this case the manufacturing industry.

Physical work environment has dominated the research on the association between work exposure and health in the manufacturing industry. Sex differences were found when studying injuries in the US aluminum manufacturing industries. Compared to men with the same job descriptions, women had more injuries in general and more musculoskeletal-related injuries in particular (Taiwo, Cantley, Slade, Pollack, Vegso, Fiellin, & Cullen, 2008). Kines, Hannerz, Lyngby Mikkelsen, and Tüchsen (2007) also concluded that there was a stronger association between work exposure, operationalized as industry sector, and upper extremity injuries in women than in men. It is interesting to note that even if women often have been found to be weaker in their shoulders (Miller, Mac Dougall, Tarnopolsky, & Sale, 1993) and wrists (Nordander, Ohlsson, Balogh, Hansson, Axmon, Persson, & Skerfving, 2008; Nordander, Ohlsson, Åkesson, Arvidsson, Balogh, Hansson, Strömberg et al., 2013), they work with their hands more often above shoulder height even when having the same job description as men (Dahlberg, Karlqvist, Bildt, & Nykvist, 2004). This work posture is a risk factor for neck- and shoulder problems in general and given that women on average may be weaker than men in the exposed muscles, it is not surprising that they report more problems in the neck and the back than men (Widanarko, Legg, Stevenson et al., 2011), especially in the manufacturing industry (Försäkringskassan, 2011).

Research has pointed to a relationship between psychosocial factors and musculoskeletal health in women. For instance, Bildt, Backstig, & Andersson Hjelm (2006) showed that musculoskeletal health was associated with demand, control and sense of coherence in a manufacturing setting. However, when it comes to research on psychosocial work factors in relation to health, the manufacturing industry has been somewhat overshadowed by the growing service sector. Traditionally, psychosocial work factors have been defined according to the demand-control-support model (Karasek & Theorell, 1990; Johnson & Hall, 1988). Plenty of studies have shown a relationship between health and demand, control and social support (Belkic, Landsbergis, Schnall, & Baker, 2004; Cohen, Underwood, & Gottlieb, 2000). However, the results, especially on the relationship between demand, control and health are inconclusive (Kasl, 1996; Kristensen, 1996), and working life has changed since the 1970's and 1980's when the model was postulated. Today's working life is very much characterized by smeared boundaries between working and family life thus increasing the risk of a conflict between the two (Allvin, Aronsson, Hagström, Johansson, & Lundberg, 2011). In a recent study, Hämmig and Bauer (2014) concluded that work-life conflict was the largest risk factor of both physical and psychological health. They also addressed this aspect of psychosocial work as a neglected area in occupational medicine.

Another conflict that is commonly reported in today's working life is role conflict. Experiencing role conflict at work is stressful (Fenlason & Beehr, 1994). Being expected to perform certain tasks but, for instance not having enough resources to complete these or experiencing incongruent expectations and demands, will elicit

negative emotions and decrease job satisfaction (Burke, 2002). For instance, Piko (2006) showed that role conflict contributed to emotional exhaustion and depersonalization, which are prominent aspects of Maslach's burnout construct (Maslach & Jackson, 1981).

In an industrial setting, the relationship between psychosocial work factors and health have mostly been studied in the Finnish private industry. Factors such as social support, job autonomy, and job complexity were found to be associated over time with sickness absenteeism in a multinational forest industry (Väänänen, Toppinen-Tanner, Kalimo, Mutanen, Vahtera, & Peiró, 2003). Väänänen, Kalimo, Toppinen-Tanner, Mutanen, Peiró, Kivimäki and Vahtera (2004) also studied role conflict, organizational justice, and fairness in relation to sickness absence in blue- and white collar male and female workers in the same industry. Here socioeconomic group was important for the association between the psychosocial factors and health. For instance, the authors (ibid.) found that role ambiguity increased the risk of sickness absence in white-collar men whereas organizational climate was more important to health in blue-collar women.

Sickness absence is a common outcome when studying psychosocial factors and health in the manufacturing industry. However, a promotive perspective may reduce sickness absence and save companies and the society from costs due to sick leave and loss of productivity. Therefore, this study focuses not only on factors supposed to be indicative of ill-health such as work overcommitment and fatigue, but also on neck and back pain since that is a common complaint in women in general and in women in the manufacturing industry in particular as described above. Many studies have shown that work overcommitment predicts ill-health. Work overcommitment indicates an inability to let go of work when not working (Siegrist, 1996). It has been shown to contribute to stress and stress-related diseases (Bakker, Killmer, Siegrist, & Schaufeli, 2000). Moreover, work overcommitment has been shown to predict disturbed sleep (Åkerstedt, Nordin, Alfredsson, Westerholm, & Kecklund, 2012), musculoskeletal complaints (Joksimovic, Starke, Knesebeck, & Siegrist, 2002), cardiovascular disease, and depression (Dragano, Ying, Moebus, Jöckel, Erbel, & Siegrist, 2008). In order to understand this precursor's own predictors, it is important to study as an outcome variable.

Sickness absence is also associated with fatigue. For example, in a Dutch study, Janssen, Kant, Swaen, Janssen and Schröer (2003) showed that fatigue was related to both short and long term sickness absence and that the more fatigue the shorter the time to onset of the first sickness absence spell. Moreover, fatigue increased the risk of long term sickness absence by 35% in a study on a national Swedish sample (Åkerstedt, Kecklund, Alfredsson, & Selén, 2007), and even if there seems to be a shortage of studies investigating the causal pathways between fatigue and health, research indicates that it is an important predictor of ill-health.

By using the longitudinal WOLF study from Northern Sweden we investigate the relationship between psychosocial and physical work factors and ill-health in men and women working in the same occupations in the manufacturing industries.

2. Methods

2.1. Participants

To investigate sex differences in the relationship between psychosocial and physical work environment and health in the manufacturing industry, the WOLF (WOrk Lipids and Fibrinogen)-cohort from the Northern Sweden was used. This cohort is part of a larger cohort including civil servants in the Stockholm region. However, since manufacturing industries are most prevalent in the northern part of Sweden, the WOLF-cohort of Northern Sweden is suitable for the study question. This part of the WOLF-study was launched in 1996-1998 (WOLF-Norrland) and followed up both in 2000-2003 (WOLF-follow up) and 2009 (WOLF-follow up). For the particular purposes of this study, WOLF-F (T1) and WOLF-U (T2) (with a follow-up rate of 67%) were used since the outcome measures were satisfactorily represented in both studies. The sample that answered both the WOLF-F and the WOLF-U questionnaires contains 1589 men and 286 (15%) women. The sex distribution reflects the fact that only 10% to 15% of the Swedish female working population work in the manufacturing industry. The manufacturing industries included were foremost forest industries.

2.2. Procedure

The main objective of the WOLF study is to investigate psychosocial work factors' impact on health over time in the Swedish work force. By the help of the Occupational Health Services (OHS), companies were re-

cruited to WOLF-N to give their employees a health examinations and a questionnaire on work situation, psychosocial work factors, lifestyle, and health. The questionnaire also contained some questions on physical work environment. In WOLF-F, only a subsample was given a health examination but everyone was given a questionnaire whereas in WOLF-U only a questionnaire but no health examination was offered. In WOLF-F and U, the participants who were offered a questionnaire and invited by mail, were given two reminders unless they actively declined to participate.

2.3. Measures

All the outcome and predictive measures are presented in detail in the Appendix.

2.3.1. Outcome Measures

Work overcommitment (WOC) was assessed by the six questions included in the WOC index included in the Effort Reward Imbalance model (Siegrist, 1996). The questions were summed and dichotomized on the median. Cronbach's alpha was 0.82. *Fatigue* was defined by the single question about feeling tired in the head included in the Karolinska Sleep Questionnaire (Åkerstedt, Ingre, Broman, & Kecklund, 2008). The response option scale differed somewhat between T1 and T2 as it was five-graded at T1 and six-graded at T2. The operationalization of *neck- and back pain* also differed somewhat between T1 and T2, but in essence both scales captured the same problem.

2.3.2. Predictive Measures

The Swedish version of the demand-control questionnaire was used to assess *demand*, *control* and *social support* (Karasek & Theorell, 1990). These were summed for each dimension and the demand dimension was dichotomized on the median whereas the control and social support dimensions were split on the upper quartiles. Cronbach's alphas were 0.70, 0.66, and 0.86 respectively. The questions making up the concept of *role conflict* (Petersen, Kristensen, Borg, & Bjorner, 2010) were summed and dichotomized on the median. Cronbach's alpha was 0.71. The questions on *work-family conflict* (WFC) were summed and divided on the quartile. Cronbach's alpha was 0.67. *Work posture* was assessed by five questions that were summed and dichotomized on the median.

2.3.3. Confounding Factors

A question on what *education* the participants had was used where university education was contrasted with all other response options reflecting lower education. Marital status was assessed by the question "What is your marital status?". Whether the participants worked *shift* or not was identified by the question "Do you work shift?" and the response option no was contrasted with all the other response options that reflected different types of shift work. *Age* and *sex* were also included, as was occupation. Occupation was identified by grouping the occupational classification codes from Swedish Occupational Classification System into those who worked with people (P), things (T), and symbols (S) (Härenstam, 1999). In the manufacturing industry, no people workers were present. To describe the other categories, symbol workers can be related to typical clerical work and thing workers as the typical manual manufacturing worker.

2.4. Statistical Analyses

Chi square analyses were used for testing group differences and logistic regression analyses for studying sex differences by interaction effects. Confounding variables were selected by the change in estimate procedure meaning that the variables that correlated with both the predictor and outcome variables and changed the beta-value in the relationship between the predictor and outcome variable by at least 10%, were selected. The analyses were conducted in two steps. First interaction analyses were performed between sex and the different predictor variables (demand, control, social support, role conflict, and work family conflict) in relation to the three health outcomes (WOC, fatigue, and neck and back pain) for thing and symbol workers respectively. Thereafter, post-hoc analyses were performed where interaction effects were found, for men and women separately to investigate effect modification. These analyses were controlled for baseline outcome variables and for appropriate confounding factors selected according to the change in estimate procedure. The IBM package SPSS version 18.0 and 22.0 were used.

3. Results

There were no significant differences between men and women in the responses in thing workers. Significantly more men than women who worked with symbols, reported high demands, role conflict, and work overcommitment whereas significantly more women than men who worked with symbols had higher education, reported low control, more fatigue at T1 and more neck-shoulder pain at both T1 and T2. Over time those who reported WOC and fatigue decreased whereas those who reported neck and back pain increased in all strata (see **Table 1**).

3.1. Interaction Analyses

In order to have as much control over the work context that the men and women worked in as possible, the interaction analyses were performed within the thing and symbol groups respectively. The significant interaction, and main effects are presented in relation to the occupation groups below.

3.2. Thing Workers

Work Overcommitment

A two-way interaction effect was found between sex and social support in WOC at T2 (Odds ratio [OR] 3.86; 95% confidence interval [CI] 1.09 - 13.63). No main effects were found. Post hoc analyses controlled for base-

Table 1. Distribution of background, predictor, and outcome variables among men and women working with things and symbols in the manufacturing industry.

	Men working with				Women working with				Total		
	Things		Symbols		Things		Symbols				
	n	%	n	%	n	%	n	%	N	%	*p*
Background variables T1											
Age > 47 years	224	32.2	176	42.1	14	22.6	55	39.6	469	35.6	ns
Lower education	659	96.2	246	60.9	58	98.3	94	74.0	1057	82.9	0.008^{S}
Marital status	538	77.4	345	83.3	48	77.4	119	85.6	1050	80.1	ns
Shift work	427	62.6	31	7.4	40	64.5	12	8.7	510	39.3	ns
Predictor variables T1											
High demands	256	36.6	249	60.6	22	39.3	58	43.9	585	45.7	0.001^{S}
Low control	519	75.8	174	41.7	51	85.0	85	63.0	829	63.9	0.000^{S}
Poor climate	216	31.5	127	30.8	19	30.6	51	37.2	413	31.8	ns
Role conflict	265	39.1	236	56.5	18	30.0	58	42.0	577	44.5	0.004^{S}
WFC	246	35.8	188	45.2	15	24.2	55	40.4	504	38.7	ns
Poor work posture	507	73.7	103	24.9	43	71.7	26	19.0	679	52.3	ns
Outcome variables											
Fatigue T2	62	9.0	43	10.3	8	12.9	17	12.3	130	9.9	ns
T1	191	27.9	71	17.0	18	29.5	35	25.4	315	23.6	0.034^{S}
WOCT2	168	26.0	254	64.1	14	25.5	65	51.2	501	40.9	0.012^{S}
T1	199	30.7	245	63.6	23	41.8	77	59.2	544	45.0	ns
Neck/back T2	372	54.4	171	41.4	39	66.1	85	61.2	667	51.5	0.000^{S}
Pain T1	148	21.6	74	18.0	12	19.7	40	29.0	274	21.1	0.007^{S}

N = number; ns = non-significant; ^{S} = significant difference between symbol workers; *p* for sex differences by chi-square test with 1 df.

line WOC showed a non-significant elevated risk of WOC at T2 due to poor social support in men. However, post hoc analyses for women, controlled for baseline WOC and education, revealed a significantly elevated risk of WOC at T2 due to poor social support. Shift work also classified as a confounding variable and when entered into the analysis, the relationship between social support and WOC in women was explained (see **Table 2**).

A two-way interaction effect was found between sex and demand in WOC at T2 in the employees working with things (OR 4.08; 95% CI 1.04 - 16.04). No main effects were found. Post hoc analyses controlled for baseline WOC showed an elevated risk of WOC at T2 due to high demands both in men and in women (see **Table 2**).

When testing whether there were any sex differences between sex and WFC in WOC, two main effects were found. WFC increased the risk of WOC (OR 3.53; 95% CI 2.40 - 5.19), when controlled for baseline WOC as did sex (OR 1.92; 95% CI 1.03 - 3.57) indicating that women were at higher risk of WOC given WFC.

3.3. Symbol Workers

3.3.1. Work Overcommitment

A two-way interaction effect was found between sex and demand in WOC at T2 in the employees working with symbols (OR 0.35; 95% CI 0.15 - 0.81). Main effects were found for demand in WOC at T2 (OR 10.37; 95% CI 3.32 - 32.39). Post hoc analyses controlled for baseline WOC showed an elevated risk of WOC at T2 due to high demands in men but not in women (see **Table 2**).

A two-way interaction effect was also found between sex and role conflict in WOC at T2 (OR 0.36; 95% CI 0.16 - 0.82). A main effect for role conflict was also found (OR 7.47; 95% CI 2.46 - 22.65). Post hoc analyses controlled for baseline WOC showed a significantly elevated risk of WOC at T2 due to role conflict in men whereas an insignificant under risk was found in women (see **Table 2**).

Moreover, a two-way interaction effect was found between sex and WFC in WOC at T2 (OR 0.41; 95% CI 0.17 - 0.97). No main effects were found. Post hoc analyses controlled for baseline WOC showed an elevated risk for WOC at T2 due to WFC in men but an insignificant risk approaching unity in women (see **Table 2**).

3.3.2. Fatigue

A two-way interaction effect was found between sex and role conflict in fatigue at T2 (OR 0.19; 95% CI 0.05 - 0.71). A main effect was found for sex (OR 3.50; 95% CI 1.35 - 9.07). Post hoc analyses controlled for fatigue at baseline and education, showed a significantly elevated risk of fatigue at T2 due to role conflict in men but an insignificant under risk in women (see **Table 2**).

Table 2. Odds ratios (OR) and 95% confidence intervals (CI) from post hoc logistic regression analyses of significant interaction effects adjusted for relevant confounding factors.

	Thing workers				Symbol workers			
	Men		Women		Men		Women	
	OR	CI	OR	CI	OR	CI	OR	CI
WOC								
Social support	1.27	0.86 - 1.87	3.49	0.83 - 14.66				
Demands	1.67	1.14 - 2.44	6.17	1.53 - 24.99	2.29	1.40 - 3.75	0.65	0.25 - 1.68
Role conflict					2.01	1.26 - 3.22	0.80	0.35 - 1.85
WFC					2.73	1.64 - 4.51	0.99	0.39 - 2.55
Fatigue								
Role conflict					3.18	1.34 - 7.54	0.63	0.21 - 1.92
Neck and back pain								
Role conflict					1.01	0.60 - 1.70	2.01	0.95 - 4.58

WOC = work overcommitment; WFC = work-family conflict.

3.3.3. Neck and Back Pain

A significant two-way interaction effect between sex and WFC was found in neck and back pain at T2 (OR 2.60; 95% CI 1.04 - 6.47). No main effects were found. Post hoc analyses controlled for baseline neck and back pain, showed no significant relationships between WFC and neck and back pain at T2 in either men or women. However, the OR was larger in magnitude in women than men (see **Table 2**).

No interaction effects were found for control or work posture in either occupation group, or for fatigue and neck and back pain in the thing working group.

4. Discussion

The aim of this study was to investigate the associations between work exposure and health in men and women with the same type of occupation in the manufacturing industry. The results show that women were at larger risk of ill-health, in the form of work overcommitment, in thing workers, whereas men were at larger risk of both work overcommitment and fatigue when working with symbols. Women working with symbols also had a larger risk of neck and back pain due to work-family conflict.

Work overcommitment was the health outcome that was most affected by sex differences in this study. Work overcommitment is an important predictor of ill-health (Bakker et al., 2000; Dragano et al., 2008; Joksimovic et al., 2002; Åkerstedt et al., 2012), so understanding what predicts such a risk factor is important. Interestingly, in the present study, the sex difference in the psychosocial factors predicting work overcommitment differed with context: high demands increased the risk of work overcommitment in female thing workers, whereas it increased the same risk in both male and female symbol workers, however with a larger magnitude in men. Working with things in the manufacturing industry implies surveillance, service, and maintenance, whereas typical symbol work in this type of industry include working in departments of personnel, finances, marketing and product development. Thus, working in a symbol laden work may mean a boundary less work with more decision making and deadlines, which makes it more difficult for employees to assess when work is done and when they have done enough.

Another indication of boundary less work is role conflict, a concept related to demands. Role conflict is associated with psychological distress (Johannessen, Tynes, & Sterud, 2013) and Väänänen et al. (2003) showed that a closely related concept, role ambiguity, predicted foremost men's sickness absence. In line with this, role conflict increased the risk of work overcommitment foremost in male symbol workers in the present study. Additionally, more men than women working with symbols reported role conflict. This may reflect differences in horizontal and vertical division of labor in the organization. Despite the fact that men and women are holding the same type of job in terms of working with symbols, they are often performing different tasks with women doing routine tasks more often than men. This shows that even if we have taken occupation group into account, we have not been able to adjust for position in the company. However, consequently the work context plays a role in the association between role conflict and health. Fatigue is another aspect of psychological health which has been shown to predict sickness absence (Janssen et al., 2003; Åkerstedt et al., 2007) and in the present study men working with symbols had an increased risk of fatigue. Having to do things differently than you find suitable, to not have the resources to perform the work tasks, and to have contradictory demands is stressful. Piko (2006) found that role conflict was associated with aspects of burnout. Burnout is a depletion of energy and is often depicted as exhaustion (Melamed, Kushnir, & Shirom, 1992), a concept that is not far from that of fatigue. Moreover, work overcommitment predicts sleep disturbances (Åkerstedt et al., 2012) which is yet another factor that leads to fatigue.

Low social support increased the risk of work overcommitment in female thing workers. Väänänen et al. (2003) argue that supervisor support functions as an important resource for women in the Finnish forest industry as the supervisor may be central in women's social contacts, and in how to perform the tasks. In the present study, it was not possible to disentangle whether it was the lack of support from the supervisor that increased the risk of work overcommitment in female thing workers or not. However, the social support scale used here is more indicative of social climate and the association between low social support and work overcommitment was explained by entering shift work into the statistical model. Shift work was very common among thing working women (64.5%), but considering that there were very few women among many men working with thing work in total, the social climate may have developed into an atmosphere that was not to the advantage of women. Here the supervisor of course is important in order to set the right tone in the work group.

There were no sex differences in the association between work family conflict and work overcommitment in thing workers. However, symbol working men experienced work family conflict to increase work overcommitment more than symbol working women. This can be understood so that symbol work demands the employee to be more accessible and the flexibility that the work is presumed to entail is "eaten up" by the work instead of being spent on the family. Moreover, the family was previously the responsibility of women. However, the male role is undergoing a change in Sweden as it becomes more common for men to take on responsibilities with both the household and with the children.

Being a woman working with things increased the risk of work overcommitment given work family conflict. Work family conflict was found to predict, among other health outcomes, both stress and back pain in a study on building, machine, chemical/pharmaceutical, and metal working industries (Hämmig & Bauer, 2014). The study found that psychosocial work factors were stronger risk factors for ill-health than physical work factors. Thus, it is not surprising that ill-health was not predicted by work posture in our study, but that work family conflict was associated both with work overcommitment (which is operationalized as internal demands and can be related to stress) and neck and back pain.

By using a longitudinal design, we have studied the sex different associations between work factors and health. Since men and women typically work in different occupations, thus being exposed to different work contexts, we categorized the participants into working with things or symbols. However, information on vertical position could not be achieved by this categorization and previous research has shown that even if men and women have the same job description they do not necessarily have the same work content (Dahlberg et al., 2004). Thus, the issue of sex differences in work exposure is not completely resolved by our approach.

The fact that only few women work in the manufacturing industry, especially with things, is reflected in the data material and the results must therefore be interpreted with caution.

In this study, fatigue was assessed by only one question and is consequently not measured in nuanced way. However, meta-analyses show that single-item questions often correspond well to indexes when it comes to reliability (Wanous, Reichers, & Hudy, 1997). The time frame differed between T1 and T2 in the fatigue question, as it did in the questions on neck and back pain. However, we don't foresee this as a large problem since the variables at T1 were controlled for.

5. Conclusion

Psychosocial work factors affect men's and women's health differently in the manufacturing industry depending on the work context (thing and symbol work). Thus, how work is organized seems to matter in the sex differences in the association of psychosocial work factors and ill-health. Moreover, work overcommitment seems to be a sensitive health outcome. Given that work overcommitment is a predecessor of disease, it should be of interest for the OHS and personnel departments to survey this variable. Future research should focus on studying men's and women's work tasks in relation to the psychosocial environments to be able to understand the impact of the actual work context on health.

Acknowledgements

We are grateful for the support of this study provided by AFA Insurance.

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Appendix

Questions	Response options	
	T1	T2
Outcome measures		
Work overcommitment (*WOC*)		
• I get easily overwhelmed by time pressures at work. • I start thinking about work as soon as I get up in the morning. • When I get home, I can easily relax and forget all about work (reversed). • People close to me say I sacrifice too much for my job. • Work is usually on my mind when I go to bed. • If I put up doing something that need to get done today, I'll have trouble sleeping at night.	(1) Agree completely (2) Almost agree (3) Hardly agree (4) Disagree (Summed and median split)	(1) Agree completely (2) Almost agree (3) Hardly agree (4) Disagree (Summed and median split)
Fatigue		
• Have you felt tired in the head during the past 12 months (T1)/past three months (T2)?	(1) Never (2) Rarely (3) Sometimes (4) Most of the time (5) Always	(1) Never (2) Rarely (3) Sometimes (4) Often (5) Most of the time (6) Always
Neck- and back pain		
T1: • Have you had pain in the upper back or the neck during the past 12 months?	(1) No never (2) Yes a couple of days the past year, (3) Yes a couple of days per months (4) Yes a couple of days per week (5) Yes everyday	
T2: • Have you during the past five-year period had pain in the neck at least three months in a row, which has disturbed you considerably? • Have you during the past five-year period have had pain in the back at least three months in a row which has disturbed you considerably?		(0) No (1) Yes
Predictive measures		
Demand		
• Does your work demand that you work very fast? • Does your work demand that you work very hard? • Does your work demand too much work effort? • Do you have enough time to manage your work tasks (reversed)? • Are there conflicting demands in your work? • Do you get to learn new things at work?	(1) Yes, often (2) Yes, sometimes (3) No, seldom (4) No, never (Summed and median split)	
Control		
• Does your work demand skill (reversed)? • Does your work demand ingenuity (reversed)? • Does your work entail carrying out the same task over and over again? • Do you have the freedom to decide how your work is to be carried out (reversed)? • Do you have the freedom to decide what is to be done in your work (reversed)?	(1) Yes, often (2) Yes, sometimes (3) No, seldom (4) No, never (Summed and quartile split)	
Social support		
• There is a calm and pleasant atmosphere at my workplace. • There is a good spirit of unity. • My workmates are there for me • People understand that I can have a bad day. • I get on well with my superiors. • I like my workmates. • It is easy to have open discussions with my workmates.	(1) Completely correct (2) Almost correct (3) Hardly correct (4) Not at all correct	

Continued

Role conflict	
• Do you sometimes have to do things that ought to be done in a different way? • Are conflicting demands placed on you at work? • Do you get work tasks without getting the resources that are needed to carry them out? • Does your work entail work tasks which are in conflict with your personal values?	(1) Very seldom or never (2) Fairly seldom (3) Sometimes (4) Fairly often (5) Very often or always (Summed and median split)
Work family conflict (*WFC*)	
• Are your current work such that you can unite work and leisure/family? • Do the demands at work affect your home and family life negatively? • Do the demands from your home/family affect your work negatively?	(1) Very rarely (2) Fairly rarely (3) Sometimes (4) Very often (5) Always (Summed and quartile split)
Work posture	
• Do you perform work tasks with your hands placed at or above the shoulders for more than half an hour per day? • Do you perform work tasks with your hands placed below the knees for more than half an hour per day? • Do you lift, carry or handle burdens weighing 1 to 5 kilos? • Do you lift, carry or handle burdens weighing 5 to 15 kilos? • Do you lift, carry or handle burdens weighing more than 15 kilos?	(1) Not at all/never (2) 1 - 3 days per month (3) 2 - 4 days per week (4) One day per week (5) Every day (Summed and median split)

Underlining marks cut-off for dichotomization.