

# CHAPTER 7

## Work-Related Musculoskeletal Disorders and Psychosocial Factors

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### SUMMARY

While the etiologic mechanisms are poorly understood, there is increasing evidence that psychosocial factors related to the job and work environment play a role in the development of work-related musculoskeletal disorders (MSDs) of the upper extremity and back. Though the findings of the studies reviewed are not entirely consistent, they suggest that perceptions of intensified workload, monotonous work, limited job control, low job clarity, and low social support are associated with various work-related musculoskeletal disorders.

As some of these factors are seemingly unrelated to physical demands, and a number of studies have found associations even after adjusting for physical demands, the effects of these factors on MSDs may be, in part or entirely, independent of physical factors. It is also evident that these associations are not limited to particular types of jobs (e.g., video display terminal work [VDT]) or work environments (e.g., offices) but, rather, seem to be found in a variety of work situations. This seems to suggest that psychosocial factors may represent generalized risk factors for work-related MSDs. These factors, while statistically significant in some studies, generally have only modest strength.

At present, two of the difficulties in determining the relative importance of the physical and psychosocial factors are: (1) psychosocial factors are usually measured at the individual level, while physical factors are more often measured at the group (e.g., job or task) level and often by methods with limited precision or accuracy and (2) "objective measures" of aspects of the psychosocial work environment are difficult to develop and are rarely used, while objective methods to measure the physical environment are more readily available. Until we can measure most workplace and individual variables with more comparable techniques, it will be hard to determine precisely their relative importance.

### INTRODUCTION

There is considerable confusion regarding the contribution of psychosocial factors to musculoskeletal illness and injury. Because of this, it is examined in this separate section of the report. Unlike the more finite (and generally more familiar) range of physical factors (e.g., force, repetition, and posture), the concept of psychosocial factors includes a vast array of conditions. Indeed, the term "psychosocial" is commonly used in the occupational health arena as a catchall term to describe a very large number of factors

that fall within three separate domains:

(1) factors associated with the job and work environment, (2) factors associated with the extra-work environment, and (3) characteristics of the individual worker. Interactions among factors within each of these domains constitute what is referred to as a "stress process," the results of which are thought to impact upon both health status and job performance [Bongers and deWinter 1992; ILO 1986; Sauter and Swanson 1996; WHO 1989].

Included in the domain of job and work environment are a host of conditions, sometimes referred to as “work organization factors,” which include various aspects of job content (e.g., workload, repetitiveness, job control, mental demands, job clarity, etc.); organizational characteristics (e.g., tall versus flat organizational structures, communications issues); interpersonal relationships at work (e.g., supervisor-employee relationships, social support); temporal aspects of the work and task (e.g., cycle time and shift work); financial and economic aspects (e.g., pay, benefit, and equity issues); community aspects (e.g., occupational prestige and status). These work and job environment factors are often thought of as demands, or “risk factors,” that may pose a threat to health [Hurrell and Murphy 1992]. Extra-work environment parameters typically include factors associated with demands arising from roles outside of work, such as responsibilities associated with a parent, spouse, or children. Finally, individual worker factors are generally of three types [Payne 1988] corresponding to: genetic factors (e.g., gender and intelligence); acquired aspects (e.g., social class, culture, educational status); and dispositional factors (e.g., personality traits, and characteristics and attitudes such as life and job satisfaction).

### **PSYCHOSOCIAL PATHWAYS**

The purpose of this discussion is to summarize research evidence linking work-related psychosocial factors, as described above, to MSDs of the neck, shoulder, elbow, hand/wrist, and back. It should be recognized at the outset, however, that the linkages between work-related psychosocial factors and health outcomes of all varieties are often complex and influenced by a multitude of

conditions. In particular, both personal and situational characteristics may lead to differences in the way individuals exposed to the same job and work environment perceive and/or react to the situation [Hurrell and Murphy 1992]. Recent theoretical models of the relationship between psychosocial factors and MSDs [Bongers et al. 1993; Sauter and Swanson 1996] clearly reflect the complexity and multifactorial nature of the problem.

In general, four plausible types of explanations have been suggested to account for associations between work-related psychosocial factors and MSDs [Bergqvist 1984; Bongers et al. 1993; Bernard et al. 1993; Sauter and Swanson 1996; Sauter et al. 1983; Ursin et al. 1988]. First, psychosocial demands may produce increased muscle tension and exacerbate task-related biomechanical strain. Second, psychosocial demands may affect awareness and reporting of musculoskeletal symptoms, and/or perceptions of their cause. Within this second explanation may fall the “perverse incentive” view, in which societies may provide workers with systems (such as workers' compensation) that may lead to overreporting of MSD symptoms [Frank et al. 1995]. Third, initial episodes of pain based on a physical insult may trigger a chronic nervous system dysfunction, physiological as well as psychological, which perpetuates a chronic pain process. Finally, in some work situations, changes in psychosocial demands may be associated with changes in physical demands and biomechanical stresses, and thus associations between psychosocial demands and MSDs occur through either a causal or effect-modifying relationship.

The research evidence reviewed in the following discussion is organized into two separate sections. The first section includes studies of disorders of the neck, shoulder, elbow, hand and wrist which are discussed under the rubric of “upper extremity disorders.” This convention was adopted because many of the studies utilize measures which combine symptoms associated with several upper extremity body areas (e.g., neck and shoulder), and it is therefore not possible in reviewing these studies to isolate the effects of the psychosocial variables under consideration on more specific areas. The second section examines studies of back disorders. Associations reported in this review are statistically significant in nearly all cases (at the  $p < 0.05$  level and frequently also at the  $p < 0.01$  level). Where possible, odds ratios (ORs) are also reported.

The studies examined in this review are summarized in Tables 7-1 and 7-2. In interpreting the studies reviewed, it is necessary to be aware that, in general, researchers have not used standardized methods for assessing psychosocial factors in relationship to MSDs. Thus, individual psychosocial factors assessed by investigators vary from study to study. Moreover, even when work-related psychosocial factors (e.g., workload, job control, social support, job satisfaction, etc.) included by various investigators are the same or similar, they may be measured by different methods and different kinds of scales which can vary in psychometric quality. These methodological limitations complicate the process of drawing definitive conclusions regarding the literature as a whole and when comparing results between studies, one must take these differences into account.

## **UPPER-EXTREMITY DISORDERS (NECK, SHOULDER, ELBOW, HAND AND WRIST)**

### **Individual and Extra-Work Environment Factors**

A variety of psychosocial factors associated with both the individual worker and extra-work environment have been linked to upper extremity MSDs [Sauter and Swanson 1996; Bongers and deWinter 1992; Bongers et al. 1993]. These factors have included such conditions as depression and anxiety [Helliwell et al. 1992], symptoms of psychological distress [Leino 1989], and home problems [Karasek et al. 1987]. The connection between factors of this nature and the job and work environment, however, is unclear. While affective problems (such as anxiety and depression) and symptoms of distress may certainly be a consequence of the work situation, they may also be causally related to non-work circumstances only. Likewise, while extra-work environment conditions (e.g., “home problems”) may be exacerbated by the work situation (e.g., shift work) their “work-relatedness” remains unclear. Because of the uncertainty regarding the work-relatedness of these individual and extra-work environment factors (and because discussions can be found in other sources), only the individual psychosocial factor, job dissatisfaction, is examined here.

#### ***Job Dissatisfaction***

A number of studies suggest associations between low levels of satisfaction with work and upper extremity musculoskeletal symptoms and disorders. Tola et al. [1988], for example, in a study of 1,174 machine operators, 1,054 carpenters, and 1,013 office workers, found an

association (OR 1.2) between job dissatisfaction and neck and shoulder physical findings or symptoms, after adjusting for confounders. Likewise, Hopkins [1990] reported a positive association between job dissatisfaction and musculoskeletal symptoms. However, low job satisfaction was not found to predict neck and shoulder problems one year later in a study of 154 Finnish workers [Viikari-Juntura et al. 1991a]. Likewise, in a study of 273 nursing aids employed in a geriatric hospital [Dehlin and Berg 1977] job satisfaction was found to be unrelated to reports of ever having cervical pain.

## **Job and Work Environment Factors**

### ***Intensified Workload***

One of the factors most consistently associated with upper extremity MSDs has been the perception of an intensified workload, as measured by indices of perceived time pressure, workload, work pressure, and workload variability. Pot et al. [1987], for example, in a cross-sectional study of 222 VDT operators, found high levels of perceived time pressure associated with the reporting of upper extremity musculoskeletal complaints. Kompier [1988] found perceived time pressure to be associated with upper extremity complaints (in the preceding 12 months) among some 158 male bus drivers. Likewise, Takala et al. [1991], in a longitudinal study of 351 female bank cashiers, reported a positive association between perceived time pressure and symptoms of the neck and shoulder after adjusting for postural load. Theorell et al. [1991], however, in a sample of some 206 workers from six occupations, found that perceived time pressure was not significantly correlated with neck or shoulder symptoms.

Positive associations with upper extremity disorders have also been found in studies using measures of perceived work pressure and workload. High levels of perceived workload, for example, were found to be positively associated with musculoskeletal symptoms in the Pot et al. [1987] and Theorell et al. [1991] studies (which adjusted for physical demands such as lifting and awkward postures) reported above. Kvarnström and Halden [1983], in a case control study of 112 cases and 112 age- and sex-matched controls from an engineering firm, found sick leave due to fatigue or shoulder muscle soreness to be positively associated with high perceived workload. Karasek et al. [1987], in a study of 8,700 full-time members of the Swedish white collar labor union federation, found perceived workload to be positively associated with musculoskeletal aches as measured by a combination of several questions (OR 1.1 for males, 1.2 for females). Likewise, Sauter et al. [1983], in a study of 248 VDT users, found perceived workload and demands for attention to be associated with neck, back, and shoulder discomfort after adjusting for a wide variety of variables denoting physical demands. Bernard et al. [1993], in a study of 1,050 newspaper employees, found perceived increased workload demands (increased time working under deadline and increased job pressure) to be positively associated with neck, shoulder, and hand-wrist symptoms. Similarly, Hales et al. [1994], in a study of 553 telecommunications workers, found increased work pressure to be associated with neck (OR 1.2) and upper extremity (OR 1.1) disorders, as defined by physical examination and questionnaire. Ryan and Bampton [1988], using a total sample of 143 data processors, compared 41 individuals

reporting a number of neck symptoms to 28 reporting very few neck symptoms (middle group left out) and found a positive association between symptom reports and reports of having to push themselves (OR = 3.9). Ekberg et al. [1994] compared 109 workers who consulted a physician for new musculoskeletal neck and shoulder disorders with 637 controls and found a positive association (OR 3.5) with rushed work pace. Houtman et al. [1994], in a representative sample of 5,865 workers in the Netherlands, found reported high work pace associated with muscle or joint symptoms (OR 1.3) after adjusting for physical stressors and modifying personal characteristics. However, Dehlin and Berg [1977] in the study described above, found no relationship between reports of high perceived physical and psychological demands and reports of ever having pain in the cervical region. Finally, Houtman et al. [1994], in a representative sample of 5,865 workers in the Netherlands, found reported high work pace associated with muscle or joint symptoms (OR 1.29) after adjusting for physical stressors and modifying personal characteristics.

Variability in workload (surges in workload) has also been linked to upper extremity disorders. The studies by Hales et al. [1994] of 553 telecommunication workers and Hoekstra et al. [1994] of some 108 teleservice representatives, found perceived workload variability to be associated with elbow (OR 1.2) and neck (OR 1.2) disorders, but not with shoulder or hand disorders.

### ***Monotonous Work***

Monotonous work has been positively linked to the prevalence of upper extremity symptoms in various studies. In a study of 143 data processors, Ryan and Bamptom [1988] found

that self-reports of “being bored most of the time” were highly (OR = 7.7) associated with neck symptoms. Likewise, Linton [1990], in a study of approximately 22,200 Swedish workers undergoing a screening examination by the occupational health care service, found that monotonous work was positively associated with neck/shoulder pain (OR 2.3) during the preceding year. Ekberg et al. [1994], in the study described above, found an association between “low quality work” (lacking stimulation and variation) and neck and shoulder problems (OR 2.6). Similarly, Kvarnström and Halden [1983] in the case control study described above, found monotonous work to be associated with sick leave due to fatigue or tenderness in the shoulder muscles. Finally, Hopkins [1990] in a study of around 280 clerical workers found high levels of boredom to be associated with musculoskeletal symptoms (in any part of the body) during work hours.

### ***Job Control***

Numerous studies have reported positive associations between limited job control or autonomy at work and upper extremity problems. These include neck symptoms [Ryan and Bamptom 1988, OR 3.9; Hales et al. 1994, OR 1.6], neck/back/shoulder symptoms [Sauter et al. 1983; Theorell et al. 1991], musculoskeletal aches [Karasek et al. 1987], and muscle/joint symptoms [Hopkins 1990; Houtman et al. 1994]. The study by Pot et al. [1987], however, failed to support this relationship.

### ***Job Clarity***

A number of studies, including those of Ryan and Bamptom [1988], Karasek et al. [1987],

and Ekberg et al. [1994], have shown positive associations between reports of role ambiguity (uncertainty about job expectations) and upper extremity disorders (particularly neck disorders). Similarly, uncertainty regarding job future was found to be predictive of neck and shoulder discomfort [Sauter et al. 1983] and elbow, neck, and hand/wrist symptoms [Hales et al. 1994].

### **Social Support**

Limited social support from supervisors and coworkers has been found to be positively associated with a variety of upper extremity symptoms. The studies by Pot et al. [1987], Kompier [1988], Hopkins [1990], Sauter et al. [1983], and Hales et al. [1994], all support a positive association. Linton [1990] reported a positive association between neck symptoms and limited support from supervisors. Ryan and Bampton [1988] reported an effect of limited support from coworkers (OR 6.7), but not supervisors, on neck symptoms, while Kvarnström and Hagberg [1983] reported an effect of limited support from supervisors but not coworkers on sick leave due to shoulder muscle symptoms. Dehlin and Berg [1977], however, found no effect of social support on neck/shoulder symptoms, while Theorell et al. [1991] found no effect of social support at work on neck and shoulder symptoms or symptoms of the other joints (with or without adjustment for physical load). Likewise, Karasek et al. [1987] found no significant association between musculoskeletal aches and social support at work.

### **Extremities**

Overall, the epidemiologic studies of upper extremity disorders suggest that certain psychosocial factors (including intensified workload, monotonous work, and low levels of social support) have a positive association with these disorders. Lack of control over the job and job dissatisfaction also appear to be positively associated with upper extremity MSDs, although the data are not as supportive.

The evidence for the relationship between psychosocial factors and upper extremity disorders appears to be stronger for neck/shoulder disorders or musculoskeletal symptoms in general than for hand/wrist disorders. This stronger association for neck/shoulder disorders may be due to the following reasons: the large number of studies performed in the Nordic countries which have focused more on the neck/shoulder MSD health outcome than a hand/wrist outcome; many of the neck/shoulder studies included numerous psychosocial variables in their models, whereas studies of hand/wrist MSDs have not, as a rule, included as extensive psychosocial variable testing (therefore the variables are absent from the risk factor models); and the fact that most of the studies with extensive psychosocial scales were in office settings, where physical factors may be less important than psychosocial factors in their relationship with MSDs. This finding can be contrasted with studies in heavy industrial settings, where higher exposure to physical factors may have

## **Summary and Conclusions for Upper**

played a greater role than psychosocial factors in the development of MSDs. Also, pathophysiologic processes resulting from adverse psychosocial and work organization factors may exert a greater effect on the neck/shoulder musculature to produce increased muscle tension and strain than on the hand/wrist region.

## **BACK DISORDERS**

### **Individual and Extra-Work Environment Factors**

As with upper extremity disorders, a host of psychosocial factors associated with the individual worker (e.g., personality and psychological status) and extra-work environment (e.g., living alone) have been linked to back pain and disability [Bongers et al. 1993]. As the “work-relatedness” of these factors is unclear and because they have been examined by others (e.g., Bongers [1993]), with the exception of job dissatisfaction discussed above, they will not be extensively reviewed in this report. In general, these studies show clear associations between measures of psychological distress or dysfunction and self-reported back pain. However, the temporal relationship between psychological factors and musculoskeletal symptoms/ disorders remains unclear. One possibility is that psychological distress is simply a consequence of chronic low back pain, with no etiologic role in the development of the disorder. Alternatively, it is possible that psychological factors may have some etiologic role in the transition from an employee with a history of back pain to the status of an unemployed patient with chronic back pain, due to fear of re-injury, or other factors which would make it impossible to perform the job [Feyer et al. 1992].

While there are a number of prospective studies of low back pain and individual physical factors, there appear to be only a few prospective studies that incorporate individual and extra-work environment psychosocial factors. Bigos et al. [1991b] defined, in a 4-year study of 3,020 hourly wage earners at an aircraft manufacturing plant, an outcome as reporting a back pain complaint to the company medical department, filing a back-related incident report, or filing an industrial insurance claim. The psychosocial assessment included personality traits, as measured by the Minnesota Multiphasic Personality Inventory (MMPI), and limited information on family support, health locus of control, and work social support. One question about enjoyment of tasks in the job was also included. Of the 37 variables used to evaluate the role of social support, health locus of control, and personality traits, three were found to be significant in a multivariate analysis. They were Scale 3 of the MMPI [tendencies towards somatic complaints or denial of emotional distress (relative risk [RR]=1.4), dissatisfaction with work (RR=1.7), and prior back pain (RR=1.7)]. Although significant, these variables explained only a small fraction of the back pain reports in this population. The number of back pain reports was three times higher in the group with the highest scores on these three variables compared with the group with the lowest scores, although only 9% of the work force was in the highest risk group. Because this study focused on the reporting of back pain complaint and not the actual development of back pain, it would be a mistake to generalize the results to workers developing back pain. This study suggests

that individual premorbid personality traits only explain a small fraction of work-related lower back problems.

### ***Job Dissatisfaction***

Job dissatisfaction has been associated with back disorders in both longitudinal and cross-sectional investigations. Bergenudd and Nilsson [1988], studying some 575 residents of Malmö for over 19 years, found job dissatisfaction to be associated with self-reported back pain. As described above, Bigos et al. [1991b] found a positive association between job dissatisfaction and workers filing compensation claims for back injury. Here, subjects who stated that they “hardly ever” enjoyed their job tasks were 2.5 times more likely to report a back injury than those who “almost always” enjoyed their job tasks. However, as Frank et al. [1995] point out, some reviewers have argued that the airplane manufacturing jobs with the highest levels of dissatisfaction were also the most physically demanding. Frank et al. [1995] also noted that, unfortunately, the extent of the interaction is difficult to assess because of the limited measurement of workplace biomechanical exposures in the Bigos et al. studies [1986a,b; 1991a,b]. While psychosocial and psychological factors were assessed at the individual level, workplace biomechanical factors were assessed only at the group level. Biering-Sorensen et al. [1989], in a one-year follow-up mail survey study of some 928 inhabitants of Denmark (which adjusted for confounders such as previous back pain), also found no association of back pain with job dissatisfaction. Because information was limited to the use of mailed survey questionnaires, no workplace biomechanical factors were measured in this study either.

The cross-sectional study by Dehlin and Berg [1977] of nursing aids described earlier found an association between dissatisfaction and self-reported back symptoms. However, this study did not adjust for confounders. Likewise, Magora [1973] in a mailed survey study of Israeli workers in 8 occupational categories found job satisfaction to be associated with reports of sick leave due to low back pain. This study also did not adjust for potential confounders. Svensson and Anderson [1989], in a cross-sectional study of 1,746 Swedish residents, found an association after adjustment. However, in a cross-sectional study by Åstrand [1987] of 391 male Swedish paper company workers (clerks and manual workers), no association was found between dissatisfaction and back disorders, as assessed by symptoms and physical examination after confounder adjustment.

## **Job and Work Environment Factors**

### ***Intensified Workload***

A number of studies have reported associations between perceptions of intensified workload, as measured by reports of time pressure and high work pace, and self-reports of back pain. Heliövaara et al. [1991] in a study of approximately 5,600 Finns, found a composite measure (containing items on perceived time pressure at work, monotony, and fear of mistakes) to be associated (OR 2.0) with back disorders (defined by interview and physical examination) after adjusting for potential confounders, including physical load and previous back pain. Lundberg et al. [1989] found perceived time pressure to be associated with perceived back load among 20 workers on a Swedish assembly line. In a similar vein, Houtman et al.

[1994], in the study of 5,865 Dutch workers across all occupations reported above, found an association (OR 1.21) between reporting high work pace and self-reported back pain (but not chronic back pain problems, defined as back pain for more than three months or at least three times in the study period) (OR 1.2). Magora [1973], in the study of Israeli workers described above, found high levels of concentration to be associated with reports of sick leave due to low back pain (OR 2.9). However, Åstrand [1987], found no association between “hustling” and “nerve wracking work” and back pain in male paper company workers.

### **Monotony**

Several studies described above [Heliövaara et al. 1991; Houtman et al. 1994] have reported associations between perceived monotony and reports of back complaints. Svensson and Anderson [1983], in a study of 940 male residents of Goteborg, Sweden, between the ages of 40 and 47, similarly found monotonous work (rated “absolutely” or “unacceptably” boring) to be associated with back complaints. This relationship remained after adjusting for several physical factors. However, Svensson and Anderson [1989] found no relationship between monotony and back pain complaints among Swedish women in a multivariate analysis which included measures of job and task satisfaction. Similarly, in the Houtman et al. [1994] study, controlling for a combination of physical stressors (dangerous work, heavy physical load, noise at work, dirty work, and bad smell at work) reduced the magnitude of the relationship (for back complaints, the OR decreased from 3.90 to 3.46.) The authors suggest that this may be because

monotonous work is often work which is also either short-cycled or involves a high static (postural) load.

### **Job Control**

In the study of teleservice operators cited above, Hoekstra et al. [1994], after controlling for a number of individual and work-related factors, found perceived job control at work to be inversely associated with back disorders (OR 0.6), that is, the less perceived job control at work, the higher the odds of back disorders. Likewise, as noted above, Sauter et al. [1983] found that low job control was related to neck, back, and shoulder discomfort.

### **Social Support**

Bigos et al. [1991b] found a significant univariate relationship between limited social support at work and back trouble. However, this association was found to be nonsignificant by the investigators when included in a multivariate analysis.

## **Summary and Conclusions for Back Disorders**

In general, the studies reviewed suggest an association between back disorders and perceptions of intensified workload as measured by indices of both perceived time pressure and workload. Despite the considerable differences in the types of methods used to assess both the independent and dependent variables, four of the five studies that explicitly included measures of intensified workload found significant associations. It is also noteworthy that all four of these studies attempted to control or adjust for potential covariates. Five of the seven studies that assess job dissatisfaction

also found positive associations with back disorders. While this evidence is clearly suggestive, Biering-Sorensen et al. [1989] found no association in a large-scale one-year follow-up study; while Åstrand [1987] likewise found no evidence of an association among 391 paper workers. Limited support for an association between back disorders and low job control is also evident, while the evidence for a relationship between monotonous work and back disorders is mixed. Only one study examined the relationship between social support and back disorders and found only weak evidence for an association.

### **Overall Conclusions**

While the etiologic mechanisms are poorly understood, there is increasing evidence that psychosocial factors related to the job and work environment play a role in the development of work-related MSDs of the upper extremity and back. Though the findings of the studies reviewed are not entirely consistent, they suggest that perceptions of intensified workload, monotonous work, limited job control, low job clarity, and low social support are associated with various work-related MSDs. As some of these factors are seemingly unrelated to physical demands, and a number of studies have found associations even after adjusting for physical demands, the effects

of these factors on MSDs may be, in part or entirely, independent of physical factors. It is also evident that these associations are not limited to particular types of jobs (e.g., VDT work) or work environments (e.g., offices) but, rather, seem to be found in a variety of work situations. This observation seems to suggest that psychosocial factors may represent generalized risk factors for work-related MSDs. These factors, while statistically significant in some studies, generally have only modest strength.

At present, two of the difficulties in determining the relative importance of the physical and psychosocial factors are the following: (1) psychosocial factors are usually measured at the individual level, while physical factors are more often measured at the group (e.g., job or task) level and often by methods with limited precision or accuracy, and (2) “objective measures” of aspects of the psychosocial work environment are difficult to develop and are rarely used, while objective methods to measure the physical environment are more readily available. Until we can measure most workplace and individual variables with more comparable techniques, it will be hard to determine precisely their relative importance in the causation of MSDs.

**Table 7–1. Summary of studies examining psychosocial factors and upper extremity disorders (neck, shoulder, elbow, hand, and wrist)**

Study	Methods					Associations with UE outcomes					
	Worker group (particip. rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job/task dissat.	Int. wkld.	Mono. work	Low job control	Low job clarity	Low social supp.
Bernard et al. 1993	1,050 newspaper workers (93%)	Cross-sectional	Self-report questionnaire with job stress scales	MSD case definition based on questionnaire			+		+		
Dehlin and Berg 1977	233 nursing aides (85%)	Cross-sectional	Self-report questionnaire—7 scales	Interviews—pain/ache symptoms		o	o				o
Ekberg et al. 1994	109 workers vs. 637 controls	Cross-sectional (case-control)	Self-report—modified Nordic questionnaire	MD consults for MSD disorders			+			+	
Hales et al. 1994	553 telecommunications workers	Cross-sectional	Self-report questionnaire with job stress scales	Disorders based on symptom questionnaire and MD exam	Controlled for extra job factors		+		+	+	
Hoekstra et al. 1994	108 teleservice workers (95%)	Cross-sectional	Self-report job stress questionnaire	MSD case definition based on self-report questionnaire			+				
Hopkins 1990	291 keyboard operators and other clerical groups	Cross-sectional	Self-report questionnaire—items from habits of living questionnaire	Questionnaire symptoms		+		+	+	+	

See footnotes at end of table.

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**Table 7–1(Continued). Summary of studies examining psychosocial factors and upper extremity disorders (neck, shoulder, elbow, hand, and wrist)**

Study	Methods					Associations with UE outcomes					
	Worker group (particip. rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job/task dissat.	Int. wkld.	Mono. work	Low job control	Low job clarity	Low social supp.
Houtman et al. 1994	5,865 workers—general population	Cross-sectional	Self-report work-living questionnaire	Symptoms questionnaire	Physical stressors — personal characteristics		+		+		
Karasek et al. 1987	8,700 white collar labor union members (87%)	Cross-sectional (random sample)	Self-report questionnaire	Questionnaire—musculoskeletal aches			+		+	+	+
Kompier 1988	158 male bus drivers (73%)	Cross-sectional	Self-report questionnaire	Self report questionnaire—complaints and sick leave			+				+
Kvarnstrom and Halden 1983	224 fabrication workers	Cross-sectional (case-control)	Structured interview questionnaire	Disorders from medical and sick absence records			+	+			+/o
Linton 1990	22,200 workers—general population	Cross-sectional	Self-report work environment questionnaire and habits of living questionnaire	Pain				+			+
Pot et al. 1987	222 VDT operators	Cross-sectional	Structured interview questionnaire	Complaints—structured interview			+/+		o		+

See footnotes at end of table.

(Continued)

**Table 7–1(Continued). Summary of studies examining psychosocial factors and upper extremity disorders (neck, shoulder, elbow, hand, and wrist)**

Study	Methods					Associations with UE outcomes					
	Worker group (particip. rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job/task dissat.	Int. wkld.	Mono. work	Low job control	Low job clarity	Low social supp.
Ryan and Bampton 1988	143 data processors	Cross-sectional (high vs. low symptoms)	Self-report questionnaire—items from work environment scale	Symptoms based on MD interview and exam			+	+	+	+	+/o
Sauter et al. 1983	248 VDT users and 85 non-users (90%)	Cross-sectional	Self-report questionnaire—work environment scale items	Questionnaire—discomfort scale	Physical work demands (adj.)		+		+	+	+
Takala et al. 1991	351 bank cashiers	Longitudinal	Self-report questionnaire	Questionnaire—muscle symptoms	Postural load (adj.)		+				
Theorell et al. 1991	207 workers in 6 occupations	Cross-sectional	Self-report questionnaire	Questionnaire—muscle tension symptoms	Physical load (adj.)		+/o		+		o
Tola et al. 1988	1,174 machinists; 1,034 carpenters; 1,013 office workers (67% to 76%)	Cross-sectional	Mailed questionnaire—worker characteristics	Symptoms in last 12 months; questionnaire and interview		o					

+ = Significant association found.  
o = No significant association found.  
+/+ = Two different measures of factor (e.g., time pressure and workload) found significant.  
+/o = Mixed results (on factor significantly associated; second factor not significantly associated).

**Table 7–2. Summary of studies examining psychosocial factors and back disorders**

Study	Methods				Associations with back disorders					
	Worker group (participation rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job dissat.	Int. wkld.	Mono. work	Low job control	Low social supp.
Åstrand 1987	391 workers in paper-pulp industry	Cross-sectional	Questionnaire—questions on work conditions	Interview and MD exam—back pain abnormalities		o	o			
Bergenudd and Nilsson 1988	575 55-year-old city residents (96%)	Longitudinal	Interview and mailed questionnaire	Interview reports of back pain		+				
Biering-Sorenson et al. 1989	928 persons—general population (82%)	Longitudinal	Mail questionnaire	Questionnaire—back pain in last 12 months		o				
Bigos et al. 1991b	3,020 male aircraft plant employees (54% with all data)	Longitudinal	Questionnaire—Personality Inventory (MMPI), other questions	Back problems—medical reports, insurance claims	Control for prior back problems	+				o
Dehlin and Berg 1977	233 nursing aides (85%)	Cross-sectional	Questionnaire—7 scales, 52 items	Interview—reported pain/ache symptoms		+				
Heliövaraa et al. 1987	5,600 workers—general population (92%)	Cross-sectional	Questionnaire—scale assessing combined hurried work, monotonous work, tight work schedules	MD exam and interview—back disorders	Physical load, prior back problems	+	+			

See footnotes at end of table.

(Continued)

**Table 7–2 (Continued). Summary of studies examining psychosocial factor and back disorders**

Study	Methods					Associations with back disorders				
	Worker group (participation rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job dissat.	Int. wkld.	Mono. work	Low job control	Low social supp.
Hoekstra et al. 1994	108 teleservice workers (95%)	Cross-sectional	Job stress questionnaire	MSD case definition based on questionnaire data	Individual work factors				+	
Houtman et al. 1994	5,865 workers—general population	Cross-sectional	Questionnaire—work living questionnaire survey	Questionnaire—symptoms	Physical stressors; personal characteristics		+	+		
Lundberg et al. 1989	20 male assembly line workers	Cross-sectional	Ratings of time pressure during 2-hr work period	Back load ratings during 2-hr work period			+			
Magora 1973	3,316 workers in 8 occupations	Cross-sectional (low pain vs. controls)	Questionnaire—ratings of job aspects and satisfaction	Questionnaire—reports of low-back pain and sick leave due to low-back pain	Analyses stratified by occupation	+	+			
Sauter et al. 1983	248 VDT users; 85 non-users (90%)	Cross-sectional	Questionnaire—work environment scale survey	Questionnaire—reports of discomfort	Physical work demands				+	
Svensson and Anderson 1983	940 males—general population	Cross-sectional	Questionnaire—perceptions of stress, boredom	Interview report of back pain	Physical work demands—life and job satisfaction			+		

See footnotes at end of table.

(Continued)

**Table 7–2 (Continued). Summary of studies examining psychosocial factor and back disorders**

Study	Methods					Associations with back disorders				
	Worker group (participation rate)	Design	Psychosocial factor assessment	MSD outcome assessment	Covariate adjustments	Job dissat.	Int. wkld.	Mono. work	Low job control	Low social supp.
Svensson and Anderson 1989	1,746 females ages 38–64—general population	Cross-sectional	Questionnaire—items on job and task satisfaction	Interview—reports of back pain	Physical workload	+		o		

+ = Significant association found.  
o = No significant association found.