Chapter 5
The Role of Psychosocial Factors in Musculoskeletal Disorders

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Abstract Musculoskeletal disorders (MSD) are the most prevalent pain disorders in industrialized countries, and their costs can represent up to 2 % of gross national product. MSD are often work associated and recurrent and may lead to disability. In occupational health we are interested in the opposite process: in the return to work (RTW). Different models of disability and RTW exist with different conceptions of psychosocial factors. We therefore propose to analyze the influence of factors from work, patient, health care providers, and broader societal domains along the different phases of the MSD process, adopting a biopsychosocial approach. The analysis of risk factors for the different phases of MSD indicate that work stress factors have an impact on the occurrence of MSD and RTW with MSD, but their effect is low to moderate and nonspecific. Physical work demands, work place adaptation, and pain experience are much stronger predictors of RTW. Lack of modified or adapted work is one of the major factors that hinder RTW. The longer the pain lasts, the longer the patient is out of work, the more personal factors and broader context factors become dominant. There is a clear lack of RTW studies concerning neck and upper limb pain. MSD and especially chronic MSD should be viewed as public health concerns, implying a wider socio-economic and insurance and disability problem. Adequate medical support tailored to the different dimensions and phases of MSD must be on offer, and work accommodations must be promoted and supported.

Keywords MSD • Psychosocial factors • Work • Return to work models • Biopsychosocial • Context factors

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G.F. Bauer and O. Hämmig, *Bridging Occupational, Organizational and Public Health: A Transdisciplinary Approach*, DOI 10.1007/978-94-007-5640-3_5,

5.1 Introduction

Musculoskeletal disorders (MSD) are the most prevalent pain disorders in industrialized societies/countries, and their costs can represent up to 2 % of gross national product. They have to be viewed as a major public health concern. Most MSD are self-limiting, but about 20 % of persons with MSD remain on sick leave, and about half of them will stay on prolonged sick leave or have sustained restriction in function, leading to considerable costs and individual suffering (Waddell, 2004).

In Switzerland, low back pain (LBP) alone has been estimated to generate 2.6 billion euros in direct medical costs, representing 6.1 % of total healthcare expenditure. Productivity losses were estimated between 2.2 and 4.1 billion euros. The total economic burden of LBP in Switzerland was between 1.6 % and 2.3 % of GNP (Wieser et al., 2011). A recent report by the State Secretariat for Economic Affairs (Läubli & Müller, 2009) estimated that work-related MSD costs the Swiss economy over 4 billion Swiss francs per year, with this estimate not including the health care and health insurance costs associated with MSD. Notwithstanding these worrying figures, and even after the famous Carol Black report (Black, 2008), MSD and their consequences are still not on the list of political priorities in Switzerland's public health program. This is also despite the considerable efforts undertaken by researchers in the domains of rheumatology, rehabilitation, and occupational health (see, for example, www.fitforworkeurope.eu or www.fitforworkswiss.ch).

MSD are understood to be caused by a multitude of factors including physical-mechanical, personal, and psychosocial factors. There is substantial and consistent evidence that MSD are strongly work-related (Mehlum, Kjuus, Veiersted, & Wergeland, 2006; Punnett & Wegman, 2004; Räsänen, Notkola, & Husman, 1997). MSD are a major source of disability and lost work time (Buckle, 2005), particularly among blue collar workers (Horneij, Jensen, Holmstrom, & Ekdahl, 2004; Morken et al., 2003) and account for over 50 % of all occupational diseases in the European Union (European Foundation for the Improvement of Living and Working Conditions, 2007). The contribution of psychosocial factors and psychosocial factors at work has been discussed for over 25 years (Bongers, de Winter, Kompier, & Hildebrandt, 1993).

MSD are generally recurrent, and about 10 % become chronic and lead to disability. A prognosis is dependent upon, among other factors, the time since the last pain event (Dunn & Croft, 2006). MSD have therefore been viewed as an illness process in itself, and this can be accompanied by a disability process. In occupational health we are interested in the opposite process: in the return to work (RTW). Therefore, the influence of psychosocial factors has to be analyzed considering their different phases (onset, process of chronification, etc.) and the two concepts (disability and RTW).

When discussing musculoskeletal disorders and psychosocial factors, we must have a clear understanding of both the terms and their relationship. The terms musculoskeletal disorders and psychosocial factors are both based on underlying research concepts and models of health or disease, and the interaction of human

beings with their environment, especially at work. Furthermore, does the "and" imply a unidirectional relationship or a bidirectional one (causal or moderating)? This chapter will therefore revise the different definitions of MSD and psychosocial factors and will discuss the influence of different factors applying a biopsychosocial conception on the different stages of MSD, especially low back pain and neck/upper limb pain.

5.2 What Are MSD?

MSD are the most prevalent, costly, and commonly researched conditions in relation to the workplace. MSD involve an injury to the muscles, tendons, ligaments, joints, cartilage, or spinal discs (Schultz, Stowell, Feuerstein, & Gatchel, 2007). MSD, in a broad sense, are defined as pain phenomena; work-related MSD are defined as pain phenomena in relation to work (experienced at or after work). In most epidemiological studies evaluating causal factors of MSD, they are examined as pain phenomena, sometimes categorized by pain location, i.e. back pain, neck pain and upper limb pain.

The term MSD as a pain definition encompasses very different clinical phenomena, from specific diagnoses with clear bio-medical manifestations (such as inflammatory rheumatic diseases or ankylosing spondylitis) to unspecific symptom groupings (such as pain in the lower back or upper limbs). In case of LBP, only 15 % can be related to a specific cause, whereas 85 % fall into the unspecific category. As also the factors that influence chronification and patients' ability to work differ between these categories (Boonen, 2006; Bräm, 2011; Verstappen et al., 2004), epidemiological studies commonly distinguish between specific and nonspecific MSD. This chapter will primarily focus on nonspecific MSD, such as nonspecific LBP and neck and upper limb pain, but other studies are included, as the definitions are overlapping and reviews or meta analyses have integrated different pain locations. We will distinguish between LBP and neck/upper limb MSD, because (1) work related factors may not be the same for these two locations, (2) upper limb pain encompasses quite specific diagnoses (carpal tunnel syndrome, tendovaginitis, and so on), which are accepted as occupational diseases in most countries, and (3) the quantity and quality of data for these two locations are very different. There are far more good prospective studies and reviews for RTW of LBP patients than for MSD of the neck and upper limbs. MSD of the lower limbs are not taken into account in this chapter. Nevertheless, the influence of psychosocial factors in how MSD has been defined will be taken into account. How MSD are conceptualized also depends on the study approach (see section on psychosocial factors). To illustrate different definitions and their prevalence, Table 5.1 shows different study results from Switzerland. The severity of pain is sometimes also assessed, either as the duration of pain/discomfort or as the frequency of pain events. Assessments vary enormously and make it very difficult to compare and pool studies, and this is also true for the stages of the disease (acute, subacute, chronic) or the RTW process.

Table 5.1 Prevalence of different MSD definitions in Switzerland

Pain location	Population/study	Question	Results	Comments
LBP	Swiss population in general (Wieser et al., 2011)	LBP in the last 4 weeks	50 % (for 90 % the duration was around 4 weeks)	18 % under medical treatment
Work-related LBP	Swiss working population (Graf et al., 2007)	Back pain in the last 6 weeks	18 %	
Work-related pain, other locations	Swiss working population (Graf et al., 2007)	Pain in the last 6 weeks	13 %	Swiss working population 2010: work related neck and upper limb pain: 54 %[a]

Note. [a](Swiss) State Secretariat for Economic Affairs: Data from the 2010 Swiss Working Conditions Survey (summary of the results available online: http://www.seco.admin.ch/dokumentation/publikation/00008/00022/04921/index.html?lang=en)

MSD are the most common health problems in the general population and the health problems most often perceived as work related (Mehlum et al., 2006; Räsänen et al., 1997). Mehlum, Veiersted, Waersted, Wergeland, and Kjuus (2009) showed that compared to an expert assessment, individuals' attribution of their problem to their work did not seem exaggerated. The definition of work-relatedness may differ according to the purpose. The World Health Organization (WHO) defines work-related diseases as multifactorial diseases, in which work (the work environment and the performance of work) contributes significantly but as one of a number of factors in the causation of the disease. Physical factors at work, such as lifting, strenuous positions, highly repetitive tasks, tiring positions, vibrations, noise, and temperature, have been recognized as factors contributing to MSD for several years (Punnett & Wegman, 2004), and there is clear evidence that MSD can be caused directly by strenuous working conditions. Work-associated diseases can also be understood in a more general sense. A disease is work associated, when the cause, development, or treatment is hindered by work or interacts with work. In this sense, most MSD can be considered work-associated diseases.

In Switzerland, MSD are the second most common grounds for consulting a doctor, the most important cause for long-term absenteeism, and the second most common reason for receiving a disability pension (Quadrello, Bevan, & McGee, 2009). Over 40 % of the working population reported MSD pain in relation to work (Graf et al., 2007). MSD are technically and operationally linked with disability. MSD in general are often recurrent, and recurrence should be considered in disability or RTW research, as the study by Kolb, Canjuga, Bauer, and Laubli (2011) showed that with back pain the probability of recurrence depends on the consecutive years of pain. Work disability is usually defined operationally as time off work, reduced productivity, or working with functional limitations as a result of traumatic or non-traumatic clinical conditions.

5.3 Psychosocial Factors and Psychosocial Factors at Work

The broad term 'psychosocial factors' is based primarily on psychiatry research and general disability research. It encompasses the psychological factors of the individual concerned, such as beliefs and behaviors (e.g., fear avoidance concept) and coping styles. This model is increasingly expanded, and contextual factors are integrated, such as the medical care system, insurance and compensation systems, and formal and informal support (for example, family).

In occupational health research psychosocial factors at work are treated as risk factors at work that have their origin in the organizational, psychological, and social work environments. Organizational factors include the fast pace of work, monotonous tasks, working time (length; atypical hours, such as night work), and high workload or overload in terms of volume or hours. How health and safety at work are managed is also an organizational factor. Adaptations or modifications to a job are largely organizationally determined. The psychological factors at work are job satisfaction, perceived job demands, social support at work, conflicts at work, and perceived job stress. Psychosocial factors at work represent a non homogenous group of factors. They can act as resource and as stressor, and they can interact with each other as well as influence people's relationship with their work environment and their behavior in their work environment. Many of these factors have been researched with respect to MSD via various approaches. The dominant research approach is limited to factors of work stress using Karasek's model (Karasek & Theorell, 1990) or more recently Siegrist's model (Siegrist, 1996) (for a review of stress models, see Semmer, 2010). Neither of those measurement tools takes into account all the work-related psychosocial risk factors as defined above, and this is equally true for organizational factors and psychological factors. Furthermore, both tools are based on a specific conception of stress (psychological demands – control or effort – reward model), which is also one of their strengths. Unfortunately, the contributions of individual factors cannot be analyzed based on these analyses, which would be helpful for elaborating preventive measures. Especially for a better understanding of RTW, research should be designed with newer 'stress' models that include also resources and not only strains.

Several possible pathways through which psychosocial factors at work might contribute to MSD have been suggested (Bongers, Ijmker, van den Heuvel, & Blatter, 2006): First, psychosocial factors may increase real physical loads, through highly demanding jobs, for example, which may increase the frequency and duration of exposure. There are indications that this is the case. For example, in the study by van den Heuvel, van der Beek, Blatter, Hoogendoorn, and Bongers (2005), the estimated effects of psychosocial factors at work on neck and upper limb disorders decreased after adjusting for the physical exposure associated with highly demanding jobs.

A second pathway would be that highly demanding jobs increase psychosocial stress and that responses to stress enhance the susceptibility of developing MSD

e.g. due to continuous, stress-induced muscle tensions. In some studies on neck and upper limb MSD, a mediating effect of that kind emerged, but mostly the relative risks of highly demanding jobs remained considerable, indicating that the role of demanding jobs in the etiology of MSD is partly but not fully mediated by the symptoms of stress. Third, MSD are a stress experience for the individual and enhance the influence/perception of psychosocial factors at work. Although stress research provides some indication that such a pathway exists (called adverse causation), this question is rarely researched in MSD.

In a seminal paper, Engel (1977) proposed that to truly understand a patient's illness, it is not sufficient to simply focus on the pathophysiology of the disease. The healthcare provider must consider the social context and psychosocial factors that might have contributed to the illness or influenced its exacerbation or the maintenance of a clinical problem. Engel termed this the biopsychosocial concept of disease.

A shift to a more holistic understanding of long-term work absences due to MSD has taken place – from a biomedical model to a broader biopsychosocial model. This has been advocated strongly by Feuerstein (e.g., Feuerstein & Thebarge, 1991), Waddell (2004), and Loisel et al. (2005). At the same time, MSD, work absences, and work disability have come into the focus of other research disciplines and stakeholders: sociologists, economists, insurance specialists, social policy and disability researchers, and so on. Three major theoretical schools influenced the models and definitions of occupational disability: biomedical, social construction, and biopsychosocial (Imrie, 2004). More recent models are mostly overlapping and enriched by other approaches (e.g., economics; see Schultz et al., 2007 for details). Table 5.2 shows the main models (following Schultz et al.) of a disability or RTW process and the understanding of psychosocial factors in these models. Depending on the different interpretations of psychosocial factors in the different models, different factors are studied to understand and influence these factors.

The classic **biomedical and forensic** model continues to be the standard framework in acute health care and proves effective in dealing with acute diseases and their treatment. The focus is on individual, accurate diagnoses implying an identifiable pathology, which is central for further action. The determinant for RTW or disability (especially in insurance terms) is medical impairment. In practice, this means that a medical examination and determination of impairment defines disability – a model on which current insurance compensation is still based. Due to the recognition that there is often a weak relationship between impairment and function and the increased recognition of the many factors influencing disability (see above), the purely biomedical approach is no longer perceived to be accurate. Disability insurance/compensation systems have recently become more focused on rationing treatment and on effective case management rather than on the determination of ever elusive causation of impairment approaching a more holistic model (Schultz et al., 2007). Recent developments in the forensic model include the integration of gains and losses in the disability process, which may have an impact on the interaction between the injured worker and the disability insurance system.

Table 5.2 Synthesis of RTW models concerning the understanding of psychosocial factors, based on Schultz et al. (2007)

Basic model	Focus	Understanding of psychosocial factors
Biomedical forensic (insurance)	Individual, diagnosis, impairment. Evolving to rationing treatment and effective case management	Primary: no psychosocial factors. Evolving to individual psychosocial factors (motivations, cognitions)
Psychosocial (psychiatry)	Individual; evolving to system factors; diagnosis not relevant	Subjective drivers for disability, individual psychosocial factors primarily dominant, but system factors are more and more taken into account
Ecological/case management Economic (insurance)	System/system–individual interaction; diagnosis not relevant	System factors including work, individual psychosocial factors, and psychosocial factors at work
Biopsychosocial	System–individual interaction; diagnosis relevant	System factors (including work), individual biopsycho- social factors/capacities and biopsychosocial factors/ demands at work

In recent years, the **psychiatric/psychosocial** perspective of disability has evolved enormously and has shifted away from a focus on psychopathology and diagnostic dominance to a broader psychosocial model. In this model RTW is understood as a behavior, and the cognitive-behavioral perspective is the most commonly applied and benefits from the most consistent support (Karjalainen et al., 2003). The bases of the psychiatric model are that the person's beliefs, perceptions, expectations, and coping factors represent the underlying mechanism of disability. In the broadest models, occupational disability is viewed as the result of a complex set of conditions, activities, and relationships that rely on the person's social surroundings, including health care, the compensation system, the family, and other institutions (the workplace is sometimes also taken into account). This broader psychiatric/psychosocial model is very close to a biopsychosocial model. The important factors for this research and intervention approach are: expectation of outcomes, beliefs, coping factors, and more recently health care and compensation systems, formal and informal support (the family and other institutions).

Although originating from different perspectives, the **ecological, case management, and economic** models have merged and share similarities. Importantly, they all take a stakeholder perspective: The drivers are the overwhelming societal and financial costs of the failure of RTW decisions and processes for society, employers, the economy in general, and the insurance business. The development of disability assumes an interaction of personal factors with a mesosystem (such as workplace, health care system, insurance system) and a macrosystem (such as

economic and legislative factors). The work relation model – as a very advanced type of case management model – focuses on workplace characteristics, such as physical job demands, work organization, and adaptations, and on effective RTW case management, and includes the health care system and legislative and insurance aspects. Loisel's conceptual model of RTW (Loisel et al., 2005) represents a case management model that is biopsychosocial all at once. Studies driven more by economic concerns focus on macro-systemic factors, such as labor force participation, labor market themselves, shifts in labor demands, economic incentives, and long-term economic impact. Investigation of the role of professional care providers is an important contribution.

In practice, in Switzerland, the case management approach is still very much focused on the management of the insurance and clinical factors. Workplace factors are rarely taken into account.

The psychosocial and case management models tend to omit medical factors as likely to be non-contributory. According to Schultz et al. (2007), this is of concern, as the assumption is a priori and requires verification. The **biopsychosocial** theory advocates the integration of individual characteristics, including biological impairment, in a system-based approach. RTW is viewed as the consequence of the interaction between the individual biopsychosocial capacities and the biopsychosocial demands of the environment (including work), and this interaction is shaped by macro-systemic factors. The biopsychosocial model strives to best explain the disability–RTW continuum by understanding both the individual and the system factors involved, and their interactions. Due to this complexity, the biopsychosocial approach is difficult to fully conceptualize in a single research paradigm. Early biopsychosocial models (e.g., Feuerstein & Thebarge, 1991) already proposed and showed a modulation of the discrepancy between physical capacities and the demands of work, through the ability to manage pain, psychological readiness to RTW, fear of re-injury, or expectations towards RTW. A significant contribution to the biopsychosocial models is the recognition of dynamic and time or phase-based dimensions of the RTW process (Linton et al., 2005).

Psychosocial and systemic factors are well represented in all of the models except the classic biomedical and forensic model, but the focus on different factors varies strongly. The different models have evolved by integrating factors from other models and have started to converge. We will therefore apply a biopsychosocial model and analyze the factors from the individual dimension, the health care provider dimension, the work dimension (physical, psychosocial and organizational), and broader context or macro dimensions, such as insurance, compensation, and labor market participation. The influence of these factors will be analyzed along the different phases of disability and RTW. The attribution of a factor to one dimension or another is not unambiguous, as job security, for example, could be attributed to either the work organization or the macro dimension (labor market) or even to the individual (in general, an individual with sought-after skills has higher job security).

5.4 Influence of Different Dimensions/Factors on the Different Phases of MSD

Table 5.3 provides a schematized layout for the existing evidence regarding factors deriving from the work environment, personal domain, health care provider, and macro systemic dimension in a biopsychosocial understanding. The influence of these factors on the different phases of MSD – occurrence, pain chronification, RTW acute, RTW subacute, and disability – will be discussed below. The process of pain chronification is distinguished from the RTW process, as predictors of disability and predictors of RTW seem to differ (Gauthier, Sullivan, Adams, Stanish, & Thibault, 2006; Schultz et al., 2002). Research on long term disability due to MSD and failure to return to work are also integrated.

Table 5.3 Evidence for influence of work and personal and broader context factors on different phases of MSD, especially of LBP

Dimension	Influence factor	Occurrence	Pain chroni-fication	RTW <6 w	RTW 6 w	Disability
Work						
Physical	Physical factor	++		++	+	
Psychosocial						
	Stress (Karasek)	+	+	+	(+)	
	Support	(+)			(+)	
	Job satisfaction	–			(+)	
Organization	Work accommodations			++	+	
	Job stability			+	+	+ (duration of absence from work)
Person	Age			–		
	Sex	+				
	Genetic	+				(+)
	Pain experience/ duration		++	++		++
	Fear-avoidance		+		(+)	+
	Depression	–	(+)	–	–	+
	Expectation recovery		+	++	++	
	Health care providers		+	+		++
Macro						
	Informal support		+			
	Compensa-tion		(+)			(+)
	Socioeco-nomic status	+				++

Note. – evidence of no effect, (+) conflicting or insufficient data, + some to moderate effect, ++ clear effect

5.4.1 Occurrence

By 1993, Bongers had already shown that psychosocial factors favor the emergence of MSD. Sultan-Taieb, Lejeune, Drummond, and Niedhammer (2011) calculated the percentage of disease attributable to the effect of Karasek's job strain on MSD of different locations based on a systematic review. The relative risk for MSD varied between 0.94 and 2.5. Using data from the French SUMMER study, Sultan-Taieb et al. then calculated the percentage attributable to job strain (individuals with high job demands and low decision latitude), which was from 3.4 % to 20 % for both sexes. For women, the percentage attributable to job strain was significantly higher.

Most studies on the occurrence or prevalence of **LBP** show a higher risk for men, although interestingly, sex is seldom considered in most of the reviews. Socioeconomic disparities have been identified in the prevalence and occurrence of LBP (Dionne et al., 2001; Kaila-Kangas et al., 2006). Plouvier, Leclerc, Chastang, Bonenfant, and Goldberg (2009) analyzed the role of biomechanical and psychosocial work factors in the GAZEL cohort (employees of the French national energy company). The prevalence of LBP lasting longer than 30 days was 13.6 % and was significantly higher for blue-collar workers and clerks than for managers. The number of socioeconomic disparities observed was significantly reduced when biomechanical strains were taken into account. Adjusting for psychosocial factors measured using the Karasek model (high psychological demands, low decision latitude, and low social support) had little impact. A review by Pope, Goh, and Magnusson (2002) showed that mechanical load is the most influential factor on the occurrence of LBP, but psychosocial factors can influence LBP disability. Hartvigsen et al. (2009) found moderate evidence for no association between LBP occurrence and perception of work, organizational aspects of work, and social support at work and insufficient evidence regarding a positive association between stress at work and LBP occurrence. The influence of genetic factors on spinal pain was estimated using data from the Danish Twin Registry (Hartvigsen et al.): "Genetic susceptibility explained ~38 % of lumbar pain, 32 % of thoracic pain, and 39 % of neck pain" (p. 1343). Hartvigsen et al. concluded that there is moderate to strong evidence for a common genetic basis for many spinal pain syndromes and that the effect is higher in women. But overall, environmental factors including physical and psychosocial work factors had a greater influence than genetics. The study showed genetic factors to have a strong influence on disability. A study conducted by Nyman, Mulder, Iliadou, Svartengren, and Wiktorin (2011) and administered by the Swedish Twin Registry investigated whether a high physical workload is associated with LBP and/or neck-shoulder pain (NSP) when taking into account the influence of genetic and shared environmental factors: "In the cohort analyses, the association between high physical workload and the group with any one symptom (LBP and/or NSP) was OR 1.47. The co-twin control analyses indicated that the association was not confounded by genetic and shared environmental factors …. Concurrent LBP and NSP was the only group that showed a stepwise decrease of the point estimates of the cohort analysis and co-twin analyses …. High physical workload was associated with LBP and/or NSP even

after adjusting for genetic and shared environmental factors. Only for concurrent LBP and NSP, genetic and shared environmental factors seemed to have an influence on the association with high physical workload" (Nyman et al., p. 395).

We have clear evidence that physical demands at work and being male are risk factors for the occurrence of LBP. Concerning sex, the influence of specific gender-related work tasks and family tasks should be better analyzed and taken into account. We have some evidence that genetic factors and socioeconomic class (which may be mediated by the associated biomechanical load) may be risk factors, and low to moderate evidence for stress, especially for high psychological demands/efforts. There is evidence of no association for support at work.

In their exhaustive review, Bongers et al. (2006) showed that in longitudinal studies, high work demands and little control at work (measured by Karasek) are related to **MSD of the neck and upper limbs**. High effort and low reward was also related to MSD symptoms scores. Perceived stress has not been studied as well but is more consistently related to neck and upper limb symptoms. Bongers et al. concluded that psychosocial factors at work contribute to MSD, although the effects are moderate and nonspecific. A large review (Panel on Musculoskeletal Disorders and the Workplace, Commission on Behavioral and Social Sciences and Education, National Research Council, Institute of Medicine, 2001) concluded that there was strong evidence for a causal relationship between neck disorders and highly repetitive work, forceful extension, heavy static loads, prolonged static loads, extreme postures, and a combination of these factors. There was insufficient evidence on vibration effects on neck-shoulder disorders.

Larsson, Sogaard, and Rosendal (2007) reviewed the risk factors for work-related neck-shoulder pain. There was clear evidence that women suffer more from neck-shoulder pain. The review confirmed evidence for repetitive movement, high force demands, and work posture, whereas there was still insufficient evidence concerning vibration. There was some evidence for a relationship between stressful jobs with high demands and upper extremity disorders; however, jobs with low control and low support showed conflicting results, and the magnitude of influence was low to moderate. Limited evidence was found concerning computer use. MSD are mostly measured using symptom/pain scores: Studies with a more specific clinical disease definition that examine the influence of the psychosocial factors at work are still lacking.

There is clear evidence that gender and the demands of physical work have an influence on neck and upper limb MSD. There is moderate evidence for the influence of genetic factors and psychosocial factors at work, and the effect is nonspecific. Recently, stimulated by the overcommitment concept developed by Siegrist et al. (2004), work style has become a focus of both MSD and stress research. For example, van den Heuvel et al. (2005) found a positive relation between overcommitment and MSD, largely mediated by work style. At present, these types of studies are cross-sectional, and it is impossible to draw firm conclusions. Work style is often seen and discussed as a personal trait, as is overcommitment, but this should be viewed as an assumption, because work organization and psychosocial factors can modify work style, too (Rochat, Gonik, & Danuser, 2011).

5.4.2 Pain Chronification

Kopec and Sayre (2004) studied risk factors for the development of chronic pain involving MSD and migraine in a cohort of the general population. Work-related stress (high demands and low decision latitude) was a risk factor for developing chronic pain, but no association was found for physician-diagnosed chronic back problems or arthritis.

The evolution of LBP (over 52 weeks following current pain at baseline) and the influence of beliefs about inevitability and fear avoidance beliefs was studied by Elfering, Mannion, Jacobshagen, Tamcan, and Muller (2009). Mean recovery time was 12 weeks. Duration of LBP at baseline was < 4 weeks in 63 % (acute low back pain) and < 12 weeks in 15.5 % (subacute) and > 3 months in 20.1 % (chronic). Work-related fear avoidance beliefs predicted greater weekly pain and impairment. Recovery was faster for participants who reported less fear avoidance and fewer negative beliefs in general.

Ramond et al. (2011) reviewed the influence of psychosocial factors for the transition from acute to chronic low back pain and found some evidence for depression, stress (measured by Karasek), passive coping, and fear avoidance behavior. Evidence was found for perceived risk by the patients themselves and by the care providers. Furthermore, in a review Kikuchi (2008) found evidence that the relationship between doctors and patients affects both treatment outcomes and patient satisfaction. Moderate evidence was found suggesting that informal social support (families, friends, social groups) influences the prognosis of spinal back pain (Campbell, Wynne-Jones, & Dunn, 2011). The authors showed with the help of Kaplan-Meier curves, that the time to improvement of MSD is dependent on the time since the last pain-free month. Memory of the duration of LBP episodes was an independent predictor of time to improvement and was associated with pain, disability, and psychological status of people in a cohort of general practitioners' consultants (Dunn & Croft, 2006).

There is some evidence that stress and care providers influence the pain chronification process: moderate evidence concerning informal social support, passive coping, and depression, and growing evidence that the duration of pain events is a risk factor for chronification. Concerning fear avoidance beliefs, the results of different reviews are contradictory (see Elfering et al., 2009), and the findings seem to depend on the population and outcomes studied and on whether the fear avoidance beliefs are measured in general or are specifically work-related.

5.4.3 RTW

Steenstra, Irvin, Mahhod, and Hogg-Johnson (2011) recently published a very well done and conclusive review on the prognostic factors of acute LBP (> 1 day to 6 weeks) for return to work. Strong evidence was found that the following factors

influence RTW: workers' recovery expectations (personal prediction of how likely it is that they will return to work), radiating pain, self-reported pain, modified duties and physical work factors in the workplace, and treatment related factors. Moderate evidence was found for the psychosocial work environment, claim-related factors, and treatment-related factors (not related to the care provider: for instance, clinical examination results). No evidence was found for depression and age. Psychosocial predictors of failure to return to work in non-chronic, nonspecific LBP (baseline measure within 12 weeks of onset of LBP) were reviewed by Iles, Davidson and Taylor (2008). The review focused on psychosocial factors and did not evaluate other work factors. Strong evidence was found that recovery expectation is predictive of failure to RTW; depression, job satisfaction, and stress are not predictive. Moderate evidence was found that fear avoidance beliefs are predictive of work outcome, but that anxiety, as such, is not. The researchers conclude that for compensation and locus of control, the evidence of prediction is insufficient. Bethge (2010) reviewed prognostic work-related psychological factors in acute and subacute LBP and found evidence for low decision latitude and high psychosocial demands and low support.

Heitz et al. (2009) reviewed the risk factors predicting return to work with subacute (2–10 weeks) and chronic (10–24 weeks) nonspecific low back pain. The pattern of risk factors (biomedical and psychosocial) did not change markedly with increasing duration of symptoms. A higher rate of modifiable psychosocial factors at earlier stages, as compared to later stages, was observed, in accordance with the findings by Waddell, Burton, and Main (2003). Heitz et al. showed that at the subacute stage, psychosocial factors (using a broad definition, including context factors) play an important role in the development from subacute to chronic LBP.

Most studies concerning RTW with MSD have unclear or large inclusion criteria concerning duration of absence of work, and the results are hard to interpret according to acute, subacute, or chronic state. In the last two decades several studies have been conducted on the management of workers absent due to MSD, especially back pain (Loisel et al., 2005; Campbell et al., 2007; Durand et al., 2007; Elders, van der Beek, & Burdorf, 2000; Franche, Baril, Shaw, Nicholas, & Loisel, 2005; Staal et al., 2002; Williams, Westmorland, Lin, Schmuck, & Creen, 2007). These results have modified our understanding of long-term absences due to MSD. Hindering factors for RTW are not only associated with the causal illness but more strongly to broader psychological and social factors, including job environment, job loss, and duration of work absences. Expectations of the affected individuals concerning RTW and expectations of the health providers are contributing factors for chronicity. On the other hand, job stability was found to facilitate RTW.

An interesting qualitative study from Canada (Soklaridis, Ammendolia, & Cassidy, 2010) aimed at a better understanding of the psychosocial factors in RTW using focus groups with various stakeholders (employers, injured workers, unions, health care providers, and compensation boards). The majority of the study participants described how psychosocial factors were the product of wider systemic or organizational issues (including issues of work organization). Soklaridis et al. concluded that "although it is important to understand how psychosocial factors

affect RTW, organizational structures within our social context seem to play a role in shaping how all stakeholders see and emotionally respond to LBP and RTW, as well as the degree to which they can envision taking action on them" (p. 1557). Wales, Matthews, and Donelly (2010) provided a comprehensive review of the published literature and policy documents in Australia on workers with chronic pain. The researchers identified a variety of contextual factors influencing RTW for people living with persistent pain. They found that conceptual models underpinning the rehabilitation system are driven by a strong focus on early RTW but are based on medical determinations of impairment and rehabilitation planning applying a biomedical model, as prescribed by the compensation jurisdiction. "Professionals are influenced by, and in their turn influence, the context in which chronic pain is experienced" (Wales et al., 2010, p. 167) and may therefore accentuate the chronic pain experience for the injured.

There is clear evidence that workplace factors such as physical demands and workplace accommodations, as well as pain experience, expectations of recovery, and health care factors all influence RTW in the acute and subacute phase of MSD, especially LBP. The longer the absence from work, the more that macro context factors (socioeconomic status, the health care providers, and system) and personal factors become important. There is a clear lack of RTW studies concerning neck and upper limb MSD.

5.4.4 Disability

In an editorial, Valat (2005, p. 193) wrote: "patients with no noticeable improvements after 6–8 weeks are at very high risk for progression to chronic disease." In recent analyses of a MSD cohort recruited by general practitioners concerning prognostic factors for poor outcome, unemployment and high pain intensity were found to be the strongest predictors (Dunn, Jordan, & Croft, 2011). Eighty-five percent of poor outcomes were explained when combining these two factors. Depression, anxiety, catastrophizing, and fear avoidance beliefs did not contribute to the final model in a significant. Socioeconomic factors, especially work status (not in work) predicted functional disability (Moffett, Underwood, & Gardiner, 2009) in another cohort of consulting general practitioners for MDS. In a 6-year follow-up study Chibnall and Tait (2009) showed that long-term adjustment was worse for people with lower socioeconomic status, particularly for economically disadvantaged African Americans. The duration of absences from work and job loss are strong predictors of disability (Linton, 2000; Waddell et al., 2003). In a 6-month prospective study of the general population, Leeuw et al. (2007) studied the influence of fear of movement, pain catastrophizing, and functional deficits on LBP disability. Chronic LBP was defined as suffering from LBP during both measurement periods. The study was unable to demonstrate a mediator relationship between fear of movement and pain catastrophizing, as pain catastrophizing was not related to disability/loss of functions.

Melloh et al. (2009) undertook a review to identify prognostic factors for chronicity in patients with LBP by analyzing different screening instruments and examining their predictive effectiveness for the dependent variables of work status, functional limitations, and pain. Melloh et al. observed that studies' time spans were varied and often not well defined, making sound conclusions difficult. The strongest predictors for work status were occupational structures and psychological structures. For functional limitation and pain, individual psychological structures dominated.

There is clear evidence that work status, time off work, and socioeconomic status influence the disability process.

5.5 Discussion and Conclusions

The term psychosocial factors should be avoided if at all possible, as different models and definitions exist. We propose to group all the different factors into environment/work, personal, health care provider, and broader macro factors, analogous to Engel's (1977) understanding of biopsychosocial factors. Applying this approach allowed us to better understand these different factors and their interactivity.

The analysis of risk factors for the different phases of MSD indicate that work-stress factors have an impact on the occurrence of MSD and RTW with MSD, but their effect is low to moderate and nonspecific. Concerning subacute LBP there is even evidence that stress factors, support at work, and job satisfaction have no influence on RTW (Iles et al., 2008). Physical work demands and work place adaptation, as well as pain experience, are much stronger predictors for RTW. Lack of modified or adapted work is one of the major factors that hinder RTW (Soklaridis et al., 2010; Waddell & Burton, 2005). It is also of interest that the factors influencing pain chronification are not the same as the RTW factors. Fear avoidance and catastrophizing, as well as depression, show moderate evidence for influence on pain chronification but do not significantly influence RTW. On the other hand, fear avoidance behavior is related to disability, but it is less related to functionality (Valencia, Robinson, & George, 2011). The dominant personal factors are clearly pain experience (frequency, duration, and pain intensity) and expectations of recovery and return to work, and there is growing evidence that genetics play a role as well. Both the patient's and the care provider's expectations about RTW have an important influence on RTW outcomes. The longer pain lasts, the longer the patient is out of work, the more disability furthering behavior is observed, and person-related factors and broader context factors, such as the health and social insurance system and the economic situation, become dominant. There is a clear lack of RTW studies concerning neck and upper limb pain.

The assembled evidence indicates that organizational structures within our work and broader context factors shape how individuals respond to MSD and RTW. Truchon (2001) proposed viewing the process of disabling MSD as a stress process and suggested in particular that the stress caused by pain could have a negative impact on the outcome: either indirectly through the negative emotional responses

that it produces, which can cause biological or behavioral changes, or directly through biological or behavioral changes, which can in turn negatively affect the emotional response. Feeling pain is one of the greatest bodily and psychological stressors, inducing a cascade of biological responses. Having MSD primarily calls into question an individual's physical room to maneuver: In some people this may induce fear avoidance behavior, whereas others will force themselves on. Both behaviors seem to be of importance in the development of chronic pain (Ehrlich, 2003). Having a physically demanding job and experiencing pain and discomfort, especially in relation to one's work, will enhance a person's stress just when their ability to work is threatened, as well as their work status and income. Managers with recent regular episodes of LBP might be able to adapt their workplace as well as their work load and style. And they can return to work on reduced duty when necessary. Fundamentally, their ability to work is not put into question. Non-skilled workers dependent on being physically active who experience MSD face a much deeper problem with regard to their perceived ability to work. This threat is much bigger for persons with a lower socioeconomic standing or with a lower level of education, as they often only qualify for physically demanding jobs. When the doctor prescribes reduced duty but the employer says that the employee can only return to work when 100 % fit, and such a belief can be also part of the occupational role understanding, the injured parties will stay at home and find their doubts concerning their ability to work confirmed.

Nevertheless, managers with enormous workloads and conflictual relationships with their superiors, which do not allow them to modify their work, may also find themselves in a risky situation. In the French literature on stress the notion of 'marge de manoeuvre' or room to maneuver has been in use for a long time; it is very well conceptualized for the workplace by Durand et al. (2008). I propose enlarging the notion of room to maneuver to include all dimensions studied: the work and work organization and social surrounding encompassing social class, education, and insurance or compensation system. The room to maneuver is a result of the individual's capacities and self-regulation abilities on one hand, and the means given to the individual and the demands on him, on the other. When this room to maneuver is respected, the person should be healthy and productive. Having pain limits a person's room to maneuver a priori, and when other factors are added to this stress, a disability processes is more likely. Different ways of increasing a worker's room to maneuver include: reducing work intensity and working at one's own pace, delegating work, working fewer hours, or a modified job description, and so on. When workers can temporarily accept a lower income without it threatening their longer term financial stability, that is also increased room to maneuver. All of these factors have to be taken into account and assessed when we wish to successfully intervene and expand the injured person's room to maneuver and to avoid a process leading to disability. This means that further research on RTW with MSD should apply a strain and resources perspective that includes larger context factors.

In line with this dynamic, multifactor concept, the latest review of the effects of multidisciplinary interventions on RTW in patients with LBP (Norlund, Ropponen, & Alexanderson, 2009) shows that the effect depends on the definition of the prior

sick leave; the reviewers concluded that multidisciplinary interventions showed evidence of having a clinically relevant effect on RTW outcomes in LBP patients and that this effect was even stronger for subacute stage LBP (Norlund et al.). Taking into account the recurrent nature of MSD, more studies adopting a dynamic, time-sensitive paradigm of the pain experience and RTW or remaining at work are needed.

Participatory ergonomics aims to improve the room to maneuver of workers by giving them tools to adapt their workplaces. In a review concerning injury prevention, Rivilis et al. (2008) concluded that there was partial to moderate evidence that approaches incorporating participatory ergonomics improve workers health: Fewer MSD symptoms, injuries, and workers' claims and sickness absenteeism are reported, but the magnitude of the effect was unclear. Participatory ergonomics seems to be an intervention that gives persons with LBP more room to maneuver and should be the subject of further research.

The longer the disease and recovery process last, the more RTW seems difficult and disability factors dominate. Early recognition and intervention are therefore imperative. This therefore raises the questions of who is responsible for recognizing the risk of chronification in MSD patients and what measures should be taken to prevent chronification. This process must be defined within a health care system that focuses on recovery and not on RTW. Danuser et al. (2009) showed that organizational and broader context factors even have a strong influence on the recruitment design and process of an RTW study. Coordination between the different domains of work, health care, or broader contextual factors has to be developed to successfully prevent longer-lasting disability. Interventions should be tailored to the dominant strain factors and should take more account of the resources and abilities of the patient and the phase of the process. Tackling the problem of work-related MSD requires an integrated public health approach, from awareness-raising to training to policy development, which implies involving employers and organizations as well as the medical and compensation system.

Chronic MSD especially should be viewed as public health concern, implying a wider socioeconomic and insurance and disability problem. It is of crucial importance to strengthen society's commitment to getting injured employees back to work. Adequate medical support tailored to the different dimensions and phases of MSD must be on offer, and work accommodations must be promoted and supported.

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