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Strategies for preventing prolonged disability in workers compensated for work related musculoskeletal disorders: A systematic and comprehensive literature review

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Occupational Rehabilitation

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REPORT **R-719**

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ABSTRACT

Work-related musculoskeletal disorders (WRMSDs) constitute a heavy economic burden in our society due to the constantly growing number of workdays lost by a small percentage of workers on prolonged disability. The continuous proliferation of concepts in the field of work disability, the diversity of implementation contexts and interventions, and the varied interests of the stakeholders involved in the rehabilitation and return-to-work (RTW) process of workers suffering from WRMSDs still constitute major challenges for researchers and stakeholders in the work disability research field. The main purpose of this literature review was to provide an overview of the main topics and recent trends in contemporary work disability research and to identify potentially successful intervention modalities for preventing prolonged disability in workers compensated for WRMSDs.

A systematic electronic search of the literature published in English or French between January 2000 and January 2008 was performed in ten scientific databases. Descriptors were searched using key words related to workplace absenteeism, work-related musculoskeletal disorders, work disability interventions, rehabilitation and RTW interventions, and compensation issues. Descriptive analyses were performed on 186 articles reporting on one or more revelatory studies, 20 theoretical articles and 12 literature reviews. In order to identify the topics and trends in work disability research, the articles were categorized based on the main objective pursued, stakeholder(s) involved in the study or interested in the study's results, research perspective, and specific area of application (e.g. physical exercise program). In the next step, content analysis was performed on the 88 articles that were found to describe strategic components of intervention aimed at preventing prolonged disability in workers compensated for musculoskeletal disorders.

The major topics in work disability research appear to be the factors contributing to prolonged disability and a clear interest in intervention modalities for people at risk of prolonged disability. Multidisciplinary, multimodal, and targeted intervention is an increasingly prevalent topic in the studies reviewed, depending on the area of application. In addition, the investigation of psychosocial and ergonomic-related workplace factors, especially for workers identified as being at risk of prolonged disability, is frequently considered. Taking into account the different stakeholders' points of view also constitutes a widespread trend in contemporary research on intervention aimed at preventing prolonged disability in workers compensated for WRMSDs.

Finally, the literature reviewed identifies a number of strategies as potentially successful in preventing prolonged disability. First, the early screening of injured workers at risk of prolonged disability and the concentration of intervention efforts on them are reported as effective ways of preventing prolonged disability. Second, early intervention using multimodal approaches to biopsychosocial and workplace factors appears to be vital to effective and sustainable RTW, and effective management of those workers at risk of prolonged disability. Third, improving communication between stakeholders and enhancing coordination between the actors involved in the intervention process are reported as essential to increasing the effectiveness of multidisciplinary intervention in preventing prolonged disability.

The findings of the present literature review will enlighten stakeholders and practitioners in the work disability intervention field by providing them with potentially successful strategies for preventing prolonged disability and with information about specific areas in need of further research regarding workers compensated for WRMSDs.

EXECUTIVE SUMMARY OF THE LITERATURE REVIEW

Musculoskeletal disorders are among the most common types of work injury in industrialized countries and constitute a major economic burden on contemporary society. Moreover, work-related musculoskeletal disorders (WRMSDs) are among the leading causes of significant human suffering, loss of productivity, and heavy financial costs to society. A large portion of this burden is associated with the number of workdays lost by a small percentage of workers being compensated for prolonged disability caused by musculoskeletal disorders.

In the work disability research field over the past two decades, numerous studies have described and evaluated different types of interventions found to be helpful in preventing disability in workers who have WRMSDs, with many of these interventions originating from the rehabilitation and RTW fields. More recently, several systematic literature reviews and meta-analyses have been published with the aim of enlightening the decision-making process by providing evidence-based data on the best interventions for preventing work disability. However, very little of the literature addresses the issue of preventing prolonged disability in workers compensated for WRMSDs. In addition, the controversial nature of the results evaluating the effectiveness of the different interventions, the incomplete description of the participants involved in the studies, and the absence of explanations concerning the implementation process and strategies of the different programs and interventions make their application dangerous in actual practice. The endless proliferation of concepts in the work disability field, the diversity of implementation contexts and interventions, and the multiple interests and points of view of the stakeholders involved in the intervention process compound the complexity of the challenges faced, not only by researchers but also by managers and practitioners, in preventing prolonged disability. Many questions persist, particularly regarding the strategies to be used to prevent prolonged disability and promote successful rehabilitation and sustainable return-to-work (RTW). Stakeholders still need comprehensive reviews that provide a synthesis of and details on interventions and their application context, especially from the perspective of preventing prolonged disability. The main objective of this literature review was therefore to provide an overview of the main topics and trends in contemporary work disability research and to identify potentially successful intervention modalities for preventing prolonged disability in workers compensated for WRMSDs.

A systematic electronic search of the literature was performed in ten scientific databases by a specialized librarian. The descriptors and key words searched in the databases pertained to five key concepts: 1) workplace absenteeism, 2) work-related musculoskeletal disorders, 3) work disability intervention, 4) rehabilitation and return-to-work intervention, and 5) compensation issues. After correcting the list of references obtained for duplications and misspellings and checking the references against the inclusion and exclusion criteria, 218 articles were selected for review: 186 articles reporting on one or more revelatory studies, 20 theoretical articles and 12 literature reviews. Descriptive quantitative analyses were performed on the 218 abstracts. In order to pinpoint the main topics and recent trends in research on intervention, the articles were first described in terms of the country of the first author, publishing journal, and type and stage of WRMSDs discussed. Second, the articles reporting on one or more revelatory studies (186) were categorized on the basis of their main objective, stakeholder(s) involved in the study or interested by the study's results, research perspective, and area of application. A grid constructed especially for these purposes was used to categorize the articles and compile the relevant

information. Two reviewers, whose decisions were made by consensus, proceeded to define the main categories and classes to be included in the grid, to categorize the articles, and to extract the pertinent information for describing the topics and trends. A database was created for further reference. Finally, qualitative analyses were performed on the articles found by the reviewers to describe strategic components of intervention aimed at preventing prolonged disability (88 out of the 186 articles that reported on one or more revelatory studies), to identify these strategic components in the different programs, policies, strategies, and guidelines reported by the authors, to identify the main strategies aimed at preventing prolonged disability, and, further, to explain their usefulness to practitioners and stakeholders in their decision-making processes.

Five main topics were identified in the literature reviewed. The first major topic concerns the factors contributing to prolonged disability and a clear interest in developing modalities for screening people at risk of prolonged disability in order to provide them with appropriate interventions. A second major topic pertains to the evaluation of outcomes associated with different programs or combined interventions, either from the perspective of the successful component(s) or mix of interventions to be used to obtain better outcomes, or from the perspective of the best practices to be used by the concerned practitioners or stakeholders in order to achieve such results. Multidisciplinary, multimodal, or targeted intervention was often reported as being incorporated into the development of such programs. Based on the literature, psychosocial and ergonomic-related workplace factors appear to be the components most frequently associated with processes aimed at preventing prolonged disability in workers compensated for WRMSDs. A third topic of interest to researchers in the work disability field is the documentation and evaluation of the key actors' practices in terms of their rehabilitation and RTW interventions. More specifically, we observed a clear interest in describing the role and responsibility of the different actors involved in the rehabilitation and RTW process. A fourth major topic concerns the compensation issue. The differences in outcomes associated with the different compensation systems in place, or between people with different compensation status, are the predominant issues explored. Finally, a fifth topic pertains to the different methodological issues related to the development, validation, and evaluation of tools useful in the work disability management process, specifically, in measuring the disability outcomes obtained in diverse populations according to the different types of interventions.

Four recent trends emerge in the literature reviewed. First, authors frequently point out phenomena associated with prolonged disability, yet they rarely focus on the prevention of these phenomena. Second, they appear to regard the taking into account of the different stakeholders' points of view as a key feature in preventing prolonged disability. Third, descriptive studies in the field show researchers' interest in better understanding the process of implementation (role of the different actors, role of the contextual factors, barriers and facilitators) of the different interventions (programs, policies, strategies, etc.). A final trend observed is that of factoring workers into the equation in order to raise the different stakeholders' awareness of the economic, social, and personal consequences of the workers' disability. Indeed, some studies appear to suggest that workers' perceptions of the work disability phenomenon and its related issues constitute a powerful force in interventions aimed at improving their chances of moving away from disabled status towards employed status or shifting from a disempowered to an empowered perception of themselves.

Although the studies reviewed differ in their methodologies, objectives, areas of application, and research perspectives, and although they portray the different stakeholders and practitioners involved as having different views and concerns, they concur in identifying the same key strategies as potentially successful in preventing prolonged disability in workers compensated for WRMSDs. First, early screening of injured workers at risk of prolonged disability and the concentration of efforts on them through targeted intervention appears to be an effective way to prevent prolonged disability. Second, different types of interventions or combinations of interventions included in a given program appear to be beneficial in terms of helping prevent prolonged disability and promoting RTW. Multidisciplinary and multimodal programs are frequently associated with positive outcomes such as workers' leaving the sickness benefits scheme and getting compensation claimants back to work, and with having a positive impact on the following: sick-leave status, recurrence rates, work disability status, cost-effectiveness, socio-economic impacts, pain intensity, disability, depression and cumulative physical capability, and physical performance. Moreover, early targeted intervention for people who have been screened for psychosocial and ergonomic risk factors appears to be central to preventing prolonged disability and promoting sustainable safe RTW. Third, the actors' practices have a significant impact on the implementation of these interventions. Physicians and other healthcare providers, case manager nurses or insurance representatives, and workplace actors all play an important role in the process of preventing prolonged disability through their actions and interactions with the workers. Other key elements of the different actors' practices, including providing early access to appropriate advice, keeping workers at work, or returning them to work as quickly as possible, and the employer and compensation board representatives staying in touch with the individual and the physicians during the work absence also appear to be important, as reported by various authors. Continually providing practitioners with updated guidelines and directives for improving their practices appears to have**,** at least theoretically, a beneficial impact in terms of helping prevent prolonged disability. Providing them with knowledge about the different outcomes associated with diverse conditions of application could improve their ability to adapt their practices to a specific implementation context. Fourth, improving collaboration and communication among the key stakeholders and actors could enhance the coordination of actions aimed at preventing prolonged disability. Indeed, the coordination of key stakeholders' actions appears essential to increasing the effectiveness of early multidisciplinary interventions aimed at preventing prolonged disability. Fifth, providing adequate information to the injured workers, but also to the multiple actors and stakeholders involved in the rehabilitation and RTW process, and making them aware of the human and social consequences of prolonged disability also appear to be critical to the sustainable RTW of injured workers compensated for WRMSDs.

The findings of this literature review inform stakeholders and practitioners in the field of work disability intervention of the main topics and current trends in research on intervention aimed at the successful rehabilitation and sustainable RTW of workers compensated for WRMSDs. In addition, by identifying potentially successful strategies for preventing prolonged work disability, the review provides stakeholders and practitioners with some possible avenues for action. Finally, the review highlights some further insights essential to the development of intervention programs that have the capacity to reach many employees and promote positive outcomes for all workers, especially those who need it most.

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LIST OF ABBREVIATIONS

AWCBC	Association of Workers' Compensation Boards of Canada
CBT	Cognitive behavioural therapy
CCT	Controlled clinical trials
CIHR	Canadian Institutes of Health Research
CLBP	Chronic low back pain
CSST	Commission de la santé et de la sécurité du travail
CTS	Carpal Tunnel Syndrome
DOD	Duration of disability
FRP	Functional restoration program
HC, HCP, HCS	Health Care, Health Care Provider, Health Care System
ICFDH	International Classification of Functioning, Disability, and Health
IRSST	Institut de recherche Robert Sauvé en santé et sécurité du travail
LB(P)	Low Back (Pain)
MBR	Multidisciplinary biopsychosocial rehabilitation
MSD	Musculoskeletal Disorders
MSI	Musculoskeletal injuries
MSP	Musculoskeletal Pain
OHP	Occupational Health Practitioner
OLBP	Occupational Low Back Pain
RCT	Randomised controlled trial
RTW	Return-to-work
RSI	Repetitive Strain Injury
SC	Societal context
TL	Time loss

UL(E)D(I)	Upper Limb (Extremity) Disorders (Injuries)
VR	Vocational rehabilitation
W	Worker
WCB	Worker Compensation Board
WHO	World Health Organization (WHO)
WP	Workplace
WRMSDs	Work related musculoskeletal disorders

CONCEPTUAL GLOSSARY

Case management

Collaborative process that assesses, plans, implements, coordinates, monitors, and evaluates options and services needed to meet a person's health needs. The case manager uses communication and the resources available to promote quality, cost-effective outcomes. In the rehabilitation field, case management is a goal-oriented approach used to keep employees at work and facilitate early RTW.

Chronic

As an adjective, chronic can refer to a persistent and lasting medical condition. Chronic course is to be distinguished from recurrent course; recurrent diseases or injuries relapse repeatedly, with periods of remission in between. The qualifier “chronic” is usually associated to a condition lasting more than three months. The rate of onset and development of long-lasting or recurrent diseases are the more usual measures used in the field.

Disability

Restriction or lack of ability to perform an activity in a normal manner resulting from impairment, i.e., changes in a person's behavior or interaction with the environment. The disability may be or not caused initially by such an activity in the workplace. Interventions targeted to the level of disability include retraining to achieve a goal using new methods (including equipment), or altering the personal or physical environment. Many people with disabilities can work and the jobs they can hold vary with each individual's abilities and limitations. No one but the individual, in consultation with his or her healthcare professional, has could decide what job he or she can hold. Disability could results from

Handicap

Disadvantage resulting from impairment or disability that limits or prevents acting in a normal role in society, i.e., changes in the person's social role functioning. Interventions address the quality and quantity of social role functioning by increasing the patient's behavioral repertoire and through increasing opportunities for social interaction, e.g., through transport.

Impairment

Abnormality in structure or function of the organ system resulting from an underlying disease process, i.e., changes in a person. Interventions targeted at the level of impairment include equipment to increase functioning, patient or caregiver behavior to increase functioning, or surgery to improve structure.

Intervention

Act of intervening, interfering or interceding with the intent of modifying the outcome. In medicine, an intervention is usually undertaken to help treat or cure a condition. Different types of intervention, i.e., medical management, physiotherapy, occupational therapy, ergonomic assessment, work conditioning/ work hardening, education programmes, are

intended to assist an individual's progress through the stages of disability, and help in resolving any difficulties experienced in his or her current activities, including work.

Prevention

Intervention aimed at assisting workers in preventing musculoskeletal disorders, allowing restoration of function, and recovering the capacity to return to work.

Program

Intervention outcomes-focused combining coordinated, goal-oriented interdisciplinary team services, to measure, improve the functioning of persons with pain, and encourage the appropriate use of health care systems and services. Programs involve the delivery of multiple interventions in a package and are usually provided following the completion of treatments, but, under some circumstances, may be offered concurrently.

Prolonged disability

Disability is generally assessed on criteria such severity and duration. When "Severe" means that a person is incapable of regularly pursuing any gainful occupation, "Prolonged" means that the disability will prevent the individual from going back to work in the next 12 months, or is likely to result in death.

Recurrence

Episode of work disability or medical care that occur after a first injury followed by apparent recovery.

Rehabilitation

Process of restoration of a person's skills or functional status to regain maximum self-sufficiency and function in a normal, or as near normal manner as possible. Rehabilitation intervention includes medical, physical, psychiatric, psychological, social, educational, vocational, economic, and financial interventions applied by a wide range of people. These should include, but should not be restricted to, the person himself or herself, family members, peers, teachers, co-workers, employers, and trained professional helpers.

Return-to-work process

Course of action associated to the implementation of an interdisciplinary work rehabilitation intervention conducted with the goal of reintegration the workplace, before or after the physical return to work.

Return-to-work outcome

Measurement of rate of recovery from the disability associated to the resumption of productive activity, following a precise intervention, or as a result in a prognostic study.

Stage of injury process

Four main stages are habitually associated to the development of WRMSDs. In the first stage pain occur in a joint or muscle group when working in one position for a long period in most continual or repetitive posture. In the second stage, the pain starts to come on early in the activity and continue when the activity is stopped, being often more

noticeable at rest. In the third stage, the pain comes on early in the activity, continues long after it has ceased starting to interfere with daily life activities. In the fourth stage, pain is constant and disabling. The first three stages are manageable and treated successfully by work assessment, work management, various specialized treatment protocols, exercise regimens, etc. In contrast, recovery in the fourth stage is very difficult and can be prolonged, or with little possibility of returning to the same workload.

Stage of healing

There are three main stages considered regarding the healing after back pain or neck injury, i.e., acute (occurs at the time of the injury, and continues for up to 4 days), sub-acute (takes place between the 4th to the 21st day after the injury occurs), and chronic (begins after 21 days, and may continue for quite some time). Different types of treatment or intervention will be appropriate for each stage in order to prevent prolonged or permanent disability.

Stakeholder

Individual or group of individuals who have a stake or are directly involved in achieving project goals and whose participation and support are crucial to its success. In the process of rehabilitation and RTW stakeholders are the injured worker, the workplace, the health care system, the workers ' compensation board, and society.

Strategy

A plan of action designed to achieve a particular goal. In the prevention of work disability, strategy is distinct from program, which is concerned with the nature of elements included in the intervention itself. Strategy is concerned with how the different elements are put into place, and with the relevance of considering different conditions put into place in order to achieve the goal.

Treatment

Healthcare defined intervention, i.e., treatment, surgery, procedure, or technique.

Vocational Rehabilitation

Targeted intervention offered in order to support people getting into work and remaining at work. Vocational rehabilitation has a number of synonyms including occupational rehabilitation.

Work related musculoskeletal disorders (WRMSDs)

Group of painful disorders of the soft tissues (i.e., muscle, tendons, and nerves), occurring when there is a mismatch between the physical requirements of the job and the physical capacity of the human body. Specific risk factors associated with WRMSDs include repetitive motion, heavy lifting, forceful exertion, contact stress, vibration and awkward posture, among others. Back pain, tendonitis, thoracic outlet syndrome, tension neck syndrome, and carpal tunnel syndrome are examples of WRMSDs occurring in the workplace.

1. BACKGROUND

Despite the considerable research done over the last two decades, work musculoskeletal disorders continue to be a major source of disability among workers worldwide. Work related musculoskeletal disorders (WRMSDs) are among the most costly occupational problems, and cause significant human suffering and economic burdens for employers, workplaces, workers and society. Recent statistics in the U.S. show that each year workers experience more than 647,000 lost workdays due to WRMSDs, 34 % of all lost workday injuries and illnesses. WRMSDs cost US employers $15 to $20 billion in workers' compensation costs each year. Moreover, indirect costs from WRMSDs may run as high as $45 to $60 billion. In Québec, WRMSDs accounted for 42% of lost time claims, and 50% of lost time days from 2001-2005. The compensation and rehabilitation of workers with WRMSDs cost the provincial workers' compensation board (Commission de la santé et de la sécurité au travail, CSST) 3.3 billion dollars, and Quebec employers 12 billion dollars, in direct and indirect costs (Duguay et al., 2008).

A constantly growing number of workdays are lost by a small percentage of workers that remain absent from work because their prolonged disability. Although they represent only 3.8% of all occupational injury files, they account for close to 38% of total disbursements. In terms of injury site, spinal injuries are the main rehabilitation-related pathology, in 32.6% of all cases, while upper limb injuries represent 22.8%. In fact, after sick leave following a musculoskeletal injury, most people return to work quickly and do well. However, a small but significant proportion of injured people, approximately 10%, remain off work for long periods of time, or even permanently and account for disproportional costs (Nachemson and Jonsson, 2000, Waddell et al., 2002). As highlighted recently by Schultz and Gatchel (2005), "only a minority of individuals who sustain a trauma or an injury go on to develop chronicity, yet they disproportionately contribute to rising health care, compensation and litigation costs, as well as productivity losses." The consequences of staying off work for long periods of time are substantial for the workplace (lower productivity, declined profitability, decreased quality, and drop off motivation), for the afflicted worker (pain, suffering, weight gain, loss of fitness, increased morbidity and mortality, isolation, depression), and also for the community (higher financial costs, effects on how the community perceives itself).

1.1 Conceptual framework

The last two decades have witnessed the proliferation of concepts in the field of disability, that trend having a direct impact on models for the classification of people with disabilities and on models of intervention in rehabilitation and return-to work. Evidence from the past two decades of continual research has shown that most efforts made in rehabilitation and RTW intervention to have limited results in preventing prolonged disability.

1.1.1 Disability definition

Various definitions have been used to improve theoretical and operational models for supporting the integration of people with disabilities into society. The first models, considering disability as a result of impairment, defined it as a restriction or lack of ability to perform an activity in the

manner or within the range considered normal for a human being. Americans with Disabilities Act (1990) defined disability as "a physical or mental impairment that substantially limits one or more major life activities" [1]. And, as explained subsequently by the Nagi model[2], disability is not inherent to the person, but is rather a function of the interaction of the individual and the environment. In his model, the environment included natural environment, built environment, culture, economic system, political system, and psychological factors.

The concept of disability has shifted then from concepts of disease, conditions, and impairments *per se* to functional limitations and other barriers caused by these factors in work participation. In 1991, the World Health Organization (WHO) adopted the International Classification of Functioning, Disability, and Health (ICFDH), which is a biopsychosocial classification system of functioning, at the level of body/body part, whole person, and whole person in the social context[3]. This system provides a common framework for describing consequences of health conditions and understanding the dimensions of health and functioning. The Canadian Society and the Quebec Committee of the International Classification of Impairments, Disabilities, and Handicaps (ICIDH) contributed substantially to the development of knowledge through the clarification of the relationship between disabled individual and environment, and of the understanding of the handicap creation process (Fougeyrollas, 1995, 1991). Indeed, this conceptualization affords a modern understanding of “disability” and “functioning”; disability being considered not only as a consequence of a health condition, but also as being determined by the physical environment, the services available in the society, and attitudes and legislation, which are environmental factors in this respect. The ICF is particularly relevant for rehabilitation sciences because the health conditions of people seeking rehabilitation services are typically chronic and the associated impairments cannot be cured. The overall term in the framework is functioning, which covers body functions, body structures, activity, participation components, outcome measures used in clinical rehabilitation, and research.

A large number of countries have adopted this framework, and its relevance to the professional areas of rehabilitation and public health is acknowledged in advanced countries. However, supporting the integration of people with disabilities into the society is a difficult task; governments have still their own models to determine individuals’ eligibility to disability programs and to survey data collection. As suggested by Waddell et al. (2002), some confusion arises from the models used, none of them having explanatory power. In addition, many of the principles used to determine eligibility to the disability programs are derived from people with severe lifetime handicaps (blindness, confinement to wheelchairs etc.), but these cases represent a minority of disabled people. Rehabilitation and re-integration into society of people with more common forms of sickness and incapacity, such as back pain or musculoskeletal disorders, should equally be considered, these people presenting completely different problems in terms of service, most especially regarding rehabilitation care and RTW support.

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[1] http://www.ada.gov/pubs/adastatute08.htm

[2] From "Disability Concepts Revisited: Implications for Prevention," by S.Z. Nagi, presented by the Institute of Medicine in its 1991 report (Disability in America: Toward A National Agenda for Prevention by A.M. Pope and A.R. Tarlov (Eds.), 1991, Washington, DC: National Academy Press).

[3] http://www.who.int/classifications/icf/en/

1.1.2 Work disability models

Researchers have made considerable effort in developing conceptual models for effectively addressing work disability by incorporating economic, social, and physical environmental factors in the disability determination process. The lack of success of the traditional biomedical approach, emphasizing a disease-based view of persistent pain and disability, and focusing on treatments based on the identification and eradication of the causes of symptoms, has led to the development of biopsychosocial models. Indeed, for musculoskeletal disorders, the dominant conceptual model used currently to explain and treat work disability is the biopsychosocial model (Gatchel, 2004, Verbrugge and Jette, 1994, Feuerstein, 1991), which shifts the focus from fixable anatomic causes toward more complex determinants and systems, in which stakeholders, and interactions between them, and the role of the context and the individual, are stressed (Loisel et al., 2005). The biopsychosocial model incorporates economic, social, and physical environmental factors in the disability determination and intervention process, pointing out the relationship between the physical and social environment of work disability, and the importance of external factors affecting the development of work disability.

Research has shed light on the fact that disability is not only due to the patient's personal characteristics (physical and psychosocial), but also stems from the patient's environment; the workplace, the compensation system and even the healthcare delivery system (Durand et al., 2002, Loisel et al., 2001). The disease treatment paradigm has been replaced by a prevention work disability paradigm using an approach to manage disability through patient reassurance and intervention linked to the workplace (Loisel, 2005, Durand et al., 2002, Loisel et al., 2001). Such a disability management model, encouraging clinicians, employers, unions and insurers, as well as researchers in the field, to all work together within the perspective of the disability paradigm, seems to be the best way to avoid an unnecessary evolution towards prolonged disability (Loisel et al., 2001). However, work disability prevention remains a complex problem. The proliferation of new concepts, the diversity of contexts of application, and the multiple interests of the stakeholders involved in the compensation processes, constitute all-important challenges for researcher decision-makers. Many questions still exist about the best modalities and strategies of intervention in order to successfully achieve prevention of prolonged disability and sustainable RTW.

1.1.3 Work disability intervention

Rehabilitation intervention

The rehabilitation field is vast and the array of literature is difficult to manage owing to a lack of consensus about definitions (Waddell and Burton, 2004, Livneh and Livneh, 1989). In *Webster's New World Medical Dictionary* (2008***),*** rehabilitation is defined as the process of the restoration of the skills necessary for a person who has suffered an illness or injury to regain maximum self-sufficiency and function in a normal or as near normal manner as possible. Work rehabilitation implies in addition the restoration of the ability to conduct productive activity (Hanson et al., 2006). In this more than clinical perspective, the concept is frequently interchangeable with Occupational or Vocational rehabilitation. Work rehabilitation intervention involves multi-dimensional methods for influencing functional restoration, work retention, RTW or

reintegration into the workplace of employees with injuries or diseases that have led to time off work, and deployed by experts in provenance from diverse disciplines.

In the last two decades, many studies have been published in order to improve clinical intervention in rehabilitation of workers with WRMSDs. Studies often address low back pain disability, many of them focus on a specific stage of injury (i.e., acute, subacute, chronic). Only a few of them tackle musculoskeletal disorders together, or address a specific disorder (e.g. carpal tunnel syndrome, whiplash). Interventions focus on a specific group of actors (e.g. general practitioners, health care providers, supervisors, and nurses), a particular area of intervention (e.g. rehabilitation care, occupational rehabilitation, and workplace), a specific perspective of research (prognosis, disability costs, training, public information), or a specific activity or industry (e.g. nursing, computer users).

RTW intervention

Countless studies have shown that getting back to work as soon as possible after complete healing of injury or illness is in everyone's best interest. An early comprehensive attempt to provide rigorous data of RTW work outcomes was completed in the mid-1990. This three-part review covered acute interventions for low back pain (Scheer et al., 1995), discogenic back pain (Scheer et al., 1996), and subacute & chronic interventions (Scheer et al., 1997). The authors observed that few good quality studies were available then and that the effectiveness of most of the commonly used treatments or procedures of that time remained unclear. RTW outcomes were even less likely to be reported and the knowledge that the small minority of chronic cases was responsible for the largest proportion of costs had not yet been translated into any effective management strategies.

Rowlingson and Berthoud (1996) have already pointed out that physical or mental capacity to perform certain tasks is only one aspect of finding and keeping a job. Capacity or incapacity for work depends on complex interactions between a worker's medical condition and physical capability, ergonomic demands of the job and psychosocial factors. Besides, factors that influence stopping work may be different from those that influence staying off work and different again from those that influence going back to work. The social process of becoming sick and incapacitated probably occurs insidiously and unconsciously. Recovering and returning to work may be a completely different process and not just a reversal of the original process of stopping work. However, RTW depends on labour market, economic conditions, and reflects the worker-employer relationship and may be modified by strategic approaches, including business incentives, and disability management programs in the workplace to reduce sickness absenteeism. Business's culture, philosophies and strategies about sickness and disability, although not well documented, may be most important for RTW rates (Waddell et al., 2002). Indeed, as emphasised by Waddell et al. (2002), social security and compensation systems may modify the behaviour of sick and disabled workers and their employers, and then influence whether they are likely to retain or leave their jobs. Statutory or negotiated sick pay can help to maintain the employer-worker relationship, and the costs may provide an incentive to employers to support RTW. Issues of wage-replacement levels, benefit traps, RTW with partial benefits, the "all or nothing" assessment of work incapacity and the assumption that these benefits are permanent, may all influence the chances of returning to work and of retaining or leaving

employment. Uncertainty and apprehension (in both the worker and the employer) constitute also obstacles to RTW being dependent about the ability to cope with disability and disabled people.

The process of returning a disabled worker to work presents numerous challenges to employees, employers, healthcare providers and insurers (Waddell et al., 2002, Loisel et al., 2005). There are now many innovative and experimental intervention schemes, although little conclusive evidence exists on their effectiveness when implementation and long-term outcomes are assessed. There is increasing recognition of the need to adjust the workplace as far as it is reasonable to meet the needs of individuals to enable them to overcome their disabilities (Waddell et al., 2002). Indeed, RTW management presupposes enterprises assuming control and responsibility for prevention, monitoring early intervention, and reintegration of disabled or injured workers.

Prevention of the prolonged disability

The prevention of prolonged disability constitutes a major concern for all stakeholders involved in the disability management of WRMSDs, because it was observed that once someone has been off work and on long-term benefits for more than 6 to 12 months, he or she has a very low chance of returning to work (Spitzer and Walter, 1986). There is still very little evidence that any system is particularly effective at preventing or overcoming this phenomenon (Waddell et al., 2002).

Three different levels of intervention are considered in research for preventing disability (Frank et al., 1996). One level, known as primary prevention, is inhibiting the development of disease before disability occurs. Secondary prevention, also called "screening", aims to identify and detect disease in its earliest stages. Intervention in secondary prevention includes prevention of complications, recurrences, or exacerbations of a disease already diagnosed. A Canadian review examined evidence for the secondary prevention of work loss following onset of work-related low back pain (Frank et al., 1996). The authors concluded on strong evidence that employers promptly offering appropriately modified duties can reduce time lost per episode of low back pain by at least 30%. Furthermore, they noted growing evidence demonstrating that subacute intervention delivered between 3 and 12 weeks from the time of injury has the potential to reduce lost time from work by 30% to 50%. These observations, although not expressed in direct cost-benefit calculations, clearly show that such interventions represent substantial savings. Tertiary prevention consists of the prevention of disease progression and, generally focussing on people already affected by disabilities, attempting to reduce resultant disability, and restore functionality. Moreover, it aims to improve the quality of life for people with various diseases by limiting complications and disabilities, reducing the severity and progression of disease, and providing rehabilitation (therapy to restore functionality and self-sufficiency).

The recent move of intervention efforts from tertiary rehabilitation toward secondary prevention, in both health care and occupational settings, offers a tremendous opportunity for integrating the latest understanding about the prevention of disability in a systemic approach focusing on the obstacles to complete recovery (Main et al., 2005).

1.2 Methodological framework

1.2.1 Potential of the different types of literature reviews

For decision-makers and practitioners involved in the prevention of prolonged work disability related to WRMSDs, keeping up-to-date with relevant and appropriate research is a challenging task. As in health care, in the area of work disability prevention, the use of literature reviews is very useful for furnishing the decision-makers and practitioners with current best evidence and strategic cues. However, a distinction should be made between the systematic and narrative reviews and their role in decision-making.

Systematic reviews formulate questions clearly and use systematic and explicit methods to identify, select, and appraise relevant research. They collect and analyze data from studies to provide practitioners and decision-makers with current best evidence. Current best evidence is up-to-date information from relevant, valid research about the effects of different forms of health care, the potential for harm from exposure to particular agents, the accuracy of diagnostic tests, and the predictive power of prognostic factors[4]. Systematic reviews and meta-analyses, such as those provided by the Cochrane Database, provide the best available data about healthcare interventions, and explore the evidence for and against the effectiveness and appropriateness of intervention (medication, surgery, education, etc.) in specific circumstances. Systematic reviews help identify which interventions work, which do not, and which are even harmful, by comparing results from similar randomized controlled trials**.** Quantitative statistical methods (i.e. meta-analysis) may or may not be used to analyze and summarise such results from the included studies[5]. Systematic reviews then assess trials and combine those of good and unbiased quality to produce statistically reliable results, which may be easily applied in other settings. The value of systematic reviews results from their explicit and rigorous methodology. The very nature of a systematic review requires focusing on the commonalities across studies at the expense of features which are unique to each study, and that limits the degree to which evidence regarding one specific component can provide definitive answers. Moreover, systematic reviews frequently include only randomized controlled trails (RCT) or controlled clinical trials (CCT). RCTs are certainly of great value for finding out whether or not a specific treatment or intervention in general has achieved the supposed effects, and are very useful to practitioners when they need to make decisions in health care. However, much more is needed in the advancement of intervention, for such studies provide only a small part of the guidance that research can offer health practice. RCTs may seem impressive and powerful, but they need to be complemented by other types of knowledge, among which certainly is the knowledge generated by qualitative research (Grypdonck, 2006).

By contrast, narrative reviews are usually unfocused, and generally describe all areas of a topic: condition, aetiology, diagnosis, prognosis, and effects of a range of treatments. Narrative reviews

[4] First Annual Nordic Workshop on how to critically appraise and use evidence in decisions about healthcare, National Institute of Public Health, Oslo, Norway, 1996.

[5] Higgins JPT, Green S, editors. Glossary of terms in the Cochrane Collaboration. Cochrane Handbook for Systematic Reviews of Interventions 4.2.5 [updated May 2005]. http://www.cochrane.org/resources/handbook/hbook.htm (accessed 30 August 2006).

are usually qualified as too broad, and are criticized because they may not base recommendations on the totality of the literature, but only on the literature the authors want to bring to the attention of the reader. While narrative reviews are not likely to be the most reliable source of evidence to inform clinical decision making, they are certainly useful for providing background information on topics and trends in research and intervention at certain times, and/or to bring to light some cues on factors and conditions that underlie positive results or account for why workers remain absent. For example, qualitative research can provide understanding of processes such as adherence to, or self-management of, a therapeutic regimen, and thus provide the foundation for developing interventions that address the factors that are at play in these situations (Grypdonck, 2006). At the same time, qualitative research can contribute by providing explanations and improving understanding necessary for applying, properly and safely, findings from quantitative research, generally expressing relations between variables, or cause- effect relationships. Combining systematic and narrative approaches in a same review of the literature seems to be a promising way to provide practitioners and researchers with pertinent information to use in the decision making process (Grypdonck, 2006).

1.2.2 Previous and contemporary literature reviews

In the last two decades, many systematic literature reviews and some narrative have been published in order to enlighten the decision-making process by providing evidence-based data on what the best intervention in rehabilitation and RTW of workers with WRMSDs. Recent systematic reviews, some included in the Cochrane Database, examine the effectiveness of different interventions to provide practitioners and decision makers with relevant and appropriate evidence-based guidelines for practice in the areas of rehabilitation and RTW (Arnau et al., 2006, Breen et al., 2006, Staal et al., 2003, Verhagen et al., 2003, Koes et al., 2001, van Tulder et al., 2004, Verbeek, 2001, Côté et al., 2001, Guzman et al., 2001, Karjalainen et al., 2000, 2001, Waddell and Burton, 2001, Heymans et al., 2005, Schonstein et al., 2003). Recent Cochrane Collaboration has produced systematic reviews on multidisciplinary biopsychosocial rehabilitation for subacute and chronic low back pain (Guzman et al., 2001, Karjalainen et al., 2001, Karjalainen et al., 2005). The authors report that intensive multidisciplinary biopsychosocial rehabilitation with a functional restoration approach improves pain relief and function (Guzman et al., 2001). For repetitive strain injuries and shoulder and neck pain, the authors conclude that there is insufficient evidence available to draw conclusions on this matter (Karjalainen et al., 2000, Karjalainen et al., 2005). Physical conditioning programs, work-related, including a cognitive-behavioral component plus intensive physical training seem to be effective in reducing the number of sick days for some workers with chronic back pain and for workers with back and neck pain (Schonstein et al., 2003). A review on the effectiveness of back schools for nonspecific low back pain (Heymans et al., 2005) suggests that back schools, in an occupational setting, reduce pain, and improve function and RTW status, in the short and intermediate-term, compared to exercises, manipulation, myofascial therapy, advice, placebo or waiting list controls, for patients with chronic and recurrent LBP. However, the controversial nature of the results evaluating the effectiveness of the different programs and interventions, the incomplete description of the characteristics of the participants in the studies, and the absence of explanations concerning the process and strategies of the implementation of the different programs and interventions, makes their application in practice hazardous. In addition, only a

few of these reviews extend the question to the application of such interventions in the field of prolonged disability and compensated worker populations.

Although authors generally acknowledge the diversity of potential areas of long-term impact of work disability, the strategies for preventing prolonged disability in workers suffering from WRMSDs are not described or evaluated much. Strategies reported still focus on a clinical view of intervention (McCarthy et al., 2007, Cates et al., 2006, Hagberg, 2005, Koes et al., 2001), or on critical assessment of the measurement of outcomes (Walsh et al., 2008, McCarthy et al., 2007, Gross et al., 2006), and are rarely specific to workplace-based RTW interventions (van Oostrom et al., 2009, Franche et al., 2007). Some other reviews focus on clinical and occupational guidelines to provide stakeholders with information useful for successfully implementing best practices, and/or to revise policies or research design in accord with the prevention paradigm of work disability (Loisel et al., 2005, Schultz and Gatchel, 2005, van Tulder et al., 2004, Staal et al., 2003, Waddel and Burton, 2001). However, stakeholders, including occupational health and safety professionals, ergonomic consultants and other actors intervening in the medical, rehabilitation, and RTW fields, still face difficulties making decisions. They especially need reviews providing quality synthesis (Loisel et al., 2005) of the best practices and strategies, with a more comprehensive approach to the context and the conditions of implementation, and more detailed specifications in order to position intervention on the continuum from acute to chronic disability.

1.2.3 Rationale behind and originality of the current review

As mentioned earlier, in the past two decades, numerous studies have described and evaluated interventions aimed at workers suffering from WRMSDs. However, only a few of these have been based on the work disability paradigm, which focuses directly on work disability (rather than addressing it in terms of a disease) and looks for its causes and solutions at the level of both the person and his or her environment. More recently, several systematic literature reviews and meta-analyses have been published with the intention of enlightening the decision-making process by providing evidence-based data on best interventions. However, very little of the literature addresses the issue of preventing prolonged disability in workers compensated for WRMSDs. The endless proliferation of concepts in the work disability field, the diversity of implementation contexts and interventions, and the many interests and points of view of the stakeholders involved in the intervention process compound the complexity of the challenges faced, not only by researchers but also by managers and practitioners, in preventing prolonged disability.

The main rationale behind this literature review was to provide managers and practitioners with an overview of contemporary research literature in order to highlight the main topics and recent trends on intervention modalities for preventing prolonged disability in workers compensated for WRMSDs. In the first part of the review, the main topics and recent trends in research are analyzed by categorizing the articles on the basis of their main objective, area of application, research perspective and stakeholder(s) involved/interested. A further motivation for this literature review was to identify reportedly successful strategies for preventing prolonged disability in workers compensated for WRMSDs and to highlight the conditions necessary for their successful implementation. Then, in the second part of the review, intervention programs,

policies, and strategies successful in preventing prolonged disability in workers with compensated WRMSDs are described, and guidelines for intervention and research are provided. This literature review combines the use of quantitative and qualitative methods. Quantitative methods are used to describe the main topics and recent trends in research on intervention modalities in the rehabilitation and RTW fields involving workers compensated for musculoskeletal disorders. Qualitative methods are used to describe the strategies reported as being potentially successful in preventing prolonged disability in the same population.

2. MAIN PURPOSE AND SPECIFIC OBJECTIVES

The main purpose of this literature review was to provide an overview of the main topics and recent trends in research on work disability interventions with workers compensated for WRMSDs, and to highlight potentially successful intervention modalities for preventing prolonged disability in such workers.

Three specific objectives were therefore pursued for the purpose of analysis:

1. To map recent work disability research and identify studies on interventions specifically aimed at preventing prolonged disability in workers compensated for WRMSDs.
2. To identify the main topics and recent trends in research on work disability intervention.
3. To describe potentially successful intervention modalities for preventing prolonged disability and promoting sustainable RTW in workers compensated for WRMSDs.

Two additional operational objectives were pursued:

4. To compile a selective bibliography that provides practitioners, stakeholders, and new researchers with useful references regarding studies relevant to the prevention of work disability in workers compensated for WRMSDs.
5. To compile a list of links and references that provide relevant and practical documents for practitioners working with workers compensated for WRMSDs.

3. METHODOLOGY

3.1 Overall approach

The overall methodological approach used in this literature review, the type of analyses performed, and the main deliverables of this review are presented in Figure 1.

A systematic electronic search was performed of the descriptors in ten scientific databases. The descriptors and key words searched in the databases pertained to five key concepts: 1) workplace absenteeism, 2) work-related musculoskeletal disorders, 3) work disability intervention, 4) rehabilitation and return-to-work, and 5) compensation issues. The application of a rigorous procedure resulted in the selection of 218 references (186 articles on one or more revelatory studies, 20 theoretical articles and 12 literature reviews) and systematic data collection.

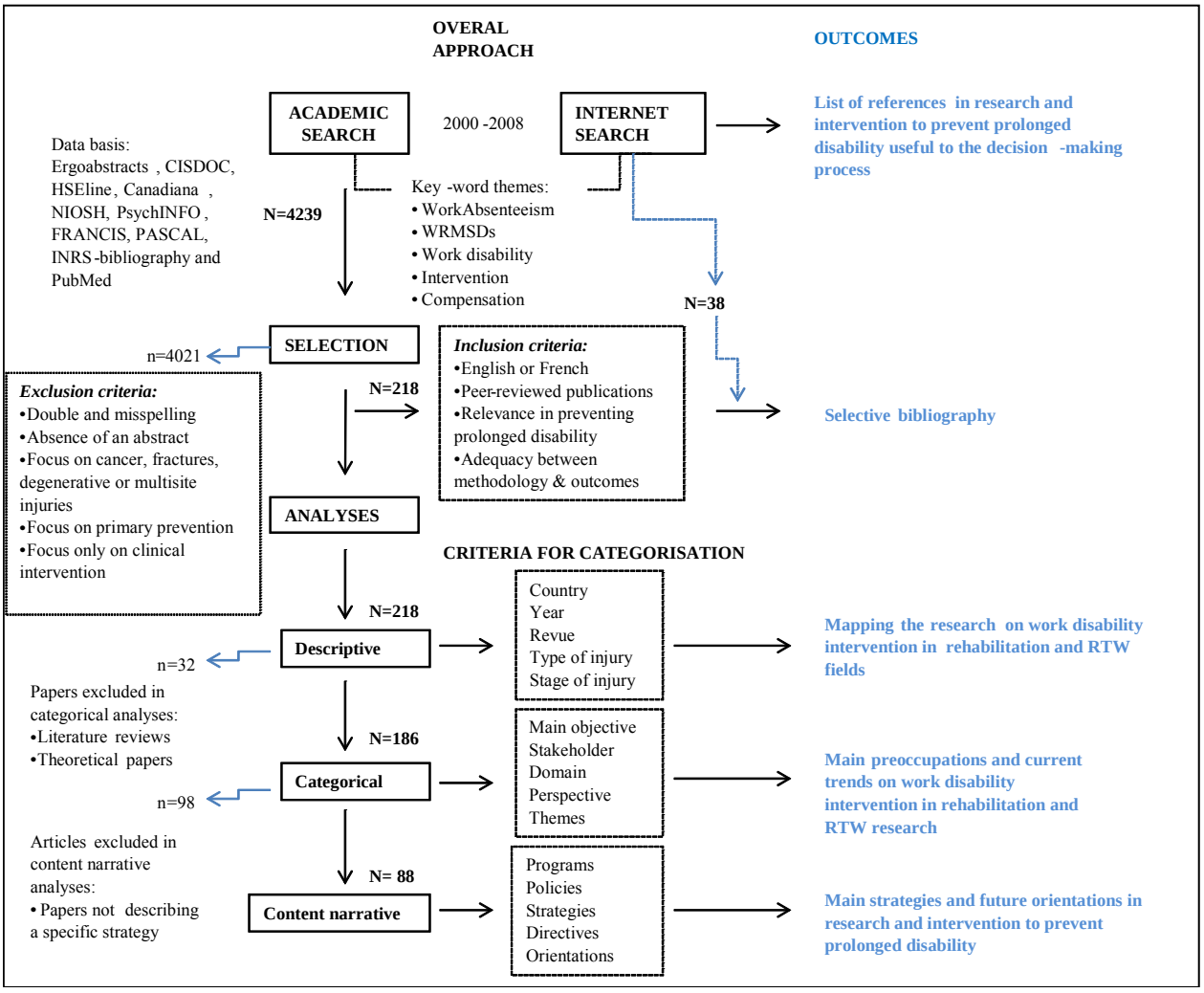

Figure 1 Overall methodological approach and main outcomes expected

Quantitative descriptive analyses were performed on all the abstracts in order to achieve the specific objectives stated in the previous section. In order to describe the literature reviewed, the abstracts were categorized according to the country of the first author, publishing journal, and type and stage of WRMSDs discussed. In a second step, the articles reporting on one or more revelatory studies were categorized on the basis of four main criteria (main objective, stakeholder(s) involved in the study or interested in the study's results, research perspective, and area of application) in order to identify the main topics and recent trends in work disability intervention in rehabilitation and RTW research. Finally, qualitative analyses were performed on the 88 articles (out of the 186 articles on revelatory studies) found to describe strategic components of intervention to connect these components to different intervention modalities (programs, policies, strategies, guidelines, and research needs), identify the main strategies reported as successful in preventing prolonged disability in workers compensated for WRMSDs, and, further, examine their potential usefulness to practitioners and stakeholders.

A selective bibliography was compiled of the articles reviewed and of other recent references we consulted for the purpose of interpreting the results of our review. Moreover, a parallel search was conducted on the Internet to compile a list of useful documents and links that would guide practitioners and stakeholders in adapting their practices to the goal of preventing prolonged disability.

3.2 Search strategy

A systematic electronic search of the scientific literature published between January 2000 and January 2008 in either English or French was performed by a specialized librarian. The starting date was chosen specifically because of the presumed application of the disability prevention paradigm after 2000. Different groups of descriptors were screened in the ten databases searched: Ergoabstracts, CISDOC, HSEline, Canadiana, NIOSH, PsychINFO, FRANCIS, PASCAL, INRS-bibliographie and PubMed by using combinations of key words related to five main themes. The first theme, workplace absenteeism, encompassed terms related to sickness absenteeism from work. The second theme included terms pertaining to work-related musculoskeletal disorders, while the third theme included terms related to work disability (e.g. disability, handicap, incapacity). The fourth theme incorporated terms linked to work disability prevention interventions (e.g. rehabilitation, reinsertion, RTW, re-entry, return, modified work, hardening, exercise therapy, vocational rehabilitation, modified work, behavioural or psychological intervention). The last theme included terms related to compensation issues. After careful removal of duplications and correction of misspellings, a total of 4,239 references were retrieved and stored for future reference in a Reference Manager database. The details of the specific searches conducted are presented in Appendix 1.

3.3 Selection of the articles

3.3.1 Procedure

The titles and abstracts of the references retrieved in the previous step were then screened to select the relevant articles. The screening was done independently by two of the reviewers (RT, IN). First, the titles and abstracts were searched again for the term "work-related musculoskeletal

disorders" or a corresponding term (i.e. cumulative trauma disorders, repetitive strain injuries, musculoskeletal disorder/injury/pain, back/neck/upper extremity disorder/injury/pain, carpal tunnel syndrome, trouble musculosquelettique, lombalgie). This step yielded 1,210 articles reporting on one or more individual studies, 116 literature reviews, 18 conference articles, 13 research reports, and 5 book chapters.

In a second step, the abstracts were read again specifically for the purpose of retaining only those articles that included strategic components of prolonged disability intervention. As a result, 793 references were discarded because their focus on primary prevention was irrelevant to the present review. In a final step, the two reviewers carefully screened the remaining 569 references, this time in order to retain only those articles related to compensation issues or compensated populations and meeting the inclusion and exclusion criteria. For this purpose, abstracts and titles were searched one more time using appropriate truncated key words (indemnis*, assur*, insur*, compens*, claim*). Two hundred and seventy nine references remained after this step. After a final correction for duplications and misspellings and again checking against the inclusion and exclusion criteria, 218 articles were retained for the quantitative analyses: 186 articles reporting on one or more revelatory studies, 12 literature reviews and 20 theoretical articles. Eighty-eight of the 218 articles were found to describe specific intervention modalities for preventing prolonged disability and were thus retained for qualitative analyses.

3.3.2 Inclusion and exclusion criteria

Only peer-reviewed scientific articles published in academic journals were selected. The language of publication was English or French. Articles with no abstracts were excluded, as were articles with a definite focus on the outcome of a clinical intervention (surgery, drug treatment, actual drug use, etc.). Also excluded were studies on topics such as fractures, cancer, rheumatic and degenerative diseases, and multi-site injuries, which, although they may also result in discomfort and disability and require particular interventions, imply healthcare outcomes rather different from those expected in cases of musculoskeletal disorders.

An interrater agreement procedure was followed to check the decisions reached by the reviewers (RT and IN) based on their application of the inclusion/exclusion criteria. The interrater agreement rate, calculated based on a random sample of 44 articles, was between 89% and 95% for the inclusion/exclusion criteria checked (disability, work, intervention, presence of strategic components, WRMSDs, compensation, only secondary and tertiary prevention). The final decisions to reject or retain articles were reached through consensus.

3.3.3 Quality appraisal

Given the variability of the methodologies reported in the abstracts of the reviewed articles, the diversity of the nature of information extracted, and the variety of outcomes reported, it was impossible to use only one grid to compile information on the relevance and quality of the studies. However, the following minimum relevance and quality criteria had to be met for an article to be retained for analysis: clarity of the purpose stated, proper fit between the choice of methodological approach and the objectives reported in the abstract, and relevance of the objectives to the goal of preventing prolonged disability in workers compensated for WRMSDs.

The two reviewers' judgement and consensus were used to decide whether or not to retain a given study in the review.

3.4 Data collection

Three dedicated Excel databases were used to store the information retrieved from the abstracts. The first database stored the information extracted from the 186 articles reporting on one or more individual studies. The two other databases stored the information extracted from the 12 literature reviews and the 20 theoretical articles respectively. We used three different databases to collect the information retrieved from these different types of articles because of the varying types of information reported.

Based on a preliminary reading of the abstracts, the reviewers were able to construct a grid for systematically extracting and compiling the different types of information relevant to the review from the articles reporting on one or more individual studies. The descriptive categories included the title of the article, names of the authors, year of publication, country of the first authors, objectives as stated in the abstract, and site and stage of the WRMSDs. The analytical categories corresponded to the four main categorization criteria: the main objective, stakeholder(s) involved in or interested by the study's results, research perspective, and area of application.

3.5 Analyses

Descriptive and categorical analyses were conducted on the article abstracts in order to map the articles and identify the main topics and recent trends in research in the field. When clarifications were necessary, information was sought in the original articles.

The descriptive analyses made it possible to map all the articles (n=218) selected from the search and satisfying the inclusion and exclusion criteria in terms of their origin (continent, country, research centre, journal), year of publication, main focus**,** and type and stage of disorder. Information extracted from the theoretical and literature review articles concerned only their country, main goal, and main conclusions (see appendices 4 and 5). No further analysis was conducted on these articles. This decision was based on the fact that the information reported in such articles generally referred to studies conducted before the reference period considered or already included in the current review.

Categorical analyses were conducted on the articles reporting on one or more individual studies (n=186) in order to describe the main topics and recent trends in research and intervention aimed at preventing prolonged disability. The articles were categorized on the basis of four criteria (main objective, stakeholder(s) involved in or interested by the study's results, research perspective, and area of application). A technique of grouping items according to their similarity was used to build the different classes within a same category. Each article was assigned to only one category or class. Appendix 2 summarizes the definitions of the categories and classes used for the categorical analyses. An interrater agreement procedure was used to check concordance between the reviewers. The final decision to designate an article to a given category or class was the result of a consensus process. The interrater agreement rate, calculated on the basis of a sample of 40 abstracts, was approximately 90%.

Qualitative analyses were performed in order to identify potentially successful intervention modalities for preventing prolonged disability in and promoting the sustainable RTW of workers compensated for WRMSDs. After carefully screening all the abstracts to identify those describing specific strategic components of intervention aimed at preventing prolonged disability in such workers, content narrative analyses were performed on 88 out of the 186 articles reporting on one or more individual studies. Programs, policies, strategies, guidelines for improved intervention, and future research needs reported by the authors of the articles were the strategic components described. The qualitative analyses consisted of extracting significant passages on the strategic components mentioned, grouping them by intervention modality, and describing the strategic components discussed. The same two reviewers (RT and IN) identified the relevant articles, making their decisions on a consensus basis according to criteria established a priori. The overall interrater agreement rate was over 82%.

3.6 Selective bibliography

A selective bibliography comprising the references used in the literature review is presented at the end of this report. This bibliography is intended to provide practitioners, stakeholders and new researchers with useful references on studies conducted in the work disability field involving workers compensated for WRMSDs. It itemizes 186 scientific articles reporting on one or more individual studies, 12 literature reviews, and 20 theoretical articles. Thirty-eight other scientific articles, essentially tutorials, book chapters, reports, and scientific articles, were added to the bibliography because of their relevance to understanding the topic addressed by this literature review and to the discussion of our findings.

3.7 List of useful documents and links

Of the 72 references initially retrieved from an Internet search, 32 documents and links were deemed consistent with the current research on work disability prevention and relevant to practical use by the various practitioners involved in the different fields of intervention aimed at preventing prolonged disability. In general, these references come from different compensation boards and research centres around the world and differ in nature: reports, articles for the general public, published guidelines, questionnaires, etc. A list of these references is presented in Appendix 3 and is intended to provide practitioners with useful information in adapting their practices to the perspective of preventing prolonged disability.

4. RESULTS

4.1 Description of the literature

This section contains results describing the studies overviewed in this review. First, descriptive analyses were conducted on the titles and abstracts of the articles reviewed in the actual literature review. Information such as the country of the first author or his affiliation, the main question tackled, the publishers, the type and stage of injury addressed was recorded. Second, classificatory analyses were conducted on the 186 articles presenting one or more individual studies, and meeting the inclusion and exclusion selection criteria. In a first step, the articles were categorized by 4 criteria: the topic addressed in the article, the stakeholder involved/interested by the results of the intervention, the area of application of the results, and the perspective of researchers on the ways to improve the intervention.

4.1.1 Literature reviews

Twelve literature reviews published in ten different journals were found as a result of the search. The articles come from six different countries: USA (4), Canada (2), Sweden (2), Netherlands (2), UK (1) and Australia (1). The questions they tackle are very diverse: efficacy of the different modalities of clinical assessment, intervention, and management in the areas of rehabilitation or RTW, prognostic factors for RTW or prolonged disability, evaluation of the rehabilitation and compensation costs and their impact on prolonged disability, occupational association of particular disorders, performance of actors in terms of best practices, etc. Although low back pain, acute or chronic, is still the authors' prime interest, other disorders, such as tenosynovites, epicondylitis, whiplash, or other anatomical sites such as the neck, upper limb and shoulders caught the authors' attention. When the focus is the prevention of prolonged disability, the questions are tackled more generally, regardless of the site or the type of disability. In Appendix 4, the interested reader may consult the main issues identified in these reviews (authors, country, objective, main results or conclusions).

4.1.2 Theoretical articles

Twenty theoretical articles were retrieved from sixteen different scientific journals. The first authors' countries are the USA for 14 articles, Canada for 3 articles and Switzerland for 3 articles. The authors all discuss results from extended national or international experiences, scrutinizing them from a comparative or replication perspective, and, focussing on specific topics, review scientific evidence in a particular domain of intervention. In Appendix 5, the interested reader may consult the main issues identified in these theoretical articles (authors, country of the first author, issues).

4.1.3 Studies

One hundred and eighty-six abstracts were retrieved from 60 different scientific journals published between 2000 and 2008 (Appendix 6). A brief scan of the tables of content of the publishing reviews for the period of reference showed that the field of prevention of prolonged disability in workers compensated for WRMSDs represents a very small fraction of the

published content. In fact, only 2% of the titles compiled in the period of reference refer to this population.

Figure 2 presents the distribution of first authors of the research articles by country of origin. As is shown in this graph, more than three out of four articles originate from the USA or Canada. The most represented research centres are the Center for Disability Research at the Liberty Mutual Research Institute for Safety, in the USA, and the Institute for Work & Health in Toronto and the Department of Public Health Sciences, University of Toronto, in Canada. In Quebec, the authors work out of different centres such as the Center for action in work disability prevention and rehabilitation (CAPRIT), the Faculty of Medicine at the University of Sherbrooke, the Department of Epidemiology and Biostatistics and the Department of Neurosurgery at McGill University, the Centre Hospitalier de l'Université de Montréal (CHUM), etc. Of the other countries, the most represented in the research are the Scandinavian countries (Denmark, Finland, Norway, Sweden), and Australia and New Zealand. The majority of research was done in more than one centre and the articles written collaboratively by two or more authors. For the most part, the articles are equally distributed through the years covered by the review.

As may be seen in figure 3, the articles reviewed are based on variable design methodologies. Even though quantitative approaches (RCTs, control-studies, etc.) predominate (76%), qualitative (grounded theory, etc.) (6%) and mixed methodologies are also used (18%). In fact, more than 30% of the studies were based on retrospective data, versus 70% that were prospective in nature. Studies are mainly observational, but evaluative studies of clinical intervention are also frequently used. Studies are seldom based on objective measures; frequently they consist of administrative (extracted from WCB and other databases) or subjective data (collected by questionnaires). The populations participating in the studies were compensated workers for WRMSDs or actors in the process of rehabilitation. The methods of collecting and analysing the data were variable: survey, questionnaires designed for a specific purpose, extraction of data from the databases of different organizations. The results of the analyses, frequently quantitative and rarely qualitative, are reported more frequently in an evaluative pattern than in a descriptive way.

Regarding the WRMSDs location (see figure 4), the articles reviewed focus, for the most part, on low back disorders and pain. However, some of the reviewed articles report results in general on WRMSDs, on upper extremity disorders (UEDs), and on a specific articulation (neck, shoulder etc), or condition (e.g. carpal tunnel syndrome (CTS), tendonitis, epicondylitis, etc.). Only one article in two specifies the stage of the WMSDs injury. More than one article in three refers to different chronic concerns such as pain, recurrences, or re-injury, when the stage of injury has been specified (Figure 5).

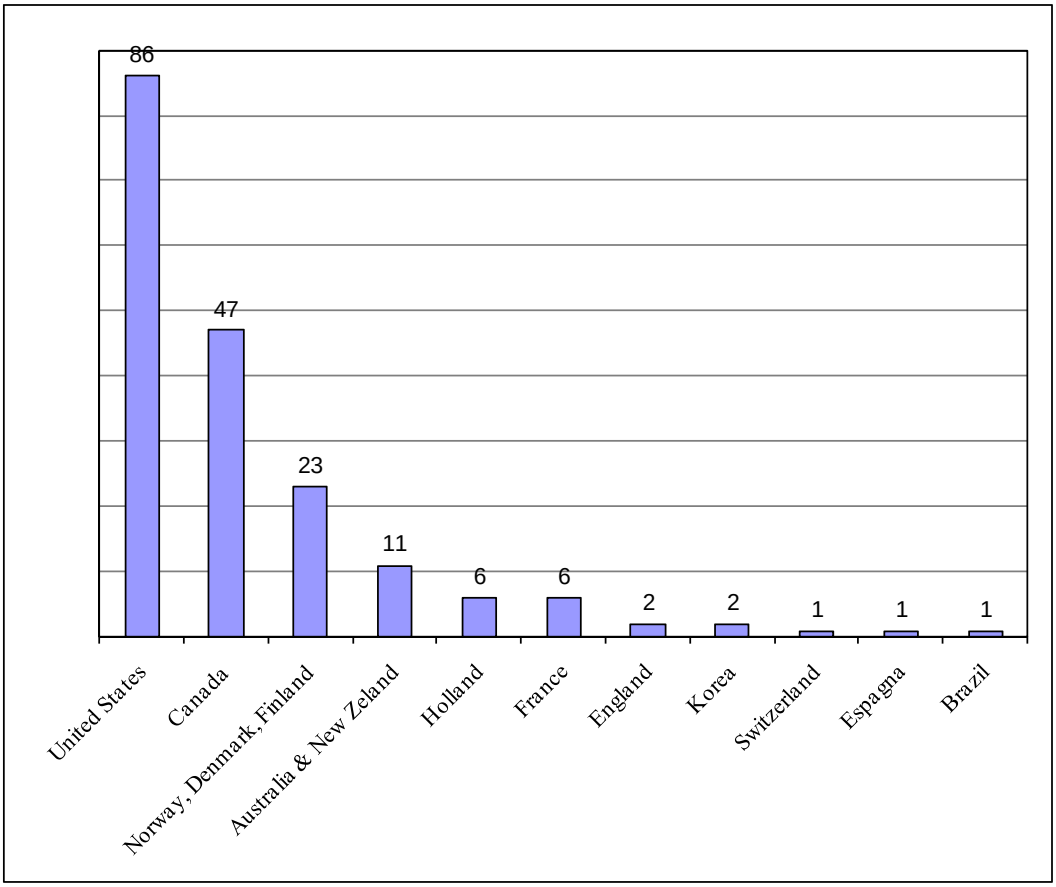

Figure 2 Distribution of studies by country of first author

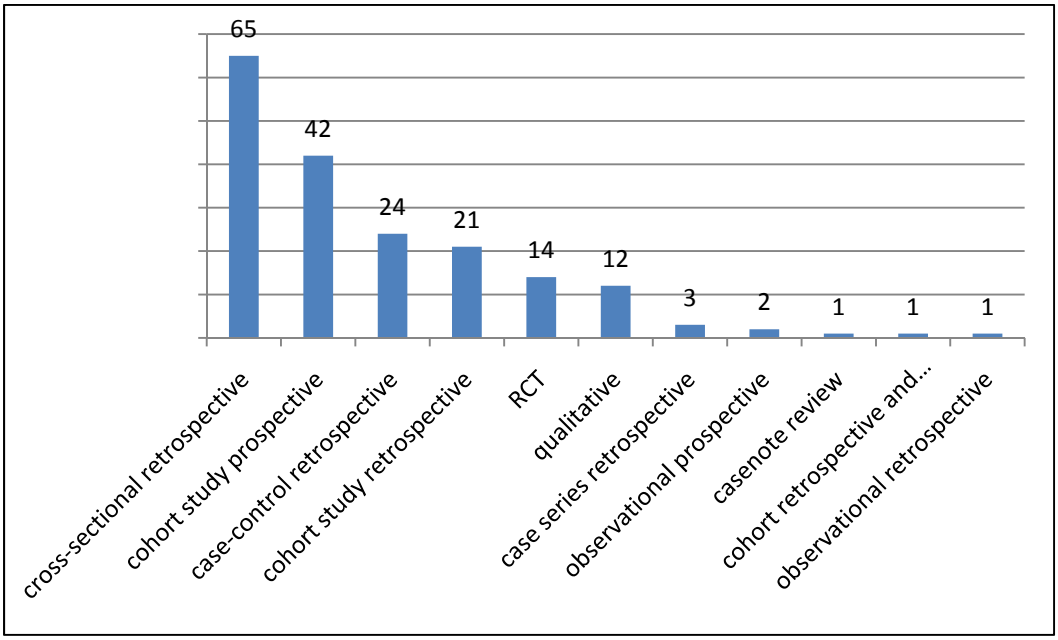

Figure 3 Distribution of studies by methodological design

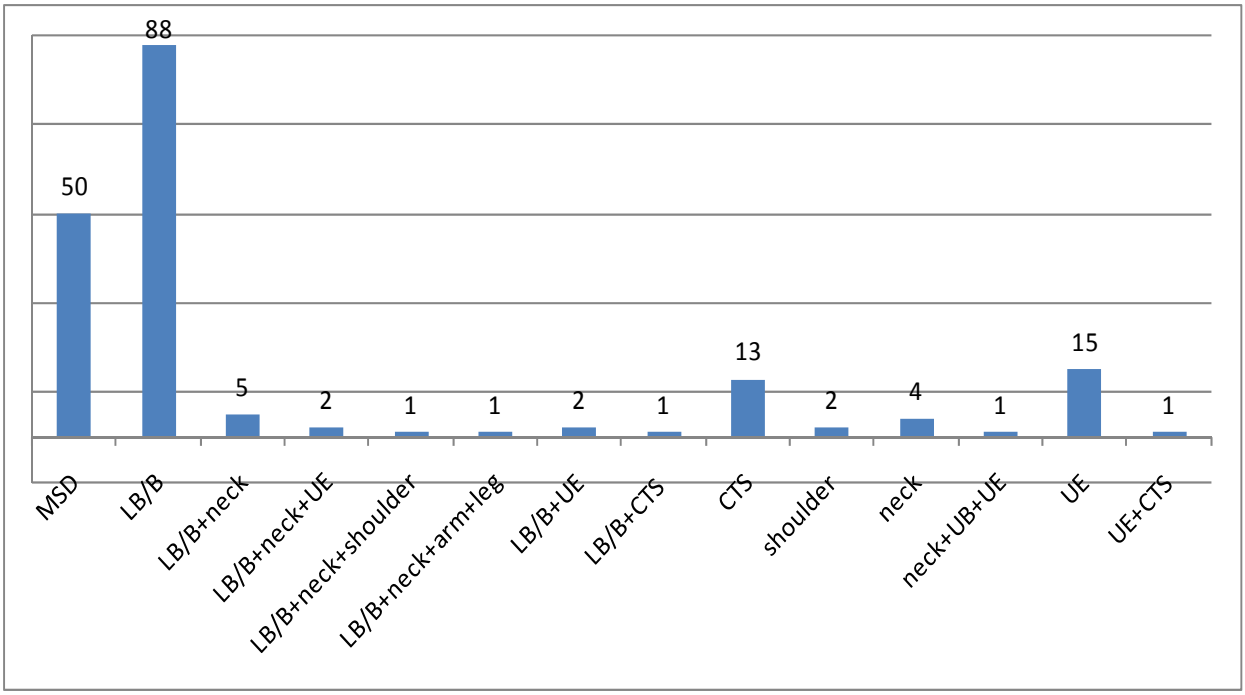

Figure 4 Distribution of studies by MSD type

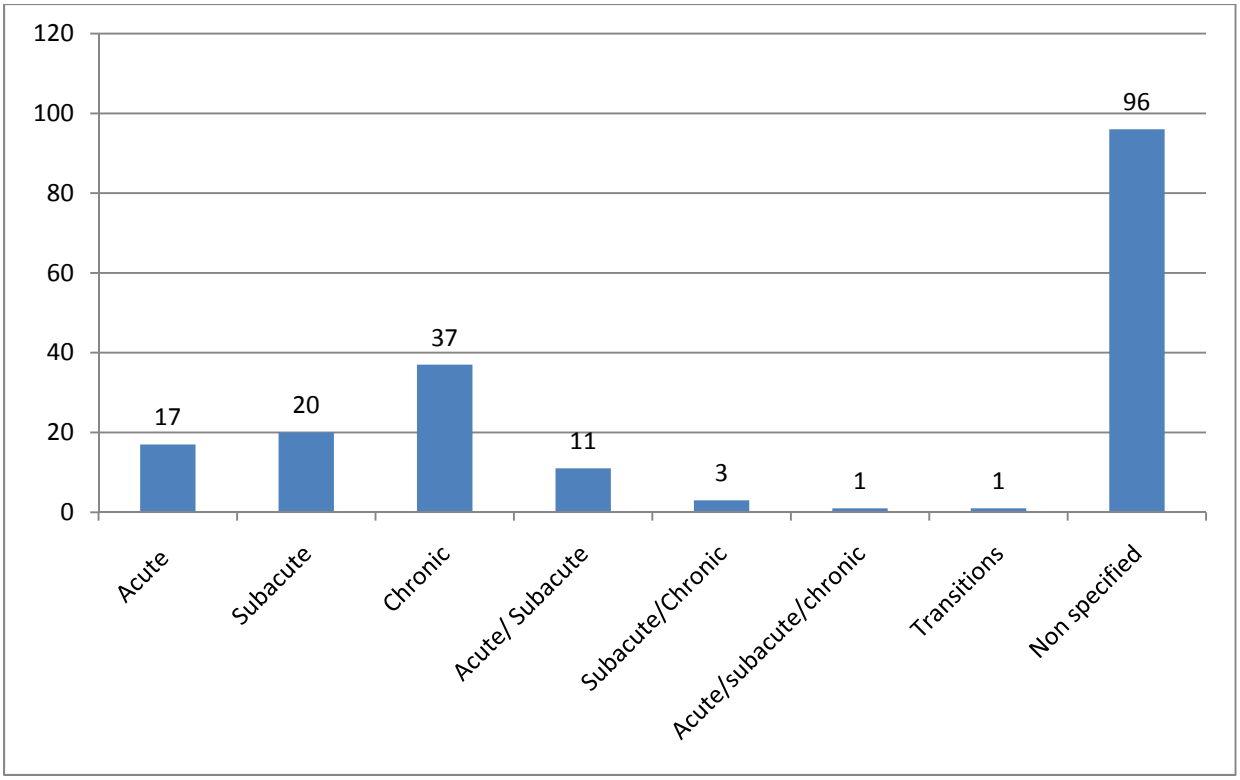

Figure 5 Distribution of studies by MSD stage

4.2 Topics and trends

4.2.1 Objective

After identifying the objectives in each abstract as stated by the authors, articles were classified, by their main objective in ten different topics: *assessing risk factors & determinants, evaluating effectiveness of programs/ components/ interventions, effectiveness of strategies/ policies, and efficacy treatments/surgeries, describing views/experiences/perception of the actors, comparing outcome between jurisdictions/ countries, impact of the WCB status/type of on the disability and RTW outcomes, development and validation of tools, describing consequences of disability, describing trajectories of injured workers.* The most important issues in terms of goals, results, and conclusions gleaned from the authors' statements in the abstracts were extracted and summarized for each topic, and are presented in appendices 7 to16. The articles were afterward regrouped into five main topics in research on intervention in prevention of prolonged disability (see table 1).

As may be observed in table 1, studies focusing on assessing risk factors and determinants for disability are obviously predominant (66/186). The details of the risk factors and determinants as they related to certain outcomes are found in Appendix 7. The most assessed outcome is chronic pain or the linked prolonged disability, followed by recovered RTW status, claims or injuries costs. The majority of these studies question social, demographic and clinical predictors. Only a few articles address psychological, social and ergonomic workplace factors.

A second main topic concerns the effectiveness of intervention (51/186). Details of the effectiveness of interventions are found in Appendices 8, 9 and 10. The evaluation of the effectiveness of programs constitutes the second major topic in the field of prevention of prolonged disability (Appendix 8). Even though a variety of outcomes are measured by evaluation of the impact of these programs (disability, lost-time claims, compensation costs, direct and indirect costs, claims incidence, health care costs, medical costs), the majority of them are only variants of sickness absence, RTW and costs (see Appendix 9) and do not extend in outcomes such as quality of life. Articles evaluating the effectiveness of workplace-based strategies, or the impact of policies, favour the investigation of RTW outcomes, while studies evaluating the effectiveness of clinical treatments and surgeries usually favour diverse clinical outcomes in different populations (see Appendix 10). Multidisciplinary and multimodal programs and targeted intervention are all topics considered in relation to their effectiveness and value in preventing prolonged disability. Psychosocial and ergonomic workplace factors seem to be the determinants most associated with the processes for prevention of prolonged disability in workers with compensated WRMSDs and the obtaining of sustainable safe outcomes. Even though many authors recognize the importance of cost-effectiveness in the evaluation of different programs of intervention, very few tackled this issue. Some descriptive studies also show the researchers' interest in describing the process of intervention (contextual factors, conditions for successful intervention, and experiences of the actors).

A third main topic concerns the description of views, experiences, and perceptions of the different actors, directly or indirectly involved in the process of intervention (see Appendix 11). Fifty eight articles report results concerning one or more actors involved in the process of intervention to prevent work disability. The majority of these articles describe the views and

experiences of practitioners involved in the process of intervention. The most studied actor practices or experiences concern the physician. Only a few articles focus on the worker, in terms of trajectory, consequences of disability on personal or social life, or on their perceptions while interacting with the different systems: health care, workplace, compensation (see appendices 11, 15, 16). Trajectories of injured workers and consequences of disability on injured workers and their families interest most authors only in terms of human or financial costs for the individual, the society and the different systems involved (compensation, health care, workplace).

A fourth main topic is related to the compensation issue. Articles associated to this topic relate to either comparisons between different jurisdictions, countries, or systems of compensation, in terms of performance relative to the work disability problem (see Appendix 12), or the impact of worker's compensation status or type of insurance on the disability outcome (see Appendix 13).

Finally, a fifth main topic is related to the measurement issues in the area of work disability and readiness to RTW (see Appendix 14). Articles associated to this topic are dedicated to one or more aspects of the validity or the reliability of the methodologies used, or having to be used, by the different clinicians and practitioners in the rehabilitation and RTW fields.

Table 1 Topics addressed in research on compensated workers for WRMSDs

Topics	Number of articles
Assessing risk factors & determinants	66
Evaluating effectiveness of intervention	51
• Program/ component /intervention	24
• Strategy/policy	15
• Treatment/surgery	12
Describing views, experiences, and perception of actors	32
• Views, experiences, and perception of actors	18
• Consequences of disability on injured worker and family	9
• Trajectories of injured workers	5
Compensation issues	23
• Impact of the WCB status/type of insurance on disability outcomes	15
• Comparison between jurisdictions/systems/countries	8
Measurement issues	14
Total	*186*

4.2.2 Stakeholder

Stakeholders mentioned, and the authors' concerns about societal context, were considered in order to describe trends in recent research on work disability intervention. First, the articles were categorised by the main stakeholders mentioned (table 2), and second, by the main objective of the study and the stakeholders involved (table 3). A stakeholder is a major player in the process of rehabilitation or RTW.

As expected, almost all of the articles involve or concern, in one way or another, the *workers' compensation system*. As a matter of fact, 150 articles mention it, alone or in collaboration with other stakeholder(s), as a direct participant in the study or as a potential end-user of the results of the study. Beside the compensation board, the most frequent stakeholder mentioned is, as a principal stakeholder or in association with another stakeholder, the health care system. The *health care system* is mentioned in 96 articles, 83 of them also mentioning other stakeholders. In addition, the most frequent association of stakeholders mentioned is that of *Workers' Compensation* and the *Health Care System*.

In the research reviewed, involvement or consideration of more than one stakeholder is observed to be a current trend. Indeed, in more than the half of the reviewed studies, two or more stakeholders are mentioned (100/186 articles). Furthermore, consideration of societal context in the analyses, or in the interpretation of the results, is another important trend observed (25/186 articles). Only 10 articles focus on the workplace or the worker himself or herself. However, 26 other articles consider the worker and/or the workplace in interaction with other stakeholders in the process of rehabilitation and RTW. The prognosis constitutes the major topic of interest to mostly the Worker's Compensation and the health care system. Indeed, for this last stakeholder, the evaluation of the efficacy of clinical intervention or other different treatments in different categories of the compensated population also seems to be subject matter worth attention.

Table 2 Distribution of studies by stakeholders involved or concerned

	Number of articles
Single stakeholder	*86*
workers' compensation board	54
workers' compensation board, + societal context	8
health care system, + societal context	1
health care system	13
workplace	7
worker	2
worker, + societal context	1
Two stakeholders	*91*
workers' compensation board, health care system	54
workers' compensation board, workplace	6
workers' compensation board, worker	5
health care system, workplace	4
health care system, worker	5
workplace, worker	2
workers' compensation board, health care system, + societal context	13
workers' compensation board, workplace, + societal context	1
workers' compensation board, worker, + societal context	1
Multiple stakeholders	*9*
multi: workers' compensation board, health care system, workplace	1
multi: workers' compensation board, workplace, worker	2
multi: health care system, workplace, worker	1
multi: workers' compensation board, health care system, workplace, worker	5
Total	*186*

Table 3 Topics addressed in the studies by stakeholder involved or concerned

Stakeholder[1]	Risk factors & determinants	Effectiveness of program/ component/ intervention	Views/ experiences/ perception of actors	Effectiveness of strategy/ policy	Impact of WCB status on disability	Measurement issues	Efficacy of treatment/ surgery	Consequences of disability on worker & family	Comparison between jurisdictions/ countries	Trajectories of injured workers
WCB	30	3	3	2	7	6	-	2	-	1
HCS	4	-	2	2	-	5	2	-	-	-
WP	1	5	1	-	-	-	-	-	-	-
W	-	-	-	-	-	-	-	2	-	-
WCB+ SC	4	-	-	1	-	1	-	1	1	-
HCS+SC	1	-	-	-	-	-	-	-	-	-
W+SC	-	-	-	-	-	-	-	1	-	-
	40	*8*	*6*	*5*	*7*	*12*	*2*	*6*	*1*	*1*
WCB, HCS	12	10	5	4	8	2	9	3	-	2
WCB, WP	2	2	-	2	-	-	-	-	-	-
WCB, W	3	-	1	-	-	-	-	-	-	1
HCS, WP	2	-	1	1	-	-	-	-	-	-
HCS, W	2	-	1	-	-	-	1	-	-	-
WP, W	-	-	2	-	-	-	-	-	-	-
WCB, HCS,+ SC	1	2	-	3	-	-	-	-	5	-
WCB, WP, +SC	-	-	-	-	-	-	-	-	1	-
WCB, W, +SC	-	-	-	-	-	-	-	-	1	-
	22	*14*	*10*	*10*	*8*	*2*	*10*	*3*	*7*	*3*
WCB, HCS, WP	-	1	-	-	-	-	-	-	-	-
WCB, WP, W	2	-	-	-	-	-	-	-	-	-
HCS, WP, W	1	-	-	-	-	-	-	-	-	-
WCB, HCS, WP, W	1	1	2	-	-	-	-	-	-	1
	4	*2*	*2*	-	-	-	-	-	-	-
Total	***66***	***24***	***18***	***15***	***15***	***14***	***12***	***9***	***8***	***5***

[1]One article was categorised in only one main topic but could refer to one or more stakeholder(s).

Legend

WCB: Workers Compensation Board;
HCS: Health Care System; WP: Workplace;
W: Worker;
SC: Societal context

4.2.3 Area of application

The area of application mentioned by the authors in theirs abstracts were considered in order to pinpoint trends in work disability research on intervention in compensated workers for WRMSDs. Five area of application were considered in order to classify the studies: *Claims/injury management*; *Clinical decision-making*; *Rehabilitation management*; *Occupational management*; *Readiness for RTW assessment*. An area of application was defined as a domain of intervention, or a phase of the process of intervention during which the disability paradigm is addressed.

The classification of the studies by their main topic and area of application shows that the majority of studies are conducted in order to guide claims/injury management and clinical decision-making, to achieve a better prognosis of risk factors and determinants of prolonged disability (51/186). Indeed, as can be seen in table 4, the results arising out of the largest part of the studies are relative to the area of claims or injury management (70/186), most particularly in order to find out predictors, factors and determinants of disability outcome (40/70).

Even though in the area of clinical decision-making the studies focus on issues related to the more reliable predictors (42/186), they concern as well the efficacy of different treatments for the workers disabled. In fact, more than one in four studies conducted in this area focus on finding out how a specific treatment could influence the course of disability.

The articles related to the occupational (36/186) and rehabilitation management (23/186) mostly focus on the evaluation of the impact of the different programs, interventions and strategies on the disability outcome in compensated workers for WRMSDs (29/59). Even though less frequent, describing the best practices to achieve such outcomes is also part of the current subject matter associated with these areas (9/59).

The readiness to RTW assessment area consists mainly of results from studies focusing on tools available, in development, or in validation, to better assess the capacity of workers to reintegrate back into work (7/13).

Table 4 Area of application by topic

Objective	claims/injury management	clinical decision making	occupational management	rehabilitation management	readiness to RTW assessment	*Total*
Assessing						
Risk factors & determinants	40	11	7	4	4	*66*
Evaluating						
Effectiveness of a program/intervention	2	4	9	9	-	*24*
Effectiveness of a strategy/policy	-	4	7	4	-	*15*
Efficacy of a treatment	-	11	-	1	-	*12*
Describing						
Views/experiences/ perception of actors	2	6	8	1	1	*18*
Consequences on workers & families	6	-	3	-	-	*9*
Trajectories of injured workers	4	-	1		-	*5*
Compensation issues						
Impact of insurance status	10	5	-	-	-	*15*
Comparison between jurisdictions/ countries	4	1	1	1	1	*8*
Measurement issues	*2*	*2*	-	*3*	*7*	*14*
Total	***70***	***44***	***36***	***23***	***13***	***186***

4.2.4 Perspective of research

The authors' perspective on the way to improve intervention was considered to pinpoint more trends in work disability research on intervention in compensated workers for WRMSDs. Eight perspectives of research were considered in order to classify the abstracts: *Prognosis*, *Guidelines*, *Tools*, *Contextual factors*, *Awareness, Training/Education*, *Barriers/Facilitators*, *Cost-effectiveness*. A perspective was defined as the authors' view of the element(s) to take in consideration in order to improve rehabilitation and RTW intervention. The classification of the articles by perspective and main objective is presented in table 5.

Even though the majority of the studies were done from the perspective of prognosis (66/186), with the main objective being to establish risk factors and determinants associated with disability outcomes (50/66), other perspectives such as providing guidelines for intervention or practices of the different actors involved (45/186) and assessing disability (34/186), were also frequently adopted. This last perspective is generally associated with either developing better strategies for screening disabled workers to better target appropriate intervention (15/34), or better assessing the disability (14/34).

Although not so frequently tackled, perspectives such as understanding the contextual factors, awareness of the social and economic consequences of disability, and training of actors involved in the process of intervention, are considered by authors. These last perspectives are mainly associated with topics such as evaluating the effectiveness of different types of interventions, programs and policies, describing the differences between the contexts of intervention (role of actors, conditions, obstacles and barriers) in different countries, jurisdictions or compensation systems, and improving the practices of the actors involved in the process of intervention.

Finally, only few studies (5/186) were done from the sole perspective of cost-effectiveness evaluation.

Table 5 Perspectives by main topics

Objective	Prognosis	Guidelines	Assessing disability	Contextual factors	Awareness	Training/ Education	Barriers/ Facilitators	Cost-Effectiveness	*Total*
Assessing									
Risk factors & determinants	50	1	15	-	-	-	-	-	*66*
Evaluating									
Effectiveness of program	1	14	-	-	-	6	-	3	*24*
Effectiveness of strategy/policy	1	12	-	1	-	1	-	-	*15*
Efficacy of treatment/surgery	2	10	-	-	-	-	-	-	*12*
Describing									
Views/experiences/ perception of actors	3	8	1	-	-	1	5	-	*18*
Trajectories of injured workers	1	1	1	-	2	-	-	-	*5*
Consequences on workers & families	-	-	-	-	7	-	-	2	*9*
Compensation issues									
Comparison WC jurisdictions	1	2	2	3	-	-	-	-	*8*
Impact WC compensation status	7	-	1	7	-	-	-	-	*15*
Measurement issues	-	-	*14*	-	-	-	-	-	*14*
Total	***66***	***48***	***34***	***11***	***9***	***8***	***5***	***5***	***186***

4.3 Modalities of intervention for preventing prolonged disability

Descriptive content analyses were conducted on 88 articles identified as describing programs, policies, strategies and guidelines for improved intervention, and reported by the authors as being strategical modalities in successfully preventing prolonged disability in compensated workers for WRMSDs.

4.3.1 Programs

Of the forty-two articles describing, evaluating, and/or comparing programs or policies, twenty-five discuss the type of intervention included in the program as a strategic component in preventing prolonged disability. The programs, the types of intervention, and the potential impact of outcomes related to prolonged disability, are presented in Table 6.

Multidisciplinary and multimodal programs combining different disciplines and modalities of intervention, such as vocational and rehabilitation medicine (Taylor et al., 2001), behavioural or cognitive medicine and physiotherapy (Jensen et al., 2005), exercise, disability management, functional restoration (Mayer et al., 2002, Hinter et al., 2006), occupational and clinical rehabilitation (Loisel et al., 2002), educational, self-management, clinical management and administrative duties (Storro et al., 2004, Taylor et al., 2001) are associated with potentially beneficial effects in secondary or tertiary intervention. Eight articles report positive outcomes in secondary or tertiary prevention: leaving the sickness benefits scheme (Taylor et al. 2001), getting compensation claimants back to work (Aakvik et al., 2003), sick-leave status (Storro et al. 2004, Jensen et al., 2005), recurrence rates, work disability status, cost-effectiveness (Abasolo et al., 2005, Jensen et al., 2005, Loisel et al., 2002), socio-economic outcomes, pain intensity, disability, depression and cumulative physical capability (Mayer et al., 2002), physical performance and subjective musculoskeletal symptoms (Arokoski et al., 2002). Only two articles report moderate or no effect of functional restoration programs in tertiary intervention (Proctor et al., 2004, McGeary et al. 2003).

Six uni-disciplinary programs, based on specific types of intervention, are reported to have potentially beneficial effects in secondary or tertiary intervention. Interventions such as psychosocial (Sullivan et al., 2005), ergonomic (Anema et al., 2004), cognitive behavioural (Linton and Nordin, 2006), and management programs, based on early intervention with light mobilisation (Hagen et al., 2000), supervised physical activity (Heymans et al. 2007), result in successful outcomes in both secondary and tertiary prevention. Functional restoration (Hunter et al., 2006), and exercise-base rehabilitation (Kenny, 2000) programs are beneficial in a tertiary intervention context. However, the outcomes evaluated in the articles are different: RTW rates (Anema et al., 2004), long-term health and economic consequences (Linton and Nordin, 2006), duration of sick leave (Hunter et al. 2006, Hagen et al. 2000), work status (Heymans et al., 2005, Kenny, 2000), physical performance and subjective back and neck musculoskeletal pain (Hunter et al., 2006), psychological status (Sullivan et al., 2005, Hunter et al., 2006).

Finally, workplace-based programs are frequently reported as having achieved positive outcomes. Workplace-based disability management programs, such as occupational (Badii et al., 2006, Abasolo et al., 2005, Lemstra and Olszynski, 2003), musculoskeletal disability management (Bunn et al. 2006), early active and safe RTW (Davis et al., 2004), are reported to

have gained good results in terms of lower injury claim incidence, duration, and costs (Abasolo et al., 2005, Davis et al., 2004, Lemstra and Olszynski, 2003), compensation and health care costs (Badii et al., 2006, Loisel et al., 2002), medical costs and productivity (Bunn et al., 2006) and improving short- and prolonged work disability outcomes (Abasolo et al., 2005). Training programs, targeting the improvement of skills and knowledge of workplace actors in the management of disability are reported to have great potential for generating sustainable reductions in new and active lost-time claims (Shaw et al., 2006). These programs help to bring about changes in practice and behaviours of case manager nurses, regarding the workplace accommodation process (Lincoln et al., 2002) and of supervisors, in terms of the degree to which they may blame employees for their own injuries, take their condition seriously, or discourage workers from filing claims (Pransky et al., 2001). A randomized controlled intervention study also reports the positive impact of minimal postal intervention in the workplace, in reducing overall sick leave (Fleten and Johnsen, 2006).

Table 6 Programs

Type of program	Description of the program and impact on outcomes	Authors
Multidisciplinary/Multimodal(10)		
Vocational medical oriented rehabilitation management program	vocationally medical oriented rehabilitation management, beneficial effect on physical performance and subjective musculoskeletal back and neck pain	Arokoski et al., 2002
Outpatient multidisciplinary treatment	multidisciplinary outpatient treatment program for BP, positive effect on the probability of leaving the sickness benefits scheme	Aakvik et al., 2003
Rehabilitation program	rehabilitation program characterised by a cognitive-behavioural approach with self-management, reconditioning, vocational rehabilitation and psychological pain management, positive impact in getting compensation claimants back to work	Taylor et al., 2001
Multidisciplinary active multidisciplinary program for chronic patients	rehabilitation active multidisciplinary program for chronic low back, neck or shoulder pain when compared with usual treatment, superior long-term effects	Storro et al., 2004
Occupational and clinical rehabilitation for subacute BP patients	occupational and clinical rehabilitation intervention combined in model of management of subacute OBP, cost beneficial for the WCBs, saving more days on benefits than usual care or partial interventions.	Loisel et al., 2002
Behavioural medicine rehabilitation program	behavioural medicine rehabilitation program, including behaviour-oriented physiotherapy and cognitive behavioural therapy, strongest effect on females	Jensen et al., 2005
Interdisciplinary rehabilitation	quantitatively directed exercise progression + multimodal disability management approach, not contraindicated as long as interdisciplinary rehabilitation is available for complex cases	Mayer et al., 2002
Tertiary rehabilitation for functional restoration in patient with persistent LBP	tertiary functional restoration program, improvements in psychological status, perceived pain, disability and work capability, decrease in sickness absence and the need for post-treatment work restrictions, reduction in ill-health retirements and compensation claims for LBP	Hunter et al., 2006
Multidisciplinary/multimodal tertiary rehabilitation for functional restoration	tertiary rehabilitation functional restoration program, combining quantitatively guided exercise progression with a multimodal disability management approach using psychological and case management techniques; men: moderately better 1-year post-treatment socioeconomic outcome	McGeary et al. 2003
Rehabilitation for functional restoration	rehabilitation functional restoration program in chronic patients, 25% of patients pursue new health-care services after completing the program, subgroup accounting for a significant proportion of lost productivity, unremitting disability payments, and excess in health-care consumption.	Proctor et al. 2004
Uni-disciplinary intervention (6)		
Psychosocial	psychosocial intervention in secondary prevention of disability, viable approach to the management of work disability	Sullivan et al., 2005
Ergonomic	ergonomic intervention: adaptation of the job tasks and working hours, effective on RTW rate after a period of more than 200 days of sick leave	Anema et al., 2004
Cognitive-behavioural	cognitive behavioural BP intervention, long-term health and economic benefits	Linton and Nordin,

		2006
Early intervention with light mobilisation	early intervention with light mobilization, significant effects in reducing sick leave for patients with LBP	Hagen et al., 2000
Physical activity	supervised physical activity programs, LB work status improved	Heymans et al., 2007
Exercise-based rehabilitation	tertiary exercise-based rehabilitation program, work status improved	Kenny, 2000
Workplace-based & occupational management programs (5)		
MSD prevention/RTW	comprehensive integrated workplace-based program intended to reduce MSI and its associated morbidity implemented in a large hospital; the program returned injured employees back to work in a shorter time and, compared with average historical data, reduced compensation costs and healthcare costs associated with TL MSIs during the first year	Badii et al., 2006
MSD prevention/RTW	program to reduce MSD & related absenteeism, implemented in a North American manufacturing facility; return injured employees back to work in a shorter time, reduce compensation and healthcare costs during the first year	Bunn et al. 2006
MSD prevention/RTW	RTW safely program combining primary prevention and on-site early intervention; implemented at a large urban hospital, savings in time loss and compensation payments in nurses and health science professionals (therapists, technicians).	Davis et al., 2004
Occupational & disability management	Occupational management approach, in comparison with standard care or early intervention, is recommended to be considered for the management of WC injury claims	Lemstra and Olszynski, 2003
Occupational & disability management	health program including education, protocol-based clinical management, and administrative duties to workers with recent-onset disability, improving short- and long-term work disability outcomes, cost-effective.	Abasolo et al., 2005
Training/information programs for case managers and workplace actors (4)		
Nurse case managers: implementation of workplace accommodations	training program, facilitate the implementation of workplace accommodations, changes in the practice behaviour of case managers	Lincoln et al. 2002
Supervisors: attitudes	training program decreasing in blaming employees for the injury, not taking the condition seriously, discouraging the worker from filing a claim	Pransky et al., 2001
Supervisors: skills & practices	training workshop emphasizing communication skills and ergonomic accommodation to optimize response to injury, reduction in new claims and in active lost-time claims	Shaw et al., 2006
Inform injured workers	postal intervention at workplaces, reduce length of sick leaves in overall sick leaves lasting 12 weeks or more	Fleten and Johnsen, 2006

4.3.2 Policies

Of the forty-two articles describing, evaluating, and/or comparing programs or policies, eight articles discuss strategic components in preventing prolonged disability related to the implementation of diverse policies and the resulting outcomes. Table 7 presents the summarised information on the policy, the implementation context and the results reported.

Three articles report positive results after the implementation of specific compensation legislation (Eden et al., 2006, Becker et al, 2006, Aakvik et al., 2003). A study examining the impact of new legislation in Sweden, permitting disability pensioners to go back to work without jeopardising their benefits (Eden et al., 2006), shows that it may be meaningful to continue/resume rehabilitation efforts, even after several years as a disability pensioner. An article estimating treatment effects after the implementation of a low-key social insurance reform in Norway, expanding the multidisciplinary outpatient program for treating back pain patients, shows positive effects on the probability of leaving the sickness benefits scheme (Aakvik et al. 2003). A descriptive study, reporting results from a vocational initiative by the "Commission technique d'orientation et de reclassement professionnel" (COTOREP) in France, recommends maintaining the back-pain injured workers at work, concomitantly with restoring their back function, making the necessary accommodations in the workplace and helping them in managing their fears and beliefs related to the association between work and pain (Becker et al. 2006).

However, some observations put into question the positive impact of different policies, in particular compensation legislation and contexts of application, on the behaviour of workers or actors involved in their rehabilitation (McNaughton et al., 2006, Wasiak and McNeely, 2006). Findings from a retrospective case-note review study, following the implementation of a new policy covering workers with back pain in a no-fault 24-hour-cover accident compensation system in New Zealand, suggest that this particular legislation may discourage RTW by its compensation context (McNaughton et al., 2006). Authors report that New Zealand has a unique accident compensation system that provides incentives for health professionals to classify people with backache as having a back injury and incentives for back pain claimants to continue claims longer than would be the case in other compensation systems. Results from a study involving seven jurisdictions in the US, investigating the differences in utilization and costs of chiropractic care for work-related back pain injuries relative to workers' compensation payment policies, indicate the necessity of cost containment components (Wasiak and McNeely, 2006).

Three articles describe outcomes after the implementation of a policy in Norway. The policy is provided by the Norwegian National Insurance Administration (NIA) for patients with LBP (Scheel et al., 2002 a, b, c). Introduced in Norway in 1993, active sick leave (ASL) is an option that enables employees to return to modified duties at the workplace with 100% of normal wages. National Insurance Administration (NIA) pays 100% of wages, thereby allowing the employer to engage a substitute worker at no extra cost. The authors report that even though all the players involved consider the policy effective in reducing long-term absenteeism and enhancing RTW and quality of life of patients, efforts to increase the use of ASL are not likely to result in measurable economic benefits or improved health outcomes at the population level. According to them, "if early return to modified work is effective, implementing it may require targeted intervention at identified barriers (lack of information and time, poor communication and coordination of the activities between the players required to implement the policy).

Table 7 Policies

Information on the policy's content and context of implementation	Strategic component	Authors
Low-key social insurance reform in Norway to promote outpatient multidisciplinary treatment for leaving the sickness benefits scheme	Expanding the multidisciplinary outpatient program for treating back pain patients shows positive effect on the probability of leaving the sickness benefits scheme	Aakvik et al. 2003
New legislation in Sweden on "resting disability pension" that allows disability pensioners to go back to work without jeopardising their benefits	Continue/resume rehabilitation efforts and trying to motivate persons to RTW, even after several years as a disability pensioner	Eden et al., 2006
Occupational retraining of insured workers with chronic low back pain (LBP) benefiting from a Commission technique d'orientation et de reclassement professionnel (COTOREP) agreement in France	Maintaining the back-pain injured worker at work concomitantly to the restoration of his back function, to do the necessary accommodations of his workplace and manage his fears and beliefs	Becker et al., 2006
Active sick leave (ASL) for pts with LBP: option provided by the Norwegian National Insurance Administration (NNIA)	Efforts to increase the use of ASL are not likely to result in measurable economic benefits or improved health outcomes at the population level	Scheel et al., 2002 a
Active sick leave (ASL) for patients with LBP: option provided by the Norwegian National Insurance Administration (NNIA)	Early return to modified work is effective. Implementing early RTW by the use of ASL may require targeted intervention at identified barriers (lack of information, lack of time, poor communication, and coordination of activities between the players required to carry out ASL).	Scheel et al., 2002 b
Active sick leave (ASL) for pts with LBP: option provided by the Norwegian National Insurance Administration	A passive intervention that addressed identified barriers to the use of ASL did not increase its use. Although modest, a proactive intervention did increase its use. The main impact of the intervention was through direct contact and motivating telephone calls to patients.	Scheel et al., 2002 c
WC payment policies in seven jurisdictions in US	The differences in utilization and costs of chiropractic care for work-related back pain injuries when these can be associated with workers' compensation payment policies, indicate necessity to consider cost containment components	Wasiak and McNeely, 2006
No-fault 24-hour-cover accident compensation, New-Zeeland	Legislation that may discourage RTW	McNaughton et al. 2006

4.4.3 Strategies aimed to prevent prolonged disability and manage sustainable RTW in compensated workers for WRMSDs

From the fifty-eight articles explicitly mentioning one or more strategies in their abstracts, twenty-four explain strategies potentially effective in preventing prolonged disability and managing sustainable RTW in compensated workers for WRMSDs. Four groups of strategies were identified in the articles analysed: triage/screening of workers at risk of prolonged disability for subsequent guidance in appropriate and effective intervention, enhancing key actors' skills for better coordination of their actions and interactions with the workplace, providing guidelines for efficient practices, and informing workers and the public of the human, social and economic implications and consequences of disability. Table 8 presents the description of the strategies as reported by the authors.

Six studies imply that triage and screening of people at risk of prolonged disability is an efficient strategy for identifying people at risk of becoming prolonged disabled and for subsequently orienting targeted intervention. Predictive factors of prolonged disability in new workers' compensation claims (such as: delay between injury and first medical treatment, older age, construction industry, logging occupation, longer time from medical treatment to claim filing, back injury, smaller firm size, female gender, higher unemployment rate, and having dependents) are reported as being useful in identifying jobs or workers at increased risk of prolonged disability which warrant preventive intervention, and guide secondary prevention and target intervention for high-risk claims and individuals (Stover et al., 2007, Sewitch et al., 2000). Such predictors could be useful to actors involved in the management or intervention process by concentrating on those injured workers requiring additional intervention. Then a small set of prognostic factors could enable occupational health practitioners to triage injured workers within the first month and concentrate on those requiring additional assistance to RTW (Hogg-Johnson and Cole, 2002). Knowledge of the predictive value of specific indicators, such duration of complaints, functional disability, disc herniation treatment, and fear avoidance beliefs by physicians and physiotherapists (Heymans et al., 2007, Webster et al. 2007), may benefit recovery and enhance clinical decision-making. In addition, some work-related variables, such as perceived stress or fears and beliefs, seem important enough to be considered in the identification of people at risk of prolonged disability, especially in the subacute phase of LBP (Soucy et al., 2006, Pransky et al., 2006). Consequently, data collection and risk prediction provide case managers and practitioners, not only specific information on who should receive intervention, but also some guidance on the factors to be addressed (Pransky et al., 2006, Sewitch et al., 2000).

Ten studies report strategies targeted to improve actors' and stakeholders' practices. Some of the strategic elements mentioned by the authors constitute guideline recommendations, in general, for the entire process of disability, or, in particular, for a group of actors or the workplace. Providing evidence-based care is reported successful in retaining patients at work, reducing time off work or modifying duties, and reducing recurrences and prolonged disability. Gains are achieved by active interventions such as conscientiously talking to patients, early RTW and building on functional capacity and employee ability (McGuirk and Bogduk, 2007, Dasinger et al., 2001). Allowing case managers to play a more active role (Arnetz et al., 2003), as well as involving an ergonomist in workplace adaptations (Arnetz et al., 2003, Shaw et al., 2002) is

reported as being helpful for effective early RTW, to reduce absenteeism and number of claims in the workplace. Such strategies include taking into account the perceived functional limitations, ergonomic exposure, and severity of symptoms (Feuerstein et al., 2003) to enhance modified duties for workers with persistent pain or disability, offer work accommodation (Franche et al., 2005), identify issues contributing to employee job satisfaction, foster motivation by recognising employees at the workplace among all workers, allow employees to develop new capacities and new learning, and provide on-site physiotherapy services for early, cost-effective management of WRMSDs (Fisher; 2003, Sadi et al., 2007). Company policies and procedures, job satisfaction, worker relationships and work environment are all factors related to RTW. Communicating with employers would be less difficult in the presence of an explicit organizational strategy designed to allay family practitioners' anxieties about whether direct liaison with an employer is inappropriate, or a compromise of confidentiality (Russell et al., 2005).

The third group of strategies concerns improvement in the practices and skills of the main actors or stakeholders involved in the management of injured workers or the RTW intervention process. These strategies refer essentially to communication skills and practices (Franche et al., 2007, Kosny et al., 2006, Schonstein et al., 2002, Côté et al., 2001, Dasinger et al., 2000) and matters of collaboration (Loisel et al., 2005, Hultberg et al., 2005, 2006, Shaw et al., 2001). For example, health care provider communication with the workplace is reported to be critical in effective early RTW interventions (Franche et al., 2005) and better communication between actors (chiropractors, medical doctors, and workers' compensation boards) is reported to decrease inter-professional tensions and improve the recovery of workers with WRMSDs (Côté et al., 2001). However, in general, stakeholder endorsement of a team's therapeutic principles and confidence in its approach constitute particularly important factors (Loisel et al., 2005). Co-financed collaboration between primary care, social insurance and social services in the rehabilitation of people with MSD, is reported to induce positive results on both staff and organization (Hultberg et al., 2006). Other strategies, most often based on education and awareness-raising, could foster collaboration among stakeholders and contribute towards optimising the outcomes of intervention (Shaw et al., 2001, Keogh et al., 2000).

One article reports on the obvious potential of information campaigns as a strategy in changing public beliefs (about rest or staying active), and attitudes (professional help sought and advice received), but not in the work-related outcomes (Waddell et al., 2007).

Table 8 Strategies for preventing prolonged disability

Strategy	Description of the specific strategy considered and impact in term of outcomes	Authors
Triage/screening of workers at risk to prolonged disability for subsequent guidance for appropriate and effective intervention (7)		
Focus on a small set of prognostic factors	Focus on a small set of prognostic factors for enable occupational health practitioners to triage within the first month, and concentrate on those requiring additional assistance to RTW.	Hogg-Johnson and Cole, 2002
Knowledge of the predictive value of indicators	Considering the predictive value of indicators (duration of complaints, functional disability, disc herniation and fear avoidance beliefs) by physicians and physiotherapists will help to identify subgroups of patients and will thus enhance clinical decision-making	Heymans et al., 2007
Collect data and predict risk to provide specific information for guidance for intervention	Data collection and risk prediction by nurses or case managers provide specific information that can be used to identify who should receive intervention, as well as some guidance on factors that should be addressed.	Pransky et al., 2006
Identify jobs or workers at risk for prolonged disability	Prognostic factors can be used to identify jobs or workers at increased risk for prolonged disability	Stover et al., 2007
Awareness of the psychological profiles & previous LBP experiences	Awareness of the clients' psychological profiles and previous LBP experiences may benefit recovery	Sewitch et al., 2000
Considering fears and beliefs as indicators	Considering fears and beliefs about work is important when identify people in the subacute phase of LBP who are at risk of developing chronic disability.	Soucy et al., 2006
Improve key actors' skills for better coordination of their actions (7)		
Better communication between stakeholders	Better communication between stakeholders (chiropractors, medical doctors, and workers' compensation boards); decrease interprofessional tensions and improve the recovery.	Côté et al., 2001
Communication practices between physiotherapists and insurers	Propose ways of improving communication practices between physiotherapists and insurers	Schonstein et al., 2002
Communication between HCP , patient and workplace	Early proactive HCP communication with the patient and workplace plays an active role in the RTW process.	Kosny et al., 2006
Inter-organisational collaboration in occupational rehabilitation	Inter-organizational collaboration in occupational rehabilitation: perceptions of an interdisciplinary rehabilitation team	Loisel et al., 2005
Co-financed collaboration: primary care, social insurance & services	Co-financed collaboration between primary care, social insurance and social services in the rehabilitation of people with MSD: effects on self-rated health and physical performance	Hultberg et al., 2005, 2006
Educating employers and physicians about ergonomics	Educating employers and physicians about ergonomics could result in prevention of UECTDs.	Keogh et al., 2000

Training in conduct problem solving to provide ergonomic accommodations (nurse case manager)	Help nurse case managers through a training seminar to identify ergonomic risk factors, provide accommodations, and conduct problem solving skills training.	Shaw et al., 2001
<u>Improve key actors and stakeholders' practices (10)</u>		
Doctors: talking to the patients	Evidence-based care is successful in retaining patients at work, reducing time off work/on modified duties and reducing recurrences & chronicity. Gains are achieved by conscientiously talking to the patients, and not by any particular or special passive interventions.	McGuirk and Bogduk, 2007
Doctors: prescribe opioids	Use of opioids in the management of acute LBP is counterproductive to recovery	Webster et al., 2007
Doctors: early proactive communication & RTW recommendation during	Early doctor proactive communication and RTW recommendation during the first 3 month after injury	Dasinger et al., 2001
Insurance case manager: Focus on early RTW and building on functional capacity	Focus on early RTW and building on functional capacity and employee ability. A more proactive role for insurance case managers and early workplace intervention for employees with MSD-related absenteeism.	Arnetz et al., 2003
HCP: Work accommodation and communication with the workplace, advice	Work accommodation and targeted HCP communication with the workplace are critical for effective early RTW interventions: work accommodation offer, acceptance and advice from HCP to the workplace, and receiving an ergonomic visit.	Franche et al., 2007
Workplace: modified duty & appropriate assessment of functional limitation and ergonomic exposure	Modified duty for workers with persistent WRUEDs enhanced by assessing perceived functional limitation and ergonomic exposure.	Feuerstein et al., 2003
Workplace: pain coping techniques and active problem solving	Usefulness of pain coping techniques and active problem solving to overcome functional barriers and to reduce workplace ergonomic risk exposure.	Shaw et al, 2002
Workplace: on site physiotherapy services	On-site physiotherapy services can provide early, cost-effective management of WRMSDs; large reduction in claims	Sadi,et al., 2007
Workplace: explicit organisational strategy for direct liaison (employer & doctors)	Communicating with employers would be less threatening if there were an explicit organizational strategy designed to allay family practitioners' anxieties about whether direct liaison with employer is inappropriate advocacy, a compromise to confidentiality.	Russell et al., 2005
Workplace: fostering motivation and job satisfaction (companies)	Manufacturing companies: identify those issues contributing to employee job satisfaction, (b) develop a plan for achieving increased job satisfaction and employee recognition at the workplace among all workers, and (c) consider allowing employees to develop new capacities and new learning, thus fostering motivation and job satisfaction	Fisher; 2003
<u>Inform workers and actors of the human, social and economic implications and consequences of disability (1)</u>		
Education multimedia campaign	A public and professional health education multimedia campaign including information leaflets for people with back pain, for all health professionals who treat back pain, and for employers aimed to change public beliefs about the management of BP.	Waddell et al., 2007

4.4.4 Guidelines for improved intervention

Twenty-three other articles report guidelines for improving intervention to prevent prolonged disability, without necessarily focusing on the presentation or evaluation of a particular program, policy, or strategy (see table 9). These guidelines concern four main intervention modalities for preventing prolonged disability: active rehabilitation with the involvement of the key actors and through cooperation with the workplace, training/ education/ information to improve skills, practices and attitudes of key actors and stakeholders, contextual factors intervening in the implementation of interventions, and methodological issues supporting the intervention.

A first group of guidelines concerns specific directives for achievement of active rehabilitation, involvement of the key actors and cooperation with the workplace. Active rehabilitation management consists of considering that there is a point in time when workers need to prepare for RTW by forecasting their off-treatment period (Kim et al., 2005). Shared decision making between doctor and patient to RTW is then essential to recovery (Nicot and Nicot 2006). For long-term sick-listed persons or workers who have recurrences, there is a great potential for improvement in the workplace arena by the involvement of, and cooperation between, the actors (Heijbel et al. 2005). Supportive organizations have an impact on successful work role functioning after clinical intervention and rehabilitation (Amick et al, 2004). Workers' satisfaction with the firm's treatment of their disability claims and with health care providers plays an important role in RTW (Butler et al., 2007).

The second group of guidelines concerns directives on contextual factors to be considered in the implementation of rehabilitation and RTW interventions. Better integration of prevention, early active RTW, safety programs, follow-up and greater attention to the social-political environment (Davis et al., 2004), constitute important elements to be considered by the workplace. Success or failure of the RTW programs for workers with musculoskeletal disorders is reported to depend on such factors as trust, respect, communication and labour relations (Baril et al., 2003). A great number of the elements in this group deal with compensation issues, especially better understanding of the dynamics of contemporary family, the barriers to workplace liaison (Russell et al. 2005) and the determinants of escalating costs in low risk workers' compensation claims (Bernacki et al., 2007, DeBerard et al., 2003, Wasiak et al., 2006). Workers' compensation systems are also concerned with payment policies, and some articles indicate necessary components of effective cost containment (Wasiak et al., 2006, Evans et al. 2001).

The third group of guidelines concerns directives for training/ education/ information for improving skills, practices and attitudes of key actors and stakeholders. Such directives involve evaluation of the informational needs of injured workers (Hazard et al. 2000), training case-manager nurses in problem solving and addressing the most salient recovery factors affecting RTW (Shaw et al., 2003), educating employers, front-line supervisors and physicians about ergonomics (Keogh et al., 2000). Rehabilitation professionals may be able to improve disability management practices and accommodation ability especially through employer education (Pransky et al., 2001).

Finally, the fourth group of guidelines concerns the effective use of different methodologies in supporting intervention for the prevention of prolonged disability. Methodologies address three

main aspects: the identification of workers at risk of prolonged disability, the assessment of the readiness to RTW, and the evaluation of long-term prolonged disability effects. The Orebro Musculoskeletal Pain Questionnaire (OMPQ) is reported to be a useful routine screening tool, facilitating clinical decision-making through early identification of individuals likely to fail a program, and might be used for more complete biopsychosocial intervention (Margison & French, 2007, Dunstan et al., 2005). Self-perceived health status, measured through validated SF-36, also helps to identify patients at risk of delayed recovery (Hee et al., 2001). In fact, the administration of simple self-report measures of individual, psychosocial, and workplace factors can identify individuals with increased odds for development of chronic occupational disability (Fransen et al., 2002); workers' subjective interpretations and appraisals being reported as being more powerful predictors of the course of post injury recovery than medical assessments exclusively (Hunt et al., 2002). The Readiness for RTW (RRTW) scale is a tool proposed for facilitating the offer of stage-specific services tailored to injured workers' needs, and for use in evaluation of RTW interventions (Franche et al., 2007). Finally, the Quality of Life Systemic Inventory (QLSI), measuring patients' goal attainment and quantifying the perceived impact of the disorder and the gap between the present and aspired for states, is reported as presenting concurrent validity and responsiveness among workers on sick leave due to WRMSDs and is recommended to serve in future research as an outcome measurement instrument to evaluate more long-term effects of rehabilitation programs (Coutu et al., 2005).

Table 9 Guidelines for improved intervention

Perspective	Directives for intervention	Authors
Active rehabilitation, involvement of the key actors and stakeholders and cooperation with the workplace (5)		
Active rehabilitation	Active rehabilitation management of work-related LBP should consider that there is a point in time when workers with LBP need to prepare to RTW by forecasting their off-treatment period;	Kim et al., 2005
Involvement & cooperation of key actors/stakeholders	For long-term sick-listed persons, there is a great potential for improvements of the rehabilitation at the workplace arena, in the involvement and cooperation between the already existing rehabilitation actors.	Heijbel et al., 2005
	Proposer aux patients lombalgiques de partager la décision de reprise du travail malgré la douleur, non comme une sanction, mais comme un élément indispensable à la guérison	Nicot &Nicot, 2006
	Supportive organizations have an impact on successful work role functioning after clinical intervention and rehabilitation	Amick et al., 2004
	workers' satisfaction with the firm treatment of their disability claim and with the HCP plays an important role in determining RTW	Butler et al., 2007
Contextual factors intervening in the implementation of interventions (7)		
Socio-political environment	Better integration of prevention, follow-up efforts, and greater attention to the socio-political environment are required	Davis et al., 2004
Addressing barriers and facilitators	RTW programs in 3 Canadian provinces, failure or success depend on factors such trust, respect, communication and labour relations in the failure or success of RTW programs for injured workers	Baril et al. 2003
WC issues: attributes responsible for cost escalation	Cases presenting certain attributes (particularly attorney involvement and claim duration) may be identified and addressed before rapid cost escalation from a small number of claims	Bernacki et al., 2007
	Those who have recurrences may be an especially important target for secondary prevention efforts	Wasiak et al., 2006
	Identifying biopsychosocial factors might benefit cost reduction programs (reduction of medical and compensation costs)	DeBerard et al., 2003
	LBP related to discrete antecedents such as falls and motor vehicle crashes merits consideration on the basis of exceptionally severe disability	Murphy & Courtney, 2000
WC issues: understanding dynamics of contemporary family and barriers to workplace liaison	WC authorities could benefit from a better understanding of the dynamics of contemporary family practice and particularly of the barriers to workplace liaison.	Russell et al. 2005

Training/ education/ information to improve skills, practices and attitudes of key actors and stakeholders (4)		
Training case manager nurse in problem solving	Problem solving skills training of nurses may help focus case management services on the most salient recovery factors affecting RTW.	Shaw et al., 2003
Informational needs of injured workers	Efforts to prevent back disability through education should include evaluation of the informational needs of injured workers	Hazard et al., 2000
Educating employers and physicians about ergonomics	Educating employers and physicians about ergonomics could result in prevention of UECTDs	Keogh et al., 2000
Educating employers & training supervisors	Rehabilitation professionals may be able to improve disability management practices and accommodations ability through employer education, especially when training is directed toward front-line supervisors	Pransky et al., 2001
Methodological/assessment issues (7)		
Early detection of workers at risk of prolonged disability	Early identification of injured workers at risk of long-term disability using Orebro Musculoskeletal Pain Questionnaire as routine screening	Dunstan et al., 2005
	Orebro Musculoskeletal Pain Questionnaire (OMPQ) can facilitate clinical decision-making through early identification of individuals likely to fail a physical therapy program and who may benefit from more complete biopsychosocial treatment	Margison & French 2007
	Simple self-report measures of individual, psychosocial, and workplace factors administered when earnings-related compensation for back pain is claimed initially, can identify individuals with increased odds for development of chronic occupational disability	Fransen et al., 2002
	SF-36 can be used to objectively identify the patient at risk for delayed recovery. Future protocols should pay special attention to improve the health-related quality of life, especially general health and physical functioning of spinal patients receiving WC	Hee et al., 2001
	Workers' subjective interpretations and appraisals are more powerful predictors of the course of post injury recovery, than exclusively medical assessments.	Hunt et al., 2002
Readiness for RTW	Readiness for RTW (RRTW) scale may facilitate the offer of stage-specific services tailored to injured workers' needs, and be used for evaluation of RTW interventions	Franche et al., 2007
Evaluation of long-term effects of programs	Quality of Life Systemic Inventory (QLSI) measurement instrument could serve as an outcome in the evaluation of more long-term effects of rehabilitation programs	Coutu et al., 2005

4.4.5 Future research

Twenty-five studies explicitly identify needs to be addressed in future research to achieve preventing prolonged disability goals. Three issues concern tips for enhancing intervention in preventing prolonged disability: knowledge of more appropriate and useful factors influencing prolonged disability and RTW, validation of findings obtained in previous exploratory research, and methodological development for better assessment of disability.

First, knowledge of more appropriate and useful factors for prognosis such as contribution of worker characteristics (Stover et al., 2006), psychosocial factors, (Coste et al. 2004), and beliefs and expectations in the therapeutic process (Waylett-Rendall & Niemeyer, 2004), is reported to have great implications in management and intervention to prevent prolonged disability. Also, a focus on the nature of the association between clinical management factors, such as health care utilization and the physician's initial management of disability duration, is recommended for further exploration (Mahmud et al. 2000). Providers of vocational rehabilitation services must be aware of the influence specific demographic and vocational factors may have on employment outcomes for a workers' compensation claimant with a back injury (Blackwell et al, 2004). Although risk factor data collection is feasible and practical in insurance settings, future studies should explore additional variables and refined data collection methods in order to achieve a more accurate prediction (Okurowsky et al., 2003). Better understanding of how different patterns of care for patients with claims relate to outcomes, and how these patients compare with individuals without such a claim, is important. As well, understanding the factors that lead patients to involve their primary care provider, or not, in the process of claiming also seems to be of major concern in future research valuable to prolonged disability care (Atlas et al., 2004).

Second, findings reported in prior exploratory research as related to successful modalities of intervention should be confirmed on larger (Loisel et al., 2002, Azoulay et al., 2005, Dasinger et al., 2001), different samples (Chibnall and Tait, 2005), or intervention settings (Evans et al., 2001), and should constitute ways of providing more evidence-based data for practice. Larger samples should confirm long-term cost-benefit effective interventions such the Sherbrooke model of management of subacute occupational back pain, combining an occupational and a clinical rehabilitation intervention (Loisel et al., 2002). For example, a study investigating the usefulness of the Orebro Musculoskeletal Pain Questionnaire (OMPQ) to predict RTW outcomes in a compensable injury population requires replication with a larger sample (Dunstan et al., 2005). Replication of the comparison between recurrent versus non-recurrent patients is needed in other settings to determine whether this could be generalized to the entire compensated population (Evans et al., 2001). Moreover, prospective studies should be conducted to confirm the effect of proactive patient-doctor communication on the duration of disability (Dasinger et al., 2001). Longitudinal investigations should be conducted to offer insights as to whether more global aspects of the illness are antecedent, coincident, or confounding aspects of repetitive strain injury or cumulative trauma disorder experience (Helfenstein and Feldman, 2000).

Third, some issues related to methodologies used for intervention in prevention of prolonged disabilities need further attention. The effectiveness and the utility of functional capacity evaluations (FCEs), commonly used to determine RTW readiness and guide decision-making for RTW following work related injury, has been largely questioned in the last few years (Wind et

al. 2006, Gross et al., 2006, Gross and Battie, 2005). The validity of the utility of FCE, such as the objectivity of the measurement method or the redundancy of the information, needs to be addressed in future studies. Future FCE research studies should examine the effects of a number of potentially influential factors, including variability in evaluator judgements across settings, the evaluator-patient interaction, and patients' expectations of the influence of FCE results on disability compensation (Asante et al., 2007, Reneman et al., 2006). Methodological problems in measurement of outcomes constitute another issue signalled by authors for future investigation (Hultberg et al. 2006, Koehorn et al., 2006, Pole et al., 2006). Future studies planning to incorporate days of absence as an outcome variable should carefully consider what measures would be more appropriate and potentially collect both self-report and administrative data to assess the discrepancy. In fact, many studies have used insurer-reported compensable days absent as an outcome measure when studying work-related injury or illness, because compared to self-reported days absent, insurer data are less expensive to collect. Previous work has identified that insurer-claim data consistently underestimate the duration of days absent when compared to that self-reported (Pole et al., 2006). Clear differences observed in outcomes from six local national insurance offices in Sweden, concerning the effectiveness of various rehabilitation measures, led the authors to state that the impact of social and demographic factors on the rehabilitation process requires further investigation (Ahlgren et al., 2004). Consistency of definitions and, of follow-up parameters across studies is also required to enable valid comparisons between administrative databases (Wasiak et al., 2003).

5. DISCUSSION

The main purpose of this literature review was to provide an overview of the main topics and recent trends in research on work disability interventions with workers compensated for WRMSDs, and to highlight potentially successful intervention modalities for preventing prolonged disability in such workers.

5.1 Strengths and limitations

The originality of the present literature review consists of reviewing the recent literature through the paradigm of work disability prevention, by using a mixed quantitative and qualitative methodology. Indeed, a major strength of the review consists of giving importance to variables related not only to the effectiveness of intervention, but also to the process of implementation. Such elements are critical since, through them, one addresses the real issues of how easily an intervention can be implemented and how well the intervention is received (Franche et al., 2005), and this allows for enlightening effective and efficient strategies with a huge potential for successful implementation (Loisel et al., 2005).

Some limitations should also be mentioned. The search and retrieval process limits the interpretation of the results to the field of work disabled prevention and compensated workers for musculoskeletal disorders. Even though the major bibliographic databases were searched, primarily they cover easily accessible English-language scientific journals. Indeed, it is known that much evidence (textbooks, editorials, non-systematic reviews, and guidelines), even though important for decision makers and practitioners, remains unpublished, and is not included in such bases. In addition, the grey literature was not reviewed systematically because of the difficulty accessing that type of information. Also, the list of references built-up in order to accomplish the first operational objective could not be exhaustive. For example, some workplace programs were certainly ignored because of the initial choice of databases included in the search. Furthermore, the choice to analyse only scientific articles limits conclusions in terms of knowledge as to the best modalities of intervention. The selection of the articles reviewed and the type of analyses done also limits the interpretation of the current results. Indeed, the selection of articles was based on titles and abstracts of articles, so other interesting articles not using the key-words in their title or abstract might have been ignored. Finally, even though quality criteria were used to establish, by consensus, the seriousness of the studies reviewed, no criteria were used to evaluate the methodological strength of the articles selected to be analysed. This allowed the inclusion of many descriptive and qualitative studies presenting an important informative value for stakeholders involved in decision-making processes.

5.2 Topics and trends

Despite the great heterogeneity of the methodologies and objectives of the articles reviewed in the present literature review, the categorical analyses allow for the identification of five main topics and four recent trends in contemporary work disability research on intervention aimed at preventing prolonged disability in compensated workers for WRMSDs. For the purpose of the review, a topic was defined as an idea that concerns the researchers and holds their attention in a particular area of intervention. In this review the topics were revealed through the categorization

of the scientific articles by the main objectives stated in the abstract. A trend was defined as a general direction in which research tends to lead**.** In this review, the trends were revealed through the categorization of the articles by the main stakeholder(s) involved in the process of rehabilitation and RTW, the area of intervention, and the perspective of research.

A first main topic concerns the assessment of risk factors and determinants of disability. Prognosis of disability obviously concerns researchers interested in developing modalities for the early screening of people at risk of becoming prolonged disabled. The purpose of screening is to identify individuals with a higher probability of developing a particular outcome. Even though multiple predictors were tested in order to link them with the different stages and outcomes of disability and the RTW status, little is known about the characteristics of workers at risk of becoming prolonged disabled and how to better intervene in order to prevent them from developing prolonged disability. Only a few studies have examined predictors across multiple domains in a large population-based sample. The use of many different constructs in order to identify psychosocial predictors of long-term sick leave has made it impossible to determine the role of these factors (Steenstra et al., 2005). The overview of the factors associated with RTW following vocational rehabilitation for problems in the neck, back, and shoulders reveals that a great number of demographic, psychological, social, medical, rehabilitation-related, workplace-related, and benefit-system-related factors are associated with RTW. People with a greater chance of returning to jobs after vocational rehabilitation are younger, native, highly educated, have a steady job and high income, are married and have stable social networks, self-confident, happy with life, not depressed, have a low level of disease severity and no pain, high work seniority, a long working history and an employer that cares and wishes to have them back in the work place. Unfortunately, people with the above profile are seldom found among the long-term sick (Selander et al., 2002). It seems to be a growing consensus in research and intervention that psychosocial (distress/depression) and ergonomic factors are predictors of RTW outcomes and play an important role in intervention at early stages. These findings are consistent with previous research examining the predictive values of psychosocial factors for RTW (Schultz et al., 2005, Feuerstein et al., 2003).

A second main topic concerns the development and evaluation of various types of interventions carried out to achieve successful outcomes in terms of preventing prolonged disability, and sustainable RTW of workers with compensated WRMSDs. Multidisciplinary programs and multimodal intervention for clinical and occupational management seem to be considered beneficial in secondary and tertiary prevention. Consideration of psychosocial factors as important modifiers in the process and outcome of intervention is becoming an important trend in the research on workers with compensated WRMSDs. Recent results demonstrated positive effects of psychological interventions especially for chronic LBP. Ergonomic issues are also noticeably included in workplace intervention. Moreover, there has been a change in the understanding of how to achieve effective rehabilitation, with the recognition now that the workplace is the key place for the employee to recover. Rehabilitation therefore needs to pay attention to, not only appropriate treatment and activities to encourage restoration of function, but also to the tasks required for work.

The description of views, experiences, and skills of the key actors, directly or indirectly involved in the process of rehabilitation and RTW, constitutes a third main topic in recent research. More

specifically, we observed an interest in the role and responsibility of different actors in the process of rehabilitation and RTW. Better collaboration and communication between key stakeholders and workplace and insurance actors (e.g. supervisors, nurses) is critical regarding the implementation of successful strategies for musculoskeletal injured workers at risk of prolonged disability, and so has a great potential for avoiding the setting in of prolonged disability. Better communication between actors such as chiropractors, medical doctors, workers, and workers' compensation boards would likely decrease inter-professional tensions and improve the coordination of activities in the process of rehabilitation and RTW, enable the reproduction of work demands in clinical settings, and allow for knowledgeable decisions as to whether to gradually expose workers to the real work environment or permanently reduce its demands.

A fourth main topic concerns the openness to consider compensation practices in provenance from other social or geographical contexts. Some of the articles inventoried in the present literature review are dedicated to comparisons between many jurisdictions, countries, or systems of compensation. Others focus on the evaluation of the impact of different insurance status/type on disability or RTW outcomes. Overall, compensation costs are recognized as affecting all stakeholders, including workers, employers, providers, regulators, legislators, and insurers and continue to be a challenge, given the need to balance costs, benefits, and the quality of medical and health care. Consequently, a continued commitment to quality, accessibility to care, and cost containment will help ensure that workers are offered accessible, high quality, and cost-effective care. Compensation of occupational illness can be problematic for disorders that are not specific to work and for which there are no distinctive clinical features in occupationally related cases. Attribution can, however, be made on the balance of probabilities if there is convincing evidence that risk is at least doubled in an occupational group. A recent review highlights the relative lack of data to support such attribution for tenosynovitis and epicondylitis, and discusses the difficulty in compensating upper limb disorders (Palmer et al., 2007).

Finally, a fifth main topic concerns the methodological issues; the development, validation, and evaluation of tools needed for successful intervention, and their usefulness in the process of management of work disability. Although researchers generally acknowledge the diversity of potential areas of impact of work disability, research has tended toward a relatively narrow view of outcomes, and consequently a somewhat restricted measurement approach.

Four recent trends emerge in the work disability research on intervention aimed at preventing prolonged disability in compensated workers for WRMSDs. First, we noticed that authors have an obvious interest in prolonged disability. However, their studies rarely focused on that phenomenon. Second, consideration of the multiple stakeholders involved in the process of implementation and taking into account the societal context and intervention related to the prevention and management of prolonged disability is another common feature. Third, various descriptive studies show researchers' interest in describing the process of intervention (role and practice of the different actors, facilitators, obstacles, context of the intervention's implementation) in the field of prevention of prolonged disability. A final trend observed is that of factoring workers into the equation in order to raise the different stakeholders' awareness of the economic, social, and personal consequences of the workers' disability. Indeed, descriptive studies appear to suggest that workers' perceptions of the work disability phenomenon and its related issues constitute a powerful force in interventions aimed at improving their chances of

moving away from disabled status towards employed status or shifting from a disempowered to an empowered perception of themselves.

5.3 Strategies

The analysis revealed some four key strategies as potentially successful in preventing prolonged disability in workers compensated for WRMSDs. First, the early routine screening for early identification of injured workers at risk of becoming prolonged disabled, followed by appropriate targeted intervention on the specific risk factors identified, are reported as effective ways to prevent the development of prolonged disability in a proactive way and to achieve sustainable safe RTW.

Second, different types of interventions seem to be beneficial in the prevention of prolonged disability and favourable RTW. Multidisciplinary and multimodal programmes are frequently associated with positive outcomes such as leaving the sickness benefits scheme, getting compensation claimants back to work, sick-leave status, recurrence rates, work disability status, costs-effectiveness, socioeconomic outcomes, pain intensity, disability, depression and cumulative physical capability, physical performance, and subjective musculoskeletal back and neck pain. Early intervention on physical, ergonomic and biopsychosocial factors appears to be important in terms of effective prevention of prolonged disability and the RTW of compensated workers for WRMSDs identified as being at risk of prolonged disability. Early intervention with light mobilisation, early active intervention in the physical workplace and on biopsychosocial factors appear to be central strategic elements in preventing prolonged disability and for providing sustainable, effective RTW for compensated workers with WRMSDs. While physical adaptations to the workplace may be helpful, by themselves they do not ensure successful rehabilitation for those with MSDs. Additional approaches would help manage safe and durable RTW. As stated in a recent systematic Cochrane review (van Oostrom et al., 2010), “There is moderate-quality evidence to support the use of workplace interventions to reduce sickness absence among workers with musculoskeletal disorders when compared to usual care”. However, developing appropriate tools for evaluating progress in functional capacity and following up the long-term effects of clinical and rehabilitation outcomes is essential and a constant topic in the research in the field (Coutu et al., 2005, Gross and Battie, 2006).

Third, the practitioners’ and stakeholders’ practices have a great impact on the implementation of these interventions. By their actions and interactions with workers, three categories of actors play an important role in preventing prolonged disability: physicians and other health care providers, case manager nurses or insurers, and workplace actors. A recent review (Rainville et al., 2005) highlights the role of physicians as mediators in temporary and permanent disability in patients with chronic musculoskeletal complaints. Physicians' recommendations for activity seem to have important health and financial implications. Indeed, patients' desires strongly predict disability recommendations (i.e., physicians often acquiesce to patients' requests). The most successful efforts in influencing physician recommendations seem to be related to mass communication directed at influencing public attitudes, while reinforcing the current standard of practice for physicians. Also, there is good scientific evidence to show that the use of *case management* practices is cost-effective through reducing time off work and lost productivity, and reducing healthcare costs (Hanson et al., 2006). ‘Case management’ is a goal-oriented approach to keep

employees at work and facilitate early RTW. Case management approaches may involve the use of “treatment”, “programs”, and/or “vocational rehabilitation” (Lemstra and Olszynski, 2003). It may deploy some or all of these, or none at all, based on the premise that case managers describe their role as: “Doing whatever it takes, with whatever you’ve got, for as long as it takes, to get the job done” (Missouri Foundation for Health, 2003). Training was one of the sspecific trategies associated with achieving a change in the practice behavior of heath care providers, case managers or occupational practitioners in the workplace accommodation process.

Fourth, improvement in the key practitioners' and stakeholders’ skills, especially in matters of communication and collaboration between stakeholders and managers of disability in the workplace, is reported to enhance the coordination of their actions in the process of rehabilitation, RTW and workplace intervention, and is an essential strategy in preventing prolonged disability. Indeed, recent conceptual models (Franche et al., 2002, Schultz et al., 2007) and reviews (Loisel et al., 2008, Loisel et al., 2005, Franche et al., 2005, Friesen et al., 2001) suggest that optimal relationships among stakeholders constitute an important condition for RTW interventions to be most effective. Improved coordination and collaboration between key stakeholders and in the activity of the different actors involved in the rehabilitation and RTW process is essential to the enhancement of the effectiveness of an intervention in order to prevent prolonged disability in workers with compensated WRMSDs. As emphasized in a recent literature review on models of disability management and prevention with respect to communication, communication-based interventions may further improve disability outcomes, reduce adversarial relationships, and prove cost-effective (Pransky et al., 2004). From a different perspective, real and better communication between the main players enables researchers and clinicians to better reproduce the work demands in clinical settings and to come quickly to knowledgeable decisions as to whether to expose workers gradually to the real work environment or permanently reduce exposure to workplace demands.

Fifth, providing adequate information to injured workers, but also to the multiple actors and stakeholders involved in the process of rehabilitation and RTW, seems to be critical for sustainable and effective RTW of injured workers with compensated WRMSDs. It is related to promoting informed and active commitment of workers in the process of rehabilitation and RTW through clear and transparent shared goals.

5.4 Future research

From the present review of literature, four major types of developments might need to be addressed by those funding or leading research programs in order to contribute at the advancement of knowledge on the main successful strategies to prevent prolonged work disability. First, clearer conceptualisation needs to take into account the process of implementation, the context and their inter-relationships which will contribute to developing new programs to support optimal RTW among prolonged disabled workers and achieve sustainable RTW outcomes. As a matter of fact, a recent critical review of the literature (Schultz et al., 2007) describing the evolution of disability models, reveals that biomedical, psychosocial, ecological/case management and biopsychosocial models are still used in the field by different stakeholders. The authors highlight the need for future development of models that are truly multidisciplinary and address temporal and multidimensional aspects of occupational disability.

This would imply that studies should involve multiple stakeholders, and aim at developing innovative strategies that are effective, efficient, and have the potential for successful implementation (Loisel et al., 2005). More specifically, programs and strategies for improving workplace competence in disability management are needed in the workplace.

Secondly, conducting high-quality research studies, and generating excellent evidence-based findings suppose elucidating the particular characteristics of measures and their influence on outcomes is now essential. For example, simply measuring RTW did not appear to capture the full range of job-related consequences. As a matter of fact, a major limitation of the literature reviewed is that both at the level of the individual study as well as when considering the literature as a whole there is inadequate recognition of the range of factors involved in actual return to work achievement of any individual or group level. Timing of RTW, reduction of occupational ergonomic risk, and appropriate job modifications also appear to be important to a safe return to the job after occupational musculoskeletal injury (Pransky et al., 2002). In addition, taking into account outcomes such as recurrences and re-injury could give a more accurate picture of long-term consequences of disability and the durability of results of different interventions. Moreover, the assumption guiding reviews of risk factors for prolonged disability is that self-report measures of disability, and RTW status, essentially measure the same thing. But there are grounds for arguing that self-report measure of disability and RTW status tap very different processes. Given the important theoretical, clinical and policy implications of the outcomes of risk factor research, more research is needed to further clarify the respective advantages and limitations of using self-reported measures of disability vs RTW status (Gauthier et al., 2006).

Third, comparison of interventions and outcomes in provenance from different workers' compensation systems should be done more frequently in order to identify attributes of the most effective work disability insurance systems and effective policies for maintaining coverage of the active workforce. Variables should include generosity, duration, and timeliness of benefits in different workers' compensation schemes, cost to employers of different workers' compensation schemes, investment in OHS prevention services, financial sustainability of schemes, and mechanisms and procedures for ensuring fairness.

Finally, quantitative and qualitative investigations are needed to further clarify the requirements for successful implementation of different interventions. Descriptive, systematic reviews and meta-analyses should synthesise the information resulting from these investigations and better equip actors and stakeholders concerned with the outcomes of interventions. This also implies developing more tools, easily adaptable to specific, legal, social, administrative and cultural contexts.

CONCLUSION

This literature review reveals that only a few studies directly address the work disability prevention paradigm from a long-term perspective. The findings bring to light five main topics in contemporaneous research on intervention modalities for preventing prolonged disability in workers compensated for WRMSDs: identifying the factors contributing to prolonged disability; developing and evaluating effective interventions; describing potentially successful practices for the actors involved in the rehabilitation and RTW process; exploring compensation issues; and improving the methodological issues related to the development, validation, and evaluation of useful tools in the work disability management process. Four trends were observed in the research literature on intervention aimed at preventing prolonged work disability. First, a clear interest in screening people at risk of prolonged disability was observed. In addition, multidisciplinary, multimodal, and targeted intervention was found to be of interest in the studies reviewed. Moreover, taking into account the psychosocial and ergonomic-related workplace factors, especially for workers identified as being at risk of prolonged disability, constitutes an important trend in research. Finally, factoring in the different stakeholders' points of view and the implementation context was found to be a recent trend in research in the field.

Certain key strategies have been identified in current research literature as potentially successful and worth considering for the purpose of enhancing intervention effectiveness, successful implementation, and the prevention of prolonged disability. Early screening of injured workers at risk of prolonged disability and the concentration of efforts on them through targeted intervention appears to an effective way to prevent prolonged disability. Early intervention on physical, ergonomic, and biopsychosocial factors also appears vital to preventing prolonged disability and to promoting effective, sustainable RTW. Improving communication between key stakeholders would appear to enhance the coordination of actors' actions in the intervention process. Finally, providing adequate information to injured workers, but also to the multiple actors and stakeholders involved in the rehabilitation and RTW process, and improving communication between them, would appear to be critical in achieving the effective and sustainable RTW of injured workers compensated for WRMSDs. In addition, this literature review highlights further insights essential to the development of intervention programs that have the capacity to reach many employees and promote positive outcomes for all workers, especially those who need it most. Indeed, many concerns still need to be addressed if we are to enhance the implementation and effectiveness of interventions. This makes for an enormous task in which new methodologies and theoretical models will need to keep pace with the growing volume of literature. An interdisciplinary, biopsychosocial approach will have to be used to take into account individual factors, the work environment, sociocultural variables, healthcare system issues, and the economy in general, in order to overcome the current epidemic of disabilities we are facing, and which threatens to continue to worsen in the future if left unchecked. Although this represents an enormous undertaking, significant advances are being made, as observed in this literature review. Persistence in these efforts is now of prime importance.

Lastly, the findings of this literature review provide stakeholders and practitioners in the rehabilitation and RTW field with potentially successfully strategies for preventing prolonged work disability in workers compensated for WRMSDs, while identifying specific areas in need of further research.

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APPENDICES

APPENDIX 1

Search strategy used by the specialist librarian to find the relevant references

Data base	
Ergoabstracts	physically AND handicapped (all) OR rehabilitation OR hardening OR absenteeism (all) published after 1/1/2004
CISDOC	capacity <IN> Title <OR> capacities <IN> Title <OR> predicting <IN> Title <OR> hardening <IN> Title <OR> return <IN> Title <OR> reentry <IN> Title <OR> reinsertion <IN> Title <OR> rehabilitation <IN> Title <OR> handicapped <OR> absenteeism <IN> Title <OR> absence <IN> Title <OR> absences <IN> Title <OR> incapacity <IN> Title <OR> incapacities <IN> Title <OR> recurrence <IN> Title <OR> recovery <IN> Title <OR> outcome <IN> Title <OR> outcomes <IN> Title <OR> prognostic <IN> Title <OR> prognostics <IN> Title <OR> predictor <IN> Title <OR> predictors <IN> Title <OR> limitation <IN> Title <OR> limitations <IN> Title <OR> sickness absenteeism <IN> Descriptor <OR> severity rates <IN> Descriptor <OR> handicapped workers <IN> Descriptor <OR> rehabilitation <IN> Descriptor <OR> accident absenteeism <IN> Descriptor <OR> work capacity <IN> Descriptor <OR> prediction <IN> Descriptor <OR> degree of disability <IN> Descriptor
HSLINE CANADIANA NIOSH	capacity <IN> Title <OR> capacities <IN> Title <OR> predicting <IN> Title <OR> hardening <IN> Title <OR> return <IN> Title <OR> reentry <IN> Title <OR> reinsertion <IN> Title <OR> rehabilitation <IN> Title <OR> absenteeism <IN> Title <OR> absence <IN> Title <OR> absences <IN> Title <OR> incapacity <IN> Title <OR> incapacities <IN> Title <OR> recurrence <IN> Title <OR> recovery <IN> Title <OR> outcome <IN> Title <OR> outcomes <IN> Title <OR> prognostic <IN> Title <OR> prognostics <IN> Title <OR> predictor <IN> Title <OR> predictors <IN> Title <OR> limitation <IN> Title <OR> limitations <IN> Title <OR> sickness absenteeism <IN> Title <OR> severity <IN> Title <OR> capacity <IN> Title <OR> prediction <IN> Title <OR> disability <IN> Title <OR> disabilities <IN> Title <OR> sick leave <IN> Descriptor <OR> disabled workers <IN> Descriptor <OR> rehabilitation <IN> Descriptor <OR> workplace adaptations <IN> Descriptor <OR> disabled workers <IN> Descriptor <OR> sickness absence <IN> Descriptor <OR> return to work <IN> Descriptor <OR> vocational rehabilitation <IN> Descriptor <OR> long term absence <IN> Descriptor <OR> long term incapacity <IN> Descriptor <OR> disabilities <IN> Descriptor <OR> work capability<IN> Descriptor
PsycINFO	rehabilitation OR (de*: work and de: adjustment) OR de: reemployment OR (de: vocational and de: rehabilitation) OR (de: disabled and de: person) OR (de: disabled and de: persons) OR (de: employee and de: absenteeism) OR (de: disabled and de: personnel) OR (de: occupational and de: adjustment) OR (de: psychosocial and de: rehabilitation) OR ti: hardening OR ti: return OR ti: rehabilitat* OR ti: handicap* OR ti: absenteeism* OR ti: absence* OR ti: capacity OR ti: disabilit* OR ti: incapacit* OR ti: recurrence OR ti: recovery OR ti: outcome OR ti: prognostic OR ti: predictor OR ti: limitation* OR kw: employment OR kw: occupational OR kw: worker* OR kw: work OR kw: industry OR kw: employee* OR kw: employer* OR kw: job OR kw: workplace OR kw: musculoskeletal *Legend: de= Descriptor: ti=Title; and kw= Key Word
FRANCIS	handicape* or handicape physique or handicap* or readaptation or handicaps physiques/de AND travailleur* or poste de travail* or organisation du travail* or relations de travail or medecine travail or integration sociale or formation professionnelle or entreprise or marche du travail or politique de l'emploi or securite du travail or acces a l'emploi or adaptation professionnelle

Pascal	Réadaptation physique, Réadaptation professionnelle, Réadaptation, Rehabilitation, Reprise-travail, Absentéisme, Incapacité, Congé-maladie, Incapacité-travail, Recurrence, Restauration, Reconditionnement, Capacité fonctionnelle, Réadaptation socioprofessionnelle
INRS	Réadaptation, Incapacité, Absentéisme, Réinsertion, Reprise du travail, Handicapé, Séquelle, Insertion professionnelle, Capacité physique
MEDLINE	Search #1 "occupational diseases/complications"[MeSH Major Topic] OR "occupational diseases/economics"[MeSH Major Topic] OR "occupational diseases/psychology"[MeSH Major Topic] OR "occupational diseases/rehabilitation"[MeSH Major Topic] OR "occupational diseases/statistics and numerical data"[MeSH Major Topic] OR "musculoskeletal diseases/complications"[MeSH Major Topic] OR "musculoskeletal diseases/psychology"[MeSH Major Topic] OR "musculoskeletal diseases/economics"[MeSH Major Topic] OR "musculoskeletal diseases/rehabilitation"[MeSH Major Topic] OR "sprains and strains/complications"[MeSH Major Topic] OR "sprains and strains/economics"[MeSH Major Topic] OR "sprains and strains/psychology"[MeSH Major Topic] OR "sprains and strains/rehabilitation"[MeSH Major Topic] OR "back pain/complications"[MeSH Major Topic] OR "back pain/economics"[MeSH Major Topic] OR "back OR Search #2 "workers' compensation"[MeSH Terms] OR "insurance, disability"[MeSH Terms] OR Search #3 ("injury severity score"[MeSH Terms] OR "employment, supported"[MeSH Terms] OR "disability evaluation"[MeSH Terms] OR "disabled persons"[MeSH Terms] OR "professional impairment"[MeSH Terms] OR "length of stay"[MeSH Terms] OR "rehabilitation" [MeSH Terms] OR "work capacity evaluation"[MeSH Terms] OR "absenteeism"[MeSH Terms] OR "health status indicators"[MeSH Terms] OR "recovery of function"[MeSH Terms] OR "injury severity score"[MeSH Terms] OR "recurrence" [MeSH Terms] OR "chronic disease"[MeSH Terms] OR "treatment failure"[MeSH Terms] OR "functional residual capacity"[MeSH Terms] OR chronic[Title] OR rehabilitation[Title] OR chronicity[Title] OR hardening[Title]) AND "accidents, occupational"[MeSH Terms] OR "occupational diseases"[MeSH Terms] OR "musculoskeletal diseases"[MeSH Terms] OR "sprains and strains"[MeSH Terms] OR "back pain" [MeSH Terms] OR "neck pain" [MeSH Terms] OR "cumulative trauma disorders"[MeSH Terms] OR "carpal tunnel syndrome"[MeSH Terms] OR "tendon injuries"[MeSH Terms])

APPENDIX 2

Definitions of categories and classes used in categorisation analyses

Category	Definition of the category	Classes
Topic	The main objective as stated in the abstract or reformulated by the reviewers according to the content of the article	• Predict an outcome • Evaluate effectiveness of a program/component/intervention • Evaluate effectiveness of a strategy/policy • Evaluate efficacy of a treatment • Describe views/experiences/perception of actors • Describe trajectories of injured workers • Describe consequences of disability • Impact of WC status/type of insurance on disability • Compare jurisdictions/systems/countries • Develop/validate tools
Stakeholder(s)*	The major player mentioned as potentially interested by the results of the study	• Compensation (WCB) • Health care system (HCS) • Workplace (WP) • Worker (W) or personal system (PS) • Societal context (SC)
Area of application	The work disability prevention area of intervention addressed by the study's results	• Claims/injury management • Clinical intervention/management • Rehabilitation intervention/management • Occupational/RTW/vocational intervention • Readiness for RTW
Perspective of research	The work disability prevention approach addressed by the study	• Prognosis • Guidelines for intervention • Assessment of disability • Contextual factors • Awareness of social and economic consequences of disability • Training/education/information • Barriers and facilitators • Cost-effectiveness

*The classes in this category are not mutually exclusive because more than one stakeholder could be involved or interested in the same study and its results.

APPENDIX 3

Links and references for relevant and practical documents

Canada

Ontario, WSIB.
Report of the Chair of the Chronic Pain Panel. 2000.
http://www.wsib.on.ca/wsib/wsibsite.nsf/Public/ChronicPainReport

Ontario, IWH (Institute for Work and Health).

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Health-care utilization for work-related soft-tissue injuries: understanding the role of providers (#203).
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BC Amick, D Lerner, WH Rogers, T Rooney, JN Katz.

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J Clarke, D Cole, S Ferrier.

Work organization and musculoskeletal injuries among a cohort of health care workers (#126).
M Koehoorn, P Demers, C Hertzman, J Village, S Kennedy.

Job satisfaction, upper extremity pain intensity and absenteeism in work-related MSDs: an investigation using path analysis (#112).
J Smith, D Cole, S Ibrahim, and the Worksite Upper Extremity Research Group.

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Preventing injury, illness and disability at work: what works and how we do? A discussion paper for Ontario's Occupational Health and Safety Community. 2003.
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http://www.iwh.on.ca/archive/pdfs/POCKET_evidence_sum.pdf

Québec, IRSST (Institut de recherche Robert Sauvé en santé et en sécurité du travail).

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MSDs – The impact of health, illness, pain and recovery – Strategy representations in the work rehabilitation process.
Baril, Raymond; Durand, Marie-José; Coutu, Marie-France; Côté, Daniel; Cadieux, Geneviève; Rouleau, Annick; Ngomo, Suzy.
Studies and Research Projects/Report R-592, Montréal, IRSST, 2008, 114 pages.
http://www.irsst.qc.ca/media/documents/pubirsst/r-592.pdf

Travailleurs de la construction ayant une dorso-lombalgie – Évaluation de l'implantation d'un programme de collaboration précoce en réadaptation.
Durand, Marie-José; Berthelette, Diane; Loisel, Patrick; Beaudet, Jocelyne; Imbeau, Daniel.
Studies and Research Projects/Report R-489, Montréal, IRSST, 2007, 100 pages.
http://www.irsst.qc.ca/fr/_publicationirsst_100256.html

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Loisel, Patrick; Durand, Marie-José; Baril, Raymond; Langley, Ann; Falardeau, Marlène.
Studies and Research Projects/Report R-393, Montréal, IRSST, 2004, 59 pages.
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Pratiques cliniques des physiothérapeutes dans le traitement de travailleurs souffrant de maux de dos aigus et subaigus.
Blais, Régis; Poitras, Stéphane; Swaine, Bonnie; Rossignol, Michel.
Studies and Research Projects/Report R-438, Montréal, IRSST, 2005, 74 pages.
http://www.irsst.qc.ca/fr/_publicationirsst_100170.html

Développement d'un protocole d'évaluation électromyographique de l'endurance des muscles extenseurs du tronc basé sur une approche fonctionnelle.
Larivière, Christian; Arsenault, Bertrand; Gravel, Denis; Gagnon, Denis; Gardiner, Phillip; Loisel, Patrick.
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APPENDIX 4

Main issues tackled in the literature reviews

Authors	Title	Objective	Main results/conclusions
Athanasou, 2005 Australia, *Med. Leg. J.*	Return to work following whiplash and back injury: a review and evaluation	Review the reported return-to-work rates following whiplash and back injury.	The RTW rates for 71 relevant studies were reviewed. The results suggest considerable residual RTW potential for persons with whiplash and back injury.
Baldwin, 2004 USA, *J Electromyogr Kinesiol.*	Reducing the costs of work-related musculoskeletal disorders: targeting strategies to chronic disability cases	Review evidence on the costs of MSDs, identifying the sources of disproportionately high costs, and review empirical evidence on workplace characteristics and economic incentives associated with long-term disability and large productivity losses, focusing on work-related back cases.	The workplace characteristics associated with long-term disability include: failure to receive job accommodations, receipt of disability benefit payments, and employment in high-risk industries or jobs that require heavy lifting. The benefit replacement rate is significantly positively correlated with post-injury duration of work absence. Research on the predictors of high-cost cases is limited, however, because of the lack of high-quality data and the need for a multidisciplinary approach. The new Arizona State University Healthy Back Study addresses some of these issues and promises new insights into effective strategies to reduce the proportion of high-cost claims.
Gross, 2006 Canada, *Curr Pain Headache Rep.*	Are functional capacity evaluations affected by the patient's pain?	Examine the information available in the literature related to the influence of pain on FCE.	For purposes of claims adjudication, FCE should not be considered a purely 'objective' indicator of functional impairment independent of subject or evaluator perceptions. FCE may have some value for facilitating return-to-work or re-integrating chronically disabled workers into the workforce, although pain factors must be taken into consideration when making predictions about future work status.
Hagberg, 2005 Sweden, *G Ital Med Lav Ergon.*	Clinical assessment, prognosis and return to work with reference to work related neck and upper limb disorders	Describe the clinical assessment and management of work-related neck and upper limb disorders.	Despite the large number of patients with neck and upper limb disorders, the scientific evidence used in clinical assessment to determine the prognosis and RTW management procedures is sparse.
Hoffman et al., 2007 USA, *Health Psychol.*	Meta-analysis of psychological interventions for chronic low	Evaluate the effectiveness of psychological interventions for adults with non-cancerous	The results demonstrated positive effects of psychological interventions for CLBP. The rigour of

	back pain	chronic *LBP.*	the methods used, as well as the results that reflect mild to moderate heterogeneity and minimal publication bias, suggest confidence in the conclusions of this review.
Palmer et al., 2007 UK, *Occup Med* (London).	Compensating occupationally related tenosynovitis and epicondylitis: a literature review	Assess occupational associations with tenosynovitis and epicondylitis, focusing particularly on evidence that might support compensation of these disorders 'on the balance of probabilities.'	Compensation of occupational illness can be problematic for disorders not specific to work and for which there are no distinctive clinical features in occupationally related cases. Attribution can, however, be made on the balance of probabilities if there is convincing evidence that risk is at least doubled in an occupational group. The review highlights the relative lack of data to support such attribution for tenosynovitis and epicondylitis.
Pransky et al., 2004 USA, *J Occup Rehabil.*	Disability prevention and communication among workers, physicians, employers, and insurers – current models and opportunities for improvement	Review prevailing models of disability management and prevention with respect to communication.	Improvements in communication may be responsible for successes across a variety of new interventions. Communication-based interventions may further improve disability outcomes, reduce adversarial relationships, and prove cost-effective; however, controlled trials are needed.
Rainville et al., 2005 USA, *Spine*	The physician as disability advisor for patients with musculoskeletal complaints	Review the literature related to the performance of physicians as mediators of temporary and permanent disability for patients with chronic musculoskeletal complaints.	Physician recommendations limiting activity and work after injury are highly variable, often reflecting their own pain attitudes and beliefs. Patients' desires strongly predict disability recommendations (i.e., physicians often acquiesce to patients' requests). Other influences include jurisdiction, employer, insurer, and medical system factors. The most successful efforts to influence physician recommendations used mass communication to influence public attitudes, while reinforcing the current standard of practice for physicians. Physician recommendations for work and activity have important health and financial implications.
Selander et al., 2002 Sweden, *Disab Rehabil.*	Return to work following vocational rehabilitation for neck, back and shoulder problems: risk factors reviewed	Provide an overview of the factors associated with RTW following vocational rehabilitation for problems in the neck, back, and shoulders.	Demographic, psychological, social, medical, rehabilitation, workplace and benefit-system factors are associated with RTW in many ways. People with greater chances of job return after vocational rehabilitation are younger, native, highly educated, have a steady job and high income, are married and

			have stable social networks, are self-confident, happy with life, not depressed, have low level of disease severity and no pain, high work seniority, long working history and an employer that cares and wishes them back in the workplace. Unfortunately, people with the above profile are seldom found among the long-term sick.
Staal et al., 2005 Netherlands, *J Occup Rehabil.*	Physical exercise interventions to improve disability and return to work in low back pain: current insights and opportunities for improvement	Provide an overview of the current knowledge with respect to the safety, content- and context-related aspects of physical exercise interventions for disabled workers with LBP, issues related to timing, the influence of treatment confidence and patient expectations, and the process of changing provider and employer behaviour.	Physical exercises are not associated with an increased risk for recurrences. The effects of interventions may vary depending on content-related factors (i.e., type of exercises, dosage, frequency, skills of the healthcare providers, etc.) and contextual factors (i.e., treatment setting, compensation system, etc.). Treatment confidence and patients' expectations also significantly influence outcomes of physical exercise interventions. Timing is also important; interventions targeting RTW, applied during the acute phase of work absenteeism, compete with a high rate of spontaneous recovery and may therefore be inefficient. More investigations are needed to further clarify the requirements for a successful application and implementation of physical exercise interventions.
Steenstra et al., 2005 Netherlands, *Occup Environ Med.*	Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature	Evaluate the evidence for prognostic factors for RTW among workers sick-listed with acute LBP.	Specific LBP, higher disability levels, older age, female gender, social dysfunction and social isolation, heavier work, and receiving higher compensation are predictors for a longer duration of sick leave. A history of LBP, job satisfaction, educational level, marital status, number of dependants, smoking, working more than eight-hour shifts, occupation, and size of industry or company, do not influence duration of sick leave due to LBP.
Teasell, 2001 Canada, *Clin J Pain.*	Compensation and chronic pain	Review the evidence on the role of the compensation in chronic pain and/or chronic disability.	Filing a compensation claim, retaining a lawyer, or higher pain intensities are limited predictors of longer claims. As the ratio of compensation to pre-injury wage increases, there is moderate evidence that duration of the claim increases. Compensation status, combined with higher pain intensities, is associated with poorer prognosis after rehabilitation programs.

APPENDIX 5

Main issues tackled in the theoretical articles

Authors	Title	Focus and main issues
Clifton DW, 2006 USA, *Work*	The functional IME: A linkage of expertise across the disability continuum	Focuses on approaches used for disability assessment and on ways to enhance the value of independent medical examinations and functional capacity evaluation (FCE) in a common model.
Eley C, 2006 USA, *AAOHN J*	Magnetic resonance imaging for low back injuries: appropriate use in managing workers' compensation claims	Provides data necessary for health care providers to design protocols using magnetic resonance imaging in managing workers' compensation claims for low back injuries.
Franche R & Krause N, 2002 Canada, *J Occup Rehabil.*	Readiness for return to work following injury or illness: conceptualizing the interpersonal impact of health care, workplace, and insurance factors	Proposes a new Readiness for Return-to-Work Model, focusing on the interpersonal context of the work-disabled employee. Employee interactions with the workplace, the health-care and insurance systems are considered as they influence three defining dimensions of change: decisional balance, self-efficacy and change processes.
Halpern M, 2003 USA, *Work*	The costs of job accommodations for employees with low back pain	Expands a model of the ergonomic intervention process and provides data on costs of accommodating individuals with MSDs, particularly LBP.
Harding WE, 2006 USA, *Clin Occup Environ Med.*	Worker's compensation litigation of the upper extremity claim	Provides an overview of the issues presented to physicians and lawyers in evaluating, treating, litigating, and concluding an upper extremity workers' compensation claim.
Harper JD, 2002 USA, *Foot Ankle Clin.*	Determining foot and ankle impairments by the AMA fifth edition guides	Reviews the AMA fifth edition guides, focusing on determining foot and ankle impairments.
Hefti et al., 2003 USA, *AAOHN J.*	Back injury prevention: a lift team success story	Discusses the benefits of a lift team specially trained in body mechanics, lifting techniques, and the use of mandated mechanical equipment in hospitals.
Joish & Brixner, 2004 USA, *J Pain Palliat. Care Pharmacother.*	Back pain and productivity: measuring worker productivity from an employer's perspective	Examines various methods to assess productivity gains or losses caused by back pain, from an employer's perspective.
Katz RT, 2001 USA, *Phys Med Rehabil Clin N Am*	Impairment and disability rating in low back pain	Focuses on impairment and disability rating in LBP and the role of psychiatrists in this process.

Loisel P et al., 2001 Canada, *Disease Management & Health Outcomes*	Disability Prevention: New Paradigm for the Management of Occupational Back Pain	Proposes a disability prevention management model to encourage clinicians, employers, unions and insurers, as well as researchers in the field, to work within the perspective of the disability paradigm.
Marini I, 2003 USA, *Work: Journal of Prevention, Assessment and Rehabilitation*	What rehabilitation counselors should know to assist Social Security beneficiaries in becoming employed	Outlines the Social Security Administration's (SSI) programs and process for applying, characteristics, and information regarding the psychological and physiological aspects of beneficiaries with psychiatric disabilities and MSD.
Miller CE, 2002 USA, *J Health Soc Policy*	Arthritis and the role of the physician in non-malignant pain and disability	Focuses on the role of the physician in treating chronic non-malignant LBP, on how his decision to either function as a patient's advocate or the rater of the patient's limitations may influence pain and disability.
Pennick V, 2001 Canada, *OOHNA/Ontario Occupational Health Nurses Association*	What works to reduce disability in patients with low back pain: the evidence	Assesses the recovery phase approach to developing management strategies for back injuries and its effectiveness in reducing lost time.
Pilet, F, 2003 Switzerland, *Revue médicale de la Suisse romande*	*Attester ou prescrire un arrêt de travail: le médecin traitant a-t-il le choix?: Réhabilitation et médecine du travail*	Discusses the meaning of the work disability certificate and the fourfold agenda (that of the patient, the physician, the employer, and the insurer), agendas that are often unclear. Introduces the “locus of control” concept, described as a determining factor in the ability to RTW after sick leave.
Pransky and Dempsey, 2004 USA, *J Occup Rehabil.*	Practical aspects of functional capacity evaluations	Focuses on practical aspects and concerns about functional capacity evaluations (FCE) in clinical and administrative settings.
Rainville et al., 2007 USA, *Spine*	A review of 1985 Volvo Award winner in clinical science: objective assessment of spine function following industrial injury	Reviews Mayer et al.’s article entitled 'Objective assessment of spine function following industrial injury: a prospective study with comparison group and one-year follow-up'; reports on its strengths and weaknesses, and reviews studies that have attempted to replicate this work in other settings.
Rivier G, 2001 Switzerland, *Revue médicale de la Suisse romande*	Common lumbago and returning to work: various thoughts about a complex problem	Discusses the complex problem of non-specific LBP and RTW and the scientific evidence on preventing chronic disability.
Rivier, G, 2003 Switzerland, *Revue médicale de la Suisse romande*	*Douleur lombaire, activité au travail et réadaptation*; Low back pain, activity for work and rehabilitation	Presents a conceptual framework that provides a better understanding of the factors underlying the complex relationship between back pain and level of activity at work.
Wheeler et al., 2001 USA, *Social Security Bulletin*	The US study of work incapacity and reintegration	US national study on workers with back disorders that discusses policy implications. Shows how the core design was adapted for the US study to account for differences between US disability programs versus those of other countries.

Wickizer et al., 2001 USA, *Milbank Quarterly*	Improving the quality of workers' compensation health care delivery: the Washington State Occupational Health Services Project	Documents Washington State's experiences in developing a quality improvement initiative, studying the effects of providing occupationally focused health care through managed care arrangements on health outcomes, worker and employer satisfaction, medical and disability costs.

APPENDIX 6

Distribution of articles by scientific journal and year of publication

	Year of publication								
Journal	2000	2001	2002	2003	2004	2005	2006	2007	Total
Spine	3		6	3	4	2	6	2	26
J Occup Environ Med	4	2	2	2	3	1	2	5	21
J Occup Rehabil				2		6	4	7	19
Am J Ind Med	6	1			1	2	2	4	16
Spine J		2	2	3			1	1	9
Work	1			1	1		5	1	9
Occup Environ Med			2		2		3	1	8
Pain				1	3	3			7
Int J Rehabil Res	1		1		1	1			4
AAOHN J	1	1		1					3
Arch Phys Med Rehabil				1		1		1	3
Disabil Rehabil				1		1	1		3
J Bone Joint Surg Am	1			1	1				3
Am J Orthop	1					1			2
Eur Spine J			1					1	2
J Hand Ther			1		1				2
J Pain							2		2
J Shoulder Elbow Surg	1					1			2
Occup Med							1	1	2
Phys Ther						2			2
Rheumatology (Oxford)		1		1					2
Am J Manag Care							1		1
Ann Intern Med						1			1
Arthritis Rheum					1				1
Assistive Technology		1							1
Aust J Physiother			1						1
BMC Public Health					1				1
Can Fam Physician						1			1
Ind Health							1		1
Inj Prev					1				1
Int Arch Occup Environ Health							1		1
Int J Health Serv				1					1
J Am Osteopath Assoc		1							1
J Clin Epidemiol							1		1
J Hand Surg [Am]					1				1
J Hand Surg [Br]					1				1
J Health Econ				1					1
J Interprof Care						1			1
J Korean Med Sci						1			1
J Manipulative Physiol Ther		1							1
J Rehabil Med					1				1
J South Orthop Assoc	1								1
J Spinal Disord Tech					1				1
Joint Bone Spine								1	1
Journal of Applied					1				1

Rehabilitation Counseling									
Man Ther				1					1
Med care								1	1
Med J Aust	1								1
Medecine - revue de l'Unaformec							1		1
Minn Med		1							1
N Z Med J		1							1
Pain Med						1			1
Plast Reconstr Surg			1						1
Pratiques et organisation des soins							1		1
Qual Life Res								1	1
Scand J Prim Health Care							1		1
Scand J Work Environ Health							1		1
Soc Sci Med				1					1
Surgical Neurology	1								1
Tenn Med	1								1
Total (N=60)	**23**	**12**	**17**	**21**	**25**	**26**	**35**	**27**	**186**

APPENDIX 7

Predictors, factors and determinants of work disability outcomes

Outcome	Predictors/factors/determinants
Duration of disability	
Longer	**Socio-demographic**: older age (McIntosh et al., 2000), older age, female gender (Kim et al., 2006) **Health care/clinical**: increased utilization of specialty referrals and provider visits, use of magnetic resonance imaging, use of opioids for more than 7 days (Mahmud et al., 2000), lag time from injury to treatment, pain referred into the leg, three or more positive Waddell nonorganic signs (McIntosh et al., 2000), co-morbidity, delayed referral, more severe medical diagnosis, workers with herniated intervertebral disc disorder, pain radiation (Kim et al., 2006), poorer physical health (Lotters et al., 2006), chronic stage of injury, higher pain, worse health transition, greater disability (Schultz et al., 2004) **Compensation/administrative**: receiving earnings-related compensation (McNaughton et al., 2000), presence of language barriers, attorney involvement non supportive of RTW (Pransky et al., 2006), receiving < 2,000 000 KRW for compensation benefit (Kim et al., 2006), worse WCB/employer response (Schultz et al., 2004) **Employment/organizational:** working in the construction industry (McIntosh et al., 2000), shorter job tenure, prior work absence, working in companies with ≥ 1,000 employees (Kim et al., 2006), greater skill discretion (Schultz et al., 2004) **Job physical demands**: time spent bending and lifting or pushing or pulling heavy objects at work (Dasinger et al., 2000), high physical job demands (Krause et al., 2001) **Job psychological demands**: high psychological job demands and low supervisory support (Krause et al., 2001), increased depressive symptoms (Lotters et al., 2006), low RTW motivation (Kim et al., 2006), lower expectations of recovery (Schultz et al., 2004);
Shorter	**Socio-demographic**: younger age (Dasinger et al., 2000) **Heath care/clinical**: less severe injuries, previous back injury (Dasinger et al., 2000), higher lifting performance on functional capacity evaluation (Gross and Battie, 2006), higher values of questionnaire score, intermittent pain, a previous episode of back pain (McIntosh et al., 2000) **Employment/organizational**: longer pre-injury employment (Dasinger et al., 2000) **Job psychological demands:** high job control (Krause et al., 2001)
Accuracy of prediction of sick-leaves	**Compensation/administrative**: self-predictions by sick-listed workers vs predictions by insurance officers (Fleten et al., 2004);
Prolonged disability/pain	
Prolonged work disability	**Socio-demographic**: older age, language barriers (Okurowski et al., 2003), older age, female gender, having dependents, higher unemployment rate (Stover et al., 2007), baseline demographic variables (Turner et al.,

	2007), African Americans and lower socioeconomic status persons in the Workers' Compensation system (Chibnall and Tait, 2005) **Health care/clinical**: prior low back surgery, higher initial disability questionnaire score, lower SF-36 score (Coste et al., 2004), earlier referral to nurse case manager (Okurowski et al., 2003), delay between injury and first medical treatment, back injury (Stover et al., 2007), pain, disability (Tousignant et al., 2000, symptom severity, functional limitations (Turner et al., 2007) **Compensation/administrative**: neutral or negative attorney attitude toward RTW (Okurowski et al., 2003), temporary compensation status (Coste et al., 2004), longer time from medical treatment to claim filing (Stover et al., 2007) **Employment/organizational**: construction industry, logging occupation, smaller firm size (Stover et al., 2007), lack of job accommodation, job psychosocial conditions (Turner et al., 2007), job control, workload measures (Koehoorn et al., 2006) **Job physical demands**: job physical demands (Koehoorn et al., 2006; Turner et al., 2007) **Job psychological**: perceived stress, fears and beliefs about work (Soucy et al., 2006), high work fear-avoidance and very low recovery expectations (Tousignant et al., 2000; Turner et al., 2006), worker psychosocial characteristics and conditions (Turner et al., 2006, 2007), rumination and 'powerlessness' (Magnification and Helplessness) (Chibnall and Tait, 2005)
Transition from acute to chronic pain	**Health care/clinical**: severe leg pain, all 3 Oswestry Disability Index categories above minimal disability, General Health Questionnaire score at least 6 (Fransen et al., 2002) **Employment/organizational**: light duties unavailable on RTW (Fransen et al., 2002), **Job physical demands:** a job requirement of lifting for 3/4 of the day or more (Fransen et al., 2002) **Individual**: obesity (Fransen et al., 2002)
Recurrence of disability	**Health care/clinical**: number of preadmission on healthcare visits (Gross and Battie, 2005), durations of the initial episode of care or work disability (Wasiak et al., 2004) **Compensation/administrative**: previous back-related claims (Gross and Battie, 2005) **Job psychological demands**: well being, aggressiveness, anxiety (Sewitch et al., 2000);
RTW status	
RTW	**Socio-demographic**: education, age (Blackwell et al., 2004) **Health care/clinical**: better FCE performance (Waylett-Rendall and Niemeyer, 2004), higher compliance with the treatment schedule, lower cancellation rate, shorter interval in days between reporting the injury and initiation of physical therapy rehabilitation, lower percentage of previous surgeries resulting from low back injuries (Gilbert et al., 2000), the therapist's estimate of rehabilitation potential and the patient's outcome expectation of the ability to work (Waylett-Rendall and Niemeyer, 2004), lower mean levels of pain and disability, higher positive health outcome on the SF-36 (Schultz et al., 2004) **Employment/organizational**: workers' satisfaction with the firm's treatment of their disability claim (Butler et al., 2007), working full-time at pre-injury position during the rehabilitation process (Gilbert et al., 2000), mandated vocational rehabilitation (Blackwell et al., 2004), a supportive organization (Amick et al., 2004)

	Job physical demands: physical demands of the job at injury (Blackwell et al., 2004) **Job psychological demands**: baseline work role functioning, improved self-efficacy (Amick et al., 2004), positive recovery expectations (Gross and Battie, 2005), less anxiety, better expectations of recovery (Schultz et al., 2004)
Late/no RTW	**Socio-demoghraphic**: lower income (Katz et al., 2005), men: age (Dionne et al., 2007) **Health care/clinical**: women: feeling that the physician did listen carefully, persistent pain, pain radiating to extremities (Dionne et al., 2007), men: poor self-reported health status, pain in the thoracic area, previous back surgeries, a non-compensated injury, high pain levels, satisfaction with health services (Dionne et al., 2007), diagnosis of mononeuropathy versus enthesopathy; higher pain ratings, greater functional limitations (Feuerstein et al., 2003), duration of complaints, functional disability, disc herniation (Heymans et al., 2007), NRS-101 measures of the intensity of back or leg pain, Roland-Morris scale of functional disability and mental and physical components of the SF-12 (Baldwin et al., 2007), preoperative physical functional status, change in self-efficacy between preoperative assessment and at 2 months (Katz et al., 2005) **Compensation/administrative**: workers' compensation, representation by an attorney (Katz et al., 2005) **Job physical demands**: work exposure to force and repetition (Katz et al., 2005) **Job psychological demands**: women: increasing fear-avoidance beliefs towards work and activity were determinants of "failure"; men: belief that job is below qualifications; Both genders: fear-avoidance beliefs towards work., (Dionne et al., 2007), fear avoidance beliefs (Heymans et al., 2007), lower psychological distress (Sewitch et al., 2000), higher psychological job demands and lower control, lower social support by coworkers (Katz et., 2005) **Employment/organizational**: working long-hour work schedules and nonstandard shift work (Dembe et al., 2007), women: increasing job seniority, not having a unionized job; men: likelihood of losing job, job status (Dionne et al., 2007), lower job security and supportive organizational policies and practices (Katz et al., 2005), higher level of ergonomic stressors (Feuerstein et al., 2003) **Individual**: men: cigarette smoking (Dionne et al., 2007)
Work place employer risk-reduction activities	**Employment/organizational**: safety programs and physician recommendations for job modifications (Keogh et al., 2000);
Clinical /rehabilitation outcome	
Physicians' decisions on whether or not to certify sickness at a consultation	**Health care/clinical**: length of professional experience and physicians' working time (Norrmen et al., 2006)
Early opioid prescription for back injury	**Health care and clinical**: pain radiating below the knee, and injury severity categories (major sprain and radiculopathy) (Stover et al., 2006) **Individual**: daily tobacco use (Stover et al., 2006)
Referrals to physical therapy and therapist use	**Socio-demoghraphic**: education level (Freburger et al., 2005) **Health care/clinical**: physician characteristics (orthopedic surgeons vs primary care physicians), previous

	physician use (Freburger, 2003, 2005) **Compensation/administrative**: insurance status, having WCB coverage, being in litigation (Freburger, 2003, 2005)
Response patterns during physiotherapy for soft tissue shoulder disorders	**Socio-demoghraphic**: age (Kennedy et al., 2006) **Health care/clinical**: duration of current shoulder problem, Physical Component Score (SF-36), Mental Component Score (SF-36), over the counter medication use, therapist prediction of client to return to usual activity (Kennedy et al., 2006) **Compensation/administrative**: WCB claim (Kennedy et al., 2006) **Job psychological demands**: client's global rating of problem (Kennedy et al., 2006)
Higher levels of adherence to LBP rehabilitation in the clinical setting; better degree of rehabilitation	**Health care/clinical**: higher levels of adherence to clinic-based activities (Kolt and Mcevoy, 2003) **Compensation/administrative**: non-compensable patients (Kolt and Mcevoy, 2003)
Rehabilitation failure after biopsychosocial treatement	**Socio-demoghraphic**: gender (women) (McGeary et al., 2003)
Health care utilisation after tertiary rehabilitation	**Socio-demoghraphic**: poorer socioeconomic outcomes (Proctor et al., 2004)
Disability ratings and post settlement functional status	**Socio-demoghraphic**: race (Tait et al., 2006) **Health care/clinical**: diagnosis, surgery,medical costs (Tait et al., 2006)
Functional Capacity Evaluation	**Socio-demographic**: age, sex (Gross and Battie, 2005) **Health care/clinical**: pain disability index (PDI), duration of injury (Gross and Battie, 2005), upper extremity symptoms other than pain (e.g., sleep disturbance, numbness and tingling), symptoms in one or both hands (Shaw et al., 2002) **Job physical demands**: higher ergonomic risk factor exposures at work (Shaw et al., 2002) **Job psychological demands**: Functional self-efficacy beliefs (Asante et al., 2007), feeling overwhelmed by pain, low confidence in problem solving abilities (Shaw et al., 2002);
Compensation/claim	
Time on benefits	**Health care/clinical**: body region specific functional status, change in pain (Hogg-Johnson and Cole, 2002) **Employment/organizational**: workplace offers of arrangements for return to work (Hogg-Johnson and Cole, 2002) **Job psychological demands**: recovery expectations (Hogg-Johnson and Cole, 2002)
Impairment ratings from employer-retained physicians	**Health care/clinical**: diagnosis, surgery, pain, rating year, and clinic (Chibnall et al., 2000)

Differences in health case management, post-settlement pain-related disability, psychological distress, disability, and financial struggle	**Socio-demoghraphic**: socioeconomic status and race (Tait et al., 2004; Chibnall and Tait, 2005) **Health care/clinical**: injury-related variables (Tait et al., 2004), lower satisfaction with case management (Chibnall and Tait, 2005)
Disability rate at the administrative law judge level	**Health care/clinical**: diagnosis, surgery, tests ordered, impairment rating (Chibnall et al., 2000) **Compensation/administrative**: legal representation (Chibnall et al., 2000)
Application for Social Security Disability Insurance	**Socio-demoghraphic**: black race, older age, higher preinjury wage, more education (Chibnall et al., 2006) **Health care/clinical**: herniated disc diagnosis, surgery, longer time since injury, higher satisfaction with medical treatment (Chibnall et al., 2006) **Employment/organizational**: higher satisfaction with treatment by employer (Chibnall et al., 2006)
Health-related job loss	**Health care/clinical**: women: contacts to the general practitioner in the previous year (Haahr et al., 2007) **Compensation/administrative**: women: reports of a work compensation claim within the year previous to baseline (Haahr et al., 2007) **Job physical demands**: men: repetitive work (Haahr et al., 2007) **Job psychological demands**: women: high level of health anxiety, poor leadership quality at work; men: high levels of health anxiety (Haahr et al., 2007)
Self-reported *vs* insurer-reported number of compensated days absence	**Socio-demoghraphic factors:** lower education (Pole et al., 2006) **Health care/clinical**: upper extremity injuries (Pole et al., 2006) **Job psychological demands**: lower RTW self-efficacy (Pole et al., 2006)
Filing a claim	**Socio-demoghraphic**: lower annual income (Rosenman et al., 2000) **Health care/clinical**: severity of the condition (Rosenman et al., 2000) **Employment/organizational**: increasing length of employment (Rosenman et al., 2000) **Job psychological demands**: worker dissatisfaction with coworkers (Rosenman et al., 2000)
Recurrence rates in administrative data	**Health care/clinical**: variations in definitions of recurrence (Wasiak et al., 2003);
Costs	
Compensation	**Socio-demoghraphic**: married/single/divorced status, male gender, older age (Bernacki et al., 2007; Murphy and Courtney, 2000) **Health care/clinical**: low back disorder (Bernacki et al., 2007), diagnosis, tests, impairment rating (Chibnall, 2000), symptom severity, functional limitations (Murphy and Courtney, 2000) **Compensation/administrative**: attorney involvement, claim duration (Bernacki et al., 2007) **Employment/organizational**: small company size, high premium, reporting delays, (Bernacki et al., 2007),

		lack of job accommodation, job psychosocial conditions (Murphy and Courtney, 2000) **Job physical demands**: job physical demands (Murphy and Courtney, 2000) **Job psychological demands**: worker psychosocial characteristics (Murphy and Courtney, 2000)
	Medical	**Health care/clinical**: primary care provider involvement by work-related LBP patients (Atlas et al., 2004)
	Compensation & medical	**Health care/clinical**: failure to achieve solid fusion after interbody cage lumbar fusion (LaCaille et al., 2007) **Compensation/administrative**: lawyer involvement (LaCaille et al., 2007) **Job psychological demands**: presurgical (lumbar fusion) biopsychosocial variables (DeBerard et al., 2003) **Individual:** obesity (LaCaille et al., 2007)
Wage loss		**Health care/clinical**: greater pain (Schultz et al., 2004) **Employment/organizational**: workers with more years with employer (Schultz et al., 2004) **Job psychological demands**: greater skill discretion, lower expectations of recovery (Schultz et al., 2004).

APPENDIX 8

Summary of articles evaluating programs

Study	Description of the program/aspects evaluated	Results	Conclusions
Abasolo et al., 2005, Spain	Population-based clinical program to reduce work disability offered to patients with recent-onset work disability caused by MSD, including education, protocol-based clinical management, and administrative duties: efficacy in terms of days of temporary work disability and number of patients with permanent work disability	Shorter episodes of temporary work disability in the intervention group than in the control group (mean, 26 days compared with 41 days), similar numbers of episodes per patient in both groups. Fewer patients received long-term disability compensation in the intervention group (n=38) than in the control group (n=99). Direct and indirect costs were lower in the intervention group than in the control group. Each dollar invested generated a benefit of $11.00. The program's net benefit was in excess of $5 million.	Implementation of the program, offered to the general population, improves short- and long-term work disability outcomes and is cost-effective.
Arokoski et al., 2002, Finland	Vocationally oriented medical rehabilitation (VOMR) in patients with chronic musculoskeletal symptoms: use of health-care services, work absenteeism, leisure-time physical activity, musculoskeletal symptoms and physical performance during 1 1/2 years of follow-up	The subjective physical and mental strain of work, subjective neck-shoulder and low-back pain and physical performance showed positive significant development and improvement. The changes in the use of health care services and work absenteeism were minor or insignificant.	VOMR courses had a beneficial effect on physical performance and subjective pain caused by neck and back musculoskeletal diseases of farmers, loggers, police officers and hairdressers within 1 1/2 years of follow-up, but VOMR courses did not decrease the use of health care services.
Badii et al., 2006, Canada	An integrated workplace-based program to reduce musculoskeletal injuries (MSIs): effectiveness	Time-loss (TL) MSIs increased at the intervention site during the intervention year. However, the program returned injured employees back to work in a shorter time and, compared with average historical data, reduced compensation costs and health care costs associated with TL MSIs during the first year.	The findings that MSI-associated TL and compensation costs were significantly lower during the program illustrate the effectiveness of this program and demonstrate that increased reporting of MSIs need not be associated with increased claims costs.
Bunn et al., 2006, USA	A workplace-based musculoskeletal disability management program aimed at reducing musculoskeletal disability-related absenteeism in a large manufacturing company, consisting of staged communication and educational	Overall productivity improved by a mean of 12.5 days per injured employee. Mean days lost per work-related injury decreased from 35.1 to 27.6. Number of light-duty days increased from 6.1 to 11.1 per work-related injury. Mean annual indemnity per work-related injury decreased	This intervention was associated with reduced musculoskeletal disability-related absenteeism and increased productivity. The program reduced medical costs per work-related injury and improved the company's communications and relationship with local physicians.

	interventions targeting physicians: impact on medical costs and productivity	from $9,327 to $4,493; mean annual medical costs per work-related injury decreased from $4,848 to $2,679. The annual incidence of musculoskeletal injuries declined by up to 50%.	
Davis et al., 2004, Canada	A prevention and early active RTW safely program aimed at preventing disability from occupational musculoskeletal injuries in an urban, acute and tertiary care hospital, combining primary prevention and on-site early intervention: time to return to regular duties	Although there was no reduction in incidence, the program was effective in returning injured employees to work more promptly for registered nurses and health science professionals (therapists, technicians), but not for facility support staff.	Overall savings in time loss and compensation payments were realized. However, better integration of prevention and follow-up efforts is needed, and greater attention to the socio-political environment is required to improve outcomes for facility support staff.
Evans et al., 2001, USA	Recurrent disabling work-related spinal disorders after prior injury claims in a chronic low back pain population	One year after completing the rehabilitation, patients with previous recurrent injuries responded to rehabilitation at a level equivalent to the patients without recurrent injuries.	The results of this study indicate that, although patients with recurrent injuries evidence differences in demographic, psychosocial and work history/adjustment differences when compared with patients with non-recurrent injuries, their one-year outcomes after tertiary, medically directed rehabilitation are identical. Both groups demonstrate very low rates of further work-related injuries through the first post-treatment year. Patients with recurrent injuries appear to develop skills in dealing with the workers' compensation system with a familiarity not seen in patients with non-recurrent injuries.
Fleten and Johnsen, 2006, Norway	Minimal postal intervention comprising sending of a general information letter and a questionnaire to sick-listed persons as their sick leave passed 14 days	The overall reduction of 8.3 calendar days in mean length of sick leaves in the intervention group compared to controls was not statistically significant. However, intervention significantly reduced length of sick leaves in subgroups with mental disorders, and with rheumatic disorders and arthritis, and overall for sick leaves lasting 12 weeks or more. Young people with LBP showed an adverse response to intervention. The overall relative risk of receiving benefits due to sickness after one year in the intervention group was 0.69 compared to controls.	The results should encourage employers, insurance institutions, and authorities to initiate challenges such as questions on the length of sick leave and possible modified work measures, during the first few weeks of sick leave, for at least some groups of sick-listed persons.
Haahr and Andersen, 2003,	Minimal intervention by occupational specialists involving information about the disorder, encouragement to stay active	After one year, 83% of cases showed improvement in the condition, but the intervention was found to have had no	Poor prognosis at one year follow-up for lateral epicondylitis was related to manual work and high baseline pain, while no relation was found

Denmark	and instruction in graded self-performed exercises for patients with lateral epicondylitis	advantage. Poor overall improvement was associated with employment in manual jobs, a high level of physical strain at work and a high level of pain at work. Pain reduction less than 50% was associated with manual jobs, high physical strain at work, high baseline distress and tennis elbow on the dominant side. The intervention group received less treatment and fewer treatment modalities, but the intervention was not followed by a reduction in the number of visits to general practitioners and physiotherapist clinics during 12 months of follow-up.	between the type of medical treatment given/chosen and prognosis. This may have implications for the future management of lateral epicondylitis in terms of a greater focus on interaction with the workplace regarding job modification to reduce physical demands during recovery.
Hagen et al., 2000, Norway	A light mobilization program for patients with subacute LBP	At 12-month follow-up assessment, 68.4% of workers in the intervention group had returned to full-duty work, as compared with 56.4% in the control group.	Early intervention with examination, information, and recommendations to stay active showed significant effects in reducing sick leave for patients with LBP.
Hunter et al., 2006, UK	A functional restoration program for workers with chronic LBP	Overall, there were significant improvements in psychological status, perceived pain, disability and work capability. Improvements were sustained for 24 months. Sickness absence and the need for post-treatment work restrictions decreased. The numbers of ill-health retirements and compensation claims for LBP were reduced.	The findings support the effectiveness of a tertiary intervention functional restoration program for workers with persistent LBP.
Jensen et al., 2005, Sweden	A behavioural medicine rehabilitation program for back and neck pain	The results consistently showed the full-time behavioural medicine program to be superior to the three other programs. The strongest effect was found on females. Regarding sick leave, the mean difference in the per-protocol analysis between the BM program and the control group was 201 days, thus reducing sick leave by about two-thirds of a working year. Rehabilitating women has a substantial impact on costs for production losses, whereas rehabilitating men seems to be pointless with no significant effect on either health or costs.	A full-time behavioural medicine program is a cost-effective method for improving health and increasing RTW in women working in blue-collar or service/care occupations and suffering from back/neck pain.
Kenny, 2000, Australia	Supervised physical activity programs for long-term (>6 months) injured workers	There was a 15% dropout rate and 49% of completers improved their work status by the end of the program. Those workers who were employed, referred by sources other than	

		rehabilitation providers, such as doctors, employers or insurers, did not have a diagnosis including intervertebral pathology and who began their programs within six months of injury were more likely to have improved their work status by the conclusion of the program.	
Lemstra and Olszynski, 2003, Canada	Occupational intervention, early intervention, and standard care in the management of Worker's Compensation injury claims	Standard care resulted in lower injury claim incidence, duration, and costs than early intervention, whereas occupational management resulted in lower injury claim incidence, duration, and costs than standard care.	It is recommended that an occupational management approach, rather than standard care or early intervention, be considered for management of occupational injuries.
Li et al., 2004, USA	Mechanical patient lifts to reduce musculoskeletal symptoms and injuries among health care workers	Statistically significant improvements in musculoskeletal comfort were reported for all body parts, including shoulders, lower back, and knees. Injury rates decreased post-intervention, with a relative risk of 0.37; decreased injury rates persisted after adjustment for temporal trends in injury rates in non-intervention units of the study hospital (RR=0.50). Adjusted lost-day injury rates also decreased (RR=0.35). Annual workers' compensation costs averaged $484 per full-time equivalent (FTE) pre-intervention and $151 per FTE post-intervention.	Reductions were observed in injury rates, lost workday injury rates, workers' compensation costs, and musculoskeletal symptoms after deployment of mechanical patient lifts.
Lincoln et al., 2002, USA	A two-day training program for nurse case managers designed to facilitate the implementation of workplace accommodations within a workers' compensation health care delivery system	Overall, 208 accommodations were recommended and 155 of these were implemented (75%). Claimants of trained nurses received 1.5 times as many recommendations for accommodations as claimants managed by nurses not trained in the process, and 1.4 times as many accommodations were implemented, although no differences in implementation rates were found between the two groups. Trained nurses were more likely to recommend accommodations addressing workstation layout, computer-related improvements, furnishings, accessories, and lifting/carrying aids, whereas the untrained nurses were more likely to suggest light duty and lifting restrictions.	This study indicates that the training was associated with a change in the practice behaviour of case managers regarding the workplace accommodation process.
Linton and Nordin,	A cognitive behavioural intervention for back pain	The cognitive behavioural group had significantly less pain, was more active, enjoyed	A cognitive-behavioural group intervention produces long-term health and economic

2006, Sweden		better quality of life, and had better general health relative to the information comparison group. There was no difference in health care use. The risk of long-term sick leave was three times higher in the information comparison group. The cognitive behavioural group had significantly less lost-productivity costs and a lower total cost/per person (16,514 Swedish kronor) compared to the information comparison group (45,990 Swedish kronor).	benefits. Usual medical care might be improved considerably by implementing these psychological methods.
Loisel et al., 2002, Canada	The Sherbrooke model of management of subacute occupational back pain, combining an occupational and a clinical rehabilitation intervention	At the mean follow-up of 6.4 years, all experimental study arms showed a trend towards cost benefit and cost effectiveness. These results were attributable to a small number of very costly cases. The greatest reduction in number of benefit days occurred in the Sherbrooke model arm.	A fully integrated disability prevention model for occupational back pain appeared to be cost beneficial for the workers' compensation board and to reduce the number of benefit days paid more than did usual care or partial interventions. A limited number of cases were responsible for most of the long-term disability costs, concurring with findings in occupational back pain epidemiology.
Pransky et al., 2001, USA	A pilot training program delivered to supervisors	The post-intervention results demonstrated significant decreases in supervisors (1) blaming employees for their injury, (2) not taking the condition seriously, and (3) discouraging the workers from filing a claim. Positive trends in confidentiality of discussions, access to medical care, and accommodation and work modifications were noted.	Rehabilitation professionals may be able to improve disability management practices and accommodations ability through employer education, especially when training is directed toward front-line supervisors.
Shaw et al., 2001, USA	A two-day training seminar to help nurse case managers identify ergonomic risk factors, provide accommodation, and conduct problem-solving skills training with workers' compensation claimants recovering from work-related upper extremity disorders	Results indicate moderate to high self-ratings of confidence about performing ergonomic assessments (mean=7.5 of 10) and about providing problem-solving skills training (mean=7.2 of 10) after the seminar.	The training format was suitable to experienced case managers and generated a moderate to high level of confidence about using this case management approach.
Shaw et al., 2003, USA	An integrated case management program for nurse case managers, focusing on problem-solving skills training and workplace accommodation of workers with work-related upper extremity disorders	Compared with case managers who did not receive the training, workshop participants identified more barriers related to signs and symptoms, work environment, functional limitations, and coping, but not to medical care.	Problem-solving skills training may help focus case management services on the most salient recovery factors affecting RTW.

Shaw et al., 2006, USA	A four-hour supervisor training workshop emphasizing communication skills and ergonomic accommodation to optimize response to injury in the food-processing industry	Workers' compensation claims data in the seven months before and after the workshop showed a 47% reduction in new claims and an 18% reduction in active lost-time claims versus 27% and 7%, respectively, in the control group.	Improving the response of frontline supervisors to employees' work-related health and safety concerns may produce sustainable reductions in injury claims and disability costs.
Storro et al., 2004, Norway	A multidisciplinary rehabilitation program for chronic low back, neck or shoulder pain	There was a significant treatment difference in proportion of workers taken off the sick list after 12 months (intervention group: 78.5%; control group: 50.5%). The difference was greater among LBP patients than among patients with neck-shoulder and LBP with radiating extremity pain.	Long-term effects of active multidisciplinary treatment were superior to treatment as usual in all diagnostic groups.
Sullivan et al., 2005, Canada	A community-based psychosocial intervention for work-related MSDs	63.7% of participants returned to work within four weeks of treatment termination. Reductions in catastrophizing (32%), depression (26%), fear of movement/re-injury (11%), and perceived disability (26%) were observed from pre-treatment to post-treatment. Elevated pre-treatment scores on fear of movement and re-injury and pain severity were associated with a lower probability of RTW. Reductions in pain catastrophizing were significant predictors of RTW.	The results of the present study provide further evidence that risk factor reduction can impact positively on short term RTW outcomes. Outcomes of rehabilitation programs for work disability might be improved by incorporating interventions that specifically target catastrophic thinking. Community-based models of psychosocial intervention might represent a viable approach to the management of work disability associated with MSDs.
Taylor et al., 2001, New Zealand	A comprehensive, interdisciplinary rehabilitation program for accident compensation claimants with disabling musculoskeletal pain	At five months, a vocational success was achieved in 75% of cases: working full-time (47%), part-time (12%) or actively looking for work (16%). Of those back at work, 48% went back to the same job, 7% went back to the same job but with a different employer and 15% went to a different job that used the same skills. Duration of work disability was the major predictor of vocational success.	Despite the uncontrolled nature of these results, it is likely that the rehabilitation program had a significant impact in getting compensation claimants back to work. Only a minority required substantive retraining and early intervention was associated with a better outcome.

APPENDIX 9

Summary of articles evaluating strategies/policies

Study	Description of strategy or policy: aspects evaluated	Results	Conclusions
Aakvik et al., 2003, Norway	Low-key social insurance reform in Norway to promote outpatient multidisciplinary treatment: average treatment effect, average effect of treatment on the treated, and distribution of treatment effects for multidisciplinary outpatient treatment	Distance to the nearest hospital was used as an instrument in estimating the different treatment effects. A positive effect of treatment of around six percentage points on the probability of leaving the sickness benefits scheme was found.	Sound arguments for expanding the multidisciplinary outpatient program for treating BP patients.
Arnetz et al., 2003, Sweden	Early workplace intervention based on a more proactive role for insurance case managers and workplace ergonomics interventions for employees with musculoskeletal-related absenteeism versus traditional case management: effects on sickness absenteeism	For the entire 12-month period, the total mean number of sick days for the intervention group was 144.9 days/person as compared to 197.9 days in the reference group. Compared with the reference group, employees in the intervention group significantly more often received a complete rehabilitation investigation (84% versus 27%). The time for doing this was reduced by half (59.4 days versus 126.8). The odds ratio for RTW was 2.5 (intervention versus reference group). Direct cost savings were USD$1,195 per case, yielding a direct benefit-to-cost ratio of 6.8.	Suggested that the management of MSDs should focus to a greater degree on early RTW and building on functional capacity and employee ability. Allowing the case managers a more active role, as well as involving an ergonomist in workplace adaptation meetings, might also be beneficial.
Becker et al., 2006, France	Occupational retraining of insured workers with chronic low back pain (LBP) benefiting from a Commission technique d'orientation et de reclassement professionnel (COTOREP) agreement: characteristics, management, outcomes and cost	LBP patients managed: male, young, low educational and occupational levels, off work and suffering from incapacitating low back pathology. Of 32 patients who took occupational retraining, 24 passed their examination, only 10 found jobs, of whom eight found jobs corresponding to the training taken. Similar return-to-work rates for graduates (10/24) and the other low back pain patients (11/24). Overall health insurance cost ranged from $25,000 (day school attendees) to $39,000 (residents).	Given the low added value observed of the occupational retraining, it would appear preferable to keep chronic LBP workers on the job while working to restore their spinal health, adjusting their work stations, and, above all, managing their fears and beliefs regarding the LBP-work combination.

Dasinger et al., 2001, USA	Doctor proactive communication about the workplace and RTW after an occupational injury: effect on duration of disability	Although doctor proactive communication was associated with a greater likelihood of RTW during the acute phase (<30 days of disability), this effect disappeared when injury and workload characteristics were taken into account. A positive RTW recommendation was associated with about a 60% higher RTW rate during the subacute/chronic phase (>30 days of disability) only. Prospective studies are needed to confirm this effect.	Prospective studies are needed to confirm this effect. The impact of physician communication on RTW is largely confounded by injury and workplace factors.
Eden et al., 2006, Sweden	A new law in Sweden on "resting disability pension" that allows disability pensioners to go back to work without jeopardizing their benefits: identification of variables related to RTW during 2000 by means of this legislation among disability pensioners with MSDs	Individuals in the study group, when compared to a control group, had more often been disability pensioners for several years, had additional education, estimated their previous job to have been physically strenuous to a lesser degree, were more satisfied with the treatment at the social insurance office and had a more positive self-image.	This study shows that it may be meaningful to continue/resume rehabilitation efforts and to try to motivate an individual suffering from a MSD to RTW even after several years as a disability pensioner.
Franche et al., 2007, Canada	Early workplace-based RTW strategies including work accommodation and advice from health care provider: impact on work absence duration	Work accommodation offers and acceptance, and advice from the health care provider (HCP) to the workplace on re-injury prevention were significant predictors of shorter work absence duration indexed by both self-report and administrative data. Receiving an ergonomic work site visit was a significant predictor of shorter work absence duration with workers receiving benefits only.	Analyses using administrative and self-reported indices of work absence generally converged. Work accommodation and targeted HCP communication with the workplace are critical for effective early RTW interventions.
Fritz et al., 2007, USA	Adherence to guideline recommendation for active versus passive treatments by physical therapists: association with clinical outcomes and costs for patients with acute LBP receiving physical therapy	Patients receiving adherent care had fewer visits and lower charges, and showed more improvement in disability (adjusted mean difference for percentage improvement 25.8) and pain (adjusted mean difference for percentage improvement 22.4%). Patients receiving adherent care were more likely to have a successful physical therapy outcome (64.7% vs 36.5%).	Adherence to the guideline recommendation for active care was associated with better clinical outcomes and reduced cost.
Hultberg et al., 2005, Sweden	Co-financed collaboration between personnel from primary care, social insurance and social services in the rehabilitation of people with MSDs: effect on patient status	Research has shown positive results from co-financed collaboration between staff and organization.	Although research has shown positive results from co-financed collaboration between staff and their organization, this study did not find that this new interdisciplinary team structure gave a better patient health outcome than conventional care.

Hultberg et al., 2006, Sweden	Co-financing model for collaborative rehabilitation between primary health care, sickness insurance offices and social welfare offices: effects on reducing sick leave among persons with MSDs compared to health centres with conventional rehabilitation	The intervention group had an average of 94 days and the controls, 87 days, on sick leave during the 12-month period after inclusion in the study. At 12 months the proportion of patients sick-listed was 31% in the intervention group and 32% in the control group.	The study could not show that the co-financing model reduced the number of sick-leave days among patients with MSDs. A possible explanation might be that the working procedure had in fact not really been changed and the tool mix lacked solid evidence.
Kosny et al., 2006, Canada	Early, proactive health care provider (HCP) communication with the patient and workplace: association between RTW approximately one month post-injury	The HCP giving a patient a RTW date and guidance on how to prevent recurrence and re-injury was positively associated with an early RTW. Contact by the HCP with the workplace was associated with RTW; however, this association became weaker upon adjusting for confounding variables.	This study lends support to the HCP playing an active role early in the RTW process, one that includes direct contact with the workplace and proactive communication with the patient.
McGuirk and Bogduk, 2007, Australia	Evidence-based care for acute LBP: efficacy in patients eligible for workers' compensation	Evidence-based care was accepted by 65% of injured workers. Compared with those who elected usual care, these workers had less time off work, spent less time on modified duties and had fewer recurrences. A significantly greater proportion (70%) resumed normal duties immediately, and fewer developed chronic pain, than those managed under usual care. Three types of patients were identified: those who complied readily with evidence-based care, those who initially expressed firm beliefs about how they should be managed and those with occupational psychosocial factors.	Evidence-based care can be successful in retaining patients at work, reducing time off work or on modified duties and reducing recurrences and chronicity. The gains are achieved by conscientiously talking to the patients, and not by any particular or special passive interventions.
Sadi et al., 2007, Canada	On-site physiotherapy services in an automotive plant: rate and distribution of treatment visits over a 13-year period	Disorders most commonly affect shoulder, lumbar, and cervical regions; median number of visits for these was seven, six, and five respectively. Elbow disorders occur commonly only for work-related complaints and required a median of eight visits. Rate of utilization was higher for women, with 47% of the plant's female workers attending physiotherapy in one year. Women had higher rates of cervical spine (12 vs 22%) and wrist (5 vs 10%) disorders. The two most common causes of injury reported by workers with an industrial injury were "frank injury arising out of normal employment" (51%) and "gradual onset/no frank injury" (37%). The diagnosis most often reported	On-site physiotherapy services can provide early, cost-effective management of work-related MSDs (WRMSDs) in the automotive sector. Service utilization reflects the influence of gender, job task, and shift-dynamics on rates and location of WRMSDs.

		by the physiotherapist after initial assessment was "strain," which was similar for both industrial (43%) and non-industrial (49%) injuries. The six main departments in this automotive plant account for 93% of all industrial injuries reported. Final Assembly accounted for the largest number and highest rate of injury, although shift variability was noted in utilization rates (13 vs 26%), despite the same tasks, shift schedules, and demographics.	
Scheel et al., 2002, Norway	Proactive versus passive implementation of active sick leave (ASL*) for LBP: effects of two strategies to increase the use of active sick leave	The median number of days on sick leave was similar in the proactive intervention group (70 days), the passive intervention group (68 days), and the control group (71 days). The proportion of patients returning to work before 50 weeks was also similar in the proactive (89%), passive (89.5%), and control groups (89.1%).	It is not likely that efforts to increase the use of ASL will result in measurable economic benefits or improved health outcomes at the population level. The benefits of ASL for individual patients with LBP are not known.
Scheel et al., 2002, Norway	A proactive versus passive implementation strategy to improve active sick leave (ASL) use in patients with LBP: effectiveness of the two strategies	ASL was used significantly more in the proactive intervention municipalities (17.7%) compared with the passive intervention and control municipalities (11.5%).	Passive intervention that addressed identified barriers to the use of ASL did not increase its use. Although modest, a proactive intervention did increase its use. The main impact of the intervention was through direct contact and motivating telephone calls to patients. To the extent that general practitioners' practice was changed, it was either patient mediated or effected by patients bypassing their general practitioner.
Waddell et al., 2007, UK	Working Backs Scotland: a public and professional health education campaign for back pain; effects on change of public beliefs about the management of back pain	Significant change in the balance of beliefs (from 55% rest versus 40% staying active to about 30% rest versus 60% staying active), occurred within the first month following the launch, maintained at three years. Comparable change in professional advice. No change in advice about work or the number who said they stayed off work. No effect on sickness absence or new awards of social security benefits for back pain.	A major shift was noted in public beliefs and professional advice, but no change in work-related outcomes.

Legend: *ASL – option provided by the Norwegian National Insurance Administration that enables employees to return to modified duties at the workplace with 100% of normal wages).

APPENDIX 10

Summary of articles evaluating clinical treatment efficacy

Study	Description of the treatment	Results	Conclusions
Berger, 2000, Canada	Lumbar spinal surgery: late outcomes	71% of the single operation group had not returned to work more than four years after the operation, and 95% of the multiple operations group. In none of these cases was there a neurological deficit that precluded gainful employment, the failure to RTW being blamed on chronic postoperative pain.	Although motivational (i.e., psychosocial) factors undoubtedly play a role in failure to RTW, the role of chronic pain cannot be ignored. Increased attention must be devoted to ascertaining the aetiology of this pain and ways to prevent it.
Hemmila, 2002, Finland	Physiotherapy, bone setting, and light exercise therapy: therapy use, societal costs, and quality of life of patients with prolonged back pain	One year before enrolment, 1/3 of the patients had consulted primary care; 1/2 of them had had some therapy: mainly massage, physiotherapy, naprapathy, or bone setting. 1/3 of the direct costs were spent on complementary therapies and another 1/3 on rehabilitation. Sick leaves accounted for 55% of the total costs (USD$1,029). The mean total costs slightly increased after the randomized therapies (USD$1,306). The costs of ambulatory care, with the study therapies included, were similar, whereas physiotherapy seemed the cheapest (USD$621) and bone setting the most expensive (USD$2,072) alternative in view of the total costs. More Nottingham Health Profile subscales were improved by physiotherapy and bone setting than by exercise.	A third of the direct back pain costs were spent on complementary therapies. The use of health care services and absenteeism tended to decrease after a course of physiotherapy. Physiotherapy and bone setting seemed able to improve the quality of life of patients with prolonged back pain.
Hodges et al., 2001, USA	Lumbar spine surgery: influence of various factors on the outcomes in terms of pain relief, functional status, RTW, and general health	The type of surgery performed significantly affected patient outcomes, while such factors as gender, age, smoking, and litigation were insignificant. Microdiskectomy patients, for example, had greater reduction in pain and disability than did fusion patients. RTW status was negatively affected by fusion. Overall, 55% of patients did RTW in some capacity, but the rate was 72% for microdiskectomy patients versus 43% for fusion patients. While outcomes significantly improved, postoperative scores remained severe.	

		This did not correlate with return-to-work rates, suggesting that outcomes measures may not be effective.	
Kool et al., 2007, Switzerland	Function-centered treatment (FCT) and pain-centered treatment (PCT): comparison of the effect on the number of work days, permanent disability, and the unemployment rate	After one year, the FCT group had significantly more work days (mean, 118) than the PCT group (mean, 74). The odds ratio of returning to work in the FCT group relative to the PCT group was 2.1. The differences in unemployment rates and in the numbers of patients receiving compensation for permanent disability were not significant.	FCT is more effective than PCT for increasing work days.
Lyall et al., 2002, USA	Conservative treatment followed by surgery versus surgery only: which treatment protocol is most effective to return workers' compensation patients with carpal tunnel syndrome (CTS) to their original jobs	A significant relationship between type of treatment and RTW was found. Of the 31 patients who received only surgical treatment, 83.9% returned to original employment. Of the 27 patients who received both conservative and surgical treatment, 59.1% returned to their original employment.	Although this study involves a small sample size, the findings suggest that conservative treatment alone is not effective in returning workers' compensation patients with CTS to work.
Maghout et al., 2006, USA	Lumbar fusion: influence of lumbar intervertebral fusion devices on clinical and disability outcomes among Washington State compensated workers with chronic back pain	Among the 1,950 eligible subjects, fusions with cages increased from 3.6% in 1996 to 58.1% in 2001. The overall disability rate at two years after fusion was 63.9%, the reoperation rate was 22.1%, and the rate for other complications, 11.8%. Use of cages or instrumentation was associated with increased complication risk compared with bone-only fusions without improving disability or reoperation rates. Legal, work-related, and psychological factors predicted worse disability. Discography and multilevel fusions predicted greater reoperation risk. Degenerative disc disease and concurrent decompression procedures predicted lower reoperation risk.	Use of intervertebral fusion devices rose rapidly after their introduction in 1996. This increased use was associated with an increased complication risk without improving disability or reoperation rates.
Mayer et al., 2002, USA	Combination of anterior cervical fusion (ACF) plus functional restoration, versus rehabilitation alone: comparison of objective demographic, physical and psychological measurements and socioeconomic outcomes of treatment in work-related disabling cervical pain	Although patients undergoing ACF (Group S) had lower work return and work retention outcomes, the differences were not significant. Group S patients had significantly more health utilization from a new provider in the year after completion of functional restoration (46% vs 24%). Group S patients were also more likely to be depressed, both at pre- and post-rehabilitation. There were no significant differences in recurrent injury,	Workers' compensation patients with chronic disabling work-related cervical spinal disorders who undergo a cervical fusion, combined with functional restoration, have socioeconomic outcomes after their surgery statistically similar to those for unoperated controls. Surgery patients had a higher rate of additional health-care-seeking behaviours from new providers and a greater likelihood of being clinically depressed before

		additional surgery, physical measures or pain/disability self-report between the groups.	and after rehabilitation. This study suggests that cervical fusion for degenerative disc disease in workers' compensation patients is not contraindicated, as long as interdisciplinary rehabilitation is available for complex cases after the surgical procedure.
Robertson and Jackson, 2004, New Zealand	Spinal fusion: effectiveness of the surgical procedure in terms of patient satisfaction, outcome scores, and third-party measures	Patient satisfaction was 71%; however, only 28.6% of patients followed achieved good or excellent low back outcome scores. Yet significant improvement occurred: 46.4% achieved a good or excellent outcome using the Prolo score. There was a 75% reduction in medication usage, and 75% of non-working compensation patients returned to gainful employment. Patient satisfaction was markedly higher than improvement measured by the outcome scores. Dramatic improvements in medication usage and RTW were achieved, despite less than spectacular outcome scores.	These findings support cautious use of posterior spinal fusion. Patients must appreciate improvement rather than normality as a realistic aim.
Shin et al., 2000, USA	Surgical versus non-surgical treatment of occupational carpal tunnel syndrome (CTS): comparison of the outcome with respect to disability and RTW status	Surgical release of the carpal tunnel was performed in 57% of patients and the other 43% were treated conservatively. Overall, 82% of patients returned to full work status, whereas 18% had duty modifications. Surgical treatment decreased the rate of duty modifications and disability ratings compared with non-surgical treatment and reduced the odds of incurring disability. Severity of CTS was also a significant factor affecting disability.	Despite the generally held belief that the outcome of treatment of occupational CTS is poor, the present study shows that both surgical and nonsurgical treatment is effective. However, patients treated with surgery had decreased disability when compared with those who were treated conservatively.
Wasiak and Pransky, 2007, USA	Surgical treatment versus endoscopic procedure: use and outcomes in community settings	Bivariate analyses of post-surgical outcomes demonstrated that post-surgical work disability was shorter for those with endoscopic procedures (median 27 vs 34 days). Medical costs following the procedure were also lower in the case of endoscopic procedure for those with any post-surgical medical costs (median $1,201 vs $1,717). However, controlling for jurisdiction and other factors, these differences disappeared, suggesting that in CTS the type of care received was not a major determinant of outcomes.	These findings reinforce the importance of community-based evaluations that include potential confounders to accurately evaluate the impact of medical technologies on work disability in occupational conditions.
Webster et al., 2004, USA	Lumbar intradiscal electrothermal therapy (IDET) procedure: outcomes	Mean duration of symptoms before IDET was 26 months. Mean follow-up duration after IDET was	The procedure may be less effective when performed by a variety of providers than

	of workers' compensation (WCB) claimants	22 months. 96 (68%) of the cases did not meet one or more of the published inclusion criteria. 78 cases (55%) received at least two narcotic prescriptions six months or more after IDET. 53 (37%) had at least one lumbar injection and 32 (23%) had lumbar surgery after IDET. A total of 55 (39%) were working at 24 months after IDET; of these, 28 (20%) were not working and 27 (19%) were working before IDET. Narcotic use after IDET was associated with narcotic use before IDET, the same provider performing discography and IDET (provider self-referral), and positive signs of radiculopathy. The need for invasive lumbar procedures after IDET was associated with provider self-referral, narcotic use before IDET, and older age. Continued work absence after IDET was associated with provider self-referral, male gender, litigation, narcotic use before IDET, and older age. Conformance with published selection criteria for IDET was not associated with provider self-referral or outcomes, nor was duration before IDET associated with outcomes.	suggested by initial case series performed by single providers or practices in work-related LBP cases. Provider self-referral and narcotic use before IDET are significant risk factors for poor outcomes. Randomized controlled trials are needed to determine whether there is a subset of patients with discogenic back pain who derive substantial and sustained benefit from this procedure.
Webster et al., 2007, USA	Early opioid use for acute LBP: association with disability duration, medical costs, subsequent surgery and late opioid use	21% of claimants received at least one early opioid prescription. Mean disability duration, mean medical costs, and risk of surgery and late opioid use increased monotonically with increasing morphine equivalent amount (MEA). Those who received more than 450 mg MEA were, on average, disabled 69 days longer than those who received no early opioids. Compared with the lowest MEA group (0 mg opioid), the risk for surgery was three times greater and the risk of receiving late opioids was six times greater in the highest MEA group. Low back injury severity was a strong predictor of all the outcomes.	Given the negative association between receipt of early opioids for acute LBP and outcomes, it is suggested that the use of opioids for the management of acute LBP may be counterproductive to recovery.

APPENDIX 11

Summary of articles focusing on views/experiences/practices of actors

Study	Methodological details	Issues related to the topic	Results/conclusions
Azoulay et al., 2005, Canada	Workers compensated for LBP within one week of referral to physical therapy (n=35)	Patient-physical therapist and patient-physician agreement on clinical management of LBP Patient perception of agreement between physical therapist and physician association between agreement and RTW and self-perceived disability	Patients who disagreed with their physician were less satisfied with their medical management, and catastrophized more about their pain than those who agreed. Disagreement was not associated with chronicity or disability.
Baril et al., 2003, Canada	Different actors involved in RTW programs in three Canadian provinces	Successful RTW strategies and barriers/facilitators in the RTW process Analyzing the underlying dynamics driving their different experiences	Several common themes emerged from the experiences related by the wide range of actors including the importance of trust, respect, communication and labour relations in the failure or success of RTW programs for injured workers.
Bishop and Wing, 2003, Canada	Family physicians in British Columbia (n=139)	Degree of compliance with acute LBP clinical practice guidelines of family physicians	Physicians demonstrated a high degree of compliance with the guideline-recommended history, examination procedures and medications, but low compliance with recommended imaging and many treatment recommendations. Recently published clinical practice guidelines regarding the management of patients with acute mechanical lower back pain have not been fully implemented into the patterns of practice of family physicians in B.C.
Brooker et al., 2001, Canada	Workers with soft-tissue injuries in Ontario (n=1,833)	Practical application of modified-work programs for workers with soft-tissue injuries	The fact of the worker merely being contacted by the workplace to check on how he/she was doing was not associated with reduced compensation benefit duration. Workplace offers of arrangements to help the worker RTW were associated with reduced compensation benefit duration but were not statistically associated with workers' pain grade.
Côté et al., 2001, Canada	Three focus-groups of *chiropractors* (n=8-11) in three large Canadian cities	Timely RTW in treating patients with MSD injuries by chiropractors, barriers/facilitators to successful RTW	The broad approaches described by the participating chiropractors to returning injured workers to work are consistent with those proposed in evidence-based practice guidelines. Better communication among chiropractors, medical doctors, and workers' compensation boards would likely decrease interprofessional tensions and improve the recovery of workers with musculoskeletal injuries.

Daniell et al., 2005, USA	WCB claims filed from 1990–1994, followed through 2000 (n=16,710)	Temporal trends, clinical practices, and treatment outcomes of work-related carpal tunnel syndrome (CTS)	Half of the claims were filed for conditions other than CTS, but were eventually identified to be or include CTS. The first CTS diagnosis occurred more than three months after claim filing in 20% of claims. The longer that the CTS diagnosis occurred after claim filing, the more likely that CTS was accompanied by other problems, and disability tended to be longer. Making an accurate diagnosis of CTS and initiating appropriate actions earlier than might otherwise occur could reduce the disability and costs in a large fraction of claims that are ultimately determined to involve CTS.
Fisher, 2003, USA	Safety professionals, supervisors and workers from manufacturing industry in central Kentucky	Differences between safety professionals' and supervisors' perceptions are factors that influence RTW after a MSD injury	Safety professionals' and supervisors' perceptions of the variables of job satisfaction, worker relationships and work environment differed from those of the workers. Their perceptions of the variable relating to company policies and procedures did not differ. In addition, the safety professional and supervisor groups rated the items addressing job satisfaction higher than did the worker group. The implications of this study for manufacturing companies suggest the importance of (a) identifying those issues contributing to employee job satisfaction, (b) developing a plan for achieving increased job satisfaction and employee recognition at the workplace among all workers, and (c) considering allowing employees to develop new capacities and new learning, thus fostering motivation and job satisfaction.
Hazard et al., 2000, USA	Four focus groups including health care practitioners, employers and case managers	Consensus among health care practitioners, employers and case managers regarding the need for information about the needs of people with acute and chronic back pain	While consensus was strong for most information items, there were apparent differences between the groups for several items relating to work resumption, medical attention, and legal or compensation consultation. Back-injured workers' perceptions of their educational needs may differ from those of their health care practitioners and from their employers or insurers. Future efforts to prevent back disability through education should include evaluation of the informational needs of injured workers.
Lippel K, 2003, Canada	WCB appeals tribunal decisions regarding compensation claims (n=314)	Impact of the misunderstanding of scientific data used to evaluate workers' compensation claims for work-related MSDs	Results indicate that women workers are significantly less likely than their male counterparts to have their occupational disease claims accepted by appeal tribunals. Evidence suggests that inappropriate overreliance on scientific studies for adjudication purposes contributes to a greater rate of

			refusal of claims by women workers
Loisel et al., 2005, Canada	Interdisciplinary team discussions of ongoing cases involving 22 workers absent from work	Obstacles/facilitators in the collaboration between an interdisciplinary work rehabilitation team and the stakeholders	Various factors influence collaboration between the rehabilitation team and the stakeholders. In general, stakeholder endorsement of the team's therapeutic principles and confidence in their approach emerged as particularly important factors. Diverse strategies, most often, education and awareness-raising, were used by the team to foster collaboration among the parties. The results may improve understanding of the actions taken by rehabilitation teams and help to optimize their practices.
Nicot and Nicot, 2006, France	Patients, attending physicians and consulting physicians	Understanding what sick leave signifies; identifying obstacles to RTW	Regarding an eventual return to work, 57% of the patients, 25% of the attending physicians and 28% of the consulting physicians respectively perceived the main objective of the treatment to be recovery. They envisaged a RTW (21%, 46% and 39% respectively), provided that adaptations were made to the working conditions A RTW in spite of pain was rarely envisaged (3%, 6% and 3% respectively). Rest was regarded as an essential component of treatment (54%, 67% and 70%). The RTW obstacles included pain (51%, 30% and 48% respectively), followed by impact on activities of daily living (42%, 40% and 19%). 7% of the patients feared the RTW due to having a high-risk occupation. It would appear feasible, within limits that have yet to be defined, to propose to LBP patients that they take part in the decision to RTW in spite of pain, and that they see it not as a sanction, but rather as a key part of their recovery, provided that sometimes-radical changes be made to their working conditions.
Roberts-Yates, 2003, Australia	Injured workers	Some practical considerations that need to be taken into account when workers are registered as claimants for workers' compensation	Workers reported a range of impediments experienced in the RTW process that created considerable stress and concern. These included the erratic payment of economic benefits, indifferent case managers, the management of the stigma associated with a registered WorkCover claim, a general lack of information, disrespectful communication from service providers, and a suspicious response to their injury by the employer, co-workers and some professional service providers. On this basis, some suggestions are made for improvements to practice.

Russell et al., 2005, Canada	Family physicians from London and surrounding communities in southwestern Ontario (n=10)	Experiences of family physicians in managing patients within the workers' compensation (WCB) system	Few participants enjoyed dealing with WCB problems. Despite the generally straightforward nature of most work-related musculoskeletal injuries, management had to take place within the perceived complexities of the RTW process. Suspicion, isolation, and frustration characterized experiences with care of persisting, ill-defined, or complex conditions. Challenged by lack of time, participants were wary when dealing with employers and especially concerned about patient confidentiality. Hence, workplace communication seldom extended beyond the use of standard WCB forms. While appreciative of the input of other professionals within the WCB system, family practitioners were suspicious of external influences on clinical decision making. Participants' perceived commitment to patients conflicted with insurer requirements for adherence to guidelines and pathways of care. Even when patient-doctor relationships were challenged by the effects of an injury, participants saw a clear advantage in maintaining these relationships as a base for future care. Our findings suggest that WCB authorities could benefit from a better understanding of the dynamics of contemporary family practice and particularly of time and cost barriers to workplace liaison. Communicating with employers would be less threatening if there were an explicit organizational strategy designed to allay family practitioners' anxieties about whether direct liaison with employers is inappropriate advocacy, a compromise to confidentiality, or good industrial practice.
Scheel et al., 2002, Norway	GPs (n=89), workplace representatives (n=102), local national insurance administration officers (n=22); workers (n=15) in three Norwegian counties	Barriers to the use of active sick leave (ASL) by the players required to carry out ASL	Among the barriers identified were lack of information, lack of time, and work flow barriers such as poor communication and coordination of activities between the players required to carry out ASL. Having all the players onside may be essential, but it is not sufficient to bring about action in workplace strategies for patients with LBP. If early return to modified work is effective, implementing it may require interventions targeted at identified barriers.
Schonstein and Kenny, 2000, Australia	Medical certificates of workers with compensable neck and back pain held by a workers'	Diagnostic descriptions and treatment recommendations for back and neck pain by physiotherapists; comparison with evidence-	The diagnoses most frequently given were "sprain/strain" and "pain/ache." Physiotherapy was the most frequently prescribed treatment, followed by rest and medication. Rest

	compensation insurer (n=251)	based guidelines	was prescribed for 27% workers, 87% of whom were classified as having an acute injury. Activity-based treatments were prescribed for 18% of the workers. Not all doctors used diagnostic terms consistent with recommended anatomical taxonomy. The drug therapy prescribed was consistent with current evidence-based treatment guidelines. However, the prescribing of rest, and the omission, in most cases, of explicit recommendations to resume normal activities, including work, are not consistent with current guidelines.
Schonstein et al., 2002, Australia	Consecutive treatment plans submitted to a large New South Wales WCB insurer, Australia (n=219)	Comparison of the physiotherapists' goals and the prognoses indicated in clinical practice guidelines provided by the WorkCover Authority of New South Wales	The back pain of most treated workers was classified as acute and the majority of PTs estimated that treatment would be of short duration, which is concordant with current treatment guidelines. However, most PTs did not provide precise, measurable or time-specific treatment goals, despite this being emphasized by WorkCover.
Stikeleather, 2004, USA	Older workers with sustained work-related musculoskeletal injuries (n=4)	Role of employer support and degree of flexibility in work in workers' decision to either "push self" to meet their pre-injury work demands, or "protect self" and accept a job post-injury that was less physically demanding, but was at a lower pay level	Degree of employer support in providing flexibility in work demands varied, where low support and inflexibility in job tasks contributed to difficulty in returning to work or in sustaining the work demands of the job.
Wind et al., 2006, Netherlands	RTW case managers (n=21) and disability claims experts (n=29)	Utility (arguments in favour of and against functional capacity evaluation (FCE)) by RTW case managers for RTW and disability claim assessment purposes	The mean valuation of FCE by RTW case managers was 6.5 on a 0-10 scale. The average valuation for DC experts was 4.8. Arguments in favour of FCE were (1) its ability to confirm own opinions and (2) the objectivity of its measurement method. Arguments against FCE were (1) the redundancy of the information it provides and (2) the lack of objectivity. Indications for FCE were MSDs, a positive patient self-perception of ability to work, and the presence of an actual job. Contraindications for FCE were medically unexplained disorders, a negative patient self-perception of ability to work, and the existence of disputes and legal procedures.

APPENDIX 12

Summary of articles comparing WC systems, jurisdictions, and countries

Study	Methodological details	Results	Conclusions
Ahlgren et al., 2004, Sweden	Measures and outcomes of vocational rehabilitation at six local national insurance offices in the same county in Sweden	Great differences in sickness allowance, incapacity rate, selected rehabilitation measures and work resumption. The percentage of sick-listed people who received any rehabilitation measure ranged from 1.2% to 8.7%. Outcomes varied from office B, which reported 58% fully fit after completed planned rehabilitation, to office C, which reported only 24% fully fit.	Clear differences in outcome between the offices indicate that various rehabilitation measures differ in effectiveness. The 'investigation of working ability' rehabilitation measure was not linked to any great proportion of people resuming work, but showed a greater correspondence to full disability pension. Large differences were observed in social and demographic factors in the different municipalities. The effect of these on the rehabilitation process requires further investigation.
Anema et al., 2004, Netherlands	Occurrence and effectiveness of ergonomic interventions on RTW in workers on sickness benefits with LBP from Denmark, Germany, Israel, Sweden, the Netherlands, and the United States	Ergonomic interventions varied considerably in occurrence between the national cohorts: 23.4% (mean) of the participants reported adaptation of the workplace, ranging from 15.0% to 30.5%. Adaptation of job tasks and of working hours was applied for 44.8% (range 41.0% to 59.2%) and 46.0% (range 19.9% to 62.9%) of the participants, respectively. Adaptation of the workplace was effective on return-to-work rate, with an adjusted hazard ratio (HR) of 1.47. Adaptation of job tasks and adaptation of working hours were effective on RTW after a period of more than 200 days of sick leave, with an adjusted HR of 1.78 and 1.41, respectively.	Results suggest that ergonomic interventions are effective on the RTW of workers who are long-term sick-listed due to LBP.

Bitar et al., 2002, USA	Role of socioeconomic factors and workers' compensation (WCB) in the cost, rehabilitation, and operative practices for carpal tunnel syndrome (CTS) in the United States and Sweden	The 123 patients were referred to three subgroups. Group A comprised patients from the University of Pittsburgh, US, with WCB (n=34), Group B comprised patients from the University of Pittsburgh without WCB (n=47), and Group C comprised patients from the University of Umea, Sweden (n=42). A tendency toward longer duration of postoperative sick leave was noted for those patients with WCB than for those without WCB. However, operating room times and operating times, operative cost, use of postoperative therapy, and duration of sick leave were substantially less for patients treated in Sweden. There was no statistically significant difference in time off work between Group A and Group B.	The results may indicate that the effect of compensation on a patient's ability or willingness to recover after treatment for CTS may be less important than factors that do not primarily relate to the patient or the surgical procedure.
Reneman et al., 2006, Netherlands	Performances on Functional Capacity Evaluations (FCE) in patients from the Netherlands, Canada, and Switzerland	Compared to the Dutch sample, the mean performance of patients in the Canadian and Swiss samples was consistently lower on all FCE items. This association remained statistically significant after controlling for potential confounders.	Considerable differences were observed between settings in maximum weight handled on the various FCE items. Future FCE research should examine the effects of a number of potentially influential factors, including variability in evaluator judgements across settings, evaluator-patient interaction and patients' expectations of the influence of FCE results on disability compensation.
Strunin and Boden, 2004, USA	Similarities and differences in how workers experience their interactions with the workers' compensation (WCB) systems in Florida and Wisconsin	Some interactions with the WCB were positive. However, the majority of respondents in both states experienced their encounters with the WCB system as cumbersome, frustrating, and demeaning.	Mistrust, stigmatization, payment delays, and refusal of insurer personnel to pay benefits contribute to workers' negative experiences with the WCB system. These insurer behaviours raise the costs to injured workers of WCB benefits and thus may reduce the propensity of eligible workers to apply for benefits.
Volinn et al., 2005, USA	Workers' compensation claim rates for back pain in Japan and the United States	The back pain claim rate in 1999 was 60 times higher in Washington State than in Japan. The disparity in rates for the other years in the study (1995–1998) was similar.	Back pain is common among workers both in Japan and the US, but there is no simple or necessary relationship between that symptom and how it manifests itself in one country or another. Rather, the symptom is protean in its social manifestations. As for what shapes those manifestations, or more specifically, what causes the startling disparity in back pain claim rates between Japan and the US, that remains a puzzle. Various solutions to the puzzle are discussed, but it remains essentially unsolved.

Wasiak et al., 2006, USA	Differences in surgical treatment for work-related carpal tunnel syndrome (CTS) between eight United States workers' compensation (WCB) jurisdictions	Among selected individuals (n=4,421), about 20% were treated using the endoscopic procedure; this percentage had a ten-fold variation across the eight jurisdictions. However, utilization of endoscopic release did not increase during the study period, despite reports of better RTW outcomes.	The highly jurisdictional nature of the US WCB system, with significant differences in reimbursement levels for endoscopic procedures, and geographical differences in medical training were among the potential contributors to the observed variation in utilization.
Wasiak and McNeely, 2006, USA	Differences in utilization and costs of chiropractic care for work-related low back injuries in seven workers' compensation jurisdictions	Utilization and costs varied significantly across the analyzed states. Restrictive payment policies were associated with lower costs of chiropractic care and a lower number of services per visit, but had no impact on visits or services per person.	Findings indicate necessary components of effective cost containment, even in the presence of utilization adjustment.

APPENDIX 13

Summary of articles evaluating the impact of WC status/type of insurance on the disability/RTW outcomes

Study	Details	Results	Conclusions
Atlas et al., 2000, USA	Effect of compensation on long-term outcomes for patients who have herniation of a lumbar disc and sciatica according to WC status at the time of the preoperative consultation	Patients receiving WCB at baseline were more likely to be young, male, and employed as labourers. They reported worse functional status; however, their clinical findings were similar to those for patients not receiving WC. Patients receiving WCB at baseline were more likely to be receiving disability benefits at the time of the four-year follow-up compared with those who had not (27% vs 7%). Operative management did not influence these comparisons, but decreased symptoms and improved functional status. Patients receiving WCB at baseline had significantly less relief from symptoms and improvement in quality of life than patients who had not been receiving WCB. WCB status at baseline was an independent predictor of whether the patient would be receiving disability benefits after four years but was not an independent predictor of whether the patient would be working on a job for pay at the time of the four-year follow-up.	Even after adjustment for the initial treatment of the sciatica and for other clinical factors, patients who had been receiving WC at baseline were more likely to be receiving disability benefits and were less likely to report relief from symptoms and improvement in quality of life at the time of the four-year follow-up than patients who had not been receiving WC at baseline. Nonetheless, most patients returned to work regardless of their initial disability status, and those who had been receiving WC at baseline were only slightly less likely to be working after four years. Whether or not they had been receiving WCB at baseline, patients who had been managed with an operation reported greater relief from symptoms and improvement in functional status at the time of the four-year follow-up compared with patients who had been managed non-operatively, even though the outcomes with regard to disability and work status in these two groups were comparable.
Atlas et al., 2006, USA	Long-term disability and health-related quality of life outcomes of individuals receiving or not receiving WCB at baseline evaluation	Baseline demographics, past back history, imaging findings, symptoms, functional status, and expectations significantly differed according to the patient's baseline WCB status. After five to ten years, most patients, regardless of baseline WCB status (yes or no), were not receiving disability compensation (83% vs 96%, respectively) and were employed (78% for both groups). However, WCB patients were significantly more likely to be receiving disability compensation and had worse symptoms, functional status, and satisfaction outcomes. Outcome differences diminished in magnitude after controlling for baseline differences among patients receiving	Long-term employment and disability outcomes were favourable for most patients with disc herniation, regardless of initial WCB status. However, individuals initially receiving WCB had worse disability and quality of life outcomes than individuals not receiving WCB. Despite these differences, long-term work outcomes were similarly favourable.

		WCB or not but continued to favour those not initially receiving WCB. Initial treatment received, either surgical or non-surgical, did not influence these findings.	
Balk et al., 2005, USA	Results of extensor origin release for lateral epicondylitis (tennis elbow) against WCB status	Pain relief, symptom recurrence, satisfaction with procedure outcome, and ability to RTW (same or similar job) were evaluated. Pain relief was reliably achieved in the WCB and non-WCB groups (36/37 and 24/26 elbows, respectively). Symptom recurrence was intermittent in both groups, and few patients sought medical intervention for recurrent symptoms. Patient satisfaction was high in the WCB and non-WCB groups (35/37 and 26/26 elbows, respectively). A majority of patients in both groups returned to work, but a significantly higher percentage of patients in the WCB group changed jobs because of persistent symptoms.	
Chaise et al., 2004, France	Connection between the type of patient insurance and the time taken to RTW after carpal tunnel surgery	For independent workers the average time off work is 17 days, for those in the private sector it is 35 days, and for civil servants it is 56 days. Patients with social security insurance were off work for 32 days and those with workers' compensation, for 49 days.	The comparison shows significant differences with regard to social security insurance: the RTW interval for civil servants is larger than for private sector workers, which in turn is larger than for independent workers. The difference between patients with workers' compensation and those with social security insurance is 17 days and significant. There is also a significant difference between manual and non-manual workers (both independent and private sector). There is no significant difference between the sub-groups of civil servants. These cross-references enable us to work out the influence that social security status has on the RTW time following surgery.
Goldberg et al., 2002, USA	Functional outcomes of anterior cervical discectomy and fusion in patients with and without a WCB claim; effect of compensation claim on clinical outcome	At follow-up, no discernible difference was noted for functional outcomes and fusion rate upon radiographic evaluation. In Group 1 (WCB), 97% of patients returned to work at an average of 18 weeks, whereas 98% of patients in Group 2 (non-WCB) returned to work at an average of 10 weeks postoperatively.	WCB claims did not adversely affect the functional outcome of anterior cervical discectomy and fusion. Patient selection is a critical factor in determining functional outcome, with 83% good to excellent results if the pathology, clinical presentation and radiographic findings correlate.

Hee et al., 2002, USA	Comparison of self-perceived health status of patients with neck pain receiving WCB, with that of patients not receiving WCB	Seven individual scores (except General Health) and two summary scores of the SF-36 were significantly lower in patients receiving WCB. WCB status was a significant predictor of lower SF-36 scores for Physical Functioning.	WCB status is associated with poorer physical functioning in patients presenting with neck pain. Another significant finding of the study is that confounding factors can exert major effects on the SF-36 scores obtained on normal validated instruments.
Hee et al., 2001, USA	Comparison of self-perceived health status of spinal disorder patients receiving WCB with those not receiving WCB	All eight individual scores and two summary scores on the SF-36 were significantly lower in patients receiving WCB. WCB status was a significant predictor of lower SF-36 scores for General Health, Physical Functioning, Role Physical, Social Functioning, and Mental Health.	WCB status is associated with poorer physical and mental health of patients with spinal disorders. Because the WCB group is younger, has a shorter duration of symptoms, and fewer comorbid medical problems, the lower SF-36 scores most likely reflect psychological factors and not ill health per se. The lower SF-36 scores may also reflect premorbid personality differences in the WCB patients, compared with those not receiving WCB. SF-36 is a validated tool that can be used to objectively identify the patient at risk for delayed recovery. Future treatment protocols should pay special attention to improving the health-related quality of life, especially general health and physical functioning of spinal patients receiving WCB.
Helfenstein and Feldman, 2000, Brazil	Experience with 103 patients referred to a Health Reference Center for Workers for the management of repetitive strain injury	From the total group, 73 fulfilled the American College of Rheumatology Criteria for the Classification of Fibromyalgia Syndrome. This means that they were suffering from pain above and below the diaphragm, far from the arm pain for which they were referred. These 73 patients were clinically and psychologically indistinguishable from 165 patients followed in our clinic at the Federal University of São Paulo, Rheumatology Division, who also fulfilled these criteria but did not consider their illness to be work-related.	This observation calls for longitudinal investigations that might offer insights as to whether the more global aspects of the illness are antecedent, coincident, or confounding aspects of the illness experience labelled repetitive strain injury or cumulative trauma disorder.
Koehoorn et al., 2006, Canada	Health care use, over and above WCB health care benefits, in workers with work-related MSDs	Work-related MSD injured workers had significantly higher rates of health care contacts associated with a claim compared to non-injured workers, over and above WCB health care benefits. A work-related MSD claim among injured workers was associated with an estimated 69% increase in health care use for	The pattern of visits for WRMSDs suggests that workers visit general practitioners as part of an ongoing pattern of symptoms, resulting in frequent utilization of health services prior to work disability that is also reflected in health care contacts after RTW.

		the 12-month period immediately after the injury date compared to non-injured workers.	
Lopez et al., 2000, USA	Clinical outcomes of two groups of patients depending on whether or not they were receiving WCB benefits	The two groups showed significantly different postoperative results in terms of pain, function, strength of forward flexion, and total score, with the WCB group consistently having a lower functional score. Pain did improve significantly for WCB patients over the course of treatment, but relief was not nearly as complete as in the non-WCB group. A positive response to a shoulder bursa steroid injection, even if temporary, was a good predictor of final outcome after an acromioplasty.	
Nicholson GP, 2003, USA	Comparison between WCB and non-WCB patients with subacromial impingement syndrome who were managed with arthroscopic acromioplasty	The mean outcome scores for the entire population showed significant improvement when the preoperative values were compared with the postoperative values. Postoperatively, there was no significant difference in the mean outcome scores between the WCB and non-WCB groups or between different work-demand levels. There was, however, a significant difference in the average time to return to full-duty work (13.7 weeks in the WCB group compared with 9.1 weeks in the non-WCB group), with the WCB group having relatively heavier work-demand levels. Intra-articular pathological findings did not affect the outcome scores, but pathological findings that changed treatment were associated with a longer time to RTW.	Arthroscopic acromioplasty consistently provided a good surgical outcome and the ability to RTW in both the WCB and non-WCB populations. The work-demand level had a direct effect on the time to return to full duty, regardless of WCB status. Patients, physicians, therapists, and employers may benefit from the knowledge of these expected outcomes and realistic time-frames for RTW.
Rasmussen et al., 2001, Denmark	Influence of the involvement of financial compensation on the results of physiotherapeutic McKenzie treatment of cervicobrachial pain	At follow-up, there was no improvement in the group of patients for whom financial compensation was involved, whereas the group for whom compensation was not involved showed highly significant improvement.	Despite uniform selection criteria and similarity of complaints and treatment protocols, the involvement of financial compensation seemed to be associated with an adverse effect on treatment results for patients with cervicobrachial pain who were treated conservatively.
Sallay et al., 2005, USA	Normative scores for the American Shoulder and Elbow Surgeons (ASES) questionnaire between subjects who have or not an active WCB claim with no known shoulder injury	There were no significant differences in the ASES scores between subject groups.	

Viola et al., 2000, USA	perceived shoulder function and health status in patients covered or not by WCB insurance	The results indicate that patients whose shoulder condition is covered by WCB have significantly lower self-assessed shoulder function and health status than do those patients whose shoulder conditions are not related to on-the-job injuries. The differences between the WCB and non-WCB groups could not be attributed to differences in age, sex, or diagnosis.
Yawn et al., 2001, USA	Comparison of the duration of preoperative symptoms and severity of nerve dysfunction among WCB and non-WCB recipients from a single community who had carpal tunnel releases	Duration of pre-operative symptoms was significantly longer for non-WCB patients than for WCB patients. A smaller proportion of WCB patients had severe electromyography (EMG) findings, and a larger portion had borderline EMG findings. People with work-related carpal tunnel syndrome (CTS) appear to receive surgical treatment for CTS earlier than people whose CTS is not related to work covered under WCB laws.

APPENDIX 14

Summary of articles focusing on the development or validation of assessment tools

Study	Methodological issues: tool(s)	Main results	Conclusions
Brouwer et al., 2003, Netherlands	Isernhagen Work System Functional Capacity Evaluation (IWS FCE): test-retest reliability in a sample of patients (n=30) suffering from chronic LBP and selected for rehabilitation treatment	Fifteen tests (79%) showed acceptable test-retest reliability based on Kappa values and percentage of absolute agreement. Eleven tests (61%) showed acceptable test-retest reliability based on Intra Class Correlations values.	Acceptable test-retest reliability of the Isernhagen Work System Functional Capacity Evaluation (IWS FCE).
Coutu et al., 2005, Canada	Quality of Life Systemic Inventory (QLSI): concurrent validity and responsiveness among workers on sick leave due to MSDs	There were significant correlations between QLSI scores and the Psychological Distress Index, with either the SF-12 mental component scale or the Roland-Morris Disability Questionnaire. All measures showed highly significant change over time.	Results support the concurrent validity and responsiveness of the QLSI, with a MSD population. The instrument could serve in future research as an outcome measurement instrument in the evaluation of more long-term effects of rehabilitation programs.
Dunstan et al., 2005, Australia	Orebro Musculoskeletal Pain Questionnaire (OMPQ): its usefulness to predict RTW outcomes following a compensable musculoskeletal injury	Total scores on the OMPQ were able to differentiate between work status on both occasions, indicating the potential predictive validity of this instrument.	This is the first study to evaluate the OMPQ in a compensable injury population, and although replication with a larger sample is required, the findings have significant relevance to the recommendation of routine screening for the early identification of injured workers at risk of long-term disability.
Forestier et al., 2007, France	Copenhagen Neck Functional Disability Scale (CNFDS): validation of the French version	CNFDS scores were normally distributed. CNFDS scores and their variations correlated well with the other efficacy criteria. CNFDS scores were less sensitive to change than the VAS pain scores and more sensitive to change than the other efficacy criteria.	The CNFDS holds promise as a tool for evaluating neck pain. Score reproducibility needs to be studied. The CNFDS can be added to the other instruments that have been translated in recent years to serve as tools for clinical research. However, the ease of completion of the CNFDS is consistent with use in clinical practice.
Franche et al., 2007, Canada	22-item scale assessing stage of readiness for RTW: development and validation	Confirmatory factor analyses had satisfactory fit indices to confirm the initial model. Concurrent validity of the scale was supported: relationships of readiness with depressive symptoms, fear-avoidance, pain, and general health, were generally in the hypothesized direction.	Psychometric properties of the newly developed instrument suggest that the application of the Readiness for Change model to RTW is relevant to work disability research. The instrument may facilitate the offer of stage-specific services tailored to injured workers' needs, and be used

			for evaluation of RTW interventions.
Gross and Battie, 2004, Canada	Isernhagen Work Systems' Functional Capacity Evaluation (FCE): ability to predict sustained recovery	Contrary to FCE theory, better FCE performance as indicated by a lower number of failed tasks was associated with higher risk of recurrence.	The validity of FCE's purported ability to identify claimants who are "safe" to RTW is suspect.
Gross and Battie, 2003, Canada	Kinesiophysical Functional Capacity Evaluation (FCE) administered within a worker's compensation context: construct validity	FCE performance was moderately correlated with the Pain Disability Index (PDI) and with the Pain Visual Analog Scale. Pain intensity was correlated highly with the PDI.	The moderate relationship between FCE and the PDI supports the construct validity of FCE as a functional measure. However, kinesiophysical FCE performance was not unrelated to pain severity ratings as purported.
Gross et al., 2006, Canada	Short-form FCE: development	The short-form FCE was found to predict comparably to the entire FCE protocol in two validation cohorts. Subjects meeting job demands on all three items consistently experienced faster benefit suspension.	A short-form FCE for determining future work status in claimants with low back disorders was developed. A substantially abbreviated FCE may offer an efficient alternative.
Gross et al., 2004, Canada	Isernhagen Work Systems Functional Capacity Evaluation (FCE): validity in predicting timely RTW	Few patients (4%) were found to pass all FCE tasks, yet most experienced total temporary disability suspension and claim closure within one year following FCE. Better FCE performance was related to faster time to suspension of total temporary disability benefits and claim closure after controlling confounding factors, but explained little of the variation in these outcomes (approximately 10%). Performance on the floor-to-waist lift was as predictive as the number of failed tasks in the entire FCE protocol.	Better performance on FCE was weakly associated with faster recovery; however, the amount of variation explained was small. Performance on the floor-to-waist lift was as predictive as the number of failed tasks in the entire FCE protocol.
Margison and French, 2007, Canada	Orebro Musculoskeletal Pain Questionnaire (OMPQ): predictive value of patient scores for clinical discharge status ('fit' vs 'not fit' for RTW) after a standardized 6-week physical therapy-based work conditioning program	The OMPQ was able to correctly predict the discharge status of 85% of claimants.	These results suggest that the OMPQ can facilitate clinical decision-making through early identification of individuals likely to fail a unidisciplinary physical therapy program and who may benefit from more complete biopsychosocial treatment.
Schultz et al., 2005, Canada	Psychosocial Risk for Occupational Disability Scale: predictive validity in the workers' compensation environment using a paper and pencil version of a previously	Stepwise backward elimination resulted in a model with these predictors: Expectations of Recovery, SF-36 Vitality, SF-36 Mental Health, and Waddell Symptoms. The correct classification of those workers who returned to work versus those who did	New evidence for predictive validity for the Psychosocial Risk-for-Disability Instrument was provided. The instrument can be useful and practical for prediction of RTW outcomes in the subacute stage after low back injury in the WCB

	validated multimethod instrument on a new, subacute sample of workers with LBP	not RTW (NRTW) was 79%, with sensitivity (NRTW) of 61% and specificity (RTW) of 89%.	context.
Tait and Chibnall, 2005, USA	Pain Disability Index (PDI): factor structure and effects of race and sex on the PDI	Results for the total sample and by race/sex group indicated support for a two-factor model of the PDI corresponding to voluntary activities (e.g., social, occupational, recreational) and obligatory activities (eg, activities of daily living, eating, sleeping). Additional psychometric analyses of the voluntary and obligatory subscales indicated adequate reliability and construct validity overall and in each of the race/sex groups. African Americans reported more pain-related disability on both subscales than whites. Women reported more disability on the voluntary subscale than men.	The results support use of the PDI as a bi-dimensional measure of pain-related disability, with strong psychometric properties. They also support its administration by telephone.
Turner et al., 2003, USA	Roland-Morris Disability Questionnaire (RDQ): comparison of the RDQ to widely used generic health status measures in terms of validity, reliability, responsiveness to change, and floor and ceiling effects, in a sample of workers with recent work-related back injuries	The RDQ demonstrated excellent internal consistency and validity through correlations with other measures of physical functioning, ability to discriminate between those working and those not working, and much more responsiveness to change than the Short-Form 12 and Short-Form 36 scales. However, 15% of the sample did not answer one or more RDQ items.	The RDQ is a valid measure of physical disability among workers with back injuries. Its greater responsiveness to change suggests its superiority to the Short-Form 12 or Short-Form 36 health status measures as an outcome measure in a workers' compensation back injury population.
Turner et al., 2004, USA	Pain intensity rating (0-10 scale): optimal cut-points for discriminating disability levels among individuals with work-related carpal tunnel syndrome (CTS) and low back (LB) injuries	In the CTS group, no pain intensity rating categorization scheme proved superior across all disability measures. For all disability measures examined, the relationship between pain intensity and disability level was linear in the CTS group, but nonlinear in the LB group. Among study participants with work-related back injuries, when pain level was 1-4, a decrease in pain of more than one-point corresponded to clinically meaningful improvement in functioning, but when pain was rated as 5-10, a two-point decrease was necessary for clinically meaningful improvement in functioning.	The findings indicate that classifying numerical pain ratings into categories corresponding to levels of disability may be useful in establishing treatment goals, but that classification schemes must be validated separately for different pain conditions.

APPENDIX 15

Summary of articles focusing on the consequences of disability for injured workers and their families

Study	Aspects evaluated	Results	Conclusions
Brown et al., 2007, Canada	Social and economic consequences	Lost-time workers (LTs) were more likely to move and collect income assistance benefits, and less likely to experience a relationship break-up than workers who did not lose time after their injuries (NLTs). LTs off work for 12 or more weeks were more likely to receive income assistance than LTs off for less time.	The increased risk suggests that the long-term economic consequences of disabling work injury may not be fully mitigated by workers compensation benefits.
Foley et al., 2007, USA	Post-claim earnings of carpal tunnel syndrome (CTS) claimants over a period of six years compared with earnings of claimants with either upper extremity fractures or dermatitis	CTS claimants recover to about half of their pre-injury earnings level relative to that of comparison groups after six years; they also endured periods on time-loss three times longer than claimants with upper extremity fractures. CTS surgery claimants had better outcomes than those who did not have surgery. Earnings recovery fractions among CTS claimants were better for workers who: (1) were younger; (2) had stable pre-claim employment; (3) lived in the Puget sound area; (4) worked for large businesses; (5) worked in non-construction/transportation industries; or (6) were in the higher pre-injury earnings categories. Cumulative excess loss of earnings of the 4,443 CTS claimants was $197 million to $382 million over 6 years, a loss of $45,000 to $89,000 per claimant.	This underscores the importance of prevention, early diagnosis, and accommodation for RTW.
Franche et al., 2006, Canada	Impact of work-related MSDs (WRMSDs) on workers' caregiving activities	Injured workers providing caregiving reported an average reduction in time spent in caregiving activities of 5.5 hour/week, eight months post-injury. The covariates were the mean number of caregiving hours, comorbidities, site of injury, and education. Independent of weekly hours of caregiving, decreases in caregiving hours were significantly higher if the worker was a woman or had not returned to work.	WRMSDs have a significant impact on workers' time spent in unpaid caregiving activities, an example of the social consequences of occupational injuries. Occupational and caregiving roles are limited by work-related disorders in a parallel fashion.
Keogh et al., 2000, USA	Health, functional and family outcomes of upper extremity cumulative trauma disorders (UECTD)	One to four years post-claim, respondents reported persistent symptoms severe enough to interfere with work (53%), home/recreation activities (64%) and sleep (44%). Only 64% of responses to the Activities of Daily Living scale items indicated "normal" function. Job loss was reported by 38% of	Work-related UECTDs result in persisting symptoms and difficulty in performing simple activities of daily living, impacting home life even more than work. Job loss, symptoms of depression, and family

		respondents, and depressive symptoms by 31%.	disruption were common.
Kim et al., 2005, Korea	Duration of treatment and the cost of work-related LBP	The mean and the median of the treatment duration are 252.6 days and 175 days. The mean and the median of the cost of total insurance benefit are 37,700,000 Korean won and 14,400,000 Korean won. The treatment duration of 51% of the study subjects was less than six months and their cost accounted for 10.2% of the total insurance benefit. The subjects who were treated for more than 24 months accounted for only 5.8% of the study subjects but for 29.2% of the costs. It was found that approximately 50% of the subjects who remained in treatment at the end of *n* months were off treatment at the end of *n* months.	This study presents the point in time when the LBP workers need to prepare to RTW by forecasting their off-treatment period. From the treatment duration and cost perspectives, this study may be utilized as evidence for active management of work-related LBP.
Manktelow et al., 2004, Canada	Workers' symptoms, functional disabilities, recreational difficulties, and work capability four years after treatment of CTS	75% of workers had surgery and on average returned to work three months later. Four years after treatment, 46% of workers experienced moderate to severe pain, 47% had moderate to severe numbness, and 40% had difficulty grasping and using small objects. Only 14% were symptom free. Successful RTW was considered to be a return to the same job with or without modifications, and it occurred in 64% of cases. Better clinical outcome scores were found to occur with surgery and abnormal nerve conduction study results. Worse clinical outcome scores were present with repeat surgery and surgical complications. Concurrent diagnoses of either tendonitis or epicondylitis also resulted in worse clinical outcome scores and worse RTW outcomes. The average total cost in Canadian dollars to the WSIB exceeded $13,700 per worker, for a total cost in excess of $13,200,000 per year. (In 1996, C$1 = USD$1.365.)	These outcomes indicate that Canadian workers have a large amount of permanent pain and suffering and a large loss of work productivity, and incur a considerable financial cost as a result of work-related CTS.
Pransky et al., 2000, USA	Outcomes in work-related upper extremity and low back injuries	Most (82.8%) were working at one year post-injury. Over 1/2 reported residual effects of the injury on work or activities of daily living. Many working subjects reported persistent injury-related anxiety and pain at the end of the work day, worse in those with LBP compared to those with upper extremity injuries. Almost 40% of those who returned to work suffered a re-injury. Forty-four percent of respondents suffered significant injury-related financial problems, which were worse in those who had been out of work for longer periods.	Occupational musculoskeletal injuries do result in significant, long-term adverse physical, economic, and psychological consequences, as demonstrated in self-reported surveys.

Roquelaure et al., 2004, France	Characteristics of musculoskeletal disorders (MSDs) and occupational status of workers having filed workers' compensation applications for a MSD, at time of application and two years later	Two years after applying for workers' compensation, 65% of the applicants had returned to their job in the same company, often with no ergonomic improvements, 12% had retired or voluntarily left the workforce, and 18% had been laid off. The risk of layoff was associated with three factors: being over 45 years of age, having two or more MSDs at the time of the application for compensation, and working in the cleaning activity sector.	
Wasiak et al., 2006, USA	Contribution of recurrences of low back pain (LBP) to total medical and indemnity costs; total duration of work disability	The rate of recurrent work disability was 17.2%, and the rate of recurrent care seeking was 33.9%. Individuals with recurrence had significantly higher total length of work disability, and higher medical and indemnity costs. For those with recurrent work disability, 69% of total lost time from work, 71% of associated indemnity costs, and 84% of total medical costs occurred during the recurrent period. For those with recurrence of care, the respective values were 48%, 47%, and 42%.	Recurrences contributed disproportionately to the total burden of work-related nonspecific LBP, through both additional care seeking and work disability. Results imply that those who have recurrences may be an especially important target for secondary prevention efforts.

APPENDIX 16

Main issues related to the trajectories of injured workers

Study	Methodological details	Results	Conclusions
Baldwin and Butler, 2006, USA	Post-injury employment patterns and RTW probabilities for workers with cumulative trauma disorders (CTD)	Most workers with CTD RTW at least once, but a first return does not necessarily mark the end of work disability. Among workers absent at least once, 26% with CTD report a second injury-related absence, compared to 18% with back pain and 12% with fractures. After five years, focusing on first returns underestimates work-loss days associated with CTD by 32%.	A substantial proportion of workers with CTD or work-related back pain experience injury-related absences after their first RTW. Focusing on the first RTW is misleading for both injury groups, but even more so for CTD, as these workers appear to be even more susceptible to multiple spells of work absence.
Bultmann et al., 2007, Denmark[6]	Health status and work limitations in injured workers with MSDs at one month post-injury and their RTW trajectories six months post-injury	One month post-injury, poor physical health, high levels of depressive symptoms and high work limitations are prevalent in workers, including in those with a sustained first RTW. Workers with a sustained first RTW report a better health status and fewer work limitations than those who experienced a recurrence of work absence or who never returned to work. Six months post-injury, the rate of recurrence of work absence in the trajectories of injured workers who have made at least one RTW attempt is high (38%), including the rate for workers with an initial sustained first RTW (27%).	RTW status-specific health outcomes are found in injured workers. A sustained first RTW is not equivalent to a complete recovery from MSDs.

[6] Study conducted in Ontario, Canada.

Chen et al., 2007, Canada	Back pain recovery patterns among workers with compensated occupational back injuries	Four pain recovery patterns identified: workers with high levels of pain intensity showing no improvement over time (43%); those experiencing recovery in the first four months with no further improvement or possibly some deterioration in the second half year (33%); those experiencing a slow consistent recovery but still with considerable back pain at the end of the follow-up (12%); and those quickly progressing to low level of pain or resolution (12%). Trajectories of average Roland-Morris Disability scores and SF-36 Role of Physical scores for above clusters mapped consistently with the corresponding patterns in pain. Individuals with fluctuating, recurrent pain patterns showed the shortest cumulative duration on 100% benefit and the earliest RTW among other clusters.	Patterns identified in the cohort of injured workers suggest inter-individual differences in back pain recovery. Results confirm that recurrent or chronic back pain is a typical condition in respondents with new back injuries. Pain intensity and disability scores are good measures of recovery of back pain at the individual level. Administrative measures of percentage of respondents back at work, or no longer on benefits, may not accurately reflect the individual's condition of back pain after RTW.
Fang et al., 2007, USA	Experiences of individuals with computer-related MSDs	74% filed for workers' compensation (WCB). 25% of all participants reported major financial difficulties after developing their MSD, though the majority filed for WCB. Despite filing for WCB, a large proportion relied partially on government, employer, or personal financial sources. 62% reported that overall satisfaction with the WCB insurer was poor.	Findings indicate that a majority of participants filed for WCB. Despite filing for WCB, financial difficulties after developing their MSD were considerable.
Heijbel et al., 2005, Sweden	Situation of long-term sick-listed persons employed in the public sector regarding the medical reasons for their sick leave, duration of their problems, duration of the actual sick leave, rehabilitation support, rehabilitation measures, and the persons' expectations of the future. The study group consisted of 90% women with a median age of 50 years.	The most common reasons for sick listing were long-lasting musculoskeletal neck/shoulder pain, LBP and osteoarthritis or other joint problems and mental problems, especially depression and burn-out syndromes. 44% of the men and 57% of the women had been on the sick list for more than a year. Only half of them had acceded to the legally required rehabilitation. Less than half had been in contact with the workplace-connected rehabilitation actors, the Occupational Health Service or the Trade Union.	For long-term sick-listed persons in the public sector, there is great potential for improvement in rehabilitation at the workplace level and in the involvement of, and cooperation between, the already-existing rehabilitation actors, in order to promote RTW.