“Illness is the doctor to whom we pay most heed; to kindness, to knowledge, we make promise only; pain we obey”

-Marcel Proust.

**University of Alberta**

# Pain Coping: a Study of Injured Workers with Long Term Pain

by

Leah Adeline Phillips

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Public Health Sciences

Fall 2010
Edmonton, Alberta

## Examining Committee

Linda Carroll, Public Health Sciences

Donald Voaklander, Public Health Sciences

Douglas Gross, Physical Therapy

Jeremy Beach, Community and Occupational Medicine

Derek Truscott, Educational Psychology

Patrick Loisel, Occupational and Environmental Health, University of Toronto

# Dedication

This dissertation is dedicated to my beautiful and brilliant daughter

Georgia Gail Phillips.

You are the inspiration for everything I do.

# Abstract

Pain coping is the purposeful effort people use to manage and minimize the negative impacts of pain. The scientific literature on pain coping conceptualizes its role in recovery as a reciprocal interactive process of psychological, social, and biological factors. The objective of this dissertation was to investigate how workers cope with pain and how coping relates to recovery.

Paper one- "*How Do Injured Workers Cope with Pain? A Descriptive Study of Injured Workers with Occupationally Related Long Term Pain",* aimed to identify pain coping strategies used by workers and identify characteristics related to each strategy. This study hypothesized that workers' coping may be a function of biological, social, and psychological factors. The results indicated that the most frequently used coping strategy was 'coping self statements', followed by 'praying and hoping', and 'catastrophizing'. Additionally, coping strategies differed according to gender, marital status, education, part of the body injured, levels of depressed symptomatology, and pain.

The objective of paper two, *"Predicting Recovery for Workers with Chronic Pain: Does Pain Coping Matter?",* was to measure the prognostic values of pain coping strategies, using polynomial logistic regression and Cox regression, on two commonly used measures of recovery, self perceived disability and time to suspension of benefits. The adjusted polynomial models showed that 'coping self statements' predicted moderate disability. The Cox regressions

showed that increases in ‘diverting attention’, ‘pain related behaviours’, and ‘perceived control’ meant small but significant decreased chances of suspended benefits.

Paper three, “*Self Perceived Disability in Workers with Chronic Pain: Does Depression Matter?”,* sought to identify factors associated with self perceived disability at the beginning of rehabilitation. Depression and pain interacted to affect disability therefore, two multivariable models were built. For depressed workers, every one point increase in pain was associated with a 58% increased odds of moderate disability and a 258% increased odds of severe disability, compared to low disability. ‘Pain control’ was protective for moderate and severe disability. For non-depressed workers, a one point increase in pain was associated with a 97% increased odds of moderate and a 109% increased odds for severe disability. However, ‘Pain control’ was non-significant.

# Acknowledgement

I would like to acknowledge my two primary supervisors,

Dr. Linda Carroll

And

Dr. Donald Voaklander

Thank you for all your support and guidance.

Thank you to my committee members: Dr. Douglas Gross, Dr. Jeremy Beach, and Dr. Brian Stephens, your advice was instrumental to the completion of this research.

## Table of Contents

Introduction: Pain Coping: a Study of Injured Workers with Long Term Pain 1
  Objectives 3
  Epidemiology of Occupational Injury: Alberta and Canada 3
  The Models of Occupational Disability 8
  Theoretical Approaches to coping 13
  Coping in Musculoskeletal, Occupational and Chronic Pain Research 18
  Pain coping and Prognosis 24
  Study Descriptions 34
  References 36

Study One: How Do Injured Workers Cope with Pain? A Descriptive Study of Injured Workers with Occupationally Related Long Term Pain 46
  Introduction 46
  Methods 50
  Results 54
  Discussion 68
  References 77

Study Two: Predicting Recovery for Workers with Chronic Pain: Does Pain Coping Matter? 85
  Introduction 85
  Methods 88
  Results 93
  Discussion 103
  References 110

Study Three: Self Perceived Disability in Workers with Chronic Pain:
Does Depression Matter? 114
Introduction 114
Methods 118
Results 122
Discussion 131
References 134

Conclusions 137
References 143

Appendix A: The Study Population 144

Appendix B: Coping Strategies Questionnaire (CSQ) 146
References 151

Appendix C: Self Perceived Disability 152
References 153

Appendix D: Beck Depression Inventory 154
References 157

Appendix E: Sample Size and Statistical Power 158
Appendix F: Supplemental Tables 159
Appendix G: University of Alberta Ethics Approval 160

## List of Tables

Table 1-1: Baseline Characteristics of Study Population, N=479 55
Table 1-2: Pain Coping Differences for Workers with Chronic Pain, N=479 60
Table 1-3: Pearson Correlations 63
Table 2-1: Baseline Characteristics of Study Population, N=479 94
Table 2-2: Results of Polytomous Regression 100
Table 2-3: Coping and Time to Suspension of Benefits: Cox Regression 102
Table 3-1: Baseline Characteristics of Study Population, N=479 123
Table 3-2: Factors Associated with Self Reported Pain Disability-Depressed Subgroup (n=219) 128
Table 3-3: Factors Associated with Self Reported Pain Disability-Non-Depressed Subgroup (n=205) 130
Table 3-4: Pearson Correlations: Coping by PDI 159
Table 3-5: Cross Tabulation: Depression by PDI 159

## List of Figures

Figure 1-1: Mean Coping Differences for Workers with Chronic Pain, N=479 58
Figure 2-2: Mean Coping Differences for Workers with Chronic Pain, N=479 97

## Introduction

"Illness is the doctor to whom we pay most heed; to kindness, to knowledge, we make promise only; pain we obey"-Marcel Proust.(1) All people feel pain; pain is unavoidable. Yet for some, pain is an uninvited dictator in their lives. It taunts and angers them from the beginning to the end of each day…everyday. As Proust notes, "pain we obey", because for some, pain never stops, it never rests; and it controls every aspect of life.

Occupational injuries are injuries incurred by an employee in the performance of (or in connection with) his or her work.(2) Pain related to these injuries is one of the most common causes of work related disability in Canada and other developed countries.(3-6) In the past century the types of work place incidents have shifted from ones causing fatal and acute types of injuries to ones initiating long-term (chronic) pain and disability.(7) The decrease in fatalities is largely due to the increase of safety education programs, work place injury prevention programs, and the structural change in work (i.e. a shift away from jobs with high physical demands).(7-10)

As noted, the nature and type of work related to disability claims is changing, in particular, the last two decades have seen more disability claims related to sedentary and repetitive activities.(10) In terms of compensation claims, time lost from work is on the decline, however, research has noted a sharp increase in the incidence of compensated musculoskeletal disorders such as neck and back pain claims.(11) For example, Cole et al. observed that in the past 15 years there has been a marked increase in reported shoulder and neck pain complaints.(12) Moreover, Silverstein and colleagues reported the proportion of women making injury claims for hand/wrist and elbow problems in a nine-year period had doubled.(13,14)

There are a significant number people who live with work related disability and pain related to this disability. In 2008 the Workers' Compensation Board of Alberta (WCB-Alberta) reported 60 692 claims for disabling injuries, (this includes both lost-time[1] and modifiable work[2] concepts). Additionally there was a lost-time claim rate of 1.88 and a disabling injury[3] claim rate of 3.63 per 100 000.(15) This indicates a significant need for research about the nature and course of recovery from these injuries. Moreover, the noted change in profile of occupational injuries necessitates that researchers re-examine the aetiology of these injuries and seek to develop innovative and comprehensive treatment protocols.

To assist this effort, research is re-examining the descriptive epidemiology including the current incidence/ risk and course/prognosis of occupational injuries within Canada and in the province of Alberta. In addition to understanding the epidemiology of such injuries, contemporary research informs us that knowledge

---

[1] Lost-time claim is a claim for an occupational injury or disease, which disables the worker beyond the day of injury. All claims receiving reimbursement of full or partial lost wages are included, as are payments for permanent loss of function.

[2] A modifiable-work claim is a claim for an occupational injury or disease where a worker had their normal work duties altered enabling them to remain in the work place without losing time.

[3] Disabling injury claims combine both the lost-time and modifiable-work concepts to produce an overall figure where an occupational injury or disease disables the worker causing either time-lost from work of for their normal work duties to be modified.

about the social and psychological environments of these individuals is critical to understanding the recovery process.

## Objectives

The main objective of this dissertation was to understand the role of pain coping in the recovery from long term pain related to occupational injuries. It aimed to empirically study injured workers' pain coping styles/behaviours: Firstly, by examining how workers cope with long term occupational pain; secondly, by investigating how or if pain coping is associated with recovery (as determined by self-reported pain disability and time until suspension of benefits); and thirdly, by examining the relationship between psychological (coping strategies and depression), socio-demographic (age, gender, income, and work related, etc.), injury related factors and self perceived pain disability.

This dissertation begins with an epidemiological description of occupational injuries, followed by a comprehensive discussion of coping from an Adaptational Psychology perspective, where research on coping originated.

## Epidemiology of Occupational Injury: Alberta and Canada

Epidemiology is defined as the study of the distribution, determinants, and deterrents of morbidity or mortality in human populations.(16) Injury epidemiology strives to understand the burden of injury in society within these same parameters. Presented here is an epidemiologic overview of occupational injury that will provide the basis for understanding and explaining the occurrence of workplace injuries. Furthermore, this overview provides a foundation for this dissertation and facilitates the identification of prognostic factors that may be important in terms of treatment and prevention of occupational work related injuries and pain related to these injuries.

The Canadian Community Health Survey was conducted from January to December 2003; it collected cross-sectional information about the health of Canadians. In a Health Report published in 2007, Statistics Canada reported the results of this survey related to work injuries in Canada. The report notes that in the years 2002-2004, acute injuries occurring on the job resulted in an average of 465 deaths annually and close to 300 000 compensated time loss claims. In 2003, more than 630,000 Canadians reported at least one activity-related occupational injury; this represents 5% and 2% of all employed men and women. This number accounts for 28.3% of all activity related injuries reported by employed household population aged 18-75 in Canada.(17)

Decreasing the burden of these injuries is not only important for the individual but for society as a whole. Calculating the economic burden of injury is typically done by estimating both the direct and indirect costs. Direct costs are the costs of resources consumed because of the injury, and the indirect costs are the estimated losses of potential output both at work and/or home that are associated with the morbidity or premature mortality and reductions in health-related quality of life.(3,18-20) In Canada in 1994 the total estimated cost of musculoskeletal disorders was approximately 25.6 billion or 3.4% of the Gross Domestic Product with direct costs accounting for 29% and the indirect productivity costs accounting for 71%.(21) As these findings indicate it is prudent to improve the outcomes for people suffering from long term pain due to occupational injury.

In general, young men aged 18-34, have the highest risk of experiencing a work injury. According to the Statistics Canada (2007) report, men in both 'white' and 'blue' collar occupations are significantly more at risk than women. The report states that men in management (business, finance, and administration) and trades (transport, equipment operation, processing, and manufacturing) were about twice as likely as their female counterparts to have an injury. The occupational category with the highest injury number came from the trades and transport category. These accounted for 8.5% of all the occupational injuries recorded. Within the category of trades and transport, 13% of these injured workers were machinists, metal formers, shapers and erectors. The risk for injury for people doing heavy work was twice as high in men and three times as high for women, than the risk of injury in those doing less physically demanding jobs.

Additionally, the number of hours worked per week was linked to a higher risk of injury. The likelihood of injury was greater for men who worked 35 or more hours per week, compared with those who worked fewer hours. Shift work and income level also elevated the risk for occupational injury, with those reporting a lower income level showing a significantly higher risk for injury. For both sexes, having more than one job was significantly associated with an elevated risk of work injury. Other risk factors for a work injury noted in the report included low education level, the presence of a chronic condition, smoking, heavy drinking, poor nutrition, and reporting extreme life stress.(17)

The most noted mechanisms of injury from the Health Canada report were overexertion/strenuous movements and falls. These accounted for almost half of the reported injuries. Of all injuries, the most commonly reported injured body region was the hand and this was followed by the lower back. These accounted for 28% and 16% respectively. The most frequent type of occupational injury was sprain or strain, followed by cuts, then fractures. Sprains and strains accounted for 39.8% of all the injuries reported.(17)

In 2008, the Workers' Compensation Board of Alberta (WCB-Alberta) reported 181,159 new claims due to occupational injuries. Of these claims, 21% of these were lost time claims, meaning the person was away from work for one or more days due to the injury. Of these, 63% were due to a sprain or strain, the highest of all injury categories. In terms of body region injured, the neck and back injuries made up the highest number of new claims, comprising 15% of the total new injury claims. Of these incident claims, 7.6% were unable to return to work within a year's period.(22) This finding is consistent with the existing literature on occupational injuries, for instance, Chen et al. found that a considerable proportion of their longitudinal cohort of workers (12%) reported substantial back pain at the end of the one year study period.(4) In another study by Has hemi et al., 7% of workers' disability claims were open for longer than one year and this small group accounted for over 75% the costs and 84% of total disability days.(23)

In 2006, 7.6% of injured workers in Alberta were unable to return to work. This is a small but substantially important group. In a study of an Ontario cohort of injured workers, Frank and Cullen found that 25% of cases (injured workers) were unable to return to work after three months, the overall cost from these workers accounted for 42% of the overall medical costs, 54% of the indemnity costs, and 52% of the total worker compensation costs.(24)

This dissertation focuses on this fiscally important population (7.6%) of injured workers. It investigates the nature and course of these injuries and is important because research tells us that if a worker has not returned to work by three months, there is a 50% chance that he or she will not be working at 15 months.(25) With better understanding of the diverse complexity of these workers' psychological lives we can develop better rehabilitation and pain management programs and reduce time off work.

Recovery from a work injury is a complex process that depends on multiple factors such as, age, gender, prior health status, occupation, job demands, and severity of injury along with psychological and social factors. Often, the physical injury may appear healed yet the worker continues to report persistent pain related to their injury. For example, in 2001, Truchon and colleagues found that for 90% of those labelled 'chronically' disabled due to non-specific work-related low back pain, no medical reason could be found to explain the origin of pain.(26)

Current research on recovery from occupational injury is looking to explore work-related injury and pain to identify possible psychological and socio-demographic prognostic factors. Some promising results are being found when investigating the roles of recovery expectations (27), depression (28-30), and coping style. (31-34) at the present time, the roles of these factors in occupational injury are not fully understood and the study of their roles in long-term, ‘chronic’ work related injury is only in beginning stages. A substantial systematic review on neck pain called for more empirical work to be done, and indicated that studies should consider both psychological and sociological factors when researching occupational injury.(35)

Researchers are now beginning to combine their knowledge about the biological, economic, social, and psychological factors contributing to prolonged recovery periods, with the goal of understanding the injured worker within a larger context. This biopsychosocial context, or conceptual framework, contains both modifiable and non-modifiable prognostic factors. By identifying the modifiable factors we may be better able to understand what is inhibiting ‘recovery’ and work toward preventing chronic long term illness.

## Models of Occupational Disability

There is an increasing appeal to expand the theoretical understanding of occupational disability and return to work. The complexity of this problem has made developing a complete multidimensional conceptual model of recovery from work related injury extremely challenging. Similar to recovery from injury in the general population, the recovery process from occupational injury is affected by the complexity of the interpersonal context of the disabled worker, for example, the roles of the workplace, the health care, insurance systems, and individual physical and psychological characteristics.

A conceptual model is a theoretical construct that represents physical, biological, and/or social processes as a set of variables that hypothesizes logical and quantitative relationships between them. Conceptual models are constructed to enable logical reasoning about these processes and are important components of scientific theories. Krause et al. conducted a systematic review of the 'disability' and 'return-to-work' literature in 2001. Their study concluded that the entire field of occupational 'disability' and 'return-to-work' is under-theorized and suggested a need for a conceptual framework (model) that integrates the entire discipline.(36) Other scientists have also mentioned this disparity. As of the mid-2000's, Cedraschi et al. and Linton et al.(37,38) noted that there was no clear conceptual model that relates to the recovery process or prognosis of workers with disabilities.

There have been, however, some emerging conceptual models theorized in recent years. Schultz et al. published a critical review in 2007 that evaluated the evolution and the state of the art of health and disability models with a focus on specific models of return to work.(39) The results of their consensus approach led to the identification of 6 primary underlying constructs in traditional conceptual return to work models. These were: Biomedical, Forensic, Psychosocial, Ecological/Case Management, Economic, and Biopsychosocial. A brief explanation of each of each model, adapted from Schultz et al.,(39) follows.

The Biomedical model is the predominant framework for many clinical professionals in acute health care. Schultz et al. note that the main tenets of the biomedical model are: (1) illness is always due to physical pathology, (2) symptoms of disability are directly proportionate to the physical pathology, and (3) physicians should be in sole control of diagnosis and treatment.(39) Within this model the medical condition (the observable biological problem) is the direct cause of occupational disability. The two primary parties within this framework are the injured worker and the treating physician. This model tends to apply well for individuals with acute or uncomplicated injuries, however, it often fails when explaining the complexities involved in long term disability.

The Forensic model's main focus is to understand the individual with an occupational disability as part of a compensation system. Its focus is on the detection of dishonest individuals who anticipate secondary gains. The objective of the Forensic model is 'proof of impairment'. This model takes an adversarial role in its conception of the disabled worker. Injured workers must prove their disability through objective scientific testing.

The main tenets of the psychosocial model are that psychological and social factors play a *predominant* role in disability and return to work. These psychosocial factors can be both individual and system related. In terms of diagnosis and treatment, psychosocial factors should be investigated, because these potentially modifiable factors could be targeted for intervention. This model is substantially different from the Forensic model in that it takes an integrative individual/social approach, as opposed to a systems approach, for understanding disability. Important to this model are individuals' beliefs, perceptions, and coping mechanisms underlying their disability. This model also pays attention to the interactions between the workplace and the injured worker.

The Ecological/Case Management and Economic models focus primarily on the determinants of occupational disability from a societal stakeholder position. These stakeholders include: the employer, the health care system, insurance system, and the worker's family. These models hold that the economy plays a major role in disability prevention and outcomes. The employer and employee must understand that disability and its associated costs are to be handled as part of a multidisciplinary approach. A prevalent Ecological/Case Management model is Loisel's model of occupational disability.(40) This model stresses the interactions of key stakeholders. The model includes the personal system (social, affective, cognitive, and physical), the legislative and insurance system (provincial and federal laws, jurisdictional regulations, the WCB case worker, and the compensation agent), the workplace system (the external environment, the organization, the department, and the job position), and the health care system (the interdisciplinary team, other healthcare professionals, and the attending physicians). Loisel's model presents a good example of the multiple layers of complexity of occupational disability.

This dissertation takes a biopsychosocial approach to work injury related pain and disability. The biopsychosocial framework is the most comprehensive of all the above mentioned models. First proposed by George Engel in 1977(41), the biopsychosocial framework integrates the individual focus of the psychosocial model with the systems focus of the economic model, however, the biological, (the objective scientific measures of disability implied in the biomedical model), are just as important because of the interactive effects these factors can have on each other.(42) This biopsychosocial paradigm *emphasizes* the important role that biological (the objective injury), psychological (ways of coping and emotions), and sociological factors (the environment, i.e. work place, family setting, etc) and the reciprocal interactions of these factors in the formation of and recovery from occupational disability.

Identifying the unique and interactive roles of all of these factors within the injury context, however, has only just begun. The multi-factorial nature of long-term, ‘chronic’ work-related injuries makes the study of this phenomenon difficult and to this date, no single biological or psychosocial prognostic factor has been identified as being solely instrumental for full recovery. Certainly, some factors have more merit. Psychological distress, a patient’s beliefs and expectations about their pain, pain related fear and fear avoidance (passive coping) and social factors, such as job dissatisfaction, have all been linked to poor recovery.(27-30,32-34)

As noted, within the biopsychosocial framework, occupational disability and return to work are explained by the reciprocal interactions of multiple factors. These include: pain, physical functioning, psychological impairments, and functional and social disability. Occupational disability (its duration and intensity) is a result of the interactions between the worker (the physical impairment and psychological state) and his/her environment. That environment includes employers, the work place, case managers, medical providers, family etc.

The goal of this dissertation is to add to the developing evidence for biopsychosocial understanding of occupational disability by contributing information about workers' pain coping strategies and their potential effect on disability and time until suspension of benefits. It will provide pertinent information on the role of pain coping in recovery from long term occupational injury related pain.

## Theoretical Approaches to Pain Coping

Pain coping is defined as the purposeful effort people use to manage or minimize the negative impacts of pain.(31,43,44) The role of pain coping strategies in the recovery process is in its early stages of investigation. To date, the scientific literature on pain coping has conceptualized its role in recovery as a dynamic, reciprocal and interactive process of psychological, social, and biological factors.(45) For example, Flor and Turk concluded that a person's pain coping strategy may be an important factor in the individual's recovery process and can be directly influenced by the individual's appraisal of his or her situation.(45)

The concept of 'coping' had been studied comprehensively in Adaptational Psychology. Understanding coping and its link to recovery is similar in its complexity to that of the biopsychosocial model of disease and injury. What follows is a review of the theoretical literature on coping. This discussion will provide greater comprehension and appreciation of its role in the recovery process.

The conceptualization of coping as a prognostic factor for recovery originates in the psychological studies about stress.(46) Historically, coping theory was shaped by two distinct philosophical paradigms; coping as 'person based' (an innate, unchanging aspect of one's personality) or 'situation based' (coping changes over time and depends on specific situations). In contrast to these older schools, contemporary theories tend to characterize coping as a mixture of both innate personality type and cognitive reactions to stressful situations. As a preface to understanding coping as a prognostic factor for recovery from injury, both the past and current theoretical approaches will be discussed.

*Person Based (psychoanalytic, personality, and perceptual styles)*

The person-based viewpoint posits that the personality characteristics of an individual are the primary determinants of how a person copes with stress. There are three theoretical schools that define the person based approaches, 'psychoanalytic' theory, 'personality' theory, and 'perceptual styles' theory.

According to the 'psychoanalytic' tradition, people use defence mechanisms to ward off anxiety. Anxiety arises from unconscious conflicts between the 'id' and the 'superego'. The ego tries to rationalize this struggle by distorting instinctual demands by creating defence mechanisms, such as suppression, denial, projection, reaction formation, hysteria, obsessive-compulsive behaviours, and sublimation. This type of coping is not brought on by the situation one finds him or herself in but has more to do with a person's innate personality. The person will use his or her unique defence mechanisms to regulate emotions and reduce anxiety. Therefore the behaviours, feelings, and cognitions evoked by a stressful situation are determined by the person's personality, which is determined at an early developmental stage and is not amendable to change.(47)

In a similar way to the ‘psychoanalytical’ approach, the ‘personality’ approach to coping holds that the way an individual copes with a stressful life event is an inevitable reaction, innate to a person’s unique personality makeup. Therefore, in this theoretical orientation, coping is not a modifiable factor. Additionally, the personality approach does not consider that environmental demands may shape an individual’s behaviour. The difference from the psychoanalytic approach is that instead of focusing on the role of ‘defence mechanisms’, coping is understood in terms of ‘style’ based primarily on personality type. For example, Lipinski (1970) and Leigh and Raiser (1980) illustrated eight characteristic ways people deal with health problems.(47) There is the introverted style of coping, used by people who tend to be ‘emotionally flat’, and involving use of a copying style that is called ‘minimization’. In contrast, others use ‘cooperative’ coping. These people may follow advice but do not tend to assume responsibility for their own choices of help.

Finally, coping as a ‘perceptual style’ focuses on the unique ways individuals manage situational information. Within this approach, people are often classified using dichotomized typologies such as ‘repression-sensitization’. For example, when faced with stressful conditions, repressors avoid or suppress information, while the sensitizers seek or enhance information in order to deal with the stressor.(47) Although somewhat useful for classification, applying such labels to an individual, as in this approach, may tend to oversimplify individuals’ responses to stress.

### *Situation Based (cognitive theories)*

The situational based approaches to coping are in direct contrast to the person based approaches. The situational based paradigm to coping argues that the types of strategies that individuals use to cope with problems depend on environmental demands. The most commonly cited theory within the situational based approach is the cognitive theory approach.

According to Aldwin,(47) the cognitive approach to coping is based on four assumptions. First, how an individual copes with a problem is largely dependent on his or her appraisal of the situation, for example, appraisals of the situation as being threatening, benign, or challenging. Second, cognitive approaches assume that individuals are flexible in their choice of coping strategies and modify their strategies according to the demands of the particular problem. The third assumption is that coping efforts include both problem and emotion focused strategies that are directed at the problem and at the emotions, respectively. Finally, within the cognitive approach there is no assumption of a hierarchy of adaptiveness. This means that the researcher must identify which coping strategies are used in specific situations and the conditions under which the strategies do or do not promote positive adaptation, such as recovery.

### *Contemporary Theories (motivational, meaning making, and social and religious)*

More recently, coping research has broadened and new theoretical approaches are being considered. Contemporary coping theorists see coping as “consisting of both cognitive and behavioural efforts to manage external and or internal demands that are appraised as taxing or exceeding the resources of the person” (Folkman and Lazarus, p. 310).(46) In other words, coping behaviour is viewed as a continuous feedback loop of appraisal and action.

These contemporary approaches include ‘Motivational’ coping, ‘Meaning Making’, and ‘Social and Religious’ coping. Motivational coping refers to a person’s response to feelings of stress caused by threats to basic psychological needs, such as relatedness, autonomy, and competence. This view of coping is dominant in child psychology. Here, coping is seen as an “organizational construct that describes how people regulate their own behaviour, emotion, and motivational orientation under conditions of psychological distress…It encompasses peoples’ struggle to maintain, restore replenish, and repair the fulfilment of these needs” (Folkman and Lazarus, p. 112).(46)

‘Meaning Making’ is often called cognitive reframing and this involves attempts to make intellectual sense of the problem or a stressful situation. Cognitive reframing may include a reorganization of existing cognitive-motivational structures or a reappraisal or reinterpretation of the event. In 2000, Folkman and Moskowitz described two distinct ways people engage in meaning making.  These were situational versus global meaning making. The situational meaning making is an appraisal process whereby coping is a way of infusing meaning into a situation and is related to positive affect. Whereas global meaning making refers to fundamental assumptions about the world; here, a person has a global outlook on the world around them and this outlook influences the way they cope with a stressful life event.(48)

‘Social and Religious’ coping is somewhat of a new concept in the theoretical research literature on coping. Within this perspective the importance of social support and the religious perspective of the individual are directly related to the way one copes with a stressful life event. Researchers in this area look to understand the social world around the individual. They strive to understand what the individual sees as important to his or her situation. Coping behaviours here may include: talking with friends, family or religious leaders, and the use of prayer.

These contemporary theoretical approaches bring to the forefront the influences of culture and the effect of different socio-demographic variables, such as age, gender, education, etc., on the construction of social representations. Researchers within this paradigm feel that it is important to analyze these types of variables, for differences found in these factors will denote differences in social and cultural representations.

## Coping in Musculoskeletal, Occupation Injury, and Chronic Pain Research

Work on coping largely conceptualizes coping as a behavioural response to an emotional change or a reaction to a psychological stressor, however, research is growing in the area examining the role of coping with pain.

In a recent paper by Coutu et al., they agree that coping in regard to musculoskeletal disability and pain is highly relevant, they state that, “among the factors related to the person, the way in which individuals interpret their illness or the representations they form of their illness are associated with the adoption of coping behaviours aimed at helping them adapt to or solve their health problem" (Coutu, p.522).(49)

In Coutu et al.'s review, published in 2007, the authors identify three commonly used theoretical frameworks or conceptual models used by researchers who have examined coping with musculoskeletal disability and related persistent pain. These models attempt to understand pain related to musculoskeletal disability as a function of either, solely individual-psychological factors, solely the socio-cultural milieu or as interaction of personal and socio-cultural factors. They indentify these three models as (1) Personal Experience, (2) Interactionist, and (3) Socio-cultural. What follows is a summary of their review.

### *Personal Experience (fear avoidance, transtheoretical, and lay theories)*

The Personal Experience theories or models try to explain specific behaviours, life trajectories, and therapeutic processes experienced by individuals. These types of models strive to understand a person's pain beliefs as well as how the individual interacts with his or her environment. The most noted Personal Experience models include the Fear Avoidance model, the Transtheoretical model and 'Lay' theories.

The fear avoidance model finds itself placed firmly in the 'person based' paradigm as it maintains that coping is a direct function of individual factors. Fear avoidance is one of the most commonly used theoretical models used to explain musculoskeletal disability. Researchers seek to understand person's specific beliefs about their pain, as these beliefs will lead to behaviours that will increase physical disuse and chronic pain disability. It explains disability as follows: a person's fear of pain is based on their prior experiences of pain and leads an individual to catastrophize[4] pain and thus maintains their fear by avoiding movements or behaviours that they feel may lead to a painful experience. Therefore, when faced with a decision to act (for example, doing daily activities), a person will consider whether this act will produce pain, If they feel this act will be uncomfortable and will make their condition worse; they will avoid the act. This model strives to explain long-term disability as a cyclical process of evaluation and decision making that leads to further disability.

The fear avoidance model can be problematic because it fails to appreciate the environment in which the individual interacts. Aspects of job stress, social support, and family involvement are not considered. Although fear could potentially play a part in long term disability, more complex and more holistic models should be considered.

The Transtheoretical model focuses on the individual processes associated with behaviour changes. This model identifies five stages that the individual goes through in order to acquire and maintain change in behaviour. This model is most relevant for people going through treatment programs. The five stages are as follows: Precontemplation, Contemplation, Preparation, Action, and Maintenance. This model's underlying theory is similar to Bandura's concept of 'self-efficacy'[5]. Bandura maintained that a person's self efficacy will affect choices and responses to stress. This theory is commonly referred to in musculoskeletal research as the Motivational Model of Pain Self-Management. Its key component is the idea that

---

[4] Catastrophizing is defined as an exaggerated negative orientation toward noxious stimuli.
[5] Self-efficacy is a measure of a person's confidence in his or her ability to perform specific activities under particular conditions.(50)

individuals decide to make positive or negative treatment changes and this will ultimately affect recovery.

One noted drawback with the Transtheoretical model is that it tends to over simplify a person's decision making process. It assumes that individuals act rationally and make decisions based on the most sensible choices. The model can be useful in understanding the process of change a recovering individual may be going through, although its linear prognostic stages and assumption that individuals make rational choices make it ineffective for predicting recovery.

Lay theories are representations that relate to personal, subjective experiences of illness, and to the interpretations made about the individual's experience within a health care setting, media representations of illness and the social environment of the person. These are characterized by their idiosyncratic and informal nature. There are three 'Lay' theories most commonly noted in the literature, these are: the commonsense model of self regulation, the personal construct theory and the biographical illness trajectory approach. These types of theories provide and interesting theoretical background for many studies in health sociology.

### *Interactionist (sick role, therapist/patient relationship, and gender roles)*

The Interactionist approach focuses on the interaction between individuals and the reciprocal influences that individuals have on each other's actions. There are three main theories that use this approach in musculoskeletal literature, these are: The sick role approach, the therapist/patient relationship, and the gender role approach.

The Interactionist approach to studying musculoskeletal disability comes from the systemic or structure-functionalist approach. Within this approach, the temporary state of disability allows for the individual to temporarily withdraw from his or her normal activities of daily living. Generally this model is used more frequently in studies that seek to understand acute stages of illness. Researchers of this perspective will seek to understand how individuals seek legitimization of the sick role, as this is believed to negatively influence recovery. A researcher using this perspective will make an effort to understand individuals' perspectives about the sick role and how these individuals interpret societal norms surrounding their role as a 'sick person'. Coutu found that, conceptually, the sick role approach does not general apply in cases of persistent pain in musculoskeletal studies unless it is used to study the impact that social representations of illness have on stigmatization.

Coutu et al.'s review of the literature found that the Therapist Patient Relationship perspective was generally used as a specific component of the sick role approach. First developed in 1956 by Szas and Hollender (51) it calls attention to three types of Patient/Therapist Relationships: activity/passivity, guidance/cooperation and mutual participation. This type of perspective draws attention to the power differential between patient and physician.

Finally, the Gender Role approach underscores the importance of gender in the biological and sociological conceptualization of disability and recovery. It focuses on the impact of gender on the therapeutic process. Studies using this perspective hold that men and women do not cope with pain the same way, therefore men and women may need different approaches to rehabilitation.

### *Sociocultural*

This approach draws attention to the importance of the influence of culture and the affect of various socio-demographic variables, such as age, gender, and education on an individual's ability to recover. Coutu et al. notes that research studies using this perspective strive to understand differences in individual representations as these may actual denote differences in social and cultural representations. For example, in various studies that examine musculoskeletal disability, authors emphasize the presence of social and structural factors that may negatively influence 'return to work'. These factors may be things such as: workplace characteristics, health care systems, legislation, and insurance systems as well as individual characteristics. Coutu states that this perspective is pertinent because it fosters a holistic understanding of the individual as an integral part of a societal milieu.

The purpose of theory is to provide researchers with some perspective on the phenomenon they wish to understand. The theories presented above all have merit both theoretically and empirically. When trying to understand a construct such as coping and how it influences the recovery process, having some knowledge of the theoretical background is necessary. This knowledge can influence both the method used for the study and can greatly enhance the discussion of the findings.

## Pain coping and Prognosis

‘Prognosis’ refers to the probable course and outcome of a health condition over time.(52) Prognostic studies attempt to isolate particular factors that are potentially important to the outcome. As noted above, one of this dissertation’s goals is to assess the prognostic role of pain coping in the recovery from long term occupational injury. Coping is just beginning to be added to multivariable models looking to understand its prognostic function. What follows is a discussion of some of these early studies.

### *Coping in Whiplash, Chronic Pain, Musculoskeletal, and Occupation Injury Research*

The variable ‘coping’ is becoming more common in musculoskeletal injury and pain research. Most notably coping is often included as a possible prognostic factor in studies on Whiplash Associated Disorders (WAD), chronic disease management, and occupational medicine. Much of this work recognizes that psychological factors play an important role in the risk, the development, and course of disease.

There is a small area of research seeking to confirm the suggestion that coping with an interactive problem (one that is both biological and psychological) such as pain, follows a similar process used to explain coping with psychological stress. Using the lens of the biopsychosocial framework, pain coping is seen as reciprocal threefold problem, (1) a psychological/ emotional, (2) sociological, and (3) physical. The current state of the evidence shows that pain coping has potential merit as a prognostic factor in three such areas: course and prognosis of

Whiplash Associated Disorders (WAD), Chronic Pain, and general musculoskeletal conditions such as low back pain and neck pain.

### *Whiplash-Associated Disorders*

Pain coping has shown promise as a prognostic factor in the recovery from symptoms associated with Whiplash Associated Disorders (WAD). However, it is difficult to compare the studies on coping, because coping is not consistently measured with the same psychometric index. Additionally, there are few ‘true’ (i.e., longitudinal) prognostic studies that have examined the prognostic role of coping in the recovery from WAD. What follows is a brief discussion of some promising research being done using coping as a potential prognostic factor.

In 2003, Soderlund and Lindberg found that whiplash claimants in the Netherlands who used the post-injury coping strategy of social support had shorter insurance claim duration.(53) In another prospective cohort study, Buitenhuis et al. studied victims of car accidents to determine the association between the coping styles used and the development of late whiplash syndrome. The results showed that coping style in the first few weeks after the accident and gender are related to longer duration of neck complaints. They concluded that paying attention to the coping style could be useful in prevention of late whiplash syndrome.(54)

In 2006, Carroll et al. reported that the use of passive coping strategies in the first six weeks after a traffic-related whiplash injury predicts slower self-reported recovery.(31) They found that early use of passive coping strategies was independently associated with slower recovery.

Non-prognostic studies on WAD have identified coping as a potentially important component of the WAD experience. Jones and Elklit used a correlational design to investigate the how the relationship between coping style and the symptoms of whiplash injury changes as a function of gender. They found that men and women did not differ significantly in their use of coping strategies, however, emotion focused coping strategies were related more strongly to WAD related symptoms in men compared to women. This study concluded that mood can potentially interact with coping to alter the presence and severity of injury-symptoms in men.(55)

Bosma and Kessels investigated underlying mechanisms of cognitive dysfunction in whiplash syndrome, focusing on psychological factors and coping mechanisms. In their small retrospective study they found that patients with WAD performed similarly to neurology patients on a cognitive task and performed worse on memory and attention tasks compared to their control group. Additionally, their patients with WAD displayed predominantly active and palliative coping styles.(56)

One coping style consistently mentioned in the literature concerning WAD is ‘Catastrophizing’. Catastrophizing is broadly defined as an exaggerated negative orientation toward pain stimuli and pain experience. Borsbo et al. found that pain catastrophizing in combination with depression can influence self perceived quality of life for patients with WAD.(57) Buitenhuis et al. found pain catastrophizing to be related to the severity of concurrent whiplash disability.(54)

In general, the results of these studies provide good evidence that the exploration of pain coping and its relationship to recovery from WAD has merit. Given this evidence, further prognostic study into the role of precise coping strategies, e.g. catastrophizing, should be carried out.

### *Chronic Pain*

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.(58) IASP notes that pain is always subjective and each individual learns the application of the word through experiences related to injury in early life. Further, although pain is unquestionably a sensation in part or parts of the body, it is unpleasant and therefore should be understood as an emotional experience. Long term pain, or chronic pain, is defined by IASP as pain without apparent biological value that has persisted beyond the normal duration of tissue healing (usually three months).(58)

Psychological and sociological factors are understood to play crucial roles in developing chronic pain and subsequent disability. In the scientific literature concerning chronic pain, coping as an independent variable is commonly studied in one of four ways: 1) included as one of several psychological variables added to the statistical model;(59-76) 2) as a process, i.e. measuring coping strategies;(62,77-84) 3) studying one coping strategy at a time, e.g. ‘catastrophizing’;(85-92) and 4) qualitatively.(93-96) Furthermore, preliminary work to develop a biopsychosocial model of chronic pain has identified various factors that are associated with long term pain. However, the bulk of this work is cross sectional. These studies have led to some interesting hypothesis-generating findings. For example, Cui et al. (2009) sought to examine psychological features as well as coping style and their relationships to chronic pain. They did not find that psychological factors influence the overall continuation of chronic pain, but did note that more frequent use of distraction was associated with ratings of low disability.(61) In another 2009 paper, Schmitt sought to examine the relative contribution of cervical impairments and psychological factors on perceived disability in chronic pain due to whiplash. The results of their cross sectional study found that catastrophizing, a commonly studied coping strategy, explained almost 57% of the variance.(71)

In 2006, Samwel et al. studied the contribution of various psychological factors including passive coping and their relation to pain level, disability, and depression in a cross sectional study of chronic pain patients attending an interdisciplinary pain centre. The results of their unadjusted analysis showed that helplessness, fear of pain, and passive pain coping strategies were all related to pain level, measures of disability, and depression. Following their multivariate regression analysis, however, only helplessness was found to be a significant predictor for pain level. Conversely, their analysis did find that passive coping is a significant predictor of self rated disability and post injury depression.(97)

In 2000, Turner et al. reported the results of their study that examined whether coping predicts adjustment of patients with chronic pain after accounting for the effects of beliefs and catastrophizing, and whether beliefs predict adjustment after accounting for the effects of coping and catastrophizing and whether catastrophizing predicts adjustment after accounting for the effects of coping and beliefs. This study found that coping scores, using the Coping Strategies Questionnaire, significantly and independently predicted physical disability.

As noted, the vast majority of coping and chronic pain research is cross-sectional in nature, and while cross sectional studies do identify potential relationships between two constructs, the casual nature or predictive power of such as construct is impossible to determine without prospective study. There are few prospective studies that should be mentioned as they provide the best evidence that pain coping is potentially a valuable prognostic factor.

In 2005, van der Hulst et al. published a systematic review to determine predictors of outcome of multidisciplinary rehabilitation (back school treatment) for patients with chronic pain.(74) This is one of the few reviews that is focused on predictors from multiple domains, (socio-demographic, physical, and psychological). The findings indicate consistent evidence for the predictive value of pain intensity, several work related parameters, and coping style. In particular, they found that although studies included different measures of coping variables, all accepted studies showed that low levels of active coping skills at baseline were predictive of better outcome (decreases of activity limitation).

Since the time of the van der Hulst review there have been a number of good prospective studies on coping with chronic pain. Most of the current literature focuses on attempting to assess more precise measures of coping, e.g.

catastrophizing, avoidance, and self efficacy, in order to assess their potential associations with chronic pain.

Rahman et al. studied a cohort of 354 patients referred to a rheumatology chronic pain clinic over a five year period to identify factors affecting their self-efficacy and intensity of pain.(67) Self-efficacy is conceptually related to coping, as self-efficacy may potentially affect the thought patterns that promote coping behaviours. This prospective study found that patients with poor recovery presented with low self-efficacy. Additionally, low self-efficacy was statistically associated with depressive symptoms at time of enrolment and not being employed.

Vowles et al. sought to evaluate how three proposed treatment processes faired when treating a cohort of individuals with chronic pain.(92) The treatment processes they studied were pain intensity, catastrophizing, and acceptance. The findings of their study indicate that changes in both acceptance and catastrophizing accounted for significant variance independent of, and larger than, that accounted for by change in pain intensity. This study provided further evidence that treatments that focus on modifying coping behaviour may result in better treatment outcomes for people with chronic pain.

Fear avoidance and helplessness are other potentially similar concepts to coping that have shown a fairly stable link to recovery from chronic pain. The fear avoidance model holds that a person’s fear of pain is associated with the perception that activity will lead to an increase in pain; while the learned helplessness theory holds that once pain has become chronic, continual unsuccessful coping efforts lead to increased feelings of helplessness and may further disability. Samwel et al. found that for a cohort of 181 chronic pain patients, fear of pain, avoidance behaviour, and helplessness all predicted functional disability after three months.(97)

As noted, the bulk of the evidence of these associations is taken from cross sectional studies. More prospective study into the role of coping will allow for better understanding of the problem and will better equip health care decision makers in treatment options for those suffering from chronic pain.

### *Musculoskeletal and Occupational Cohorts*

Pain is a leading reason for time lost from work. Pain-related work disability is defined as the inability to function at work due to pain.(98) Pain coping has been studied in the areas of low back pain and neck pain in both occupational cohorts and non-occupational cohorts. It is increasingly accepted that psychological factors play a key role in the causation, course, and prognosis of these types of problems.

In 2002, Pincus et al. published a systematic review that examined the state of the evidence about psychological factors and the roles they play in the transition to chronic low back pain. The results of this review indicated that only 6 studies met their criteria for acceptance for methodology, psychological measurement, and statistical analysis.(99) The authors concluded that psychological factors (notably distress, depressive mood, and somatisation) are implicated in the transition to chronic low back pain. Furthermore, they felt that there is a need for further clarification of the roles of other psychological factors, particularly coping strategies and fear avoidance, in back-related disability through rigorous prospective studies.

In 2005, Mercado et al. sought to assess the relationship between pain severity and coping. Their regression analysis revealed that passive coping was associated with being married, greater pain severity, depression, and poor health, while active coping was associated with female gender, higher education, less depression, good health, and frequent exercise.(34) In another study by the same research group, associations were examined between socio-demographic, pain, and health related factors and combinations of active and passive strategies. They found that for those who reported neck or low back pain during the past six months, pain was associated with passive coping and this was regardless of active coping. Lower education levels were associated with the combination of low levels of active and high levels of passive coping. Individuals with better self-reported general health were less likely to use high levels of passive coping regardless of their active coping.(34,100)

In one of the few occupational studies, van Eijsden-Besseling et al. used a case control study to compared 45 computer workers with work-related upper limb disorders with 45 computer workers free from such injuries and a group of chronic pain patients. Their study found no significant differences in the three groups' coping scores, although they did find significant differences for the workers with upper limb disorders on the personality trait of neurotic perfectionism.(101)

In a study of 80 patients with chronic myofascial pain, Smith et al. contrasted emotional approach coping and 5 passive pain-coping strategies in order to determine how these factors were related to sensory and affective pain, physical impairment, and depression. Emotional approach coping was defined as an emotional processing or regulation construct. In contrast to passive coping, this type of coping has an adaptive potential. Here, coping strategies refer to the process of identifying one's emotions. Smith et al. found that unlike the use of passive pain-coping strategies, which are associated with increased pain and adjustment, the use of emotional approach coping by the people with chronic pain was associated with less pain and depression.(102)

In 2008, Carroll et al. published a best-evidence synthesis examining course and prognosis for neck pain in workers. The evidence from 4 cohort studies indicated that most psychological factors did not predict the course of neck pain in workers. However, one of the accepted studies did find that workers with neck pain who perceived themselves as having little influence over their work were more likely to again report neck pain 4 years later. Although their findings indicated that there was little influence of psychological factors on course of neck pain, their review did not find any scientifically admissible studies that looked at coping strategies in occupational cohorts. This review indicates clearly that a study examining the role of coping on return to work in an occupational cohort is needed.

As this brief overview of the scientific literature shows, the study of pain coping in injured workers is still developing. Additionally, a study that looks to identify whether or not coping has a unique role in recovery from long tern pain caused by an occupational injury has yet to be carried out.

This dissertation looked to study coping using the methods employed by researchers on occupational injury to measure its effect. As coping is a potentially modifiable factor, a finding indicating that it is associated with recovery, may help practitioners tailor and improve treatment and rehabilitation programs.

## Study Descriptions

### Study 1

The aim of study one was to describe how workers with long term pain due to occupationally related injuries coped with their pain. This study hypothesized that how a worker coped with long term pain may be function of various factors, such as age, gender, injury, and or psychological states. The study described differences in coping strategies between various demographic variables, injury related variables, program related variables, and psychological variables.

The main objective is to identify what pain strategies are commonly used by these individuals and identify the characteristics of individuals with chronic occupationally related pain to provide insight into potential ‘risk factors’ for long term pain related to the occupational injury.

### Study 2

The objective of this study was to measure the prognostic values of various pain coping strategies on two commonly used measures of recovery, self reported pain disability and time to suspension of benefits, in a group of injured workers with long term pain related to an occupational injury. The hypothesis was that pain coping would be prognostic for these outcomes.

### Study 3

The purpose of this study was to identify factors associated with self reported pain disability at the beginning of a rehabilitation program. There is research evidence that depression may interact with coping, therefore interaction terms using depression, coping strategies, and pain was tested for associations with self perceived disability.

# References

1. Pinter H. Remembrance of Things Past: Marcel Proust, 1871-1922-Adaptations. London: Faber and Faber; 2000.

2. Human Resources and Social Development Canada. Occupational Injuries and Disease in Canada, 1996-2005. http://www hrsdc gc ca/eng/labour/publications/health_safety/pdf/oidc pdf 2007

3. Baldwin ML. Reducing the costs of work-related musculoskeletal disorders: targeting strategies to chronic disability cases. Journal of Electromyography & Kinesiology 2004 February;14(1):33-41.

4. Chen C, Hogg-Johnson S, Smith P. The recovery patterns of back pain among workers with compensated occupational back injuries. Occup Environ Med 2007 August 1;64(8):534-40.

5. Robinson JP, Fulton-Kehoe D, Martin DC, Franklin GM. Outcomes of pain center treatment in Washington State workers' compensation. American Journal of Industrial Medicine 2001 February;39(2):227-36.

6. Rohling ML, Binder LM, Langhinrichsen-Rohling J. Money matters: A meta-analytic review of the association between financial compensation and the experience and treatment of chronic pain. Health Psychology 1995 November;14(6):537-47.

7. Breslin FC, Tompa E, Mustard C, Zhao R, Smith P, Hogg-Johnson S. Association between the decline in workers' compensation claims and workforce composition and job characteristics in Ontario, Canada. American Journal of Public Health 2007 March;97(3):453-5.

8. Breslin FC, Smith P. Age-related differences in work injuries: a multivariate, population-based study. American Journal of Industrial Medicine 2005 July;48(1):50-6.

9. Mustard C, Hertzman C. Relationship between health services outcomes and social and economic outcomes in workplace injury and disease: data sources and methods. American Journal of Industrial Medicine 2001 September;40(3):335-43.

10. Mustard C, Cole D, Shannon H, Pole J, Sullivan T, Allingham R. Declining trends in work-related morbidity and disability, 1993-1998: a comparison of survey estimates and compensation insurance claims. American Journal of Public Health 2003 August;93(8):1283-6.

11. Cote P, van der Velde G, Cassidy JD, Carroll LJ, Hogg-Johnson S, Holm LW, Carragee EJ, Haldeman S, Nordin M, Hurwitz EL, Guzman J, Peloso PM. The burden and determinants of neck pain in workers: results of the

Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Journal Of Manipulative And Physiological Therapeutics 2009 February;32(2 Suppl):S70-S86.

12. Cole DC, Mondloch MV, Hogg-Johnson S. Listening to injured workers: how recovery expectations predict outcomes -- a prospective study. CMAJ 2002 March 19;166(6):749-54.

13. Nelson NA, Silverstein BA. Workplace changes associated with a reduction in musculoskeletal symptoms in office workers. Human Factors 1998 June;40(2):337-50.

14. Silverstein B, Welp E, Nelson N, Kalat J. Claims incidence of work-related disorders of the upper extremities: Washington state, 1987 through 1995. American Journal of Public Health 1998 December;88(12):1827-33.

15. Alberta Employment and Immigration. Occupational Injuries and Diseases in Alberta: 2008 Summary. http://employment alberta ca/documents/WHS/WHS-PUB_oid_health pdf 2009

16. Oleckno WA. Essential Epidemiology: Princliples and Applications. Long Grove, Illinois: Waveland Press, Inc.; 2002.

17. Wilkins K, Mackenzie S. Work Injuries. Statistic Canada; 2007 Aug 1. Report No.: 3.

18. Baldwin ML, Johnson WG, Butler RJ. The error of using returns-to-work to measure the outcomes of health care. American Journal of Industrial Medicine 1996 June;29(6):632-41.

19. Baldwin ML, Cote P, Frank JW, Johnson WG. Cost-effectiveness studies of medical and chiropractic care for occupational low back pain. a critical review of the literature. Spine Journal: Official Journal of the North American Spine Society 2001 March;1(2):138-47.

20. Baldwin ML, Butler RJ. Upper extremity disorders in the workplace: costs and outcomes beyond the first return to work. Journal of Occupational Rehabilitation 2006 September;16(3):303-23.

21. Coyte PC, Asche CV, Croxford R, Chan B. The economic cost of musculoskeletal disorders in Canada. Arthritis Care & Research 1998 October;11(5):315-25.

22. WCB-Alberta. WCB-Alberta 2006 Annual Report Working Progress. http://www wcb ab ca/pdfs/public/annual_report_2006 pdf 2006

23. Hashemi L, Webster, B, Clancey,E,Courtney, T. Length of disability and cost of work-related musculoskeletal disorders of the upper extremity.

Journal of Occupational & Environmental Medicine 1998 January 3;40(3):261-9.

24. Frank J, Cullen K. Preventing injury, illness and disability at work. Scandinavian Journal of Work, Environment & Health 2006 April;32(2):160-7.

25. Crook J,Moldofsky,H. The probability of recovery and return to work from work disability as a function of time. Quality of Life Research 1994 January 12;3(Supplement 1):S97-S109.

26. Truchon M. Determinants of chronic disability related to low back pain: towards an integrative biopsychosocial model. Disability Rehabilitation 2001 November 20;23(17):758-67.

27. Gross DP, Battie MC. Work-related recovery expectations and the prognosis of chronic low back pain within a workers' compensation setting. Journal of Occupational & Environmental Medicine 2005 April;47(4):428-33.

28. Carroll LJ, Cassidy JD, Cote P. Frequency, timing, and course of depressive symptomatology after whiplash. Spine (Phila Pa 1976) 2006 July 15;31(16):E551-E556.

29. Carroll LJ, Cassidy JD, Cote P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. Pain 2004 January;107(1-2):134-9.

30. Carroll LJ, Cassidy JD, Cote P. Factors associated with the onset of an episode of depressive symptoms in the general population. Journal of Clinical Epidemiology 2003 July;56(7):651-8.

31. Carroll LJ, Cassidy JD, Cote P. The role of pain coping strategies in prognosis after whiplash injury: passive coping predicts slowed recovery. Pain 2006 September;124(1-2):18-26.

32. Kivioja J, Jensen I, Lindgren U. Early coping strategies do not influence the prognosis after whiplash injuries. Injury 2005 August;36(8):935-40.

33. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Coping with neck and low back pain in the general population. Health Psychology 2000 July;19(4):333-8.

34. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Passive coping is a risk factor for disabling neck or low back pain. Pain 2005 September;117(1-2):51-7.

35. Carroll LJ, Hurwitz EL, Cote P, Hogg-Johnson S, Carragee EJ, Nordin M, Holm LW, van d, V, Cassidy JD, Guzman J, Peloso PM, Haldeman S, Bone and Joint Decade. Research priorities and methodological implications: the

Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine (Phila Pa 1976) 2008 February 15;33(Suppl):S214-S220.

36. Krause N, Frank JW, Dasinger LK, Sullivan TJ, Sinclair SJ. Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. American Journal of Industrial Medicine 2001 October;40(4):464-84.

37. Cedraschi C, Allaz AF. How to identify patients with a poor prognosis in daily clinical practice. Best Practice & Research Clinical Rheumatology 2005 August;19(4):577-91.

38. Linton SJ, Gross D, Schultz IZ, Main C, Cote P, Pransky G, Johnson W. Prognosis and the identification of workers risking disability: research issues and directions for future research. Journal of Occupational Rehabilitation 2005 December;15(4):459-74.

39. Schultz IZ, Stowell AW, Feuerstien M, Gatchel RJ. Models of Return to Work for Musculoskeletal Disorders. Journal of Occupational Rehabilitation 2007;17:327-52.

40. Loisel P, Buchbinder R, Hazard R, Keller R, Scheel I, van Tulder M, Webster B. Prevention of Work Disability Due to Musculskeletal Disorders: The Challenge of Implementing Evidence. Journal of Occupational Rehabilitation 2005;15(4):507-24.

41. Engel G. The need for a new medical model: A challenge for biomedicine. Science 1977;196(4286):129-36.

42. Curtis A. Introduction to Health Psychology. Health Psychology.London: Routledge; 2000. p. 1-16.

43. Blankfeld DF, Holahan CJ. Family support, coping strategies, and depressive symptoms among mothers of children with diabetes. Journal of Family Psychology 1996;10(2):173-9.

44. Lazarus RS. Coping theory and research: past, present, and future. Psychosomatic Medicine 1993 May;55(3):234-47.

45. Flor H, Turk DC. Chronic back pain and rheumatoid arthritis: Predicting pain and disability from cognitive variables. Journal of Behavioral Medicine 1988;11(3):-265.

46. Folkman S, Lazarus RS. The relationship between coping and emotion: implications for theory and research. Social Science & Medicine 1988;26(3):309-17.

47. Aldwin, C.M. Stress, Coping, and Development: An Integrative Perspective. 2nd ed. New York: The Guilford Press; 2007.

48. Folkman S, Moskowitz J. Positive affect and the other side of coping. American Pyschologist 2000;(55):647-54.

49. Coutu MF, Baril R, Durand MJ, Cote D, Rouleau A. Representations: an important key to understanding workers' coping behaviors during rehabilitation and the return-to-work process. Journal of Occupational Rehabilitation 2007 September;17(3):522-44.

50. Bandura A, O'Leary A, Taylor CB, Gauthier J, Gossard D. Perceived Self-Efficacy and Pain Control: Opioid and Nonopioid Mechanisms. Journal of Personality & Social Psychology 1987 September;53(3):563-71.

51. Szasz T, Hollinder M. A contribution to the philosophy of medicine:the basic models of the doctor-patient relationship. Archives of Internal Medicine 1956;97:585-92.

52. Hayden JA, Cote P, Steenstra IA, Bombardier C, QUIPS-LBP Working Group. Identifying phases of investigation helps planning, appraising, and applying the results of explanatory prognosis studies. Journal of Clinical Epidemiology 2008 June;61(6):552-60.

53. Soderlund A, Lindberg P. Whiplash-associated disorders--predicting disability from a process-oriented perspective of coping. Clinical Rehabilitation 2003 February;17(1):101-7.

54. Buitenhuis J, Spanjer J, Fidler V. Recovery from acute whiplash: the role of coping styles. Spine (Phila Pa 1976) 2003 May 1;28(9):896-901.

55. Heneweer H, Aufdemkampe G, van Tulder MW, Kiers H, Stappaerts KH, Vanhees L. Psychosocial variables in patients with (sub)acute low back pain: an inception cohort in primary care physical therapy in The Netherlands. Spine (Phila Pa 1976) 2007 March 1;32(5):586-92.

56. Bosma FK, Kessels RP. Cognitive impairments, psychological dysfunction, and coping styles in patients with chronic whiplash syndrome. Neuropsychiatry, Neuropsychology, & Behavioral Neurology 2002 March;15(1):56-65.

57. Borsbo B, Peolsson M, Gerdle B. Catastrophizing, depression, and pain: correlation with and influence on quality of life and health - a study of chronic whiplash-associated disorders. Journal of Rehabilitation Medicine 2008 July;40(7):562-9.

58. International Association for the Study of Pain. http://www iasp-pain org/AM/Template cfm?Section=Pain_Defi isplay cfm&ContentID=1728 2010

59. Ciechanowski P, Sullivan M, Jensen M, Romano J, Summers H. The relationship of attachment style to depression, catastrophizing and health care utilization in patients with chronic pain. Pain 2003 August;104(3):627-37.

60. Crombez G, Eccleston C, Van HG, De VP. Attempting to solve the problem of pain: a questionnaire study in acute and chronic pain patients. Pain 2008 July 31;137(3):556-63.

61. Cui J, Matsushima E, Aso K, Masuda A, Makita K. Psychological features and coping styles in patients with chronic pain. Psychiatry and Clinical Neurosciences 2009;63(2):147-52.

62. Esteve R, Ramirez-Maestre C, Lopez-Marinez AE. Adjustment to chronic pain: the role of pain acceptance, coping strategies, and pain-related cognitions. Annals of Behavioral Medicine 2007 April;33(2):179-88.

63. Lopez-Martinez AE, Esteve-Zarazaga R, Ramirez-Maestre C. Perceived social support and coping responses are independent variables explaining pain adjustment among chronic pain patients. Journal of Pain 2008 April;9(4):373-9.

64. McCracken LM, Gross RT. Does anxiety affect coping with chronic pain? Clinical Journal of Pain 1993 December;9(4):253-9.

65. McCracken LM, Samuel VM. The role of avoidance, pacing, and other activity patterns in chronic pain. Pain 2007 July;130(1-2):119-25.

66. Molton IR, Jensen MP, Nielson W, Cardenas D, Ehde DM. A preliminary evaluation of the motivational model of pain self-management in persons with spinal cord injury-related pain. Journal of Pain 2008 July;9(7):606-12.

67. Rahman A, Reed E, Underwood M, Shipley ME, Omar RZ. Factors affecting self-efficacy and pain intensity in patients with chronic musculoskeletal pain seen in a specialist rheumatology pain clinic. Rheumatology 2008 December;47(12):1803-8.

68. Ramirez-Maestre C, Esteve R, Lopez AE. Cognitive appraisal and coping in chronic pain patients. European Journal of Pain: Ejp 2008 August;12(6):749-56.

69. Roth RS, Geisser ME, Theisen-Goodvich M, Dixon PJ. Cognitive complaints are associated with depression, fatigue, female sex, and pain

catastrophizing in patients with chronic pain. Archives of Physical Medicine & Rehabilitation 2005 June;86(6):1147-54.

70. Schiphorst Preuper HR, Reneman MF, Boonstra AM, Dijkstra PU, Versteegen GJ, Geertzen JHB, Brouwer S. Relationship between psychological factors and performance-based and self-reported disability in chronic low back pain. European Spine Journal 2008;17(11):1448-56.

71. Schmitt MA, Van Meeteren NL, De Wijer A, Van Genderen FR, Van Graaf YD, Helders PJ. Patients with chronic whiplash-associated disorders. Relationship between clinical and psychological factors and functional health status. American Journal of Physical Medicine and Rehabilitation 2009;88(3):231-8.

72. Thibault P, Loisel P, Durand MJ, Catchlove R, Sullivan MJL. Psychological predictors of pain expression and activity intolerance in chronic pain patients. Pain 2008;139(1):47-54.

73. Tsai YF, Chu TL, Lai YH, Chen WJ. Pain experiences, control beliefs and coping strategies in Chinese elders with osteoarthritis. Journal of Clinical Nursing 2008 October;17(19):2596-603.

74. van der Hulst M, Vollenbroek-Hutten MM, Ijzerman MJ. A systematic review of sociodemographic, physical, and psychological predictors of multidisciplinary rehabilitation-or, back school treatment outcome in patients with chronic low back pain. Spine 2005 April 1;30(7):813-25.

75. Waxman SE, Tripp DA, Flamenbaum R. The mediating role of depression and negative partner responses in chronic low back pain and relationship satisfaction. Journal of Pain 2008 May;9(5):434-42.

76. Widerstrom-Noga EG, Felix ER, Cruz-Almeida Y, Turk DC. Psychosocial subgroups in persons with spinal cord injuries and chronic pain. Archives of Physical Medicine & Rehabilitation 2007 December;88(12):1628-35.

77. Claar RL, Baber KF, Simons LE, Logan DE, Walker LS. Pain coping profiles in adolescents with chronic pain. Pain 2008;140(2):368-75.

78. Lefebvre JC, Lester N, Keefe FJ. Pain in young adults. II: The use and perceived effectiveness of pain-coping strategies. Clinical Journal of Pain 1995 March;11(1):36-44.

79. Lester N, Lefebvre JC, Keefe FJ. Pain in young adults--III: Relationships of three pain-coping measures to pain and activity interference. Clinical Journal of Pain 1996 December;12(4):291-300.

80. McCracken LM, Eccleston C. A comparison of the relative utility of coping and acceptance-based measures in a sample of chronic pain sufferers. European Journal of Pain: Ejp 2006 January;10(1):23-9.

81. Mead K, Theadom A, Byron K, Dupont S. Pilot study of a 4-week Pain Coping Strategies (PCS) programme for the chronic pain patient. Disability Rehabilitation 2007 February 15;29(3):199-203.

82. Molton I, Jensen MP, Ehde DM, Carter GT, Kraft G, Cardenas DD. Coping with chronic pain among younger, middle-aged, and older adults living with neurological injury and disease. Journal of Aging and Health 2008;20(8):972-96.

83. Perrot S, Poiraudeau S, Kabir M, Bertin P, Sichere P, Serrie A, Rannou F. Active or passive pain coping strategies in hip and knee osteoarthritis? Results of a national survey of 4,719 patients in a primary care setting. Arthritis Care and Research 2008;59(11):1555-62.

84. Hadjistavropoulos HD, Asmundson GJ, Norton GR. Validation of the coping with health, injuries, and problems scale in a chronic pain sample. Clinical Journal of Pain 1999 March;15(1):41-9.

85. Buenaver LF, Edwards RR, Haythornthwaite JA. Pain-related catastrophizing and perceived social responses: Inter-relationships in the context of chronic pain. Pain 2007 February;127(3):234-42.

86. Buenaver LF, Edwards RR, Smith MT, Gramling SE, Haythornthwaite JA. Catastrophizing and Pain-Coping in Young Adults: Associations With Depressive Symptoms and Headache Pain. Journal of Pain 2008;9(4):311-9.

87. Hirsh AT, George SZ, Riley JL, III, Robinson ME. An evaluation of the measurement of pain catastrophizing by the coping strategies questionnaire. European Journal of Pain: Ejp 2007 January;11(1):75-81.

88. Martorella G, Cote J, Choiniere M. Pain catastrophizing: a dimensional concept analysis. Journal Of Advanced Nursing 2008 August;63(4):417-26.

89. Spinhoven P, Ter KM, Kole-Snijders AM, Hutten MM, Den Ouden DJ, Vlaeyen JW. Catastrophizing and internal pain control as mediators of outcome in the multidisciplinary treatment of chronic low back pain. European Journal of Pain: Ejp 2004 June;8(3):211-9.

90. Sullivan MJ, D'Eon JL. Relation between catastrophizing and depression in chronic pain patients. Journal of Abnormal Psychology 1990 August;99(3):260-3.

91. Sullivan MJ, Stanish W, Waite H, Sullivan M, Tripp DA. Catastrophizing, pain, and disability in patients with soft-tissue injuries. Pain 1998 September;77(3):253-60.

92. Vowles KE, McCracken LM, Eccleston C. Processes of change in treatment for chronic pain: the contributions of pain, acceptance, and catastrophizing. European Journal of Pain: Ejp 2007 October;11(7):779-87.

93. Douglas C, Windsor C, Wollin J. Understanding chronic pain complicating disability: finding meaning through focus group methodology. Journal of Neuroscience Nursing 2008 June;40(3):158-68.

94. Campbell C, Cramb G. 'Nobody likes a back bore'--exploring lay perspectives of chronic pain: revealing the hidden voices of nonservice users. Scandinavian Journal of Caring Sciences 2008 September;22(3):383-90.

95. Fisher GS, Emerson L, Firpo C, Ptak J, Wonn J, Bartolacci G. Chronic pain and occupation: an exploration of the lived experience. American Journal of Occupational Therapy 2007 May;61(3):290-302.

96. Patel S, Greasley K, Watson PJ. Barriers to rehabilitation and return to work for unemployed chronic pain patients: a qualitative study. European Journal of Pain: Ejp 2007 November;11(8):831-40.

97. Samwel HJ, Evers AW, Crul BJ, Kraaimaat FW. The role of helplessness, fear of pain, and passive pain-coping in chronic pain patients. Clinical Journal of Pain 2006 March;22(3):245-51.

98. Gross D, Mrazik M, Muir I. Chronic Pain in Injured Workers. In: Rashiq S, Schopflocher D, Taenzer P, Jonsson E, editors. Chronic Pain: A Health Policy Perspective.Weinheim: Wiley-VCH; 2008. p. 193-204.

99. Pincus T, Burton AK, Vogel S, Field AP. A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. Spine (Phila Pa 1976) 2002 March 1;27(5):E109-E120.

100. Carroll L, Mercado AC, Cassidy JD, Cote P. A population-based study of factors associated with combinations of active and passive coping with neck and low back pain. Journal of Rehabilitation Medicine 2002 March;34(2):67-72.

101. van Eijsden-Besseling MD, Peeters FP, Reijnen JA, de Bie RA. Perfectionism and coping strategies as risk factors for the development of non-specific work-related upper limb disorders (WRULD). Occupational Medicine (Oxford) 2004 March;54(2):122-7.

102. Smith JA, Lumley MA, Longo DJ. Contrasting emotional approach coping with passive coping for chronic myofascial pain. Annals of Behavioral Medicine 2002;24(4):326-35.

# Study One: How Do Injured Workers Cope with Pain? A Descriptive Study of Injured Workers with Occupationally Related Long Term Pain

## Introduction

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. IASP notes that, "pain is always subjective and each individual learns the application of the word through experiences related to injury in early life." Further, "although pain is unquestionably a sensation in part or parts of the body, it is always unpleasant and therefore should be understood as an emotional experience".(1) Long term pain, or chronic pain, is defined by IASP as "pain without apparent biological value that has persisted beyond the normal duration of tissue healing (usually three months)".(1)

For the individual with chronic long term pain, the ability to 'cope' with this pain is a daily struggle. Similar to chronic disease, individuals with long term pain adapt their daily routines and learn to live with pain (to cope with pain). Pain coping is defined in the literature as the combination of the cognitive and behavioural efforts people use to counter their experience with pain.(2) The cognitive component refers to the intellectual efforts an individual uses, for example, perseverance about his or her pain or ignoring the pain sensation. The behavioural efforts are the individual's activities related to his or her pain. For example, does one increase/decrease medication use because of pain or decide to increase or decrease activity levels. Taken as a whole, these strategies make up the conventional idea of pain coping.

Understanding the individual with chronic pain is a challenge. The understanding of the pain response, neurologically, physically, and psychologically, has dramatically increased over the past twenty years. Pain researchers recognize that pain is a complex subjective experience that involves physical biological responses and emotional psychological responses, all occurring within the individual's social cultural context. The biopsychosocial perspective is an integrated model that incorporates mechanical and physiological processes as well as psychological and social contextual variables.(3) Therefore, to understand a person's response to pain; the researcher must understand the unique reciprocal interactions of these variables. Successfully treating chronic pain patients therefore, requires attention to both the organic basis of symptoms and the range of factors that modulate and moderate the pain experience.(3)

Psychological and sociological factors are understood to play crucial roles in the development of chronic pain and subsequent disability.(4,5) In the scientific literature concerning chronic pain, coping as an a independent variable is commonly studied in one of four ways: (1) included as one of several psychological variables added to the statistical model(5-22), (2) as a process, i.e. measuring strategies,(8,23-30), (3) studying one coping strategy at a time, e.g. catastrophizing, (31-38) and (4) qualitatively.(39-42) Furthermore, preliminary work on the biopsychosocial model of chronic pain has identified various factors that are associated with long term pain. In 2005, van der Hulst systematically reviewed literature concerning socio-demographic, physical, and psychological predictors in a chronic low back pain population and concluded more confirmatory study is required to test such predictors.(20)

In 2006, Samwel et al. studied the contribution of various psychological factors including passive coping and their relation to pain level, disability, and depression in a cross sectional study of chronic pain patients attending an interdisciplinary pain centre. The results of their unadjusted analysis showed that helplessness, fear of pain, and passive pain coping strategies were all related to pain level, measures of disability, and depression. In their adjusted multivariable regression analysis, however, only helplessness showed to be a significant predictor for pain level. Conversely, their analysis did find that passive coping is a significant predictor of self rated disability and post injury depression.(43)

In 2000, Turner et al. examined the effects of coping, beliefs, and catastrophizing on the adjustment of patients with chronic pain.(44) They found that coping scores, using the Coping Strategies Questionnaire, significantly and independently predicted physical disability.

To date, very little research has examined pain coping in injured workers. Like chronic pain, recovery from a work injury is a complex process, one that depends on multiple factors such as, age, gender, prior health status, occupation, job demands, and severity of injury along with psychological and social factors. Often, the physical injury may appear healed yet the worker continues to report persistent pain related to their injury. For example, in 2001, Truchon and colleagues found that for a small proportion of people labelled as ‘chronically’ disabled due to non-specific work-related low back pain, there was no biomecanical reason found to explain the origin of pain in almost 90% of these cases.(45)

The investigation into the physical parameters about occupationally related pain has been studied compressively and appears to be analogous to injury research in the general population. Currently, research on occupational injury is looking to studies on injury and pain to identify potential psychological and socio-demographic prognostic factors. In relation to the recovery process some promising research is being done with recovery expectations (46), depression (47-49), and coping style (50-53). At the present time, the roles of these factors in occupational injury are not fully understood and specifically their roles in long-term, 'chronic' work related injury has yet to be completely empirically examined. A recently published systematic review on neck pain called for more empirical work to be done using both psychological and sociological factors when researching occupational injury.(54)

Previous studies have noted the importance of evaluating specific coping strategies (such catastrophizing, ignoring pain, and coping self statements) as they may provide more information about complex relationships and pain severity as well as provide guidance in treating workers with chronic pain.(55,56) The aim of this current study was to describe how workers with long term pain due to occupationally related injuries cope with their pain. This study describes the differences in coping strategies among those with various demographic characteristics, injury types, pain/disability levels, and psychological features. By understanding more about how those with chronic occupational pain problems cope, and characterizing the different coping strategies commonly used, we gain greater insight into coping as a potential prognostic factor for recovery, and better understand what groups of injured workers may benefit from interventions that modify coping styles.

## Methods

### *Design*

An observational study design was used utilizing descriptive statistics to examine the coping characteristics of a group of injured workers in a rehabilitation program for long term work absenteeism (see Appendix A). Demographic characteristics, injury types, levels of depression, self reported pain, and disability were examined in individuals to try to characterize differences in uses of coping strategies.

### *Setting and Sample Population*

Subjects for this study consisted of injured workers seeking treatment at the Millard Health Rehabilitation Centre in Edmonton, Alberta in the years between 2003 and 2005. The Millard Centre provides rehabilitation services for clients of The Worker's Compensation Board of Alberta (WCB-Alberta ). The WCB-Alberta provides 'no-fault' insurance coverage to employers and workers. Its mandate is to provide compensation to injured workers for lost employment income, treatment, and rehabilitation costs.

All subjects in this study were patients in the Return to Work Services (Complex) treatment program at the Millard Centre. Injured workers were triaged to this program if they were assessed as having a prolonged course of disability (over three months), and have been assessed as potentially having psychological or social barriers that made returning to work difficult.

### *Measures*

All data were collected at intake into the rehabilitation program, as routine assessment procedures.

### *Dependent Variable: Coping*

Pain coping strategies were measured by using the Coping Strategies Questionnaire (CSQ) (see Appendix B).(57) This questionnaire is a widely used instrument for measuring pain coping strategies. Jensen et al. note that the CSQ is the most frequently used measure to asses coping in chronic pain populations.(56) The primary aim of the CSQ is to assess the frequency and success of an individual's cognitive and behavioural pain coping strategies. These coping strategies are as follows: diverting attention, reinterpreting pain sensations, coping self statements, ignoring pain sensations, praying/hoping, catastrophizing, increased pain behaviours. An additional item relates to control over pain.(57) Individuals are asked to rate on a 7 point Likert scale how much they use these strategies when dealing with their pain.

### *Independent Variables: Factors Related to Coping*

### *Demographic Variables*

Demographic information was gathered from the admission information supplied by the individual when entering into the treatment program. Missing information was gathered from the linked WCB-Alberta administrative data file.

Demographic variables used for this study were as follows: age, sex, education level, marital status, and annual income (pre-injury).

### *Injury Related Variables*

Diagnostic information was obtained from the claims using physician documentation of injury used for payment of professional fees. The WCB-Alberta uses the International Classification of Diseases, 9th Revision (ICD-9). Additionally, it included information about the nature of injury and body part affected.

Three injury related variables were examined: primary diagnosis, part of body injured, and type of accident. Primary diagnosis was categorized into 6 categories based on the common ICD-9 classifications. For ‘part of body injured’ and ‘type of accident’, broad categories were formed based on commonality of the code (for example, abdomen and trunk were grouped together) and logical inclusion criteria (all types of falls were grouped together) this ensured adequate statistical power for analysis. The following categories were used: back-including spine and spinal cord, upper extremity, multiple body parts (this category grouped together injuries that were less common overall, such as abdominal injuries and injuries to the trunk), lower extremity, and neck and shoulder. The following categories were formed for ‘type of accident’: falls, overexertion and bodily reaction/repetitive motion, caused by an object, assault and unknown, and transportation accidents.

### *Psychological Variables*

### *Pain on Admission*

Pain on admission was measured using a visual analogue scale. This is a commonly used and validated measure of pain intensity.(58) Usual pain intensity on admission was measured using a continuous 100 mm long rating scale transposed onto an eleven point scale. Clients of the rehabilitation program were asked on admission to the program to indicate their usual pain on a scale from 0-10, where 0 is no pain and 10 is unbearable pain.

### *Self Perceived Disability*

Self perceived disability was measured on admission to the program using the Pain Disability Index (PDI).(59)(See Appendix C) The Pain Disability Index is an eleven item, self-report inventory designed to provide an overall rating of disability and ratings of specific disabilities related to seven areas of life activities (occupational, home/family, recreational, social, sexual, ADLs, life support). Each item is rated on an 11-point Likert scale (0=no disability, 10=complete disability).

### *Depression*

Depression was measured using the Beck Depression Inventory-Second Edition (BDI-II)(See Appendix D). (60,61) The BDI-II is a 21-item self-reported measure of depressive symptoms experienced during the past two week period. The 21-items have a four point rating scale that when summed yields a score ranging from 0-63. The recommended cut point of 22 was used to indicate the presence of depressive symptomatology. This cut point is recommended by Poole et al. as an appropriate cut point for pain clinic patients.(62)

*Statistical Analysis*

Analyses were performed using standard descriptive statistics. Pearson Product Moment Correlations examined the univariate associations between continuous variables (coping strategies and depression and self reported pain disability). In order to control for depression (theoretically linked to coping (36,44,63,64)) partial correlation coefficients were used to describe the linear relationship between coping strategies and pain and self perceived disability. Differences between means were tested using analysis of variance (ANOVA). Least Square Difference (LSD[1]) post hoc testing was used to produce multiple comparisons between the means of a factor with more than one category.

## Results

There was a total of 479 patients treated between the April 1, 2003 and March 31, 2005. Table 1-1 reports the cohort's characteristics.

---

[1] LSD: an approximate way to circumvent the problem of distorted significance levels when making several tests involves reducing the significance level used for each individual test sufficiently to fix the overall significance level (i.e. the probability of falsely rejecting at least one of the null hypothesis being tested) at some desired value.(65)

**Table 1-1: Baseline Characteristics of Study Population, N=479**

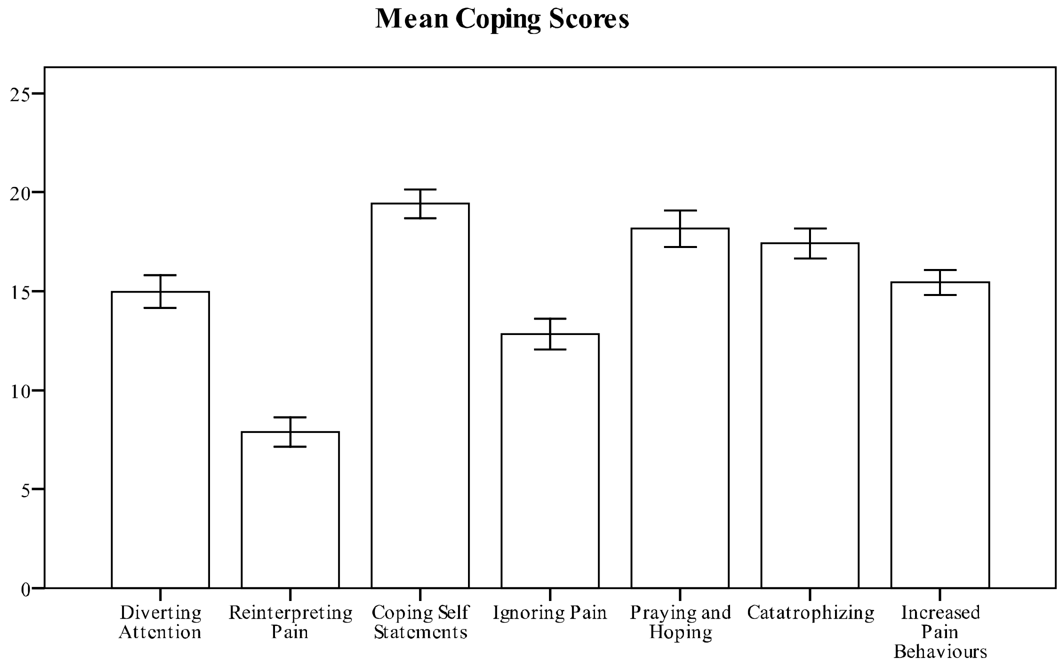
| Category | | N (%) | Mean (SD) |
|---|---|---|---|
| **Demographic/Socioeconomic** | | | |
| Gender | | | |
| | Male | 280 (58.5) | |
| | Female | 171 (35.7) | |
| Age | | | 44 (9) |
| | 18-29 | 30 (6.3) | |
| | 30-39 | 108 (22.5) | |
| | >40 | 314 (65.6) | |
| Marital Status | | | |
| | Married/Common Law | 284 (59.3) | |
| | Divorced/Separated | 77 (16.1) | |
| | Single/Widowed | 93 (19.4) | |
| Education | | | |
| | University/Technical School | 126 (26.3) | |
| | High School/Partial High School | 241 (50.3) | |
| | <Grade 8 | 71 (14.8) | |
| Annual Income (Pre-Accident) | | | |
| | >50K | 103 (21.5) | |
| | 35-50K | 129 (26.9) | |
| | 25-35K | 116 (24.2) | |
| | <25K | 131 (27.3) | |
| **Injury Related** | | | |
| Diagnosis (ICD9) | | | |
| | Dorsopathies | 152 (31.7) | |
| | Rheumatisms/Nerve Disorders | 93 (19.4) | |
| | Sprains/Strains | 89 (18.6) | |
| | Fractures/Amputations/Crush | 66 (13.8) | |
| | Knee and Joint Disorders | 53 (11.1) | |
| | Pain Related Ailments (Skin or Superficial wounds) | 26 (5.4) | |
| Part of Body Injured | | | |
| | Back-including spine/spinal cord | 132 (27.6) | |
| | Multiple body parts-Including Abdomen, Truck and | 111 (23.2) | |

| | | | |
|---|---|---|---|
| | Head | | |
| | Upper Extremity | 99 (20.7) | |
| | Lower Extremity | 72 (15.0) | |
| | Neck and Shoulder | 65 (13.6) | |
| Type of Accident | | | |
| | Overexertion/Repetitive Strain | 220 (45.9) | |
| | Fall | 110 (23.0) | |
| | Caused by an Object | 58 (12.1) | |
| | Unknown or Assault | 54 (11.3) | |
| | Transportation Accident | 37 (7.7) | |
| **Psychological Variables** | | | |
| Depression (BDI-II) | | | |
| | Yes (>22) | 219 (45.7) | |
| | No (≤22) | 205 (42.8) | |
| Self Perceived Disability (μ=50.4) | >50 | 367 (55.0) | 50.4 |
| | <50 | 165 (45.1) | |
| Self Perceived Pain (VAS) (μ=7) | <7 | 216 (45.1) | 7 |
| | >7 | 144 (30.1) | |
| Coping Strategy (CSQ) | | | |
| | Diverting Attention | | 15 (8.5) |
| | Reinterpreting Pain | | 8 (8) |
| | Coping Self Statements | | 19 (8) |
| | Ignoring Pain | | 13 (8) |
| | Praying and Hoping | | 18 (10) |
| | Catastrophizing | | 17 (8) |
| | Increased Pain Behaviours | | 15 (6) |
| | Control | | 2 (1) |

### *Dependent Variable: Coping*

The means of each coping strategy are presented in Figure 1-1. The coping strategy with the highest mean score was coping self statements (μ=19.4, sd=7.6) this was followed by praying/hoping (μ=18.2, sd=9.7), and catastrophizing (μ=17.5, sd=8.0). The coping strategy with the lowest mean use was reinterpreting pain (μ=7.9, sd=7.8). The mean rating of control over one's pain was 2.4, sd= 1.4.

## Figure 1-1: Mean coping Scores for Workers with Chronic Pain, N=479



*Independent Variables*

Table 1-2 reports mean coping subscale scores stratified by patient demographic, injury-related, and psychological characteristics. Table 1-3 provides the correlation results for the continuous variables and each coping strategy.

**Table 1-2: Pain Coping Differences for Workers with Chronic Pain, N=479**

| **Variables** | **Diverting Attention Mean (SD)** | **Reinterpreting Pain Mean (SD)** | **Coping Self Statements Mean (SD)** | **Ignoring Pain Mean (SD)** | **Praying and Hoping Mean (SD)** | **Catastrophizing Mean (SD)** | **Increased Pain Behaviours Mean (SD)** |
|---|---|---|---|---|---|---|---|
| **Demographic** | | | | | | | |
| **Sex** | | | | | | | |
| Males | 13.6 (8.1) | 6.8 (7.3) | 19.0 (7.6) | 12.0 (8.1) | 17.1 (9.9) | 17.9 (8.0) | 14.5 (6.2) |
| Female | **17.2 (8.7)**** | **9.7 (8.3) **** | 20.1 (7.6) | **14.2 (8.1)**** | **19.9 (8.9)**** | 16.9 (8.0) | **17.0 (6.7)**** |
| **Age** | | | | | | | |
| 18-29 | 14.9 (6.4) | 7.8 (6.7) | 19.0 (5.6) | 13.5 (7.7) | 15.3 (7.5) | 17.4 (7.9) | 16.0 (5.9) |
| 30-39 | 15.2 (7.6) | 8.9 (7.5) | 19.6 (7.3) | 13.8 (8.0) | 17.1(9.4) | 17.7 (7.6) | 16.0 (5.7) |
| 40+ | 15.0 (9.0) | 7.6 (8.0) | 19.4 (7.9) | 12.5 (8.3) | 18.9 (9.8) | 17.4 (8.1) | 15.1 (6.8) |
| **Marital Status** | | | | | | | |
| Married/Common Law | **14.3 (8.6)*** | 7.6 (8.0) | 18.9 (7.7) | **12.0 (8.0)*** | **19.0 (9.4)*** | 17.8 (7.8) | **14.6 (6.3)*** |
| Single/Widowed | 15.6 (8.2) | 7.8 (7.1) | 20.3 (7.4) | 13.6 (8.4) | 15.8 (9.8) | 17.6 (9.1) | 16.2 (6.6) |
| Divorced/Separated | 16.8 (7.8) | 8.7 (7.5) | 16.6 (7.5) | 14.5 (7.6) | 17.6 (10.0) | 16.2 (7.1) | 17.0 (6.7) |
| **Education** | | | | | | | |
| < Grade 8 | 15.2 (8.7) | 7.9 (7.6) | 19.7 (8.0) | 13.0 (8.3) | **21.5 (10.0)**** | 19.8 (8.3) | 15.2 (6.8) |
| High School/Partial HS | 14.7 (8.2) | 7.6 (7.7) | 18.9 (7.6) | 15.6 (8.2) | 17.8 (10.0) | 17.4 (8.1) | 15.0 (6.5) |
| University/Technical | 15.5 (9.0) | 8.2 (7.5) | 19.8 (7.8) | 12.9 (7.9) | 17.0 (9.4) | 16.9 (7.8) | 16.2 (6.5) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Income** | | | | | | | |
| <25K | 16.0 (7.9) | 8.0 (7.9) | 19.2 (7.2) | 12.9 (7.8) | 20.0 (9.1) | 18.6 (7.4) | 16.2 (6.8) |
| 25-35K | 15.1 (9.6) | 8.6 (8.0) | 19.0 (7.9) | 12.6 (8.0) | 18.5 (10.1) | 17.3 (8.3) | 15.4 (6.5) |
| 35-50K | 14.6 (8.6) | 8.0 (8.0) | 20. 5 (7.6) | 13.6 (8.5) | 17.1 (9.5) | 17.1 (7.7) | 15.5 (6.5) |
| >50K | 14.1 (7.8) | 6.8 (7.2) | 18.8 (7.7) | 12.0 (8.4) | 17.2 (9.8) | 16.8 (8.0) | 15.4 (6.5) |
| **Injury Variables** | | | | | | | |
| **Primary Diagnosis (ICD-9)** | | | | | | | |
| Dorsopathies | 15.5 (8.6) | 8.8 (8.3) | 19.1 (8.2) | 12.7 (8.6) | 19.1 (9.0) | 17.9 (8.2) | 15.9 (6.5) |
| Sprains/Strains | 15.4 (9.0) | 8.1 (7.7) | 19.8 (8.0) | 13.0 (8.6) | 17.5 (10.4) | 18.0 (8.0) | 16.1 (7.2) |
| Rheumatisms | 14.7 (8.5) | 7.7 (7.6) | 19.8 (7.7) | 13.3 (9.1) | 18.8 (9.5) | 17.8 (8.1) | 14.9 (6.6) |
| Fractures/Amputations | 14.6 (7.9) | 6.6 (7.5) | 19.6 (6.5) | 12.0 (6.4) | 19.4 (9.9) | 17.2 (8.2) | 14.1 (5.9) |
| Knee/Joint Disorders | 13.4 (7.6) | 6.7 (6.7) | 19.4 (6.6) | 14.0 (6.7) | **12.7 (9.4)**** | 15.3 (7.3) | 14.4 (5.8) |
| Other Pain Related Ailments | 15.7 (10.2) | 8.7 (8.0) | 18.6 (7.7) | 11.6 (7.1) | 21.0 (8.8) | 17.4 (6.1) | 17.5 (4.7) |
| **Part of Body Injured** | | | | | | | |
| Back-Spine and Spinal Cord | 14.37 (9.0) | 8.14 (7.8) | 19.5 (7.6) | 12.6 (8.4) | 17.9 (9.5) | 17.6 (8.3) | 14.9 (6.5) |
| Upper Extremity | 15.8 (8.7) | 8.3 (8.2) | 20.5 (7.5) | 14.4 (8.0) | **21.1 (9.5)*** | 18.1 (8.1) | 15.7 (6.7) |
| Abdomen/Trunk | 14.9 (8.5) | 8.2 (8.1) | 19.5 (7.8) | 12.7 (7.9) | 16.8 (8.6) | 16.5 (7.5) | 15.4 (6.4) |
| Lower Extremity | 15.1 (7.3) | 6.6 (6.3) | 19.0 (6.4) | 12.7 (7.3) | 16.8 (10.5) | 17.9 (7.4) | 14.7 (6.1) |
| Neck and Shoulder | 15.0 (8.7) | 7.6 (8.2) | 17.8 (8.6) | 11.2 (9.0) | 18.2 (10.4) | 17.7 (8.6) | 16.6 (6.5) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Type of Accident** | | | | | | | |
| Overexertion/Repetitive Motion/Bodily Reaction | 15.5 (8.7) | 8.7 (8.0) | 19.5 (7.6) | 13.6 (8.4) | 19.0 (9.5) | 15.6 (7.8) | 15.7 (6.7) |
| Fall | 14.4 (7.8) | 6.9 (6.9) | 19.0 (7.2) | 12.0 (7.3) | 17.3 (10.0) | 15.6 (8.7) | 15.0 (6.2) |
| Caused by an Object | 14.8 (8.3) | 6.9 (7.5) | 19.5 (7.3) | 12.4 (7.9) | 18.0 (9.6) | 17.9 (7.4) | 16.1 (6.0) |
| Assault | 14.4 (9.8) | 7.4 (8.4) | 18.4 (8.7) | 11.5 (9.5) | 20.1 (9.7) | 18.8 (8.8) | 13.9 (6.8) |
| Transportation | 14.6 (7.8) | 7.9 (7.8) | 19.4 (7.6) | 12.9 (8.2) | 18.2 (9.7) | 14.3 (6.0) | 15.7 (6.5) |
| **Psychological Variables** | | | | | | | |
| Depression | | | | | | | |
| No (BDI<22) | 15.4 (8.8) | 8.1 (7.9) | **21.2 (7.0)**** | **14.15 (8.1)**** | 17.2 (9.5) | 13.3 (6.7) | **16.3 (6.6)**** |
| Yes (BDI >22) | 14.5 (8.2) | 7.7 (7.7) | 17.7 (7.8) | 11.6 (8.1) | **19.1 (9.7)** ** | **21.6 (6.9)**** | 14.5 (6.1) |
| Pain Disability on Admission | | | | | | | |
| Low (PDI< 50) | 14.3 (8.8) | 8.5 (8.0) | 19.9 (7.7) | **14.0 (8.0)**** | 16.7 (9.4) | 16.3 (7.7) | 15.7 (7.3) |
| High (PDI>50) | 15.4 (8.6) | 7.4 (7.8) | 18.5 (7.6) | 11.7 (8.3) | 18.5 (10.1) | **18.7 (7.9)**** | 14.6 (5.8) |
| Pain on Admission | | | | | | | |
| Low (<7) | 14.6 (8.9) | 7.9 (7.8) | 19.4 (7.6) | 13.3 (7.5) | 16.0 (9.3) | 16.0 (9.3) | 15.2 (6.5) |
| High (>7) | 15.3 (8.5) | 7.9 (8.0) | 18.7 (7.8) | 11.9 (9.2) | **20.2 (10.1)**** | **19.6 (8.4)**** | 14.9 (6.7) |

**Table 1-3: Pearson Correlations**

| | Diverting Attention | Reinterpreting Pain | Coping Self Statements | Ignoring Pain | Praying and Hoping | Catastrophizing | Increased Pain Behaviours |
|---|---|---|---|---|---|---|---|
| **Depression** | -.10* | -.04 | -.23** | -.14** | .11* | .60** | -.18** |
| **Pain§** | .13 | .10 | .01 | -.03 | .25** | .22** | .08 |
| **Self Perceived Disability§** | .12* | -.02 | -.06 | -.12 | -.18** | .10* | .00 |

* p<.05
**p<.01
§ partial correlation controlling for Depression

### *Demographic Variables*

#### *Gender*

Women diverted attention from pain, (17.2 vs. 13.6, p<.001), reinterpreted pain, (9.7 vs. 6.8 p <.001), and ignored pain (14.2 vs. 12.0, p<.001) *more* than men. Additionally women cope by using praying/hoping and pain related behaviours *more* than men (19.9 vs. 17.1, p<.001) and (17.0 vs. 14.5, p<.001), respectively. No differences were noted between women and men on the coping self statements or catastrophizing subscales, (p=.16 and p=.22).

#### *Age*

There were no age-related differences in the use of any of the coping strategies.

#### *Marital Status*

Significant differences were found between the marital status groups in their use of the pain coping strategies.

Married people used *less* diverting attention (14.3 vs. 16.8, p<.05) than divorced/separated people but did not differ from single/widowed individuals (14.3 vs. 15.6, p=.20). Furthermore, single/widowed people did not differ from divorced/separated in their used of diverting attention (15.6 vs. 16.8, p=.36).

Married/common law people used *less* ignoring pain than divorced/separated people (12.0 vs. 16.3, p<.05) but did not differ from single/widowed people (12.0 vs. 13.6, p= .12). Divorced/separated people did not differ from single/widowed individuals (13.6 vs. 14.5, p=.49).

Married/common law people used significantly *more* praying and hoping than single/widowed people (19.0 vs. 15.8, p<.05). There were no differences found between married/common law people and divorced separated people (19.0 vs. 17.6, p=.26) or divorced/separated and single/widowed people (17.6 vs. 15.8, p=.24).

Married/common law people used *less* pain related behaviours than both single/widowed and divorced separated (14.6 vs. 16.2, p<.05 and 14.6 vs. 17.0, p<.05). There were no differences noted between single/widowed and divorced/separated individuals (16.2 vs. 17.0, p=.47).

### *Education*

People with less than grade 8 scored used *more* praying/hoping subscale than those with high school or partial high school of university of technical training, (21.5 vs. 15.8, p<.001 and 21.5 vs. 17.0, p<.001).

### *Income*

None of the income categories differed on any of the coping strategies measured.

### *Injury Related Factors*

### *Primary Diagnosis (ICD-9)*

Several types of injuries were assessed for coping differences. These injuries were as follows: (1) dorsopathies, (2) sprains/ strains, (3) fractures/amputations/crushes, (4) knee and joint disorders, (5) other pain related ailments (skin and superficial wounds). Significant differences were only noted for the praying/hoping subscale. Individuals with knee and joint related pain or injury use *less* praying/hoping (12.7, p< .001) as a method of coping then all the other diagnostic classification groups.

### *Part of the Body Injured*

People with upper extremity injuries used *more* praying/hoping to cope with pain than people with back, abdomen/trunk, and lower extremity injuries (21.1vs. 17.9, p< .05, 16.8, p< .001, and 16.8, p< .001). Scores did not differ, however, from the neck/shoulder group (21.1, vs. 18.2, p=.07).

### *Type of Accident*

There were no coping differences noted for any of the types of accidents.

### *Psychological Variables*

### *Depression*

Depressive symptomatology was associated with all but two types of coping strategies: diverting attention and reinterpreting pain. Individuals with no depressive symptomatology (BDI<22) used *more* coping self statements (21.2 vs. 17.7, p<.001), ignoring pain (14.2 vs. 11.6, p<.001), and increased pain behaviours (16.3 vs. 14.5, p<.001) then those with higher depression scores (BDI<22). Furthermore, depressed individuals used *more* praying/hoping (19.1vs. 17.2, p< .05) and catastrophizing (21.6 vs. 13.3, p<.001).

When depression scores were used as a continuous variable it was *positively* correlated with praying/hoping and catastrophizing (r=.11, p=.03, r=.60, p<.001). Depression was negatively correlated with diverting attention (r= -.10, p=.03), coping self statements (r= -.23, p<.001), ignoring pain sensations (r= -.15, p<.001), and increased pain behaviours (r=-.18, p= -.18, p<.001).

### *Self Perceived Disability*

Since there are no validated cut-points for the PDI, the PDI was arbitrarily categorized into high disability and low disability based on the mean scores of the population (High: >50, Low: ≤ 50). Individuals with low self perceived disability ignore their pain *more* than the higher scoring group (14.0 vs. 11.7, p< .01), while people with high self reported pain disability use *more* catastrophizing (18.7 vs. 16.3, p< .001). No other differences were noted.

Diverting attention, praying/hoping, and catastrophizing were *positively* correlated with self perceived disability (r=.12, p=.03, r=.18, p=.00, and r=.10, p=.05), while ignoring pain sensations was *negatively* correlated with self perceived disability after controlling for depression (r=-.12, p=.03).

### *Self Perceived Pain*

The study population's mean for self reported pain (μ=7) was selected as a cut point, Low: ≤7, High: >7. The cut point of seven was found in previous work to be a valid cut point between moderate and sever pain levels.(66) Individuals reporting high amount of pain used significantly *more* praying/hoping (20.2, vs. 16.0, p<.001) and catastrophizing (19.6, vs. 16.0, p<.001). No other differences in coping strategies were noted.

After controlling for depression, praying/hoping, and catastrophizing were *positively* correlated with self perceived pain (r=.25, p<.001 and r=.22, p<.001).

## Discussion

The purpose of this paper was to examine how a cohort of injured workers with long term pain related to an occupational injury cope with this pain. The present findings indicate that coping strategies can differ depending on certain descriptive characteristics. This can potentially have serious repercussions for recovery from these injuries.

Coping self statements was the coping strategy with the highest mean score within this group of injured workers. Typical coping self statements are: “I tell myself to be brave and carry on despite the pain”, “I tell myself I can overcome this pain, and “I tell myself it doesn’t hurt”. The second and third highest mean scores were for praying/hoping and catastrophizing. Typical items on these scales are: “I pray for the pain to stop” and “It’s terrible and I feel it’s never going to get any better”, respectively. The high use of these types of pain coping strategies could be indicative of the helplessness involved in the typical day to day way these people cope with their pain. Conversely, the least used coping strategy by this group was reinterpreting pain, a typical item on this scale is, “I pretend it’s not part of me”. Indicating that these workers may feel they have little control over their pain and cannot actively engage in coping strategies that may help to control their pain. Furthermore, this was exhibited in the results of the pain control subscale with a mean score of 2.4 on the seven point scale.

All of these workers have had occupational injury related pain for greater than three months. The high use of coping self statements, praying/hoping, and catastrophizing were not unexpected, yet extremely informative. Previous research clearly shows that catastrophizing is consistently associated with poor clinical outcomes.(6,32,34,35,67-73) Moreover, the high use of coping self statements and praying/hoping provides intriguing insight as to how this group cognitively defines their pain, as something they consistently ruminate on and something that is perceived to be beyond their control. This finding indicates that the use of cognitive-behavioural therapy to alter perceptions around pain and perceived control of pain by lessening catastrophizing could potentially improve disability outcomes.

### *Demographic Variables and Coping*

This study confirms that there are differences in coping among people with different demographic characteristics. By measuring differences in coping strategies, future research may be able to detect potential interactions and moderating effects.

Interesting findings were noted concerning coping strategies and gender. Women divert their attention from pain, reinterpret pain and ignore pain more frequently than men. Furthermore, women have higher scores then men on the increased pain behaviours subscale than men. These differences were noted despite finding no differences in mean pain ratings (p=.4). Previous studies are inconclusive as to the relationship between gender and coping strategies. One recent study by Keogh et al. looked to describe gender differences on various coping strategies using the CSQ-R and compared these results with perceptions about pain coping in normal healthy individuals.(74) Their results showed no significant differences between genders and the coping strategies they used. Yet another study looking to assess gender differences and coping strategies in adolescents found that young women with chronic pain used more catastrophizing than young men.(75) The result of this present study showed quite contrary findings- no noted differences between men and women on the catastrophizing subscale. This finding may be, in part, due to the concept of internal locus of control. Research has shown that women labelled as having high internal locus of control used more cognitive restructuring to cope with pain then men who scored high in internal locus of control.(76) Although this study cannot confirm or refute this suggestion, the effect of locus of control is one possible complexity that should be considered in future study. Therefore, more study is needed to adequately assess the nature of these differences, in terms of modality and severity of pain and the coping strategies used.

Marital status and education level were also assessed for potentially different coping usage. Differences were noted between marital status groups and the coping strategies of diverting attention, ignoring pain, praying/hoping and increased pain behaviours. Divorced/separated individuals divert attention from pain more than married/common law people. They also use more amounts of ignoring pain than married/common law people. Conversely, married/common law people use more praying/hoping as a coping strategy than single/widowed, but significantly less pain behaviours than both divorced/separated and single/widowed people. When assessing coping differences between educational levels the results showed that people with less than a grade eight education used significantly more praying/hoping than any of the other educational groups. These results provide interesting insights as to how sociological elements may contribute to how people cope with pain and can be important elements when assessing the worker with pain and tailoring treatment options to improve outcomes.

### *Injury Related Variables and Coping*

This study assessed differences in coping strategies within injury related variables. These variables were as follows: primary diagnosis, part of body injured and type of accident. It was found that 31% of the group were diagnosed with dorsopathies (typically defined as non-specific back pain).(77) This group, however, did not show any differences from other diagnostic groups. The diagnostic group that did show significantly different coping was the group with a primary diagnosis of knee and joint problems. This group used less praying/hoping as a coping strategy than all the other groups. The reason for this finding is not known, further investigation into this finding found no discernable differences on mean pain levels (p=.51) or mean scores of self perceived control over pain (p=.58).

It was hypothesized, due in part to the popularly held perception that back pain patients have a poor recovery prognosis, that people with back injuries would use significantly different coping strategies then people with injuries to other body parts. The only significant difference noted was for people with upper extremity injuries. These people used more praying/hoping than all the other groups except for the neck/shoulder group. The lack of difference for these two groups is likely due to the proximity of the body part, yet this finding was still quite surprising. The high use of praying/hoping for this group begs the question;

is there little else these people feel they can do to help them manage their pain? Skevington found that patients that attributed events to chance happenings and not to internal control were more likely to be distressed about their pain.(78) Possibly, people with upper extremity injuries feel they are not at fault for their injury (its job related) therefore leading them to use more of this passive coping strategy.

### *Psychological Variables and Coping*

Coping and depression are inherently linked in the literature examining chronic pain, musculoskeletal injury, and whiplash.(67) When studying pain coping, there is ample evidence that one particular condition, depression, should be assessed as a potential confounder.(79) Depression is a common outcome after a musculoskeletal injury. Carroll et al. found that 42.3% (95% CI 40.9-43.6) of their initial cohort of 5,211 developed depressive symptomatology within six weeks of a whiplash injury. Additionally, they found that depressive symptoms were recurrent or persistent in 37.6%.(47) In another large cohort study, Dryden et al. reported that 28.9% of patients with a traumatic spinal cord injury were subsequently treated for depression.(80)

This current study found that 45.7% of the study group had significant depressive symptomatology (BDI-II >22). Given that reported point prevalence rates of depression in the general population are between 2-10% these findings are alarming.(81,82) This suggests that the prolonged period of recovery from an occupational injury may mirror the distress incurred by patients with musculoskeletal injuries and chronic pain. Indeed, clinical reports have consistently shown that the prevalence of depressive disorders is unusually high in individuals with chronic pain.(83-86) Perhaps inconsistencies in the literature may be explained by the failure to test for potential confounding by depression.

This study showed consistent evidence that people with differing levels of depression use significantly different strategies when coping with their pain. Individuals reporting low levels of self reported depression used significantly higher amounts of coping self statements, ignoring pain, and pain related behaviours. When correlations between depression and the coping strategies were assessed, it was found that depression was positively correlated with both catastrophizing and praying/hoping. Conversely, depression was negatively correlated with diverting attention, coping self statements, ignoring pain, and increase pain related behaviours.

Research has shown that depression alters one's ability to cognitively function; indeed both mild and severe forms of depression are associated with deficits on cognitive, motor, perceptual, and communication tasks.(87,88) People with low levels of depression are better able to tell themselves to "ignore the pain", and "overcome the pain", as compared to those with high levels of depression. While those people who reported high levels of depression use more passive pain coping such as praying/hoping and catastrophizing. The causal nature of this relationship cannot be determined, however, evidence suggests that catastrophizing plays a key role in the fear avoidance model of disability.(89)

When investigating if there were differences between groups of people who perceive themselves as having high or low pain related disability, the results showed that those individuals that perceived themselves as having low self perceived disability ignore their pain more. On the contrary, people with high rated self reported disability catastrophize their pain more. The results showed that as self perceived disability increased so did the use of diverting attention, praying/hoping, and catastrophizing. Moreover, as self perceived disability decreased the use of ignoring pain increased. Both of these findings were significant after controlling for depression.

The examination of differences in pain levels and coping strategies indicate that people with high levels of pain score significantly higher on the praying/hoping and catastrophizing subscales than any of the other groups. Additionally, after controlling for depression, when pain levels increased so did the use of praying/hoping and catastrophizing. The finding that increased pain levels are positively correlated with increased praying/hoping counters previous findings by Turner and Clancy. They found that increased use of praying/hoping was significantly related to decreases in pain intensity.(90) However, Geisser et al. found that praying/hoping and catastrophizing are both related to poorer adjustment to chronic pain.(63)

A full understanding of the variability of the coping strategies under differing levels of pain has yet to be achieved. Currently there is preliminary evidence that pain levels do matter. Haythornthwaite et al. note that the stress and coping model predicts that variability in adjustment due to pain will depend upon cognitive evaluation of the pain experience as well as behavioural and cognitive coping strategies employed to manage pain.(55) Further, they note that cognitive-behavioural models of pain propose that perceptions of control are critical moderators between pain and adaptation.(55) Jensen et al.'s critical review of the pain coping literature found that patients who believe they can control their pain, who avoid catastrophizing about their condition, and who believe they are not severely disabled appear to function better than those who do not.(56) These findings are important for planning treatment options, although more research needs to be conducted to determine the effectiveness of each of the specific pain coping strategies.

### *Limitations*

This study has some limitations that should be noted. First, the sample used is not representative of all individuals with chronic pain. However, it is comparable to individuals in similar rehabilitation programs for injured workers within the Canadian Workers' Compensation system. Secondly, the goal was to describe coping strategies for this population and the descriptive nature of this study means it is not possible to determine the causal pathway of these coping strategies. The results of this study can generate many interesting hypotheses to be further tested in the future. The next step for research will be to use a cohort design to look at pain coping and it associations with the outcome variables over time.

### *Strengths*

As noted the descriptive design offers a good way to generate hypotheses related to the results. One aspect that was noted in this study was that differences were significant for maladaptive coping strategies in conditions where there may be a perceived lack of control. High pain intensity, high self reported disability, and high self rated depression all showed significantly higher amounts of catastrophizing and praying/hoping. Potentially, perceived control over pain could be a mitigating factor for poor recovery. The descriptive nature of this paper is limiting yet the results have provided great possibilities in terms of future research.

In conclusion, this study has provided good descriptive information about how injured workers with chronic pain problems cope with their pain. The results of this work can precipitate better tailored treatment options, by triaging patients earlier in their treatment program and applying cognitive-behaviour interventions specific to their needs. Moreover, targeting specific pain related beliefs and coping strategies for modification will improve treatment outcomes.

## References

1. International Association for the Study of Pain. http://www iasp-pain org/AM/Template cfm?Section=Pain_Defi isplay cfm&ContentID=1728 2010

2. Lazarus RS. Coping theory and research: past, present, and future. Psychosomatic Medicine 1993 May;55(3):234-47.

3. Turk DC, Flor H. Chronic Pain: a biobehavioural perspective. In: Gatchel RJ, Turk DC, editors. Psychosocial factors in pain: Critical perspectives.New York: Guilford Press; 1999. p. 18-34.

4. Boersma K, Linton SJ. Psychological processes underlying the development of a chronic pain problem: a prospective study of the relationship between profiles of psychological variables in the fear-avoidance model and disability. Clinical Journal of Pain 2006 February;22(2):160-6.

5. Cui J, Matsushima E, Aso K, Masuda A, Makita K. Psychological features and coping styles in patients with chronic pain. Psychiatry and Clinical Neurosciences 2009;63(2):147-52.

6. Ciechanowski P, Sullivan M, Jensen M, Romano J, Summers H. The relationship of attachment style to depression, catastrophizing and health care utilization in patients with chronic pain. Pain 2003 August;104(3):627-37.

7. Crombez G, Eccleston C, Van HG, De VP. Attempting to solve the problem of pain: a questionnaire study in acute and chronic pain patients. Pain 2008 July 31;137(3):556-63.

8. Esteve R, Ramirez-Maestre C, Lopez-Marinez AE. Adjustment to chronic pain: the role of pain acceptance, coping strategies, and pain-related cognitions. Annals of Behavioral Medicine 2007 April;33(2):179-88.

9. Lopez-Martinez AE, Esteve-Zarazaga R, Ramirez-Maestre C. Perceived social support and coping responses are independent variables explaining pain adjustment among chronic pain patients. Journal of Pain 2008 April;9(4):373-9.

10. McCracken LM, Gross RT. Does anxiety affect coping with chronic pain? Clinical Journal of Pain 1993 December;9(4):253-9.

11. McCracken LM, Samuel VM. The role of avoidance, pacing, and other activity patterns in chronic pain. Pain 2007 July;130(1-2):119-25.

12. Molton IR, Jensen MP, Nielson W, Cardenas D, Ehde DM. A preliminary evaluation of the motivational model of pain self-management in persons with spinal cord injury-related pain. Journal of Pain 2008 July;9(7):606-12.

13. Rahman A, Reed E, Underwood M, Shipley ME, Omar RZ. Factors affecting self-efficacy and pain intensity in patients with chronic musculoskeletal pain seen in a specialist rheumatology pain clinic. Rheumatology 2008 December;47(12):1803-8.

14. Ramirez-Maestre C, Esteve R, Lopez AE. Cognitive appraisal and coping in chronic pain patients. European Journal of Pain: Ejp 2008 August;12(6):749-56.

15. Roth RS, Geisser ME, Theisen-Goodvich M, Dixon PJ. Cognitive complaints are associated with depression, fatigue, female sex, and pain catastrophizing in patients with chronic pain. Archives of Physical Medicine & Rehabilitation 2005 June;86(6):1147-54.

16. Schiphorst Preuper HR, Reneman MF, Boonstra AM, Dijkstra PU, Versteegen GJ, Geertzen JHB, Brouwer S. Relationship between psychological factors and performance-based and self-reported disability in chronic low back pain. European Spine Journal 2008;17(11):1448-56.

17. Schmitt MA, Van Meeteren NL, De Wijer A, Van Genderen FR, Van Graaf YD, Helders PJ. Patients with chronic whiplash-associated disorders. Relationship between clinical and psychological factors and functional health status. American Journal of Physical Medicine and Rehabilitation 2009;88(3):231-8.

18. Thibault P, Loisel P, Durand MJ, Catchlove R, Sullivan MJL. Psychological predictors of pain expression and activity intolerance in chronic pain patients. Pain 2008;139(1):47-54.

19. Tsai YF, Chu TL, Lai YH, Chen WJ. Pain experiences, control beliefs and coping strategies in Chinese elders with osteoarthritis. Journal of Clinical Nursing 2008 October;17(19):2596-603.

20. van der Hulst M, Vollenbroek-Hutten MM, Ijzerman MJ. A systematic review of sociodemographic, physical, and psychological predictors of multidisciplinary rehabilitation-or, back school treatment outcome in patients with chronic low back pain. Spine 2005 April 1;30(7):813-25.

21. Waxman SE, Tripp DA, Flamenbaum R. The mediating role of depression and negative partner responses in chronic low back pain and relationship satisfaction. Journal of Pain 2008 May;9(5):434-42.

22. Widerstrom-Noga EG, Felix ER, Cruz-Almeida Y, Turk DC. Psychosocial subgroups in persons with spinal cord injuries and chronic pain. Archives of Physical Medicine & Rehabilitation 2007 December;88(12):1628-35.

23. Claar RL, Baber KF, Simons LE, Logan DE, Walker LS. Pain coping profiles in adolescents with chronic pain. Pain 2008;140(2):368-75.

24. Lefebvre JC, Lester N, Keefe FJ. Pain in young adults. II: The use and perceived effectiveness of pain-coping strategies. Clinical Journal of Pain 1995 March;11(1):36-44.

25. Lester N, Lefebvre JC, Keefe FJ. Pain in young adults--III: Relationships of three pain-coping measures to pain and activity interference. Clinical Journal of Pain 1996 December;12(4):291-300.

26. McCracken LM, Eccleston C. A comparison of the relative utility of coping and acceptance-based measures in a sample of chronic pain sufferers. European Journal of Pain: Ejp 2006 January;10(1):23-9.

27. Mead K, Theadom A, Byron K, Dupont S. Pilot study of a 4-week Pain Coping Strategies (PCS) programme for the chronic pain patient. Disability Rehabilitation 2007 February 15;29(3):199-203.

28. Molton I, Jensen MP, Ehde DM, Carter GT, Kraft G, Cardenas DD. Coping with chronic pain among younger, middle-aged, and older adults living with neurological injury and disease. Journal of Aging and Health 2008;20(8):972-96.

29. Perrot S, Poiraudeau S, Kabir M, Bertin P, Sichere P, Serrie A, Rannou F. Active or passive pain coping strategies in hip and knee osteoarthritis? Results of a national survey of 4,719 patients in a primary care setting. Arthritis Care and Research 2008;59(11):1555-62.

30. Hadjistavropoulos HD, Asmundson GJ, Norton GR. Validation of the coping with health, injuries, and problems scale in a chronic pain sample. Clinical Journal of Pain 1999 March;15(1):41-9.

31. Buenaver LF, Edwards RR, Haythornthwaite JA. Pain-related catastrophizing and perceived social responses: Inter-relationships in the context of chronic pain. Pain 2007 February;127(3):234-42.

32. Buenaver LF, Edwards RR, Smith MT, Gramling SE, Haythornthwaite JA. Catastrophizing and Pain-Coping in Young Adults: Associations With Depressive Symptoms and Headache Pain. Journal of Pain 2008;9(4):311-9.

33. Hirsh AT, George SZ, Riley JL, III, Robinson ME. An evaluation of the measurement of pain catastrophizing by the coping strategies questionnaire. European Journal of Pain: Ejp 2007 January;11(1):75-81.

34. Martorella G, Cote J, Choiniere M. Pain catastrophizing: a dimensional concept analysis. Journal Of Advanced Nursing 2008 August;63(4):417-26.

35. Spinhoven P, Ter KM, Kole-Snijders AM, Hutten MM, Den Ouden DJ, Vlaeyen JW. Catastrophizing and internal pain control as mediators of outcome in the multidisciplinary treatment of chronic low back pain. European Journal of Pain: Ejp 2004 June;8(3):211-9.

36. Sullivan MJ, D'Eon JL. Relation between catastrophizing and depression in chronic pain patients. Journal of Abnormal Psychology 1990 August;99(3):260-3.

37. Sullivan MJ, Stanish W, Waite H, Sullivan M, Tripp DA. Catastrophizing, pain, and disability in patients with soft-tissue injuries. Pain 1998 September;77(3):253-60.

38. Vowles KE, McCracken LM, Eccleston C. Processes of change in treatment for chronic pain: the contributions of pain, acceptance, and catastrophizing. European Journal of Pain: Ejp 2007 October;11(7):779-87.

39. Douglas C, Windsor C, Wollin J. Understanding chronic pain complicating disability: finding meaning through focus group methodology. Journal of Neuroscience Nursing 2008 June;40(3):158-68.

40. Campbell C, Cramb G. 'Nobody likes a back bore'--exploring lay perspectives of chronic pain: revealing the hidden voices of nonservice users. Scandinavian Journal of Caring Sciences 2008 September;22(3):383-90.

41. Fisher GS, Emerson L, Firpo C, Ptak J, Wonn J, Bartolacci G. Chronic pain and occupation: an exploration of the lived experience. American Journal of Occupational Therapy 2007 May;61(3):290-302.

42. Patel S, Greasley K, Watson PJ. Barriers to rehabilitation and return to work for unemployed chronic pain patients: a qualitative study. European Journal of Pain: Ejp 2007 November;11(8):831-40.

43. Samwel HJ, Evers AW, Crul BJ, Kraaimaat FW. The role of helplessness, fear of pain, and passive pain-coping in chronic pain patients. Clinical Journal of Pain 2006 March;22(3):245-51.

44. Turner JA, Jensen MP, Romano JM. Do beliefs, coping, and catastrophizing independently predict functioning in patients with chronic pain? Pain 2000 March;85(1-2):115-25.

45. Truchon M. Determinants of chronic disability related to low back pain: towards an integrative biopsychosocial model. Disability Rehabilitation 2001 November 20;23(17):758-67.

46. Gross DP, Battie MC. Work-related recovery expectations and the prognosis of chronic low back pain within a workers' compensation setting. Journal of Occupational & Environmental Medicine 2005 April;47(4):428-33.

47. Carroll LJ, Cassidy JD, Cote P. Frequency, timing, and course of depressive symptomatology after whiplash. Spine (Phila Pa 1976) 2006 July 15;31(16):E551-E556.

48. Carroll LJ, Cassidy JD, Cote P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. Pain 2004 January;107(1-2):134-9.

49. Carroll LJ, Cassidy JD, Cote P. Factors associated with the onset of an episode of depressive symptoms in the general population. Journal of Clinical Epidemiology 2003 July;56(7):651-8.

50. Carroll LJ, Cassidy JD, Cote P. The role of pain coping strategies in prognosis after whiplash injury: passive coping predicts slowed recovery. Pain 2006 September;124(1-2):18-26.

51. Kivioja J, Jensen I, Lindgren U. Early coping strategies do not influence the prognosis after whiplash injuries. Injury 2005 August;36(8):935-40.

52. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Coping with neck and low back pain in the general population. Health Psychology 2000 July;19(4):333-8.

53. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Passive coping is a risk factor for disabling neck or low back pain. Pain 2005 September;117(1-2):51-7.

54. Carroll LJ, Hurwitz EL, Cote P, Hogg-Johnson S, Carragee EJ, Nordin M, Holm LW, van der Velde G, Cassidy JD, Guzman J, Peloso PM, Haldeman S. Research Priorities and Methodological Implications: The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008 February 15;33(4S):S214-S220.

55. Haythornthwaite JA, Menefee LA, Heinberg LJ, Clark MR. Pain coping strategies predict perceived control over pain. Pain 1998 July;77(1):33-9.

56. Jensen MP, Turner JA, Romano JM, Karoly P. Coping with chronic pain: a critical review of the literature. Pain 1991 December;47(3):249-83.

57. Rosenstiel AK, Keefe FJ. The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. Pain 1983 September;17(1):33-44.

58. Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain 1986 October;27(1):117-26.

59. Chibnall JT, Tait RC. The Pain Disability Index: factor structure and normative data. Archives of Physical Medicine & Rehabilitation 1994 October;75(10):1082-6.

60. Brantley PJ, Mehan DJ, Thomas JL. The Beck Depression Inventory (BDI) and the Center for Epidemiologic Studies Depression Scale (CES-D). In: Maruish ME, editor. Handbook of Psychological Assessment in Primary Care Settings.Mahwah: Lawrence Erlbaum Associates; 2000. p. 391-422.

61. Williams AC, Richardson PH. What does the BDI measure in chronic pain? Pain 1993 November;55(2):259-66.

62. Poole H, Bramwell R, Murphy P. Factor structure of the Beck Depression inventory-II in patients with chronic pain. Clinical Journal of Pain 2006;22(9):790-8.

63. Geisser ME, Robinson ME, Henson CD. The Coping Strategies Questionnaire and chronic pain adjustment: a conceptual and empirical reanalysis. Clinical Journal of Pain 1994 June;10(2):98-106.

64. Snow-Turek AL, Norris MP, Tan G. Active and passive coping strategies in chronic pain patients. Pain 1996 March;64(3):455-62.

65. Kleinbaum DG, Kupper LL, Muller KE, Nizam A. One-Way Analysis of Variance. In: Kugushev A, editor. Applied Regression and Other Multivariable Methods.Pacific Grove: Duxury Press; 1998. p. 423-83.

66. Serlin RC, Mendoza TR, Nakamura Y, Edwards KR, Cleeland CS. When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. Pain 1995 May;61(2):277-84.

67. Borsbo B, Peolsson M, Gerdle B. Catastrophizing, depression, and pain: correlation with and influence on quality of life and health - a study of chronic whiplash-associated disorders. Journal of Rehabilitation Medicine 2008 July;40(7):562-9.

68. Buenaver LF, Edwards RR, Haythornthwaite JA. Pain-related catastrophizing and perceived social responses: Inter-relationships in the context of chronic pain. Pain 2007 February;127(3):234-42.

69. Edwards RR, Bingham CO, III, Bathon J, Haythornthwaite JA. Catastrophizing and pain in arthritis, fibromyalgia, and other rheumatic diseases. Arthritis & Rheumatism 2006 April 15;55(2):325-32.

70. Keefe FJ, Caldwell DS, Martinez S, Nunley J, Beckham J, Williams DA. Analyzing pain in rheumatoid arthritis patients. Pain coping strategies in patients who have had knee replacement surgery. Pain 1991 August;46(2):153-60.

71. Lopez-Lopez A, Montorio I, Izal M, Velasco L. The role of psychological variables in explaining depression in older people with chronic pain. Aging & Mental Health 2008 November;12(6):735-45.

72. Stewart MW, Harvey ST. Coping and Catastrophizing in Chronic Pain: A Psychometric Analysis and Comparison of Two Measures. Journal of Clinical Psychology 2001 January;57(1):131-8.

73. Sullivan MJ, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA, Lefebvre JC. Theoretical perspectives on the relation between catastrophizing and pain. Clinical Journal of Pain 2001 March;17(1):52-64.

74. Keogh E, Denford S. Sex differences in perceptions of pain coping strategy usage. European Journal of Pain: Ejp 2009 July;13(6):629-34.

75. Keogh E, Eccleston C. Sex differences in adolescent chronic pain and pain-related coping. Pain 2006 August;123(3):275-84.

76. Buckelew SP, Shutty J, Hewett J, Landon T, Morrow K, Frank RG. Health locus of control, gender differences and adjustment to persistent pain. Pain 1990 September;42(3):287-94.

77. Croft P, Raspe H. Back pain. BailliFre's Clinical Rheumatology 1995 August;9(3):565-83.

78. Skevington SM. Chronic pain and depression: Universal or personal helplessness? Pain 2001 January;15(1-4):309-17.

79. Linton SJ, Gross D, Schultz IZ, Main C, Cote P, Pransky G, Johnson W. Prognosis and the identification of workers risking disability: research issues and directions for future research. Journal of Occupational Rehabilitation 2005 December;15(4):459-74.

80. Dryden DM. Traumatic spinal cord injury in Alberta : epidemiology, health resource utilization, and direct health care costs [Thesis] 2004.

81. Robins LN, Helzer JE, Weissman MM, Orvaschel H, Gruenberg E, Burke JD, Jr., Regier DA. Lifetime prevalence of specific psychiatric disorders in three sites. Archives of General Psychiatry 1984 October;41(10):949-58.

82. Bland RC, Orn H, Newman SC. Lifetime prevalence of psychiatric disorders in Edmonton. Acta Psychiatrica Scandinavica, Supplementum 1988;338:24-32.

83. Mallen CD, Peat G, Thomas E, Dunn KM, Croft PR. Prognostic factors for musculoskeletal pain in primary care: a systematic review. British Journal of General Practice 2007 August;57(541):655-61.

84. Fayad F, Lefevre-Colau MM, Poiraudeau S, Fermanian J, Rannou F, Wlodyka DS, Benyahya R, Revel M. Chronicity, recurrence, and return to work in low back pain: common prognostic factors. Annales de Readaptation et de Medecine Physique 2004 May;47(4):179-89.

85. Bailey KP. Physical symptoms comorbid with depression and the new antidepressant duloxetine. Journal of Psychosocial Nursing & Mental Health Services 2003 December;41(12):13-8.

86. Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity: a literature review. Archives of Internal Medicine 2003 November 10;163(20):2433-45.

87. Airaksinen E, Larsson M, Lundberg I, Forsell Y. Cognitive functions in depressive disorders: evidence from a population-based study. Psychological Medicine 2004 January;34(1):83-91.

88. Miller WR. Psychological deficit in depression. Psychological Bulletin 1975 March;82(2):238-60.

89. Cedraschi C, Allaz AF. How to identify patients with a poor prognosis in daily clinical practice. Best Practice & Research Clinical Rheumatology 2005 August;19(4):577-91.

90. Turner JA, Clancy S. Strategies for coping with chronic low back pain: relationship to pain and disability. Pain 1986 March;24(3):355-64.

# Study Two: Predicting Recovery for Workers with Chronic Pain: Does Pain Coping Matter?

## Introduction

Recovery from a work injury is a complex process, one that depends on multiple factors such as, age, gender, prior health status, occupation, job demands, and severity of injury along with psychological and social factors.(1) Often, the physical injury may appear healed yet the worker continues to report persistent pain related to their injury. In 2001, Truchon and colleagues found that for a small proportion of people labelled as ‘chronically’ disabled due to non-specific work-related low back pain there was no medical reason found to explain the origin of pain in almost 90% of these cases.(2)

In 2006, the Workers’ Compensation Board of Alberta (WCB-Alberta) reported 181 159 new claims due to occupational injuries. Of these incident claims 7.6% were unable to return to work within a year’s period.(3) This finding is consistent with the existing literature on occupational injuries, for example, Chen et al. found that a considerable amount of their longitudinal cohort of workers (12%) reported considerable back pain at the end of the one year study period.(4) In another study, Hashemi et al found that 7% of workers’ disability claims were open for longer than one year and this small group accounted for over 75% the costs and 84% of total disability days.(5) Frank found that for an Ontario cohort of injured workers, 25% of cases were unable to return to work after three months, the overall cost from these workers accounted for 42% of the overall medical costs, 54% of the indemnity costs, and 52% of the total worker compensation costs.(6) Fiscally, it would be prudent to improve the outcomes for this small group of chronically disabled injured workers. Moreover, research has shown that if a worker has not returned to work by three months, there is a 50% chance that he or she will not be working at 15 months.(7) With better understanding of the diverse complexity, both the aetiology and recovery, of these injuries we can develop better rehabilitation and pain management programs and reduce time off work.

Current research on occupational injury is looking to injury and pain research to identify possible psychological and socio-demographic prognostic factors. Some promising research is being done with recovery expectations (8), depression (9-11), and coping style (12-15) . At the present, the roles of these factors in occupational injury are not yet fully understood and specifically their roles in long-term, ‘chronic’ work related injury has yet to be completely empirically examined. A recently published systematic review on neck pain called for more empirical work to be done using both psychological and sociological factors when researching neck pain related to occupational injury.(16)

Researchers are now beginning to combine their knowledge about the biological, economic, social, and psychological factors contributing to prolonged recovery periods, with the goal of understanding the injured worker within a larger context. This context, or conceptual framework, contains both modifiable and non-modifiable prognostic factors. By identifying the modifiable factors we may be better able to understand what is inhibiting ‘recovery’ and work toward preventing chronic long term illness.

One such modifiable factor, ‘pain coping’, is defined as the purposeful effort people use to manage or minimize the negative impacts of pain.(12,17,18) The role of pain coping strategies in the recovery process is in its early stages of scientific research. To date, the literature on pain coping has conceptualized its role in recovery as a dynamic, reciprocal, and interactive process of psychological, social, and biological factors.(19) For example, Flor and Turk (1988) concluded that a person’s pain coping method can be an important factor in the individual’s recovery process and can be directly influenced by the individual’s appraisal of his or her situation.(19)

Moreover, pain coping is the combination of the cognitive and behavioural efforts people use to counter their experience with pain. The cognitive component refers to the intellectual efforts an individual uses, for example, perseverance about his or her pain, while the behavioural efforts are the individual’s activities related to his or her pain, i.e. taking medication. The current state of the evidence shows that pain coping has potential merit as a prognostic factor in three such areas: (1) course and prognosis of whiplash associated disorders (WAD), (2) chronic pain, and (3) musculoskeletal conditions such as low back pain and neck pain.(12,20-25)

Workers with chronic pain pose a unique challenge for researchers. Not only does the worker cope with their pain condition but they face the negative consequences of unemployment. Research has shown that independent of previous levels of mental health, losing a job typically results in reduced levels of psychological well-being compared to control groups who retain employment.(26)

The objective of this study is to measure the prognostic values of various pain coping strategies on two commonly used measures of recovery, self reported pain disability and time to suspension of benefits, in a group of injured workers with long term pain related to an occupational injury. Based on the previous research findings it is hypothesized that pain coping will be prognostic for recovery.

## Methods

### *Study Population*

Subjects for this study consisted of all workers' compensation claimants undergoing treatment at the major rehabilitation facility of the Workers' Compensation Board of Alberta (WCB-Alberta) in Edmonton, Alberta. Data were extracted on claimants admitted to the program between 2003 and 2005. WCB-Alberta is a not-for-profit insurance organization that provides 'no-fault' insurance coverage to employers and workers. Its mandate is to provide compensation to injured workers for lost employment income and to cover the costs of treatment and rehabilitation (see Appendix A).

All subjects in this study were clients in a complex multidisciplinary treatment program at the facility. Injured workers are triaged to this program if they are determined to have a prolonged course of disability (over three months) and psychological or social barriers to returning to work.

### *Outcome Measures*

### *Time to Suspension of Benefits*

Time to suspension of total temporary disability (TD01) and days receiving vocational rehabilitation benefits (TDVR) were measured up to 1 year. Time until suspension (TD01 and TDVR) was measured by total calendar days plus re-openings up to 365 days post discharge. Claims were censored at one year. Using two outcomes should improve reliability of the findings. Duration of wage replacement benefits is often used as an indicator of recovery and return to work within insurance and compensation contexts. (27,28) Using time until suspension of benefits as a time-dependent outcome allows for the maximum amount of subject's information to be used and also allows for adequate statistical power to detect even marginal effect sizes.

For this study, the outcome of cumulative days receiving benefits captures time to suspension of benefit as well as recurrent episodes occurring within the follow up year. For example, if a reopening of the same claim occurred, this subsequent amount of time was added to the initial time to suspension. This method of measuring time to suspension has been used by Gross et al.(29)

### *Self Perceived Disability (PDI)*

Disability was measured when the client's treatment program ended at the rehabilitation centre. Self perceived disability was measured using the seven item Pain Disability Index (PDI) (See Appendix C). The PDI is a self-report inventory designed to provide an overall rating of disability and ratings of specific disabilities related to seven areas of life activities (occupational, home/family, recreational, social, sexual, ADLs, life support).(30) These are then rated on an

11-point Likert scale (0=no disability, 10=complete disability). The PDI was trichotomized with cut off scores at the median and the 75th percentile. This method of categorization has been used previously by Holm et al.(31)

### *Exposure-Coping (CSQ)*

Pain coping strategies were measured by using the Coping Strategies Questionnaire (CSQ) (see Appendix B).(32) This questionnaire is a widely used instrument for measuring pain coping strategies. Jensen et al note that the CSQ is the most frequently used measure to asses coping in chronic pain populations.(33) The primary aim of the CSQ is to assess the frequency and success of an individual's cognitive and behavioural pain coping strategies. These coping strategies are as follows: diverting attention, reinterpreting pain sensations, coping self statements, ignoring pain sensations, praying/hoping, catastrophizing, increased pain behaviours. Individuals are asked to rate on a 7 point Likert scale how much they use these strategies when dealing with their pain. An additional item relates to control over pain.(32)

### *Covariates (Potential Confounders)*

### *Demographic Variables*

Demographic information was gathered using the admission information supplied by the individual when entering into the treatment program. When information was missing from the admission form, this information was filled in using the linked WCB data file. Demographic variables used for this study were as follows: age, sex, education level, marital status, and annual income (pre-accident).

### *Injury Related Variables*

Using the WCB-Alberta coding for ‘part of body injured’, broad categories were formed based on commonality of the code (for example, abdomen and trunk were grouped together) and logical inclusion criteria this ensured adequate statistical power for analysis. The following categories were used: back- including spine and spinal cord, upper extremity, multiple body parts (this category grouped together injuries that were less common overall, such as abdominal injuries and injuries to the trunk), lower extremity and neck and shoulder.

### *Pain on Admission*

Pain on admission was measured using a visual analogue scale. This is a commonly used and validated measure of pain intensity.(34) Usual pain intensity on admission was measured using a continuous 100 mm long rating scale transposed on a 0-10 point scale. Clients of the rehabilitation program were asked on admission to the program to indicate their usual pain, where 0 was ‘no pain’ and 10 was ‘unbearable pain’.

### *Depression*

Depression was measured using the Beck Depression Inventory-Second Edition (BDI-II) (see Appendix D). (35,36) The BDI-II is a 21-item self-reported measure of depressive symptoms experienced during the past two week period, prior to completing the questionnaire. The 21-items have a four point rating scale that when summed yield a score ranging from 0-63. The recommended cut point of 22 was used to indicate the presence of depressive symptomatology. This cut point is recommended by Poole et al as an appropriate cut point for pain clinic patients.(37)

*Statistical Analysis*

Multivariable polytomous regression was used to study the predictive effect of coping on self perceived disability. First, univariate associations were established. Potential interaction effects between each coping mechanism and gender and depression were hypothesized, therefore separate models were built that included the interaction effect. The two models were compared; using a chi square test, to assess whether the model that included the interaction would differ significantly from the model that did not. Potential confounders were checked by entering each variable into the model containing the dependent coping variable and each potential confounder. If a difference of 10% in the association was found, this variable was considered a confounder of the association between coping and the outcome.(38) However, some variables were retained in the models, regardless of significance if they were hypothesized as clinically relevant.

For time until suspension of benefits, Cox regression models were developed for each coping strategy. Cox regression allows for adjustment of covariates, using time to event as the dependent variable.(39) A bi-variate analysis was performed with each one of the coping scales to look for (first order) associations with time suspension of benefits in days. Then full models were built to assess the effect of coping while controlling for possible confounders.

## Results

### *Study Population*

There was total of 479 patients treated in the program between the April 1, 2003 and March 31, 2005. Table 2-1 outlines the details of the demographic, injury related, and psychological variables.

**Table 2-1: Baseline Characteristics of Study Population, N=479**

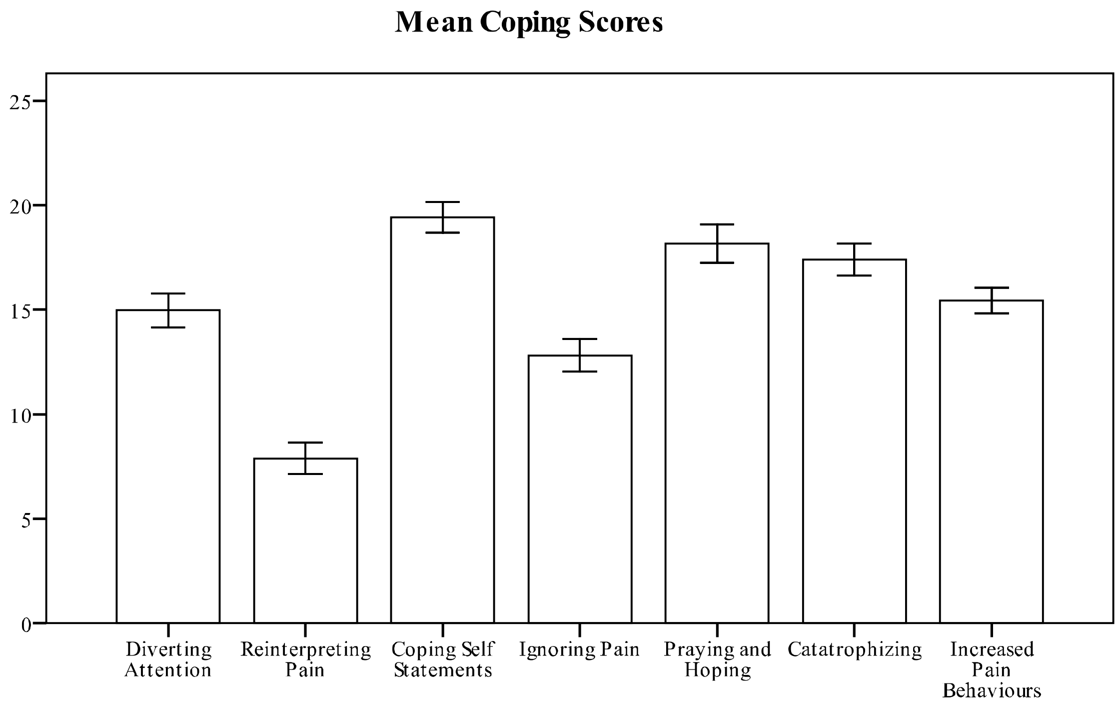
| Factors | | N (%) | Mean (SD) |
|---|---|---|---|
| Gender | | | |
| | Male | 280 (58.5) | |
| | Female | 171 (35.7) | |
| Age | | | 44 (9) |
| | 18-29 | 30 (6.3) | |
| | 30-39 | 108 (22.5) | |
| | >40 | 314 (65.6) | |
| Marital Status | | | |
| | Married/Common Law | 284 (59.3) | |
| | Divorced/Separated | 77 (16.1) | |
| | Single/Widowed | 93 (19.4) | |
| Education | | | |
| | University/Technical School | 126 (26.3) | |
| | High School/Partial High School | 241 (50.3) | |
| | <Grade 8 | 71 (14.8) | |
| Annual Income (Pre-Accident) | | | |
| | >50K | 103 (21.5) | |
| | 35-50K | 129 (26.9) | |
| | 25-35K | 116 (24.2) | |
| | <25K | 131 (27.3) | |
| Part of Body Injured | | | |
| | Back-including spine/spinal cord | 132 (27.6) | |
| | Multiple body parts-Including Abdomen, Truck | 111 (23.2) | |

| | | | |
|---|---|---|---|
| | and Head | | |
| | Upper Extremity | 99 (20.7) | |
| | Lower Extremity | 72 (15.0) | |
| | Neck and Shoulder | 65 (13.6) | |
| Depression (BDI-II) | | | |
| | Yes (BDI>22) | 219 (45.7) | |
| | No (BDI<22) | 205 (42.8) | |
| Self Perceived Pain-Admission (VAS) (μ=7) | | | 6.98 (1.6) |
| Coping Strategy (CSQ) | | | |
| | Diverting Attention | | 15 (8.5) |
| | Reinterpreting Pain | | 8 (8) |
| | Coping Self Statements | | 19 (8) |
| | Ignoring Pain | | 13 (8) |
| | Praying and Hoping | | 18 (10) |
| | Catastrophizing | | 17 (8) |
| | Increased Pain Behaviours | | 15 (6) |
| | Control | | 2 (1) |

### *Exposure-Coping (CSQ)*

The means of each coping strategy are presented in Figure 2-1. The coping strategy with the highest mean score was ‘coping self statements’ (µ=19.4, sd=7.6) which was followed by ‘praying/hoping’ (µ=18.2, sd=9.7), and ‘catastrophizing’ (µ=17.5, sd=8.0). The coping strategy with the lowest mean use was ‘reinterpreting pain’ (µ=7.9, sd=7.8). The mean rating of ‘control over one’s pain’ was 2.4, sd= 1.4.

**Figure 2-1: Mean coping Scores for Workers with Chronic Pain, N=479**



*Coping and Self Perceived Disability (PDI)*

Models were built that included each coping strategy along with each of the conceptually possible confounders. The crude odds ratios and the adjusted odds ratios of the associations between each of the coping strategies and pain disability are presented in Table 2-2. Catastrophizing was significantly associated with moderate and high self perceived disability (a one point increase on the catastrophizing scale meant a 4% higher odds of moderate disability as compared to low disability and a 7% higher odds of high disability as compared to low disability). This association, however, was not significant in the adjusted models (OR=.99, 95% CI=.94-1.04 and OR=.98, 95% CI= .92-1.05).

Additionally, coping self statements predicted moderate disability levels, as a one point increase in the coping self statement scale meant a 5% increased odds of rating oneself as moderately disabled as compared to low. However, no association was found between coping self statements and high self perceived disability. Increased pain related behaviours was significantly protective for high ratings of disability (a one point increase in the use of pain related activities and behaviours meant a 6% decrease in the odds of perceiving oneself as being highly disabled compared to having a low level of disability: OR=.94, 95% CI .90-.98). However, this association was not found in the adjusted models. Perceived control was found to be associated to both moderate and high disability. A one point increase on the control scale meant a 21% decreased odds of rating oneself as moderately disabled and a 34% decreased odds of rating oneself as highly disabled, as compared to low. These associations were not found in the adjusted analysis.

## Table 2-2: Results of Polytomous Regression

| Main Exposure: Coping- (ordinal) | **Crude OR (95% CI)** | | **Adjusted OR (95% CI)** | |
|---|---|---|---|---|
| | **Moderate Disability** PDI= 41-56 | **High Disability** PDI= >56 | **Moderate Disability** PDI= 41-56 | **High Disability** PDI= >56 |
| **Diverting Attention** | 1.00<br>(.98-1.04) | 1.00<br>(.97-1.05) | .98<br>(.94-1.05) | 1.00<br>(.96-1.05) |
| **Reinterpreting Pain** | .87<br>(.61-1.24) | .94<br>(.61-1.44) | .80<br>(.43-1.49) | .74<br>(.33-1.66) |
| **Coping Self Statements** | .99<br>(.96-1.03) | 1.05<br>(1.00-1.10) | **1.05**<br>**(1.00-1.13)** | 1.06<br>(.99-1.13) |
| **Ignoring Pain** | .98<br>(.95-1.02) | .96<br>(.92-.99) | 1.03<br>(.98-1.07) | 1.02<br>(.96-1.08) |
| **Praying and Hoping** | 1.00<br>(.98-1.03) | 1.03<br>(1.00-1.06) | .98<br>(.93-1.04) | .98<br>(.92-1.05) |
| **Catastrophizing** | **1.04**<br>**(1.00-1.08)** | **1.07**<br>**(1.03-1.12)** | .99<br>(.94-1.04) | .98<br>(.92-1.05) |
| **Increased Pain Behaviours** | .97<br>(.94-1.01) | **.94**<br>**(.90-.98)** | .99<br>(.94-1.05) | .99<br>(.92-1.07) |
| **Control** | **.79**<br>**(.65-.96)** | **.66**<br>**(.52-.83)** | 1.00<br>(.78-1.29) | .81<br>(.59-1.12) |

*All Coping models were adjusted for Age, Gender, Income, Marital Status, Education, Part of Body Injured, Pain, and Depression.

### *Coping and Time to Suspension of Benefits*

The crude hazard rate ratios (HRR’s) of the associations between the eight coping strategies and time to suspension of benefits are presented in Table 2-3. For every one point increase on the diverting attention scale, there was a 2% decreased chance of being off vocational rehabilitation benefits (HRR= .98, 95% CI .96-.99). Additionally, increasing pain related behaviours predicted 3% decreased chance being off total benefits (HRR=.97, 95% CI .95-.99) and 2% decreased chance of being off vocational rehabilitation benefits (HRR=.98, 95% CI .96-.99). Having control over pain meant a 12% decreased chance of being off total benefits (HRR=.88, 95% CI .81-.97).

**<u>Table 2-3: Coping and Time to Suspension of Benefits: Cox Regression</u>**

| **Main Exposures** | **Crude HRR TD01** | **Adjusted HRR** | **Crude HRR TDVR** | **Adjusted HRR** |
|---|---|---|---|---|
| Coping (ordinal) | | | | |
| Diverting Attention | 1.0<br>(.98-1.01) | .98<br>(.97-1.0) | 1.0<br>(.95-1.01) | **.98**<br>**(.96-.99)** |
| Reinterpreting Pain | 1.0<br>(.99-1.02) | .99<br>(.98-1.01) | 1.01<br>(1.0-1.02) | 1.0<br>(.98-1.01) |
| Coping Self Statements | 1.0<br>(.99-1.01). | .99<br>(.97-1.01) | 1.01<br>(.99-1.02) | .99<br>(.97-1.01) |
| Ignoring Pain | 1.01<br>(.99-1.01) | .99<br>(.97-1.01) | 1.01<br>(.99-1.02) | .99<br>(.98-1.01) |
| Praying and Hoping | .99<br>(.98-1.01) | .99<br>(.98-1.01) | 1.01<br>(.99-1.01) | 1.0<br>(.98-1.01) |
| Catastrophizing | .99<br>(.98-1.01) | 1.01<br>(.98-1.02) | .99<br>(.98-1.01) | 1.01<br>(.98-1.02) |
| Increased Pain Behaviours | 1.0<br>(.98-1.01) | **.97**<br>**(.95-.99)** | .99<br>(.98-1.02) | **.98**<br>**(.96-.99)** |
| Control | .95<br>(.88-1.02) | **.88**<br>**(.81-.97)** | .97<br>(.90-1.04) | .91<br>(.83-1.00) |

*All Coping models were adjusted for Age, Gender, Income, Marital Status, Education, Part of Body Injured, Pain, and Depression.

## Discussion

In 2002, Crook reported that over 2000 published articles had attempted to identify predictors of occupational low back pain disability. Following the failed attempts to build successful biomedical predictive models the focus switched to the development of empirically derived biopsychosocial models. This work has lead to some promising results. However, there is still much work to be done in terms of isolating potential factors and building multivariate models.

The objective of this study was to use multivariate methods to assess the prognostic role pain coping plays in the recovery from an occupational injury. The goal was to add to the developing strategies for primary and secondary prevention of pain related disability. Previous work on pain coping has largely been cross sectional in nature, making its role in predicting recovery unknown. This study assessed the role of pain coping in predicting self perceived pain disability and time to suspension of benefits and vocational rehab benefits. The results show that coping does not fare well in the prediction of either of these phenomena.

### *Self Perceived Disability*

Catastrophizing is defined as an exaggerated negative ‘mental set’ brought on during actual or anticipated pain experience.(40) This study found some interesting findings when assessing the role of catastrophizing in self perceived disability. The uncontrolled associations between catastrophizing and moderate and high self reported disability were significant. Finding significant crude associations was not surprising; however, it was expected that these associations would hold after adjustment for confounding. Indeed, previous research has found catastrophizing to be predictive of disability and high rates of pain (40-42). In the current study, the relationship between catastrophizing and disability was confounded by depression and pain, in other words, once pain intensity and depressive symptoms were considered, there was no important relationship between catastrophizing and subsequent disability. Therefore, future research with regard to the predictive power of catastrophizing on disability should always take into account the effects of both depression and pain as they may be confounding the true nature of the relationship.

Similar findings were found with regard to self reported pain control. In the unadjusted analysis pain control was found to be associated with both moderate and high ratings of disability. However, after adjustment this relationship no longer held. Again, the main relationship was confounded by both pain and depression. Therefore, caution should be used when creating predictive models using coping strategies as unknown confounding may be present.

Finally, a significant association between coping self statements and moderate disability was seen. For every one unit increase on this scale there was a 5% increased odds for moderate disability as compared to low. This association was not seen, however. for the high category. Coping self statements include statements such as “I tell myself to be brave and carry on” and “I tell myself to I can overcome this pain”. This finding is not fully intuitive. Perhaps those with moderate disability compared to the low group use more of this type of coping due to the high pain levels they feel. Whereas those with high disability simply don’t use this method because they feel this is not something that makes a substantial difference.

*Time to Suspension of Benefits*

Based on the administrative nature of time to suspension of benefits there was some doubt that there would be a significant association between coping and this time dependent administrative outcome. That is, suspension of benefits may not have been a marker of recovery in this group. Some research, however, has suggested that catastrophizing may be associated with return to work.(43)

This study’s findings indicated that some coping strategies could potentially be predictive of time to suspension of benefits for this group of injured workers, however, these findings were not as expected. The coping strategy of diverting attention refers to statements such as: “I try to think of something pleasant” and “I count numbers in my head or run a song through my mind”. The results showed that for every one unit increase on this scale meant a 2% decreased chance of suspension of vocational rehabilitation benefits. This finding was counter-intuitive, and may simply reflect the idea that suspension of benefits is not a marker of recovery in this group of injured workers.

Increased pain behaviours refer to items such as “I take medication” or “I use a heating pad”. The study’s results indicate that for every one unit increase on this scale the chance for suspension of benefits was reduced by 3% and 2 % for suspension of vocational rehabilitation benefits.

Lastly, perceived control over pain was found to be associated with time to suspension of benefits. For example, for every one unit increase in control there was a decreased chance for suspension of benefits by 12%, all other variables being equal. Again, this finding was not intuitive. The expected result was that increased perceived control over pain should lead an increased probability that the injured worker would return to work. Again, a potential explanation for these findings is that this outcome (suspension of benefits ) is not a marker of recovery for these injured individuals, and it may be that post-treatment cessation of benefits in this particular group of workers with long term injuries is done purely for administrative or other non-health related reasons.

### *Limitations*

Research using time to suspension of benefits can be problematic. Baldwin and colleagues (1996) noted some of the major limitations with using 'Return to Work' (as measured by time until suspension of benefits) as an outcome. First, they note that 'Return to Work' is often influenced by many factors other than "recovery".(27) This current study used two outcomes that are often used as measures for recovery in occupational cohorts. It attempted to assess potential differences between an administrative outcome (time until suspension) and a self reported outcome (pain disability). Secondly, Baldwin and colleagues noted that the first return to work after an injury frequently marks the beginning of several episodes of work disability. This current study overcomes this potential pitfall by calculating the time to include subsequent re-openings.

Another, noted limitation for this study was that through numerous analysis (16 regression models and 16 Cox models) there could be an increased chance for a type I error (the probability of finding an association when none exists). One possible strategy for dealing with this is to lower the level at which statistical significance is achieved, for example, setting the p-value at .01 or lower. This would lower the chances of making a type I error. Although setting the p-value at .01 could potentially decrease the probability of this error, this have would simultaneously increased the chances of a type II error (probability of not finding an association, when none exists) Therefore, in view of the fact that this study was exploratory, the decision was made to retain .05 as the most appropriate level of error, as is usually standard practice.(44) It should be noted that some of the findings may, therefore, have been spurious.

Finally, there are some limitations to using self reported disability questionnaires such as the PDI, for example, not all respondents may interpret the questions in the same way and may introduce bias or error variance. Additionally, some researchers feel that self report questionnaires administered under conditions where incentives are offered, like those of compensation, may make these responses susceptible to wilful distortion, however, this is difficult to prove. (43)

### *Stengths*

This study has some advantages to other studies looking to understand the role of coping with occupational related pain. The first advantage is that it uses two outcome measures, time until suspension of benefits and self reported pain disability. Galizzi and Boden (1996) noted that limiting studies to traditional return to work outcomes reflects a “limited perspective bound to underestimate duration of work disability and total burden”(Quoted in Krause et al., 2001).(1)

Furthermore, the use of two outcomes in this current study attempted to compare how coping predicts the administrative outcome of time to suspension of benefits and the self report outcome of self reported disability. Krause further states that studies that include both self-report and administrative data on disability and RTW will help to ensure a comprehensive assessment of work related disability and provide the means to assess the magnitude of reporting biases from any one source.(1)

Another strength of this study was that all the variables in the models, except for coping, were treated as confounders. This was so the direct effect of the coping variables could be measured by controlling for all other possible explanatory variables. Many studies look at either coping or depression and do not include both in the adjusted models. This is usually due to the expectation that these factors are co-linear, however, co-linearity was assessed prior to model building and no variance inflation factor (VIF) was above 3.2 (the variance inflation factor for depression was 1.5).Therefore, both variables were included for consideration in the model.

In conclusion, understanding these findings poses a unique opportunity to consider both methodological and theoretical issues as they pertain to research using administrative compensation based data. This study found that neither of the two outcomes could be highly predicted by differences in coping strategies. The group of injured workers in this study viewed themselves as highly disabled (mean PDI score was 48 out of 75) and there was very little variance between these workers and how they coped. Furthermore, their mean coping scores were all relatively low. Perhaps for a cohort such as this, with very high levels of pain related disability, coping strategies do not vary enough to show within group differences. This could explain the null results for both outcomes.

Moreover, the differences found in this study, as compared to other coping studies, are probably due to numerous factors. For example, the use of the two outcome measures was similar to a previous study by Gauthier et al.(45) Their study found psychological risk factors did not predict self reported disability; however, they did predict return to work. They concluded that more research is needed to further clarify the respective advantages and limitations to using self-reported versus return to work-based measures of disability. This current study's findings are contrary to Gauthier et al.'s, although the question remains about whether cessation of benefits in the current study reflected either recovery or return to work. Questions therefore remain about the appropriate use of return to work and disability as outcomes. This study will add to this growing body of knowledge. Importantly, the results of this study, taken with Gauthier's, can confirm that psychological risk factors are not solely an aspect of using self reported outcomes (PDI) or administrative outcomes (time to suspension of benefits).

# References

1. Krause N, Frank JW, Dasinger LK, Sullivan TJ, Sinclair SJ. Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. American Journal of Industrial Medicine 2001 October;40(4):464-84.

2. Truchon M. Determinants of chronic disability related to low back pain: towards an integrative biopsychosocial model. Disability Rehabilitation 2001 November 20;23(17):758-67.

3. WCB-Alberta. WCB-Alberta 2006 Annual Report Working Progress. http://www wcb ab ca/pdfs/public/annual_report_2006 pdf 2006

4. Chen C, Hogg-Johnson S, Smith P. The recovery patterns of back pain among workers with compensated occupational back injuries. Occup Environ Med 2007 August 1;64(8):534-40.

5. Hashemi L,Webster, B,Clancey,E,Courtney,T. Length of disability and cost of work-related musculoskeletal disorders of the upper extremity. Journal of Occupational & Environmental Medicine 1998 January 3;40(3):261-9.

6. Frank J, Cullen K. Preventing injury, illness and disability at work. Scandinavian Journal of Work, Environment & Health 2006 April;32(2):160-7.

7. Crook J,Moldofsky,H. The probability of recovery and return to work from work disability as a function of time. Quality of Life Research 1994 January 12;3(Supplement 1):S97-S109.

8. Gross DP, Battie MC. Work-related recovery expectations and the prognosis of chronic low back pain within a workers' compensation setting. Journal of Occupational & Environmental Medicine 2005 April;47(4):428-33.

9. Carroll LJ, Cassidy JD, Cote P. Frequency, timing, and course of depressive symptomatology after whiplash. Spine (Phila Pa 1976) 2006 July 15;31(16):E551-E556.

10. Carroll LJ, Cassidy JD, Cote P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. Pain 2004 January;107(1-2):134-9.

11. Carroll LJ, Cassidy JD, Cote P. Factors associated with the onset of an episode of depressive symptoms in the general population. Journal of Clinical Epidemiology 2003 July;56(7):651-8.

12. Carroll LJ, Cassidy JD, Cote P. The role of pain coping strategies in prognosis after whiplash injury: passive coping predicts slowed recovery. Pain 2006 September;124(1-2):18-26.

13. Kivioja J, Jensen I, Lindgren U. Early coping strategies do not influence the prognosis after whiplash injuries. Injury 2005 August;36(8):935-40.

14. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Coping with neck and low back pain in the general population. Health Psychology 2000 July;19(4):333-8.

15. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Passive coping is a risk factor for disabling neck or low back pain. Pain 2005 September;117(1-2):51-7.

16. Carroll LJ, Hurwitz EL, Cote P, Hogg-Johnson S, Carragee EJ, Nordin M, Holm LW, van der Velde G, Cassidy JD, Guzman J, Peloso PM, Haldeman S. Research Priorities and Methodological Implications: The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008 February 15;33(4S):S214-S220.

17. Blankfeld DF, Holahan CJ. Family support, coping strategies, and depressive symptoms among mothers of children with diabetes. Journal of Family Psychology 1996;10(2):173-9.

18. Lazarus RS. Coping theory and research: past, present, and future. Psychosomatic Medicine 1993 May;55(3):234-47.

19. Flor H, Turk DC. Chronic back pain and rheumatoid arthritis: Predicting pain and disability from cognitive variables. Journal of Behavioral Medicine 1988;11(3):-265.

20. Borsbo B, Peolsson M, Gerdle B. Catastrophizing, depression, and pain: correlation with and influence on quality of life and health - a study of chronic whiplash-associated disorders. Journal of Rehabilitation Medicine 2008 July;40(7):562-9.

21. Bosma FK, Kessels RP. Cognitive impairments, psychological dysfunction, and coping styles in patients with chronic whiplash syndrome. Neuropsychiatry, Neuropsychology, & Behavioral Neurology 2002 March;15(1):56-65.

22. Buitenhuis J, Spanjer J, Fidler V. Recovery from acute whiplash: the role of coping styles. Spine (Phila Pa 1976) 2003 May 1;28(9):896-901.

23. Carroll L, Mercado AC, Cassidy JD, Cote P. A population-based study of factors associated with combinations of active and passive coping with neck and low back pain. Journal of Rehabilitation Medicine 2002 March;34(2):67-72.

24. Jones A, Elklit A. The association between gender, coping style and whiplash related symptoms in sufferers of whiplash associated disorder. Scandinavian Journal of Psychology 2007 February;48(1):75-80.

25. Soderlund A, Lindberg P. Whiplash-associated disorders--predicting disability from a process-oriented perspective of coping. Clinical Rehabilitation 2003 February;17(1):101-7.

26. Ezzy D. Unemployment and mental health: a critical review. Social Science & Medicine 1993 July;37(1):41-52.

27. Baldwin ML, Johnson WG, Butler RJ. The error of using returns-to-work to measure the outcomes of health care. American Journal of Industrial Medicine 1996 June;29(6):632-41.

28. Gallagher RM, Rauh V, Haugh LD, Milhous R, Callas PW, Langelier R, McClallen JM, Frymoyer J. Determinants of return-to-work among low back pain patients. Pain 1989 October;39(1):55-67.

29. Gross DP, Battie MC. Does functional capacity evaluation predict recovery in workers' compensation claimants with upper extremity disorders? Occupational & Environmental Medicine 2006 June;63(6):404-10.

30. Chibnall JT, Tait RC. The Pain Disability Index: factor structure and normative data. Archives of Physical Medicine & Rehabilitation 1994 October;75(10):1082-6.

31. Holm LW, Carroll LJ, Cassidy JD, Skillgate E, Ahlbom A. Expectations for recovery important in the prognosis of whiplash injuries. PLoS Medicine / Public Library of Science 2008 May 13;5(5):e105.

32. Rosenstiel AK, Keefe FJ. The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. Pain 1983 September;17(1):33-44.

33. Jensen MP, Turner JA, Romano JM, Karoly P. Coping with chronic pain: a critical review of the literature. Pain 1991 December;47(3):249-83.

34. Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain 1986 October;27(1):117-26.

35. Brantley PJ, Mehan DJ, Thomas JL. The Beck Depression Inventory (BDI) and the Center for Epidemiologic Studies Depression Scale (CES-D). In: Maruish ME, editor. Handbook of Psychological Assessment in Primary Care Settings.Mahwah: Lawrence Erlbaum Associates; 2000. p. 391-422.

36. Williams AC, Richardson PH. What does the BDI measure in chronic pain? Pain 1993 November;55(2):259-66.

37. Poole H, Bramwell R, Murphy P. Factor structure of the Beck Depression inventory-II in patients with chronic pain. Clinical Journal of Pain 2006;22(9):790-8.

38. Rothman KJ, Greenland S. Modern epidemiology. 2nd ed. ed. Philadelphia: Lippincott-Raven; 1998.

39. Kleinbaum D. Survival Analysis: A Self Learning Text. New York: Springer; 1996.

40. Sullivan MJ, Stanish W, Waite H, Sullivan M, Tripp DA. Catastrophizing, pain, and disability in patients with soft-tissue injuries. Pain 1998 September;77(3):253-60.

41. Jensen MP, Turner JA, Romano JM. Changes in beliefs, catastrophizing, and coping are associated with improvement in multidisciplinary pain treatment. Journal of Consulting & Clinical Psychology 2001 August;69(4):655-62.

42. Spinhoven P, Ter KM, Kole-Snijders AM, Hutten MM, Den Ouden DJ, Vlaeyen JW. Catastrophizing and internal pain control as mediators of outcome in the multidisciplinary treatment of chronic low back pain. European Journal of Pain: Ejp 2004 June;8(3):211-9.

43. Gauthier N, Sullivan MJ, Adams H, Stanish WD, Thibault P. Investigating risk factors for chronicity: the importance of distinguishing between return-to-work status and self-report measures of disability. Journal of Occupational & Environmental Medicine 2006 March;48(3):312-8.

44. Oleckno WA. Essential Epidemiology: Princliples and Applications. Long Grove, Illinois: Waveland Press, Inc.; 2002.

45. Gauthier N, Sullivan MJ, Adams H, Stanish WD, Thibault P. Investigating risk factors for chronicity: the importance of distinguishing between return-to-work status and self-report measures of disability. Journal of Occupational & Environmental Medicine 2006 March;48(3):312-8.

# Study Three: Self Perceived Disability in Workers with Chronic Pain: Does Depression Matter?

## Introduction

The bio-psychosocial model of health emphasizes the important role that biological, psychological, and sociological factors play in the recovery of disease and injury. The diagnosis and treatment of disease within this model involves the examination of the social contexts, the psychological states, the biological mechanisms, and the reciprocal interactions of these factors. Identifying the unique roles of individual factors and the roles of interactive factors within the injury context, however, has only just begun. The multi-factorial nature of long-term, 'chronic' work-related injuries makes the study of this phenomenon difficult and to this date, no single biological or psychosocial prognostic factor has been identified as being solely instrumental for full recovery. Certainly, some factors have more merit. Psychological distress, such as depression, a patient's beliefs and expectations about their pain, pain related fear and fear avoidance (passive coping), and social factors, such as job dissatisfaction, have all been linked to poor recovery.(1-7)

Similar to recovery from injury in the general population, the recovery process from occupational injury is affected by the complexity of the interpersonal context of the disabled worker, for example, the roles of the workplace, the health care and insurance systems, and individual physical and psychological characteristics, making the design of a conceptual model challenging.

One factor being questioned for potential inclusion in a biopsychosocial conceptual model of work related disability is ‘pain coping’. Pain coping is defined as the purposeful effort people use to manage or minimize the negative impacts of pain.(8-10) The roles pain coping strategies play in disability is in its early stages of scientific research. To date, the scientific literature on pain coping has conceptualized it as a dynamic reciprocal and interactive process of psychological, social, and biological factors.(11) For example, Flor and Turk (1988) concluded that a person’s pain coping method can be an important factor in the individual’s recovery process and can be directly influenced by the individual’s appraisal of his or her situation.(11)

Currently, research is looking to confirm the suggestion that coping with an interactive problem, (one that is both biological, psychological, and sociological), such as pain, follows a similar process used to explain coping with psychological stress. Pain, is a biopsychosocial phenomena, psychological/ emotional, social, and physical. The current state of the evidence shows that pain coping has potential merit as a prognostic factor in three such areas: course and prognosis of Whiplash Associated Disorders (WAD), Chronic Pain, and general musculoskeletal conditions such as low back pain and neck pain.

In 2006, Carroll et al reported that the use of passive coping strategies in the first six weeks after a traffic-related whiplash injury predicts slower self-reported recovery.(9) In this same study, they found that early use of passive coping strategies was independently associated with slower recovery and depression was found to be an effect modifier in the prognostic role of passive coping.(9)

One coping style that is often mentioned in the WAD literature is ‘catastrophizing’. Catastrophizing is broadly defined as an exaggerated negative orientation toward pain stimuli and pain experience.(12) Borsbo et al found that pain catastrophizing in combination with depression can influence self perceived quality of life for patients with WAD.(13) Buitenhuis et al found pain catastrophizing to be related to the severity of concurrent whiplash disability.(14)

Linton et al. state that examining effect modification is central in studies on low back pain because its course and the effect of prognostic factors vary according to individual and environmental factors. Given this, researchers should conceptualize, a priori, how that course or the effect of prognostic factors will vary between populations and subpopulations.(15) Effect modification occurs when is an antecedent condition interacts with other conditions producing an outcome, for example when a third factor influences the direction or magnitude of an association between a study exposure and outcome.(16) This is different from confounding because with confounding the association between an exposure and the outcome would be masked due to a third variable. Typical effect modifiers reported in the injury literature are gender, self reported pain intensity, and self reported quality of life. Most notably, the literature on coping states that emotional states such as depression often interact with coping to alter outcomes.(15)

At present there is growing evidence that shows that that depression could be an important effect modifier when studying pain coping in musculoskeletal injuries. Carroll et al. found that over 40% of persons with WAD developed depressive symptomatology within six weeks of a whiplash injury. Moreover, they found that these depressive symptoms were recurrent or persistent in almost 40% of these.(1-3,7,9) In another large cohort study, Dryden et al found that for patients with a traumatic spinal cord injury, 30% were treated for depression following their injury.(17)

There continues, however, to be uncertainly about whether early psychological distress predicts poor prognosis after an occupational injury. Sterling et al have recently reported that psychological distress at baseline predicts slowed recovery.(18,19) Moreover, although the majority of the literature in this area indicates that psychological distress is common at various stages of recovery, there is limited empirical research on the initial factors that may predispose injured individuals to develop such distress.

The prolonged period of recovery from an occupational musculoskeletal injury, furthermore, mirrors the distress incurred by patients with chronic pain and clinical reports have consistently shown that the prevalence of depressive disorders is unusually high in individuals with chronic pain.(20-23) Perhaps some of the research inconsistencies are due to unknown effect modification.

The purpose of this study is to identify factors associated with self reported pain disability. Based on the above mentioned research, it was hypothesized that depression would interact with coping to affect self reported disability.

## Methods

### *Study Population*

Subjects for this study consisted of all workers' compensation claimants undergoing treatment at the major rehabilitation facility of the Workers' Compensation Board of Alberta (WCB-Alberta) in Edmonton, Alberta. Data were extracted on claimants admitted to the program between 2003 and 2005. WCB-Alberta is a not-for-profit insurance organization that provides 'no-fault' insurance coverage to employers and workers. Its mandate is to provide compensation to injured workers for lost employment income and to cover the costs of treatment and rehabilitation.

All subjects in this study were patients in a complex multidisciplinary treatment program at the facility. Injured workers are triaged to this program if they are determined to have a prolonged course of disability (over three months) and psychological or social barriers to returning to work (see Appendix A).

### *Dependent Variable: Self Perceived Disability*

Self perceived disability was measured using the seven item Pain Disability Index (PDI) (see Appendix C). The PDI is a self-report inventory designed to provide an overall rating of disability and ratings of specific disabilities related to seven areas of life activities (occupational, home/family, recreational, social, sexual, ADLs, life support).(24) These are then rated on an 11-point Likert scale (0=no disability, 10=complete disability). The PDI was trichotomized with cut off scores at the median and the 75th percentile. This method of categorization has been used previously by Holm et al.(25)

### *Potential Associated Factors*

#### *Coping*

Pain coping strategies were measured by using the Coping Strategies Questionnaire (CSQ) (see Appendix B). Originally conceived by Rosentiel and Keefe, in 1983, (26) the CSQ consists of a 42-item checklist of coping strategies where subjects are asked to indicate the extent to which they use a specific strategy on a 0 (not at all) to 6 (always) scale. The questions intend to measure the extent to which subjects use six different cognitive coping strategies (diverting attention, reinterpreting pain, coping self statements, ignoring pain, praying/hoping, and catastrophizing) and one behavioural coping strategy (increasing pain related behaviours). Additionally, for this study we included the measure of pain coping effectiveness that asks the individual to rate the amount of control one feels over his or her pain. This questionnaire is a widely used instrument for measuring pain coping strategies. Jensen et al note that the CSQ is the most frequently used measure to asses coping in chronic pain populations.(27)

#### *Depression*

Depression was measured using the Beck Depression Inventory-Second Edition (BDI-II) (see Appendix D).(28) The BDI-II is a 21-item self-reported measure of depressive symptoms experienced during the past two week period. The 21-items have a four point rating scale that when summed yield a score ranging from 0-63. The cut point of 22 was used to indicate the presence of depressive symptomatology. This cut point is recommended by Poole et al as an appropriate cut point for pain clinic patients.(29)

### *Demographic Variables*

Demographic information was gathered using the admission information supplied by the individual when entering into the treatment program. Missing information was added from the linked WCB-Alberta administrative data file. Demographic variables used for this study were as follows: age, sex, education level, marital status, and annual income (pre-accident) and industry sector.

### *Injury Related Variables*

Diagnostic information was obtained from the claims using physician documentation of injury used for payment of professional fees. The WCB-Alberta uses the International Classification of Diseases, 9th Revision (ICD-9). Additionally, it includes information about the nature of injury and body part affected.

Three injury related variables were examined: primary diagnosis, part of body injured, and type of accident. Primary diagnosis was categorized into 6 categories based on the common ICD-9 classifications. For ‘part of body injured’ and ‘type of accident’, broad categories were formed based on commonality of the code (for example, abdomen and trunk were grouped together) and logical inclusion criteria (all types of falls were grouped together) this ensured adequate statistical power for analysis. The following categories were used: back-including spine and spinal cord, upper extremity, multiple body parts (this category grouped together injuries that were less common overall, such as abdominal injuries and injuries to the trunk), lower extremity and neck and shoulder. The following categories were formed for ‘type of accident’: falls, overexertion and bodily reaction/repetitive motion, caused by an object, assault and unknown, and transportation accidents.

Additionally, the number of days since injury and numbers of healthcare visits following the injury were tested for associations to self reported pain disability. The inclusion of these variables was due to previous findings where they were shown to be potential clinically relevant to work related injury outcomes (30).

### *Pain on Admission*

Pain on admission was measured using a visual analogue scale. This is a commonly used and validated measure of pain intensity.(31) Usual pain intensity on admission was measured using a continuous 100 mm long rating scale, transposed on a 0-10 point scale. Clients of the rehabilitation program were asked on admission to the program to indicate their usual pain on a scale from 0-10, where 0 is ‘no pain’ and 10 is ‘unbearable pain’

### *Data Analysis*

A multivariable polytomous regression model was built to identify baseline (at admission to the treatment program) factors associated with self reported pain disability (reported at the same time). To identify factors for inclusion in the multivariable model, crude associations between the potential explanatory factors (listed above) and the three levels of self reported pain disability were examined. As outlined previously, the three levels of disability were determined using the median and the 75th percentile as cut points, therefore 'low' was below the median, 'moderate' was between the median and the 75th percentile and 'high' was the 75th percentile and above. Those factors whose Wald statistic in the crude polynomial regression model was associated with a p-value of < 0.10 were retained for inclusion into the multivariable model and were entered into the model as a block. Factors were then removed from the model, one at a time, if their removal did not decrease the negative log likelihood or alter the point estimates of the remaining factors in any non-trivial way. However, variables that were clinically relevant were retained in the model, regardless. Following the selection of variables, effect modification by depression was assessed. Interaction terms were created between depression and coping and depression and pain. Each term was added to the model. If the log likelihood ratio test (Chi Square) showed that a significant difference between the model with the interaction and the model without, separate models were created, (depressed and non-depressed).

## Results

The study group consisted of 479 workers. Table 3-1 provides a full description of the study group. Please refer to Appendix F for Table 3-4: Correlation Matrix of Coping and Pain Disability and Table 3-5: Cross Tabulations of Depression and Pain Disability, (low, moderate, and high).

## Table 3-1: Baseline Characteristics of Study Population, N=479

| Category | | N (%) | Mean (SD) |
|---|---|---|---|
| Demographic/Socioeconomic | | | |
| Gender | | | |
| | Male | 280 (58.5) | |
| | Female | 171 (35.7) | |
| Age | | | |
| | 18-29 | 30 (6.3) | |
| | 30-39 | 108 (22.5) | |
| | >40 | 314 (65.6) | |
| Marital Status | | | |
| | Married/Common Law | 284 (59.3) | |
| | Divorced/Separated | 77 (16.1) | |
| | Single/Widowed | 93 (19.4) | |
| Education | | | |
| | University/Technical School | 126 (26.3) | |
| | High School/Partial High School | 241 (50.3) | |
| | <Grade 8 | 71 (14.8) | |
| Annual Income (Pre-Accident) | | | |
| | >50K | 103 (21.5) | |
| | 35-50K | 129 (26.9) | |
| | 25-35K | 116 (24.2) | |
| | <25K | 131 (27.3) | |
| Industry Sector | | | |
| | Construction | 90 (18.8) | |
| | Manufacturing | 82 (17.1) | |
| | Health Care | 63 | |

| | | |
|---|---|---|
| | | (13.2) |
| | Public Admin/Education/ Arts and Recreation | 53 (11.1) |
| | Retail and Wholesale Trade | 52 (10.9) |
| | Transportation | 48 (10.0) |
| | Accommodation and Food Services | 35 (7.3) |
| | Oil and Gas/Agriculture and Forestry | 33 (6.9) |
| | Other Professional Services | 20 (4.2) |
| Injury Related Diagnosis (ICD9) | | |
| | Dorsopathies | 152 (31.7) |
| | Rheumatisms/Nerve Disorders | 93 (19.4) |
| | Sprains/Strains | 89 (18.6) |
| | Fractures/Amputations/Crush | 66 (13.8) |
| | Knee and Joint Disorders | 53 (11.1) |
| | Pain Related Ailments (Skin or Superficial wounds) | 26 (5.4) |
| Part of Body Injured | | |
| | Back-including spine/spinal cord | 132 (27.6) |
| | Multiple body parts-Including Abdomen, Truck and Head | 111 (23.2) |
| | Upper Extremity | 99 (20.7) |
| | Lower Extremity | 72 (15.0) |
| | Neck and Shoulder | 65 (13.6) |
| Type of Accident | | |
| | Overexertion/Repetitive Strain | 220 (45.9) |
| | Fall | 110 (23.0) |
| | Caused by an Object | 58 (12.1) |
| | Unknown or Assault | 54 |

| | | | |
|---|---|---|---|
| | | (11.3) | |
| | Transportation Accident | 37 (7.7) | |
| Pain Rating (VAS) | | | |
| Psychological Variables | | | |
| Depression | | | |
| | Yes | 219 (45.7) | |
| | No | 205 (42.8) | |
| Coping (Mean, SD) | | | |
| | Diverting Attention | | 15 (8.5) |
| | Reinterpreting Pain | | 8 (8) |
| | Coping Self Statements | | 19 (8) |
| | Ignoring Pain | | 13 (8) |
| | Praying and Hoping | | 18 (10) |
| | Catastrophizing | | 17 (8) |
| | Increased Pain Behaviours | | 15 (6) |
| | Control | | 2 (1) |
| Program Information | | | |
| # Previous HC visits | | | 56 (42) |
| #Days Since Accident | | | 755 (1096) |

### *Effect Modification*

The addition of the interaction terms of depression and coping did not significantly add to the multivariable model. When depression and pain were added to the model as an interaction term, however, there was a significant difference between these two models ($\chi^2$=9.9, p=.007).

Based on this finding two models were built one for depressed individuals and one for non-depressed individuals.

### *Factors Associated with Self Reported Pain Disability (Depressed Subgroup)*

Factors found to be associated with self reported pain disability for the depressed subgroup (n=219) are reported in Table 3-2. In the multivariable model, pain, diverting attention, and perceived pain control were associated with moderate disability *and* high disability (as compared to the reference group- low disability). Pain intensity, gender, number of days since the injury, number of health care visits and the other coping strategies were not associated with pain disability. For those workers with depression, every one point increase on the 11-point pain scale increased the odds of moderate disability by 58% (OR= 1.58, 95% CI 1.03-2.42) and increased their odds of reporting high disability by 258% (OR=3.58, 95% CI 2.03-6.33). Every one point increase on the 7-point diverting attention scale increased the odds of high disability by 15% (OR=1.15, 95% CI 1.00-1.33). Every one point decrease on the 7-point control scale decreased their odds of moderate disability by 40% (OR=.60, 95% CI .19-.81) and high disability by 40% (OR=.60, 95% CI .18-.84). The pseudo $R^2$ of the final model was .47

indicating that 47% of the variance in self reported pain disability is accounted for by this model.

## **Table 3-2: Factors Associated with Self Reported Pain Disability-Depressed Subgroup (n=219)**

| | | Moderate Disability (PDI 45-56) Adjusted Ors (95% CI) | Severe Disability (PDI >56) Adjusted Ors (95% CI) |
|---|---|---|---|
| Gender | Female | Reference | Reference |
| | Male | 1.20 (.30-4.90) | .73 (.16-3.35) |
| Pain | | **1.58 (1.03-2.42)** | **3.58 (2.03-6.33)** |
| Coping | | | |
| | Diverting Attention | 1.05 (.93-1.20) | **1.15 (1.00-1.33)** |
| | Reinterpreting Pain | .32 (.10-1.02) | .37 (.10-1.34) |
| | Coping Self Statements | 1.06 (.94-1.20) | .99 (.86-1.15) |
| | Ignoring Pain | 1.05 (.92-1.20) | 1.04 (.89-1.20) |
| | Praying and Hoping | 1.05 (.96-1.14) | 1.04 (.95-1.14) |
| | Catastrophizing | 1.02 (.91-1.15) | 1.00 (.88-1.13) |
| | Increased Pain Behaviours | 1.08 (.94-1.23) | 1.01 (.87-1.19) |
| | Control | **.40 (.19-.81)** | **.40 (.18-.84)** |
| # Days Since Accident | | .58 (.27-1.24) | .71 (.31-1.60) |
| # of Health Care Visits | | .93 (.44-1.98) | .95 (.16-3.35) |

*Reference Category is Low (<45)
**Pseudo $R^2$= .47
*** -2 Log Likelihood=192.67

*Factors Associated with Self Reported Pain Disability (Non Depressed Subgroup)*

Factors found to be associated with self reported pain disability for the non-depressed subgroup (n=205) are reported in Table 3-3. In this multivariable model only pain was significantly associated with both moderate disability and high disability as compared to low disability. For those workers without depression, every one point increase on the 11 point pain scale increased the odds of moderate disability by 97% (OR= 1.97, 95% CI 1.39-2.81) and increased the odds of reporting high disability by 109% (OR=2.09, 95% CI 1.35-3.23). The pseudo $R^2$ of the final model was .35 indicating that 35% of the variance in self reported pain disability is accounted for by this model.

**Table 3-3: Factors Associated with Self Reported Pain Disability-Non-Depressed Subgroup (n=205)**

| | | Moderate Disability (PDI 45-56) Adjusted Ors (95% CI) | Severe Disability (PDI >56) Adjusted Ors (95% CI) |
|---|---|---|---|
| Gender | Female | Reference | Reference |
| | Male | .74 (.28-1.93) | 1.13 (.28-1.93) |
| Pain | | **1.97 (1.39-2.81)** | **2.09 (1.35-3.23)** |
| Coping | | | |
| | Diverting Attention | 1.04 (.96-1.14) | 1.07 (.96-1.19) |
| | Reinterpreting Pain | .48 (.22-1.05) | .45 (.18-1.14) |
| | Coping Self Statements | 1.05 (.94-1.17) | 1.02 (.88-1.16) |
| | Ignoring Pain | .93 (.84-1.03) | .94 (.83-1.12) |
| | Praying and Hoping | 1.05 (.96-1.14) | 1.03 (.95-1.14) |
| | Catastrophizing | 1.01 (.93-1.10) | .96 (.87-1.08) |
| | Increased Pain Behaviours | 1.01 (.91-1.23) | .95 (.84-1.08) |
| | Control | .83 (.56-1.22) | .40 (.59-1.54) |
| # Days Since Accident | | 1.14 (.60-2.13) | 1.40 (.66-3.00) |
| # of Health Care Visits | | 1.07 (.60-1.91) | 1.13 (.60-2.38) |

*Reference Category is Low (<45)
**Pseudo $R^2$= .35
*** -2 Log Likelihood=214.49

## Discussion

The aim of this study was to identify factors associated with self reported disability. Using self-reported disability as a dependent variable is important because it allows both researchers and clinicians to gauge how an individual views his or her own health state. Self-reported pain disability is conceptually linked to an individual's self efficacy expectations. Self efficacy expectations are defined as how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences.(32,33) Therefore, asking the individual how disabled they see themselves can provide valuable information about how much that person expects to accomplish in terms of activities of daily living. As Bandura, noted if there are serious doubts about whether they can perform the necessary activities, altering their past behaviour will be difficult.(33) For example, in clinical experimental studies, researchers have found that stronger confidence in ability to tolerate pain is predictive of actual tolerance, regardless of whether cognitive or pharmacological agents were employed to control pain.(33)

This paper had some surprising results. It was expected that coping strategies would be significantly associated with pain disability. Only the coping strategy 'diverting attention' was found to be associated with pain disability and then only when workers reported depression. In this case, for every 1-point increase of the diverting attention scale, the odds of reporting high pain disability increased by 15%.

Another surprising result was that catastrophizing was not associated with self reported pain disability. In past research catastrophizing has been found to be an associated factor. We found no evidence that this was the case.

Clearly pain intensity was the most important variable associated with disability in both depressed workers and non depressed workers. However, the magnitude of the extent was strikingly different for the two groups. In depressed workers, increases in pain, related to a 258% increased odds of reporting *high* disability, as compared to only a 209% increase in non-depressed workers. Yet, for non-depressed workers, a one point increase in pain was associated with a 97% increased odds in rating themselves as *moderately* disabled and this odds ratio was *higher* than for the depressed group at only 58% (OR=1.58).

Another surprising finding was that perceived pain control was highly negatively associated with self perceived disability in the depressed group but not for the non-depressed group. Therefore, it was concluded that perceived control over pain is another important aspect of perceived disability. For workers with depression increased feelings of control meant these people were 60% less likely to rate themselves as moderate or highly disabled. This is particularly important because perceived control is a modifiable variable. Using cognitive behavioural treatments for depressed patients that emphasize ways to feel more control over their pain may be particularly beneficial.

The cross sectional nature of this study limits our ability to predict whether these factors cause self reported pain disability. However, the research on this area is still relatively new and all the associated factors and correlates are still unknown. Studies, such as this one, that identify potential prognostic factors help build a foundation for further study and are necessary for full development of conceptual models.

Additionally, the cross sectional design offers a good way to generate hypotheses related to the results. Potentially, perceived control over pain could be a mitigating factor for poor recovery. The descriptive nature of this paper is limiting yet the results have provided great possibilities in terms of future research.

Another one of this study's strengths is that the model building strategy was very specific. The initial check for interactions was particularly important, had subgroups not been created the effect sizes may have been less evident.

Future research that includes aspects of coping such a perceived pain control will be a helpful in understanding the complex nature of long term pain and disability in injured workers.

# References

1. Carroll LJ, Cassidy JD, Cote P. Factors associated with the onset of an episode of depressive symptoms in the general population. Journal of Clinical Epidemiology 2003 July;56(7):651-8.

2. Carroll LJ, Cassidy JD, Cote P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. Pain 2004 January;107(1-2):134-9.

3. Carroll LJ, Cassidy JD, Cote P. Frequency, timing, and course of depressive symptomatology after whiplash. Spine (Phila Pa 1976) 2006 July 15;31(16):E551-E556.

4. Gross DP, Battie MC. Work-related recovery expectations and the prognosis of chronic low back pain within a workers' compensation setting. Journal of Occupational & Environmental Medicine 2005 April;47(4):428-33.

5. Kivioja J, Jensen I, Lindgren U. Early coping strategies do not influence the prognosis after whiplash injuries. Injury 2005 August;36(8):935-40.

6. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Coping with neck and low back pain in the general population. Health Psychology 2000 July;19(4):333-8.

7. Mercado AC, Carroll LJ, Cassidy JD, Cote P. Passive coping is a risk factor for disabling neck or low back pain. Pain 2005 September;117(1-2):51-7.

8. Blankfeld DF, Holahan CJ. Family support, coping strategies, and depressive symptoms among mothers of children with diabetes. Journal of Family Psychology 1996;10(2):173-9.

9. Carroll LJ, Cassidy JD, Cote P. The role of pain coping strategies in prognosis after whiplash injury: passive coping predicts slowed recovery. Pain 2006 September;124(1-2):18-26.

10. Lazarus RS. Coping theory and research: past, present, and future. Psychosomatic Medicine 1993 May;55(3):234-47.

11. Flor H, Turk DC. Chronic back pain and rheumatoid arthritis: Predicting pain and disability from cognitive variables. Journal of Behavioral Medicine 1988;11(3):-265.

12. Sullivan MJ, D'Eon JL. Relation between catastrophizing and depression in chronic pain patients. Journal of Abnormal Psychology 1990 August;99(3):260-3.

13. Borsbo B, Peolsson M, Gerdle B. Catastrophizing, depression, and pain: correlation with and influence on quality of life and health - a study of chronic whiplash-associated disorders. Journal of Rehabilitation Medicine 2008 July;40(7):562-9.

14. Buitenhuis J, Spanjer J, Fidler V. Recovery from acute whiplash: the role of coping styles. Spine (Phila Pa 1976) 2003 May 1;28(9):896-901.

15. Linton SJ, Gross D, Schultz IZ, Main C, Cote P, Pransky G, Johnson W. Prognosis and the identification of workers risking disability: research issues and directions for future research. Journal of Occupational Rehabilitation 2005 December;15(4):459-74.

16. Oleckno WA. Essential Epidemiology: Princliples and Applications. Long Grove, Illinois: Waveland Press, Inc.; 2002.

17. Dryden DM. Traumatic spinal cord injury in Alberta : epidemiology, health resource utilization, and direct health care costs [Thesis] 2004.

18. Sterling M, Kenardy J, Jull G, Vicenzino B. The development of psychological changes following whiplash injury. Pain 2003 December;106(3):481-9.

19. Sterling M, Jull G, Vicenzino B, Kenardy J, Darnell R. Physical and psychological factors predict outcome following whiplash injury. Pain 2005 March;114(1-2):141-8.

20. Mallen CD, Peat G, Thomas E, Dunn KM, Croft PR. Prognostic factors for musculoskeletal pain in primary care: a systematic review. British Journal of General Practice 2007 August;57(541):655-61.

21. Fayad F, Lefevre-Colau MM, Poiraudeau S, Fermanian J, Rannou F, Wlodyka DS, Benyahya R, Revel M. Chronicity, recurrence, and return to work in low back pain: common prognostic factors. Annales de Readaptation et de Medecine Physique 2004 May;47(4):179-89.

22. Bailey KP. Physical symptoms comorbid with depression and the new antidepressant duloxetine. Journal of Psychosocial Nursing & Mental Health Services 2003 December;41(12):13-8.

23. Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity: a literature review. Archives of Internal Medicine 2003 November 10;163(20):2433-45.

24. Chibnall JT, Tait RC. The Pain Disability Index: factor structure and normative data. Archives of Physical Medicine & Rehabilitation 1994 October;75(10):1082-6.

25. Holm LW, Carroll LJ, Cassidy JD, Skillgate E, Ahlbom A. Expectations for recovery important in the prognosis of whiplash injuries. PLoS Medicine / Public Library of Science 2008 May 13;5(5):e105.

26. Rosenstiel AK, Keefe FJ. The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. Pain 1983 September;17(1):33-44.

27. Jensen MP, Karoly P. Control beliefs, coping efforts, and adjustment to chronic pain. Journal of Consulting & Clinical Psychology 1991 June;59(3):431-8.

28. Williams DA, Robinson ME, Geisser ME. Pain beliefs: assessment and utility. Pain 1994 October;59(1):71-8.

29. Poole H, Bramwell R, Murphy P. Factor structure of the Beck Depression inventory-II in patients with chronic pain. Clinical Journal of Pain 2006;22(9):790-8.

30. Gross DP, Battie MC. Does functional capacity evaluation predict recovery in workers' compensation claimants with upper extremity disorders? Occupational & Environmental Medicine 2006 June;63(6):404-10.

31. Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain 1986 October;27(1):117-26.

32. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review 1977 March;84(2):191-215.

33. Bandura A, O'Leary A, Taylor CB, Gauthier J, Gossard D. Perceived Self-Efficacy and Pain Control: Opioid and Nonopioid Mechanisms. Journal of Personality & Social Psychology 1987 September;53(3):563-71.

## Conclusions

This dissertation sought to better understand one of the most commonly cited psychological variables in pain, injury, and disability research: pain coping.

Study one used a descriptive study design to describe how injured workers with long term pain cope with the pain related to their injury. The analysis showed that coping strategies are not uniform across injured workers, and may depend on numerous demographic, injury related, psychologically, and program related variables. Most notably, this study sheds light on the role of gender differences in coping. Men and women differed in their uses of pain coping strategies. The results showed that women used more ‘diverting attention’, ‘reinterpreting pain’, ignoring pain’ and ‘pain related behaviours’ (i.e. taking medication) than men. Often in analytic studies, differences in coping strategies between men and women are controlled for statistically. As these differences may be important, treating gender as a confounder may not be appropriate. Perhaps, gender is a mediator; therefore tests for mediation should be carried out prior to regression model building. Perhaps future research will provide more insight on this first initial look into the role of gender and pain coping.

Another interesting finding of study one was the extremely high prevalence of depression within this study group. 45.7% of this cohort reported a Beck Depression Inventory-II score over 22. Given the point prevalence of depression within the general population is between 2-10% this finding is extremely significant. Furthermore, our study indicated that people with low level depression used significantly higher amount of coping self statements, ignoring pain, and pain related behaviours. Additionally, results indicated depression to be significantly correlated with catastrophizing and praying and hoping. The cross sectional nature of this study does not allow for causation to be determined, however, it does draw attention to the important relationship between depression and coping. Future research should focus of the intricate relationship between these two factors.

Finally, important differences in pain coping were noted between people who rated themselves as having high levels of pain and high levels of self reported pain related disabled. Both of these groups showed significantly more use of catastrophizing as a strategy for pain coping. The relationship between catastrophizing and depression and recovery has been noted in the literature and this study replicates these findings.

Study one of this dissertation concluded that workers with chronic long term pain use multiple pain coping strategies and these strategies may be a contingent on multiple biopsychosocial variables. The findings indicate that maladaptive pain coping strategies are significantly higher in workers with depression, those with high levels of pain and workers that perceive themselves to be highly disabled.

Study two attempted to assess the prognostic role of pain coping in the recovery from long term work related pain. The paper used two commonly used measures of recovery: time until suspension of benefits and self reported pain disability (assessed at the end of a rehabilitation program). Using multivariable regression, models were built to assess the associations between the coping strategies and these outcomes. Despite findings in other research studies of the prognostic role of pain coping in recovery, this study did not see a considerable prognostic influence by pain coping. Small increased odds were noted for those individuals that used coping self statements to rate themselves as moderately disabled. Additionally, a small significant hazard rate, (a 2% decreased chance of being off benefits), was noted for workers that use higher amounts of diverting attention and increased pain behaviours. The findings also noted a small but significant decreased chance (3%) for being off Vocational Rehabilitation benefits. These findings, however, were not intuitive and it was concluded that time until suspension of benefits was a poor indicator of recovery for this cohort of injured workers.

Study two was unique because it used two types of outcome measures: one that is self reported (pain disability) and one that is administrative (suspension of benefits). Using two measures ensured the comprehensiveness of the study as well as ensured that reporting biases could be minimized.(1)

Although coping did not show a strong prognostic association with suspension of benefits or pain disability, this does not mean that it doesn't play an important role in the recovery from work related long term pain. The method employed (multiple regression) in this study may not have been able to capture the complexity of this relationship. Future work looking to understand the role in coping may need to implement a path analysis or structured equation model that could measure the role of coping as an intervening endogenous variable rather than an exogenous variable. Using this type of analysis would allow for the measurement of the bi-direction role coping may play in the recovery process rather than trying to measure the direct role.

The goal of the third paper was to measure what factors are related to self reported disability. In study one, it was noted that depression and catastrophizing were correlated, it was also noted that over 45.7% of the cohort reported depression. Study two indicated the perhaps coping was not a significant predictor of self reported disability or return to work.

Based on these findings, it was prudent to further investigate self perceived disability to achieve greater understanding about the roles coping and depression. To do this, a cross sectional study was performed that measured the role of demographic variables, injury related variables, and psychological variables in self reported pain disability. Self reported disability allows both researchers and clinicians to gauge the individuals self efficacy expectations. Measuring the role of modifiable variables in self reported disability can help to identify treatment options for clinicians.

For study three, a multivariable polytomous regression model was built to identify factors associated with self reported pain disability. The results of this study indicated that depression was moderating the effect of pain on disability. In order to reduce the complexity of this relationship two separate models, one for depressed individuals and one for non-depressed individuals were built. The results of this study showed that for both depressed and non-depressed workers pain level was the most significant factor associated with reports of high disability. Yet the magnitude of the odds ratios differed considerably between the two groups.

One other interesting finding in this study was the role that perceived control over pain plays in the assessment of self perceived disability. The result showed that perceived control over pain was protective for high and moderate self reported disability, but only for the depressed group. Again this finding provides some indirect support to the theory that self efficacy is an important aspect of the recovery process.

Understanding the recovery process for the worker with long term pain is challenging. These three studies add to the growing understanding of this group of individuals. However, there is still much work needed.

The findings of this dissertation suggest that pain coping may be a product of differences between; demographic, psychological, and sociological elements however, perceived control over pain and depression are important. Cognitive behavioural theory holds that an individual's beliefs and coping behaviours related to their pain play important roles in their adjustment, and research guided by this theory has led to advances in understanding how an individual's pain related cognitions and coping strategies may influence subsequent physical and psychological functioning.(2)

The CSQ measures cognitive coping strategies and specific coping strategies are associated with greater perceptions of control. Coping self statements and reinterpreting pain are generally considered 'active' strategies and have shown to be predictive of greater perceived control;(3) while others, like catastrophizing, are generally considered to be maladaptive. Yet the other coping strategies have shown little in terms of predictability pain related disability, psychological functioning, or pain intensity.

Understanding these findings poses a unique opportunity to consider both methodological and theoretical issues as it pertains to research using administrative compensation based data.

Differences in the predictive role of coping found in this dissertation may be due to numerous factors. First, the bulk of the research on coping is largely cross sectional. Secondly, study two used a multivariable design to assess for possible confounding, both negative and positive. Thirdly, the use of two different outcome measures allows for confidence in the findings

In conclusion, there is merit in understanding how one ‘copes’ with pain. Although research has yet to discover a clear link between pain coping and recovery, I suggest that this is due to the complexity of the issue and not absence of authenticity.

# References

1. Krause N, Frank JW, Dasinger LK, Sullivan TJ, Sinclair SJ. Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. American Journal of Industrial Medicine 2001 October;40(4):464-84.

2. Turner JA, Jensen MP, Romano JM. Do beliefs, coping, and catastrophizing independently predict functioning in patients with chronic pain? Pain 2000 March;85(1-2):115-25.

3. Haythornthwaite JA, Menefee LA, Heinberg LJ, Clark MR. Pain coping strategies predict perceived control over pain. Pain 1998 July;77(1):33-9.

## Appendix A: The Study Population

All three studies involved workers treated at the Millard Health Rehabilitation Centre in Edmonton, Alberta. The Workers' Compensation Board of Alberta (WCB-Alberta) provides 'no-fault' insurance coverage to employers and workers. Its mandate is to provide compensation to injured workers for lost employment income and cover treatment and rehabilitation costs. Its main objective is to return injured workers to work. The WCB-Alberta uses employer pricing incentives to reward workplace safety. It encourages safety through premium rates that reflect the true cost of injuries. As an insurance system the WCB maintains a fully funded system to ensure benefit security. The assurance that the real costs of claims drives the premium rates for employers helps them to effectively manage claims and costs.

The Millard Health Rehabilitation Centre acts as the rehabilitation arm of Alberta's WCB. Its main focus is to provide rehabilitation to injured workers with 'return to work' as the central outcome. The Millard Centre provides individualized treatment planning, with a service based program that encourages client independence and self-management. Additionally, it focuses on an active treatment approach to rehabilitation. Additionally, The Millard Health Rehabilitation Centre uses an interdisciplinary health model to manage the needs of its clients. The model has a four-fold focus: physical/functional, psychosocial/cultural, vocational, and environmental aspects for return to work. The physical/functional aspect of treatment involves assessing the individual and providing treatment to increase the individual's functional tolerances, such as range of motion, muscle strength, endurance, and other restrictions in conjunction with job demands due to objective findings from medical and standardized assessments.

The program's psychosocial/cultural aspect seeks to assess individual for levels of pain, anxiety, and depression. These factors are contextualized within the individuals' cultural backgrounds and their perceived social support networks and work environments; clients are then offered an individualized treatment program. The vocational aspect of the model addresses the individual's job attachment, education, and levels of experiences within the work force. Finally, the environmental aspect of the model looks closely at the relationships between the employer and the employees, the type of work culture present in the individual's work place and other aspects of the work environment such as work related stress and union involvement.

This study focuses on a unique group of injured workers at the Millard Health Rehabilitation Centre. The Return to Work Services (Complex) treatment program focuses on injured workers considered to have more chronic problems, as they generally have a prolonged course of disability (over three months), and have been assessed as potentially having psychological or social barriers that make returning to work difficult. Information is gathered on injured workers entering the Millard Rehabilitation Centre Return to Work Services (Complex) treatment program from the years 2003 to 2005. There are approximately 200 individuals triaged to this intervention arm each year.

## Appendix B: Coping Strategies Questionnaire (CSQ)

Pain coping strategies are measured by using the Coping Strategies Questionnaire (CSQ).(1) This questionnaire is a widely used instrument for measuring pain coping strategies. Jensen et al note that the CSQ is the most frequently used measure to asses coping in chronic pain populations.(2) The primary aim of the CSQ is to assess the frequency and success of an individual's cognitive and behavioural pain coping strategies. The internal consistency alpha coefficients for each of the subscales are as follows: diverting attention: α=.85, reinterpreting pain sensations: α=.85, coping self statements: α=.72, ignoring pain sensations: α=.81, praying/hoping: α=.83, catastrophizing: α=.78, increased pain behaviours: α=.28. Additionally, a measure of control over pain is asked. Individuals are asked to rate on a 7 point Likert scale how much control they feel they have over their pain (0=no control, 6=complete control).

The choice to use individual scales rather than a factor analytic structure is due to a review of the literature that found that the factor structure of the CSQ can differ depending on the research population and choice of factor analysis technique. For example, the original study for Rosensteil and Keefe found a 3 factor solution when using the questionnaire on a sample of 62 chronic pain patients.(1) Yet a separate study by Keefe et al (1987) produced a 2 factor solution. (3) In a critical review on coping with chronic pain published in 1991, Jensen et al state that the results of factor analysis of the CSQ items tend to be inconsistent across studies and patient populations yet they favoured the three 3 factor solution suggested by Lawson.(4) In yet another study following this critical review, Robinson et al (1997) used the CSQ to assess pain coping in a large cohort of n=965 chronic pain patients, this study ultimately favoured a nine factor solution. (5) A related study by Riley et al (1997) found a six factor solution accounted for the majority of the variance in their sample of n= 472 chronic pain patients.(6;7)

A research study by Dozois et al (1996) that compared the predictive utility of the CSQ in low back pain patients using the individual scales vs. composite measures. This study reiterated the finding that most research up until that date used composite factors of the CSQ where typically a 2 or 3 factors materialize, yet the items within the factors differ due to patient population and types of coping skills examined.(8)

The Dozois study mentions that the choice of composite factors does have some benefit, for example, composite measures may enhance interpretability, statistical power and the identification of general coping dimensions. On the other hand, composite measures increase the probability of obscuring more specific relationships between coping and adjustment. Whereas the use of individual scale scores allow for idiographic assessment of particular coping strategies and how they may relate to functioning. Dozois et al caution, however, that because the individual scales contains fewer items they may have less reliability. In conclusion, the Dozois study found that the predictive utility of the composite or individual scales depended on which outcome measure was used to define adjustment.(8)

In the Dozois study when perceived disability was used as an outcome (as it is in study two) the individual scales accounted for an additional 14% of the variance over the factor scores, after the contribution of the demographic and pain-related variables were accounted for. Additionally they found that the individual CSQ scales maximally distinguished between individuals who had later return to work and those who remained unemployed.(8) Given these findings the use of the individuals scale scores appears to be most appropriate.

*Individual Subscale Items*

**Diverting Attention:**

1. I try to think of something pleasant.
2. I count numbers in my head or run a song through my mind.
3. I replay in my mind pleasant experiences in the past.
4. I think about people I enjoy doing things with.
5. I think of things I enjoy doing.
6. I play mental games with myself to keep my mind off the pain.

**Reinterpreting Pain Sensations:**

1. I try to feel distant from the pain, almost as if the pain was in somebody else's body.
2. I do not think of it as pain but rather as a dull or warm feeling.
3. I just think of some other sensation, such as numbness.
4. I try not to think of it as my body, but rather as something separate from me.
5. I imagine the pain is outside of my body.
6. I pretend it's not part of me.

**Ignoring Pain Sensations:**

1. I don't think about the pain.
2. I don't pay attention to the pain.
3. I pretend it's not there.
4. Although it hurts, I just keep going.
5. I just go on as if nothing happened.
6. I ignore it.

**Coping Self Statements:**

1. I tell myself to be brave and carry on despite the pain.
2. I tell myself I can overcome this pain.
3. I tell myself it doesn't hurt.
4. I tell myself I can't let the pain stand in my way of what I have to do.
5. No matter how bad it gets, I know I can handle it.
6. I see it as a challenge and I don't let it bother me.

**Praying or Hoping:**

1. I know that someday someone will be here to help me and it will go away for a while.
2. I pray to God it won't last long
3. I try to think years ahead, what everything will be like after I've gotten rid of the pain.
4. I have faith in the doctors that someday there will be a cure for my pain.
5. I pray for the pain to stop.
6. I rely on my faith in god.

**Catastrophizing:**

1. It’s terrible and I feel it’s never going to get any better.
2. It’s awful and I feel that it overwhelms me.
3. I feel my life isn’t worth living.
4. I worry all the time about whether it will end.
5. I feel I can’t stand it anymore.
6. I feel like I can’t go on.

*Behavioural Coping Strategies*

**Increase Pain Behaviour**

1. I take medication.
2. I use a heating pad.
3. I relax.
4. I lie down.
5. I take a shower or a bath.
6. I do anything to get my mind off the pain.

# References

(1) Rosenstiel AK, Keefe FJ. The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. Pain 1983 September;17(1):33-44.

(2) Jensen MP, Karoly P. Control beliefs, coping efforts, and adjustment to chronic pain. Journal of Consulting & Clinical Psychology 1991 June;59(3):431-8.

(3) Keefe FJ, Caldwell DS, Queen KT, Gil KM, Martinez S, Crisson JE, Ogden W, Nunley J. Pain Coping Strategies in Osteoarthritis Patients. Journal of Consulting & Clinical Psychology 1987 April;55(2):208-12.

(4) Jensen MP, Turner JA, Romano JM, Karoly P. Coping with chronic pain: a critical review of the literature. Pain 1991 December;47(3):249-83.

(5) Robinson ME, Riley JL, III, Myers CD, Sadler IJ, Kvaal SA, Geisser ME, Keefe FJ. The Coping Strategies Questionnaire: a large sample, item level factor analysis. Clinical Journal of Pain 1997 March;13(1):43-9.

(6) Riley JL, III, Robinson ME. CSQ: five factors or fiction? Clinical Journal of Pain 1997 June;13(2):156-62.

(7) Riley JL, III, Robinson ME, Geisser ME. Empirical subgroups of the Coping Strategies Questionnaire-Revised: a multisample study. Clinical Journal of Pain 1999 June;15(2):111-6.

(8) Dozois DJA, Dobson KS, Wong M, Hughes D, Long A. Predictive utility of the CSQ in low back pain: individual vs. composite measures. Pain 1996 August;66(2-3):171-80.

## Appendix C: Self Perceived Disability

Self perceived disability was measured on admission to the program using the Pain Disability Index (PDI). The Pain Disability Index is a seven item, self-report inventory designed to provide an overall rating of disability and ratings of specific disabilities related to seven areas of life activities (occupational, home/family, recreational, social, sexual, ADLs, life support). Each item is rated on an 11-point Likert scale (0=no disability, 10=complete disability). Findings from Tait et al found strong support for the usefulness of the PDI in outcome research for pain.(1) Their psychometric study on the PDI found an internal consistency of alpha=.86.(1).

## References

(1) Tait RC, Chibnall JT. Factor structure of the pain disability index in workers compensation claimants with low back injuries. Archives of Physical Medicine & Rehabilitation 2005 June;86(6):1141-6.

## Appendix D: Beck Depression Inventory

Depression was measured using the Beck Depression Inventory-Second Edition (BDI-II). The BDI was developed to assess the severity of depression in adolescents and adults. It was not, however, intended to reflect any particular theory of depression. The BDI was developed using clinical observation and symptom descriptions that were reported frequently by psychiatric patients but infrequently by non-depressed psychiatric patients. Optimal cut-off scores for the assessing of severity of depression among individuals with major depressive disorder were determined through the use of receiver operating (ROC) curves. Greater importance was placed on sensitivity relative to specificity in order to minimize the probability of false negatives. This decision was based on the fact that the instrument was designed to screen for major depression for clinical purposes.(1)

The BDI-II is a 21-item self-reported measure of depressive symptoms experienced during the past two week period. The 21-items have a four point rating scale that when summed yield a score ranging from 0-63.

In development studies, the BDI-II demonstrated excellent test-retest reliability and high internal consistency, with coefficient α's of .92 and .93 in psychiatric outpatient (N=500) and college student (N= 120) samples. The test-retest reliability was tested on a small sample (N=26) of outpatients and reported to be .93 (P<.001). The BDI-II has been further validated on populations ranging from primary medical patients and patients with chronic pain.(2) The positive relationships between the BDI-II and the Beck Hopelessness Scale and between the BDI-II and the scale for Suicidal Ideation have been cited as evidence of the convergent validity of the BDI-II. The instrument was more positively correlated with the Hamilton Psychiatric Rating Scale for Depression than it was with the Hamilton Rating Scale for Anxiety. This finding indicates evidence of discriminate validity of the BDI-II.(1)

Although the BDI-II has been frequently used to assess depression in chronic pain populations, there are a few researchers who caution its use in this population. In a paper published by de Williams and Richardson (1993) they hypothesis that there may be the potential for co-linearity between the inventory’s somatic items with symptoms of chronic pain.(3) For example, several of the BDI items have a somatic content (sleep disturbance, fatigue, etc). They caution that because chronic pain may have similar effects, the significance of the total BDI score in the population may be unclear. Additionally, other researchers have found that somatic symptoms of depression are significantly related with measures of pain severity, while the cognitive items are not related. These studies suggest that the somatic symptoms that may arise as a result of having chronic pain may lead to increased scores on self-report measures of depression and this may in turn result in incorrect interpretations regarding the presence and severity of depression. One way to potentially counter these effects is to remove the somatic items in the analysis stage and assess if differences are found. This was done in a paper by Geisser et al (1997) where they found that the somatic items did not confound the diagnosis of depression and the removal of the somatic items did not improve the accuracy of classification. They concluded that the somatic items on the BDI do appear to contribute to the identification of depression among persons with chronic pain, and dropping of these items from the total score may slightly decrease the accuracy of these measures.(4)

To avoid possible biased results, this study used the method described by Geisser et al and tested for potential confounding.(4)

## References

(1) Brantley PJ, Mehan DJ, Thomas JL. The Beck Depression Inventory (BDI) and the Center for Epidemiologic Studies Depression Scale (CES-D). In: Maruish ME, editor. Handbook of Psychological Assessment in Primary Care Settings.Mahwah: Lawrence Erlbaum Associates; 2000. p. 391-422.

(2) Poole H, Bramwell R, Murphy P. Factor structure of the Beck Depression inventory-II in patients with chronic pain. Clinical Journal of Pain 2006;22(9):790-8.

(3) Williams AC, Richardson PH. What does the BDI measure in chronic pain? Pain 1993 November;55(2):259-66.

(4) Geisser ME, Roth RS, Robinson ME. Assessing depression among persons with chronic pain using the Center for Epidemiological Studies-Depression Scale and the Beck Depression Inventory: A comparative analysis. Clinical Journal of Pain 1997;13(2):163-70.

## Appendix E: Sample Size and Statistical Power

For this particular study the sample size calculation is based on the use of survival modeling to analyze the main research question. Statistical power analysis involves the relationship between four distinct variables: sample size, significance criterion, population effect size and statistical power. To determine appropriate sample size for the desired power level the computer program PS Power and Sample Size Calculations ® version 2.1.30 was used. Given an alpha level of .05, and the desired power level 0.80., and effect size set at HR=1.2, the sample size required for this study is n=472.

# Appendix F: Supplementary Tables

## Table 3-4: Pearson Correlations: Coping x PDI

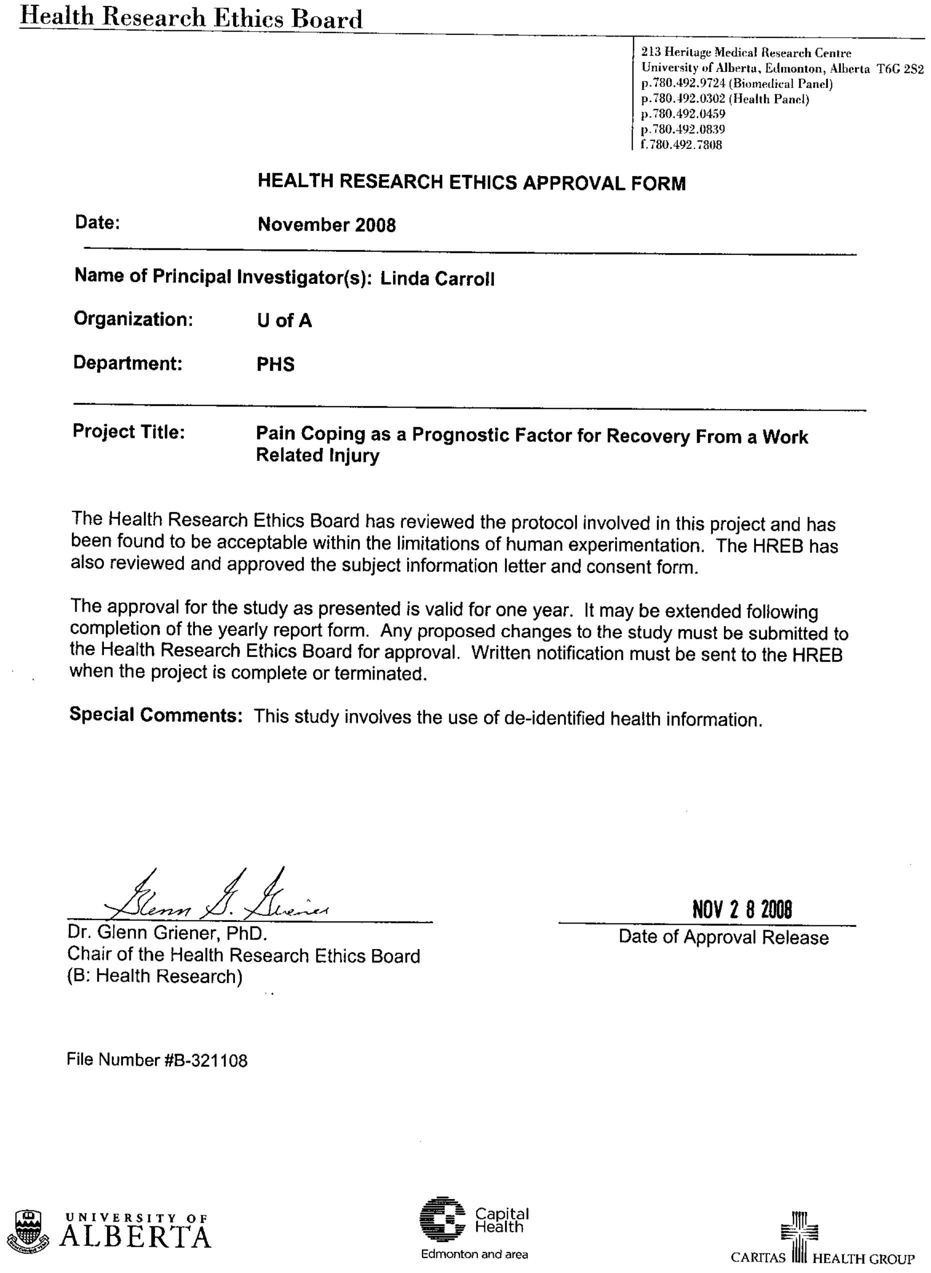
| | **Diverting Attention** | **Reinterpreting Pain** | **Coping Self Statements** | **Ignoring Pain** | **Praying and Hoping** | **Catastrophizing** | **Increased Pain Behaviours** | **Control** |
|---|---|---|---|---|---|---|---|---|
| **Self Perceived Disability§** | .01 | .01 | -.10 | -.14** | -.19** | .21** | -.03 | -.25** |

**p<.01

## Table 3-5: Cross Tabulation: Depression x PDI

| | **PDI (Low)**<br><45 (%) | **PDI (Moderate)**<br>45-56 (%) | **PDI (High)**<br>>56 (5) |
|---|---|---|---|
| **Depression (BDI<22)** | 28 (31.8) | 87 (54.7) | 69 (67.0) |
| **No Depression (BDI≤22)** | 60 (68.2) | 72 (45.3) | 34 (33.0) |

# Appendix G: University of Alberta Ethics Approval



Health Research Ethics Board

213 Heritage Medical Research Centre
University of Alberta, Edmonton, Alberta T6G 2S2
p.780.492.9724 (Biomedical Panel)
p.780.492.0302 (Health Panel)
p.780.492.0459
p.780.492.0839
f.780.492.7808

**HEALTH RESEARCH ETHICS APPROVAL FORM**

**Date:** **November 2008**

**Name of Principal Investigator(s): Linda Carroll**

**Organization:** **U of A**

**Department:** **PHS**

**Project Title:** **Pain Coping as a Prognostic Factor for Recovery From a Work Related Injury**

The Health Research Ethics Board has reviewed the protocol involved in this project and has been found to be acceptable within the limitations of human experimentation. The HREB has also reviewed and approved the subject information letter and consent form.

The approval for the study as presented is valid for one year. It may be extended following completion of the yearly report form. Any proposed changes to the study must be submitted to the Health Research Ethics Board for approval. Written notification must be sent to the HREB when the project is complete or terminated.

**Special Comments:** This study involves the use of de-identified health information.

Glenn G. Griener
Dr. Glenn Griener, PhD.
Chair of the Health Research Ethics Board
(B: Health Research)

NOV 2 8 2008
Date of Approval Release

File Number #B-321108

UNIVERSITY OF ALBERTA

Capital Health
Edmonton and area

CARITAS HEALTH GROUP

# Re-Approval Form

Date: September 17, 2009

Principal Investigator: Linda Carroll

Study ID: MS1_Pro00004372

Study Title: Pain Coping as a Prognostic Factor for Recovery From a Work Related Injury

Approval Expiry Date: October 29, 2010

The Health Research Ethics Board (HREB) has reviewed the renewal request and file for this project and found it to be acceptable within the limitations of human research.

The re-approval for the study as presented is valid for one year. It may be extended following completion of the annual renewal request. Beginning at 45 days prior to expiration, you will receive notices that the study is about to expire. Once the study has expired you will have to resubmit. Any proposed changes to the study must be submitted to the HREB for approval prior to implementation.

For studies where investigators must obtain informed consent, signed copies of the consent forms must be retained, as should all study related documents, so as to be available to the HREB upon request. They should be kept for the duration of the project and for at least five years following study completion.

Sincerely,

Glenn Griener, Ph.D.
Chair, Health Research Ethics Board - Panel B

*Note: This correspondence includes an electronic signature (validation and approval via an online system).*