Prediction Model for
Return to Work of Injured Workers in Hong Kong

By

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STATEMENT OF SOURCES

The idea of the present investigation and planning of the experiments were resulted from discussions between the author and supervisor.

All experiments in the present investigations were completed solely by the author.

The author declares that the work presented in this thesis is, to the best of the author's knowledge and belief, original, except as acknowledged in the text, and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

Yanwen Xu

June 2005

Dedication

I would like to dedicate this work to my family, friends, colleagues, and classmates who have supported me throughout my study in every way.

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Abstract

This study aims to formulate a prediction model of return to work for a group of workers who have been suffering from chronic pain and physical injury while also being out of work in Hong Kong. The results of the study will enable us to better understand the factors which might influence injured workers' resumption of a productive work role. The findings will also shed light on the development of relevant interventions and system for the return to work process of such workers.

The participants were 67 (Mean age=42.67) injured workers participated in a six-week return to work program which included training and placement. Assessments of the participants were conducted before they commenced the program (at the beginning of the 1st week), at the end of the program (end of the 3rd week), and at the end of the follow-up period (the 12th week post-program). The return-to-work outcomes were gathered in the last assessment. A total of 8 tests were administered covering physical, psychological, psychosocial, and vocational outcomes. Data on the demographic characteristics and work history of the participants were also obtained.

The return to work rate of the participants was 0% at the admission and 65.7% three months after the program. Significant differences were identified between those participants who were successful in the return to work process and those who were not. There were significantly more participants in the non return to work group (81.3%) who pursued civil claim against their employers, than in the return to work group (51.4%) ($\chi^2 = 6.59$, $df = 1$, $p = 0.010$). The participants in the return to work group were also found to

have higher scores on the confidence in return to work ($F(1,52)=9.87$, $p=0.003$) and LASER Action subscale score ($F(1,63)=5.00$, $p=0.025$). When the variable “attorney involvement” was excluded from the analysis, participants’ return to work outcomes were found to be significantly predicted by the readiness of return to work (action) (OR=1.25) at the baseline. As the participants progressed in the program, their return to work was significantly predicted by their confidence in returning to work (OR=1.41) and readiness of return to work (action) (OR=1.39). By the 3rd assessment, return-to-work outcomes were predicted by readiness of return to work (pre-contemplation) (OR=0.75). The accuracy of the predictions ranged from 65.2% (at the baseline) to 78.0% (at 3rd week of the training program). The prediction model, however, was dominated by the variable “attorney involvement”, when it was included as one of the predictor (OR=0.23 to 0.27). Besides the conventional logistic regression method, case-based reasoning was used as the alternative method to develop the prediction model. The case-based reasoning algorithm was based on 14 variables. The usefulness of the algorithm was tested on 32 new participants, and the accuracy of predicting return to work outcomes was 62.5%.

The combination of readiness of return to work, confidence, and attorney involvement appears to best predict medium-term return-to-work outcomes; that is, longer than 3 months. The findings further indicate that variables that are important for predicting return to work are likely to be confounded by the stages at which injured workers are assessed. The interventions in which the workers participate may also influence the results. As a result, these prediction models should be interpreted with caution. The results shed light on the development of return-to-work intervention programs and clinical pathways for injured workers. Further studies should focus on testing in detail the interaction effects between workers, interventions, and the environment.

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CHAPTER I

INTRODUCTION

The rehabilitation of injured workers with chronic pain for return to work is a medical, organizational, financial, and societal issue. In the United States, more than half a million workers suffer from work-related injuries each year. Studies have revealed that almost half of these injured workers never return to work (Tate, 1992). The costs associated with these injured workers already exceeded US$170 billion in 1990 (Pope, 1991). As the costs have kept on increasing, how to get more workers to return to work has become increasingly important, and the factors which can predict successful return to work have aroused the interests of researchers in this area of study (Beck, 1989; Gardner, 1991; Hall, 1994; Hester et al., 1986; Perry, 1996; Smith & Crisler, 1985).

As the advancement of medical technology has succeeded in saving the lives of workers involved in severe industrial accidents, much effort has been spent on increasing the return to work of injured workers suffering from chronic pain (Rucker & Metzler, 1995). For instance, in the United Kingdom, the healthcare costs incurred as a result of chronic low back pain were estimated to be £1.623 billion (Maniadakis & Gray, 2000). In the United States, it is estimated that 2.9 million people (1.1% of the population) are treated for chronic pain problems (Gureje, 1998).

In Hong Kong, the average number of occupational injuries per year was 60,000 for the period 1996 to 2001. The direct costs associated with these injures were between HK$760.6 million and HK$1,144 million, and the total number of lost workdays was between 1,360,092 and 1,690,009 (Hong Kong Labour Department, 2000). This has put tremendous financial pressure on the insurance industry and employers. In 2002, the Hong Kong Federation of Insurers (HKFI) published a review report on the workers' compensation system in Hong Kong (HKFI Statement of

Chairman, 2002-2003). The report highlighted the problems in maintaining a profitable operation without introducing some rational changes to the existing workers' compensation system. The same report stipulated that the insurance companies had been running at a loss for the past 11 years, and that the existing workers' compensation system and the provision of rehabilitation services were under severe scrutiny. In the report, the large amount of compensation payments to plaintiffs in very few medico-legal cases and the high legal fees were identified as major causes of the insurance industry's losses. The report proposed various ways to lower costs, including modifying the present compensation system and, more importantly, developing cost-effective rehabilitation services for injured workers. The financial losses of the insurance companies may lead to a substantial increase in insurance premiums. This would substantially increase the operational costs of industries in Hong Kong. In view of the fact that there is a lack of collective effort from the government and the healthcare industry to improve the existing rehabilitation services for injured workers, there is an obvious need to conduct research in this area, particularly to better understand the factors that can increase the return to work of injured workers.

The rehabilitation of injured workers suffering from chronic pain-related symptoms is multidimensional in nature. Pain is a subjective phenomenon that lacks reliable measures (Rucker & Metzler, 1995). It is not the duration of pain that distinguishes chronic pain from acute pain; rather, it is the inability of the body to restore its physiological functions to normal homeostatic levels (Loeser & Melzack, 1999). This fact indicates that chronic pain is associated with psychological and behavioral suffering. Hence, interventions for chronic pain should tackle problems arising from depression, anxiety, disability, and lack of social support. Common interventions for work-related injuries include exercise, education, physical capacity evaluation, work reconditioning and hardening, workstation assessment, work site surveillance and support delivered in the form of interdisciplinary intervention teams, and functional restoration programs. Their effectiveness has been substantiated elsewhere (Chan et al., 2000; Dasinger et al., 2000; Postacchini et al., 1998; Reyes, 1998; Scott, 1999). In the present study, the six-week work rehabilitation program, which was organized jointly by The Hong Kong Polytechnic University and the Hong Kong Workers' Health Centre, included physical, psychological, and psychosocial interventions for injured workers suffering from chronic pain.

This study aimed to explore the predictors and formulate a prediction model for the return-to-work of injured workers who had been suffering from chronic pain and were out of work in Hong Kong by using a conventional statistical method (the logistic regression model) and an artificial intelligence method (case-based reasoning). The results of the study would enable us to have a better understanding of the factors which might influence those injured workers with chronic pain and their resumption of a productive work role. The findings would also shed light on the development of relevant interventions for the return-to-work process of these workers.

Statement of Purpose

The impacts of work-related injuries on the return to work of injured workers have been a major concern of contemporary societies (Tate, 1992b; Weed & Field, 2001). Much effort has been made to optimize the financial and social costs incurred from the rehabilitation of injured workers with chronic pain. This study aimed to explore the predictors of and formulate a prediction model for the return to work of injured workers who had been suffering from chronic pain and were unemployed in Hong Kong. The results of the study would enable us to have a better understanding of the factors which might influence injured workers with chronic pain and their resumption of a productive work role. The findings would also shed light on the development of relevant interventions for the return-to-work process of such workers.

Research Questions

The study attempted to tackle the following four research questions:

1. What are the factors which would influence return-to-work outcomes of injured workers suffering from symptoms of chronic pain?

2. Do these factors differ throughout a worker's retraining process?

3. Are psychosocial factors more important than physical and demographic factors in influencing return-to-work outcomes?

4. Does the interpretation of these factors differ depending on whether a regression model or a case-based reasoning model is adopted?

Organization of Chapters

This dissertation report consists of five further chapters. Chapter II is a review of the background literature which outlines the common conceptual models describing the relationships between the causes and consequences of work-related injuries. The factors which were identified by other studies as influencing the return-to-work process under different workers' compensation systems are revealed. To better prepare the reader for the use of a nonconventional statistical method, the concept and mechanism of case-based reasoning are described.

Chapter III is a detailed description of the method of this study which includes the research design, the data collection procedure, instrumentation, and data analysis. The plan for designing the case-based reasoning algorithm is also presented.

Chapter IV reports the results of the study. The factors identified as important in influencing the return-to-work outcomes of injured workers with chronic pain are tested with parametric statistics. Separate logistic regression models are developed for different follow-up time-lines. The results of the regression model developed based on the baseline assessment are then compared with those generated from the case-based reasoning model.

Chapters V and VI contain respectively the discussion and the conclusion. The prediction model generated from this study is compared with models from studies conducted overseas. The importance of the influence of both physical and psychosocial factors on the workers' return-to-work outcomes is discussed. The extent to which the workers' compensation system in Hong Kong confounded the return-to-work process is also explored. The benefits of different prediction models for assisting clinical reasoning and treatment planning for injured workers with chronic pain are discussed.

CHAPTER II

LITERATURE REVIEW

Introduction

Work-related injuries and return to work after injury have become a major concern of all societies (Tate, 1992b; Weed & Field, 2001). Workers who suffer from chronic and recurring pain receive the most attention. In the United States, 17% of people who sought medical care suffered from persistent pain (Gureje, 1998). The annual cost of providing interventions to alleviate the associated symptoms was estimated to be US$20-50 billion (Wilson, 1996). In Hong Kong, though the number of occupational injury cases declined from 59,465 in 1996 to 57,109 in 2001, the costs of compensation increased from about HK$760 million to HK$910 million. The average sick leave taken by injured workers who had more than two months off amounted to 6,747 days (Table 1). This has placed substantial financial pressure on the insurance industry (Hong Kong Federation of Insurers, 2002-2003). But more importantly, this group of injured workers would have a much higher chance of developing chronic pain and hence experiencing a loss of employability. A look at the work history of these workers reveals that the majority of them work in the wholesale, retail, restaurant, and hotel industries (Hong Kong Labor Department, 1996-2002). Very often, the workers in these industries are involved in strenuous manual jobs. As a result, there is a high chance that they will develop symptoms of back-related injury. Evidence from prior studies conducted by the Department of Labor of the United States shows that occupational musculoskeletal disorders are largely attributable to over-exertion and pain suffered at work (Bureau of Labor Statistics, 1995). In Hong Kong, work-related injuries tend to be caused by: 1) slipping, tripping, or falling on the same level; 2) striking against or being struck by a moving object; and 3) lifting or carrying.

Table 1. Work-related injuries between 1996 and 2001 in Hong Kong

Year	Number of injuries#	Total lost days	Nonfatal with sick leave exceeding three days#	Nonfatal with sick leave exceeding two months#	Sum of compensation (HK$ millions)
1996	59,465	1,360,092	57,302	6,091	760.6
1997	62,776	1,520,485	59,849	6,846	1,015
1998	66,680	1,690,009	61,673	7,538	1,144
1999	60,683	1,507,190	56,960	6,806	1,002
2000	61,003	1,554,200	58,503	6,726	1,003
2001	57,109	1,472,756	54,583	6,476	910

* Hong Kong Labor Department Annual Report from 1996 to 2001.
# Number of injured workers.

Causes of Work-related Injuries

The causes of work-related injuries are multifactorial in nature. Injuries may emanate from problems with workplace design and layout, work postures, work methods, work demands, psychological or emotional stress, or the capacity of the worker to cope with the physical and mental stresses imposed on him or her. Faucett and Rempel (1994) reported that the overall effect of combined risk factors was greater than the sum of separate effects. Mickey and Robert (2003) further suggested that the risk factors for work-related injuries can be divided into four categories: psychosocial, physical, personal, and society/workplace factors (see Figure 1). Winkel and Mathiasson (1994) reported three categories of risk factors for workers who develop musculoskeletal disorders such as back pain: 1) individual factors, such as a person's weight, a history of prior low back pain, and smoking habits; 2) physical factors, such as lifting and posture; and 3) psychosocial factors, such as job control and job satisfaction. These similar risk factors were based on the classification of independent (e.g. physical, individual, and psychosocial risk factors), dependent (e.g. unemployment rate, worker's compensation system), and interaction risk factors.

Psychosocial factors

Psychosocial factors have been reported to be significant risk factors for musculoskeletal disorders. A systematic review by Bongers, Kremer, and Ter in 2002 reported that high job stress and non-work-related stress reactions are consistently associated with upper extremity disorders. Kerr et al. (2001) investigated the work-related risk factors for low back pain and found significant strengths of association between psychosocial risk factors and biomechanical factors, suggesting that workplace effort directed toward primary prevention should focus on these factors, such as monotonous work, high perceived workload and time pressure, job satisfaction, and co-worker support. The possibility that psychosocial factors make an independent contribution to the etiology of musculoskeletal disorders has been substantiated by several studies (Houtman et al., 1994). More recently, a prospective cohort study of 721 workers carried out by Torp et al. (2001) also concluded that psychosocial factors at work, such as low job control, may predict musculoskeletal pain.

Physical factors

Yagev, Carel, and Yagev (2001) found that persons employed in high force–low repetitive or low force–high repetitive jobs harbor an extra risk of developing carpal tunnel syndrome compared with controls. A 1994 cross-sectional study of a population of 3,312 Finnish forest industry workers who replied to a questionnaire survey found that work-related physical loading was strongly associated with musculoskeletal pain (Miranda et al., 2001). Working in a strained posture (bending, working with arms raised up above shoulder level, and repetitive movements of the fingers) has been found to be associated with complaints of pain in the back, the arms or neck, and the legs (Gamperiene & Stigum, 1999). Clearly, a good understanding of physical risk factors can help to predict the likelihood of work-related injury for workers.

Personal factors

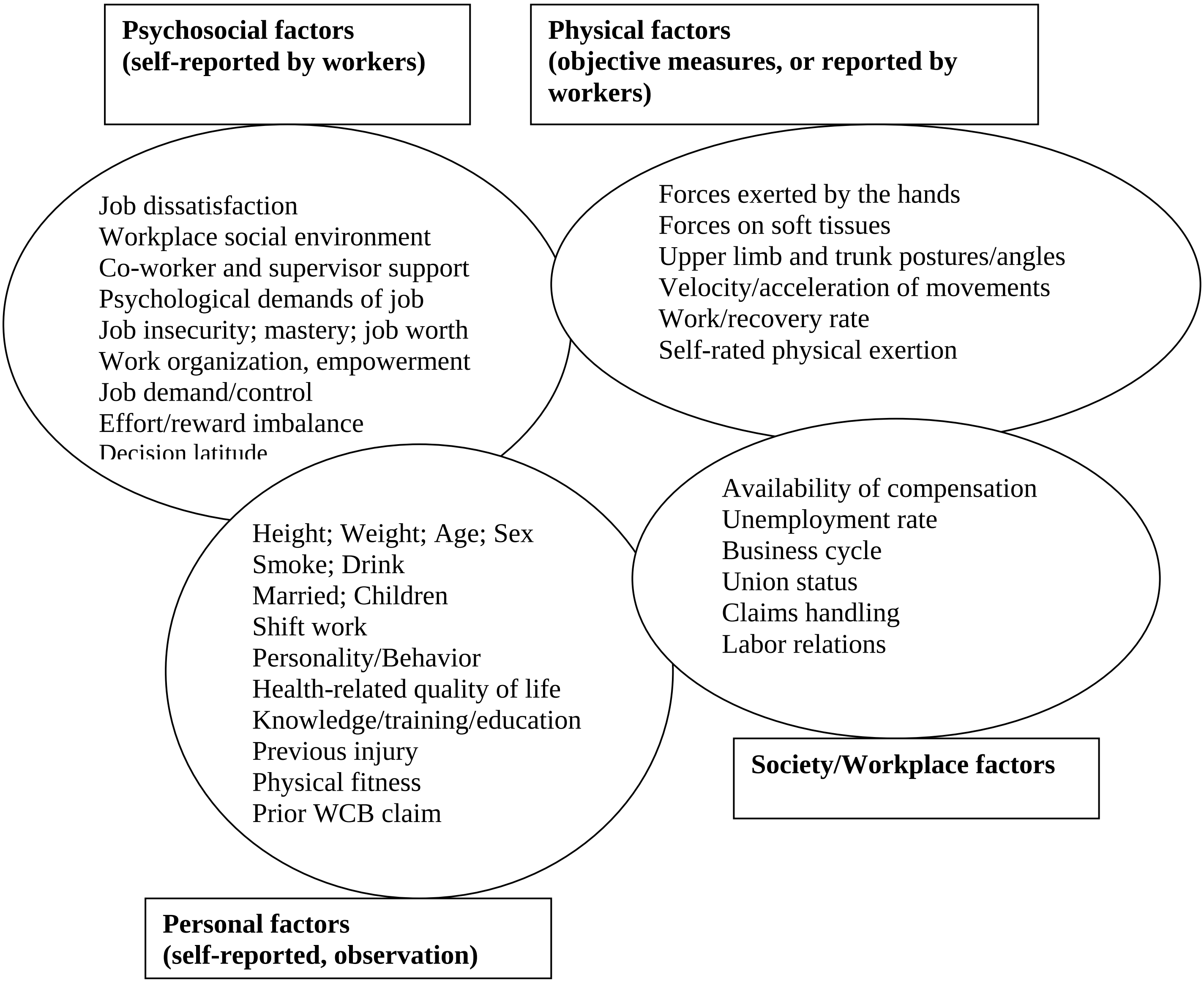
Personal risk factors include the individual's age, gender, inherited characteristics, economic concerns, return-to-work issues, and so on. The factor which associates the most with injury at work is a history of prior pain or injury. Battie and Bigos (1991) pointed out that previous episodes of low back pain have been shown to be predictive of who will report reinjury in the future. Other studies have also reported some consistency for the relationship in younger and middle-aged adults, with the risk appearing to increase with age in this range (Liira et al., 1996; Houtman et al., 1994).

Society factors

Society risk factors have also been presumed to influence the onset of work-related musculoskeletal disorders. These include societal characteristics such as unemployment rates or the extent and availability of disability benefits (Terrence & John, 2003), and workers' compensation systems (Chelius, 1976; Fishback, 1987).

Most of the previous studies emphasized the personal, physical, and psychosocial risk factors in investigating the probability of pain or musculoskeletal disorders, but showed a lack of interest in psychosocial risk factors. Andersen et al. (2002) investigated the effect of individual characteristics and physical and psychosocial workplace factors on neck/shoulder pain with pressure tenderness in the muscles. Physical risk factors were evaluated via video observations (Porru et al., 2001), and psychosocial risk factors were assessed with a job content questionnaire. Other procedures included a symptom survey, a clinical examination, and an assessment of health-related quality of life (Short Form-36). Musculoskeletal disorders were found to associate with high repetitiveness and. The strongest work-related psychosocial risk factor was high job demand. Increased risk was also associated with neck/shoulder injury, female gender, and low pressure pain threshold. Neck/shoulder pain was strongly associated with reduced health-related quality of life.

Figure 1. Summary of the risk factors proposed by Mickey and Robert (2003)



Consequences of Work-related Injuries

Work-related injuries have brought enormous losses to workers, industry, and society. It was reported that HK$804.5 million was paid out to compensate for losses in 2003, and 1.28 million work days were lost in 2002. This gives an average of HK$17,000 in compensation payment and 27 work days lost for each worker injured at work (Hong Kong Special Administrative Region Government information, 2004). Costs incurred from work-related injuries include both direct and indirect costs. Direct costs include wages, disability settlements and pensions, assessment and treatment provided by health care providers, diagnostic examinations, hospitalizations, and surgery (McGovern et al., 2000). Indirect costs include loss of work productivity, training of replacement workers, lost tax revenues, and administrative expenses (Ryden, Molgaard, & Bobbitt, 1988).

Workers' compensation provides medical care and income maintenance protection to workers disabled as a result of work-related injury or illness. Workers' compensation benefits have proven to be a strong predictor of injured workers' return to work (Carmona et al., 1998; Burnham et al., 1996; Ash & Goldstein, 1995). In Hong Kong, employers are required to provide workers' compensation claimants with four-fifths of their wages lost due to a work-related injury. Also, an employer should pay the injured employee medical expenses within 21 days after the employee has submitted the receipts for payment of medical treatment: in-patient treatment and out-patient treatment are both HK$200 per day, while it costs HK$280 for in-patient and out-patient treatment on the same day. If the employer and the employee cannot settle their dispute with the assistance of the Labor Department, or if the employee wishes to recover damages from his or her employer or a third party, the case has to be determined by the Court (Employee's Compensation Ordinance, 2004). Hong Kong has a private compensation system wherein the responsibility for compensating injury at work is put upon individual employers and insurance coverage is provided by a private insurance company (Albert & Ng, 1987). This is different from the national insurance provided in countries such as the United Kingdom, Austria, and Germany.

In Hong Kong, the Employee's Compensation Ordinance does not protect injured workers who have experienced a loss of earning capacity as assessed by the Medical Assessment Board (MAB). The fact is that following their MAB assessment, most injured workers with chronic pain find themselves unemployed.

The current workers' compensation system does not encourage workers who are permanently disabled or restricted to return to work. Often, workers who are injured on the job are labeled permanently restricted by their physicians and are then deemed permanently disabled by their employers and released from their jobs (Rachel et al., 1999). Unemployment is a consequence of chronic pain which has considerable health and economic consequences for the individual and society (Watson et al., 2004).

Chronicity of work-related injuries

The longer injured workers are off work, the less likely it is that they will return to work (Rosen, 1994). Among the possible disabilities, persistent pain has been found to prevent injured workers from returning to work to the greatest extent (Grellman, 1997). Work is defined as an activity, such as a job, which a person expends physical or mental effort to do, usually for money (Cambridge Advanced Learner's Dictionary, 2003). The definitions of what constitutes return to work used in different studies vary. For instance, return to work has been described as having a full-time or part-time job (Kelvin et al., 2003), having gainful employment (David et al., 1995), or simply making positive progress (in paid work, education/training, or voluntary work) (Watson et al., 2004). Chronic pain is caused by active disease processes, tissue damage, and other insults to the body. Rheumatoid arthritis, cancer, musculoskeletal problems (e.g. low back pain), cardiac disease, and headache can all lead to chronic pain (Angela et al., 2002).

According to the International Association for the Study of Pain (IASP), pain is an unpleasant physical sensation or emotional experience that is associated with either actual or possible damage to body tissues or nerves (Harold, 2003; Merskey, 1979). This definition emphasizes both the physical and psychological components which are experienced by sufferers. Chronic pain is defined as pathological sensations which are ongoing and have lasted for six months or longer (Angela, 2002). Loeser and Melzack (1999) further suggested that it is not the duration that distinguishes chronic pain from acute pain; rather, it is the inability of the body to restore its physiological functions to its normal homeostatic levels. Previous studies have also revealed that injured workers who develop chronic pain tend to suffer excessively from disabilities and depression (David, 2000). The rehabilitation of these workers, therefore, is multidimensional in nature. The return-to-work interventions for workers suffering from chronic pain should tackle the problems of psychological disturbance arising from depression, anxiety, loss of confidence, and loss of social contacts. At the same time, their disability, loss of physical and work capacity, and lowering of earning capacity should also be addressed. Kames et al. (1990) investigated the effectiveness of a full six- to eight-week interdisciplinary program for chronic pelvic pain which included both somatic and behavioral therapies. They found a dramatic decrease in reported levels of pain following treatment. Anxiety and depression also decreased and psychosocial functioning improved: the workers often returned to work, their social activities increased, and their sexual activity improved. Persson et al. (2004) conducted other pain management studies to evaluate the changes in occupational performance among chronic pain patients after a pain management program and to explore relationships between these changes and demographic and clinical factors, psychosocial functioning, and psychological well-being. They found that changes in occupational performance, psychological well-being, and psychosocial functioning were all relevant in the evaluation of pain management programs.

What leads to chronicity? In a study by Kopec, Sayre, and Esdaile (2004), which made use of longitudinal data from the Canadian National Population Health Survey, potential predictors of chronic back pain were entered into stepwise logistic regression models to identify the predictors of back pain. The results revealed that overall health and psychosocial factors (e.g. self-rated health, stress, restrictions of activity) are important predictors of back pain in both men and women. Another study found that self-appraised problem-solving competence and pain-relevant social support are either directly or indirectly related to pain, depression, and disability (Kerns, Rosenberg, & Otis, 2002). It has also been found that job satisfaction may protect against the development of chronic pain and disability after the acute onset of back pain, while job dissatisfaction may heighten the risk of chronicity (Williams et al., 1998). Vocational factors should also be considered in the rehabilitation of acute back injury. White et al. (1997) conducted a study to explore the role of potential risk factors in predicting the development of chronic pain and found that patients who develop chronic pain report a higher pain intensity, higher anxiety and distress, less certainty that their pain would resolve, longer hospitalization, less independence in ambulation, a diagnosis of trauma, and less need for surgery. In a study of patients with low back pain by Gatchel et al. (1995), the influence of psychosocioeconomic factors in the development of chronic disability was found to be prominent. The study prospectively evaluated a large cohort of acute low back pain patients within six weeks of acute back pain onset. At one-year follow-up evaluation, it was found that the following variables (assessed during the acute period) were different between those who had returned to work and those who had not done so because of the now chronic nature of their low back pain: high self-reported pain and disability, elevated scores on scale 3 (hysteria) of the personality inventory test, female gender, and the presence of a worker's compensation/personal injury insurance claim. It would seem that the formation of chronic pain or the transition from acute to chronic pain is very complex. Recognition of these factors could lead to the early identification of those individuals with acute pain who are at risk for developing chronic pain, so that effective rehabilitation interventions for these patients could be provided. The purpose of this study is to develop a prediction model for injured workers who experience chronic pain. Developing such a model can help to solve the chronicity of workers by identifying the predictors of return to work so as to enhance rehabilitation interventions for injured workers with chronic pain.

Return to Work and Its Intervention Models

The conventional rehabilitation approach for chronic pain sufferers is to provide interventions to alleviate the pain and improve general health and functions. However, for injured workers with chronic pain, this approach has not proven to be the most effective or useful. The fact that the outcomes stipulated by the workers' compensation system in Hong Kong are geared toward loss of work capacity and employability has put the general health and functions of workers out of perspective. As a result, whether workers can be returned to the workplace has become the ultimate goal of rehabilitation (Susan, 1995). A review of recent studies on the rehabilitation of injured workers with chronic pain indicated that return to work is the major outcome (see Table 2).

Return-to-work programs for chronic pain sufferers vary. They include a multidisciplinary pain management program (Johansson et al., 1998), an intensive multidisciplinary program (Bendix et al., 1995), interdisciplinary pain management (Miaskowski, 2004), and a cognitive-behavioral return-to-work-focused program (Marhold, Linton, & Melin, 2001). The major components of these programs are pain coping skills, stress management, psychosocial adjustment, and individual counseling, which are similar to the return-to-work components offered by the Hong Kong Workers' Health Centre.

But how can return-to-work outcomes be measured? The definition used by the Hong Kong Census and Statistics Department (2004) includes engagement in full-time or part-time jobs. A full-time job involves working for 44 hours or more per week, but does not necessarily include tenure terms. A part-time job involves working for less than 44 hours per week and can include night work or irregular work shifts. Others argue that individuals in job retraining or education programs can also be regarded as having returned to work (Vowels et al., 2004; Watson et al., 2004). The follow-up period is usually three or six months after the completion of a program (Schultz et al., 2004; Tan et al., 1997; Watson et al., 2004). In this study, I use the definition of return to work stipulated by the Hong Kong Census and Statistics Department, and the follow-up period is three months post-program.

For injured workers with chronic pain to return to gainful employment, substantial effort is required from all parties in the rehabilitation process and the workers' compensation system (Van Duijn et al., 2004). They include the worker, the rehabilitation providers, the employer and co-workers, and the insurer (Frank et al., 1996). Previous studies have identified different return-to-work models that can enhance rehabilitation outcomes. The following paragraphs review these models.

Focus on workers

The models described in this section put a major focus on providing intervention to injured workers with chronic pain who will be re-entering the work force. The readiness for change model (Prochaska et al., 1992) deals with the ways to improve the motivation of individuals so as to enhance changes in their behaviors. It conceptualizes changes in individuals as progressing through different stages. Change can initiate from an intention to not engage in a given behavior or not to perform a given behavior in a sustainable fashion. This process can be divided into five sequential stages which are relevant to describing the return to work of injured workers:

1) the pre-contemplation stage, whereby an injured worker is not considering any actions and at the same time is not having any idea about returning to work;

2) the contemplation stage, whereby an injured worker begins to consider matters related to returning to work;

3) the preparation for action stage, whereby an injured worker makes plans to return to work and actively seeks placement information on the employment market;

4) the action stage, whereby an injured worker turns the plan into action by, for example, sending out resumes and attending interviews; and

5) the maintenance stage, whereby an injured worker maintains the work status with his or her specific skills; for example, keep on practicing preventive strategies such as stretching and strengthening exercises for musculoskeletal problems, safety practices, and so on.

The occupational disability model (Krause & Ragland, 1994; Krause et al., 2001a) and the low back pain model (Frank et al., 1998; Spitzer et al., 1987) are two other models which are commonly applied in the return-to-work field. The occupational disability model outlines an eight-phase process which encompasses two predisability phases and six disability phases. The six disability phases are designated according to the duration of the work disability resulting from the work injury (Krause et al., 2001a). The low back pain model delineates three phases in terms of the pathology and duration of the pain experienced by the worker: acute, subacute, and chronic (Frank et al., 1998; Spitzer et al., 1987). Recent studies that have used the two models have distinguished three common phases which are useful for identifying problems and hence the specific interventions for tackling these problems. The three phases are classified according to the number of days for which a worker was off work: acute (up to one month), subacute (two to three months), and chronic (more than three months) (Dasinger et al., 2000; Krause et al., 2001b; Mcintosh et al., 2000). Different intervention rehabilitation services for patients are provided during different phases. Time off work has been found to be a strong predictor of injured workers with chronic pain for their return to work (Watson et al., 2004; Tan et al., 1997; Hildebrandt et al., 1997; Gallagher et al., 1989; Sandstrom, 1986; Vendrig., 1999): the longer it takes for the worker to return to normal work after injury, the more severe will his or her physical, social, and psychological problems be (Matheson et al., 2002). Schultz et al. (2004) found that the expectations of recovery and the perception of health changes are significant variables that can differentiate workers who managed to return to work in the sub-acute phase from those who could not return to work in the chronic phase. Positive expectations of recovery were found to be associated with a reduction in pain grade and an enhancement of functional status. The results of this study by Schultz et al. provide strong evidence of the critical importance of these two cognitive factors in the prediction of pain-related occupational disability. In other words, psychosocial factors and workers' perception seem to be especially important factors in the return to work of workers suffering from chronic disabilities.

Focus on healthcare providers

Saeki and Hachisuks (2004) proposed a model which stresses the importance of using medical assessments and their results to guide the return to work of injured workers. The model emphasizes the match between workers' work capacity and job demands. The researchers explained that this is an essential step which minimizes the risks taken by both the worker and the employer. Schultz et al. (2004) developed a four-factor psychosocial predictive return-to-work model for injured workers who experience chronic pain. The factors are: subacute or chronic, perception of health change, expectations of recovery, and co-worker support. These studies highlight the importance of healthcare providers' interventions to the health and rehabilitation of injured workers with chronic pain.

Focus on the workplace

Janssen et al. (2003) developed a demand-control-support model which was found to be useful for enhancing the return to work of those who were on a sick list for six to eight weeks. These workers were considered to be in the subacute phase of the developmental disability model (see the previous section). The demand-control-support model assumes a close relationship between job demand, job control, and support at work when a worker returns to a job. Job demand is regarded as an opposite factor to job control and support at work. High job demands are treated as an obstruction to return to work as they prevent the worker from re-engaging in the job task. This is particularly true when the worker has low work capacity and employability. In contrast, when the worker has high control and receives strong support at the time of re-engaging with a job, he or she will be more likely to return to work. Helm et al. (1999) argued that the reassignment of job tasks such as by putting a worker into a new job position can be a very effective return-to-work strategy as it accommodates the injured worker's lowered work capacity and employability. At the same time, the work environment can also be modified to accommodate the worker (van Duijn et al., 2004). Though the present study did not include variables which would indicate whether a worker received support or accommodation at work, an awareness of these factors can help us to further understand the behavior of injured workers with chronic pain after they return to work and how to maintain a job during the three-month follow up.

Predictors of Return to Work

As mentioned in the previous section, the return-to-work process is multidimensional in nature involving many parties, stakeholders, and financial gains and losses. Previous studies sought to identify the factors which predicted the return-to-work outcomes and long-term disability of workers with symptoms of chronic pain (e.g. Fishbain et al., 1996; Oleske et al., 2000). A systematic review of the studies on this topic enables us to have a better understanding of these predictors and the methods used to test their usefulness. The results can be used to identify service gaps and more importantly to devise relevant interventions to better tackle the problems faced by workers. No study has been conducted in Hong Kong to investigate the pattern of return to work for injured workers with chronic pain or the predictors of return to work. A prediction model for return to work may be influenced by the differences in the workers' compensation system across different places.

I began the review by accessing the electronic databases of various citation systems, including PubMed, MEDLINE (1966+) (between 1980 and 2004), the Social Sciences Citation Index (between 1970 and 2004), Rehabilitation and Physical Medicine (the last 10 years), and PsycINFO (between 1980 and 2004). The following headings and/or subheadings were used to extract relevant literature: return to work, re-employment, reintegration, predictors of return to work, factors of return to work, injured workers, work-related injury, sick leave, work disability, musculoskeletal disorder, and chronic pain.

All the abstracts and titles were screened with the following inclusion criteria: description of the content of the predictors, involvement of work-related injury and/or injured workers, work-related musculoskeletal injuries, and chronic pain symptoms. After screening, information on the sample, methods, and outcome and predictor variables was extracted. For the purpose of this study, only predictor variables which reflected the workers' conditions between the time after the injuries occurred and three months after the workers returned to work were included.

Papers which did not involve the collection and analysis of original data were excluded from the review. Other studies excluded were those that involved or addressed: 1) outcome measures that were not related to return to work, such as the measurement of impairment; 2) outcome variables that measured beyond three months after the completion of the intervention; 3) injuries that were not work related; 4) interventions conducted at the acute stage after injury; 5) conditions which did not primarily involve chronic pain, such as traumatic brain injuries, burns, and spinal cord injuries; and (6) studies that were not written in English.

A total of 940 papers were extracted from the databases. Of these, 552 were found in PubMed, 18 in the Social Sciences Citation Index, 249 in Rehabilitation and Physical Medicine, and 121 in PsycINFO. Only 16 papers met all the stated criteria of which 15 were prospective studies and one was retrospective (Table 2). Of the 15 prospective studies, five used a follow-up period longer than three months; that is, six months. A review of the results of these studies indicated that the demographic characteristics of the workers and their psychosocial variables, including age, gender, education, depression, and anxiety, were the major factors which influenced their return-to-work process. However, none of the studies investigated the behavior or readiness to change during the process of return to work as a way of building a return-to-work prediction model for injured workers with symptoms of chronic pain. The statistical methods used for analyzing the data were predominantly traditional statistical models such as the general model (GLM), logistic regression, and discriminant analysis. In many cases, the assumptions behind the application of these models were only partially fulfilled. Common problems were a nonhomogeneous distribution of the sample under study – for example, workers with very different demographics and occupational history – and a high intercorrelation between the predictor variables, such as psychosocial factors and job satisfaction (Mussone et al., 1999). Also, assumptions about the normality (sample distribution) and linearity (relationships between variables) of the independent variables and compound symmetry for repeated measures were difficult to meet (Munro, 2001). The prediction models developed would therefore likely be confounded by errors which lowered their preciseness.

Case-based reasoning (CBR) is derived from the artificial intelligence theoretical framework which tests the appropriateness of applying solutions accumulated from previous problems to solve current problems (Schank & Riesbeck, 1989). CBR relies heavily on developing an organization and indexing system for all the cases in a database. Each case is required to be described in sufficient detail and with enough appropriate features to allow the matching of the features of individual cases (Yearwood & Wilkinson, 1997). CBR is a four-component cyclical process which can be represented in a schematic cycle:

1. **RETRIEVE** the most similar cases:

   Case retrieval is facilitated by characterizing each case and problem by a variety of structural features such as the events, goals, and actors involved in the case (Kolodner, 1984). Solutions from the best retrieved cases can then be adapted to fit the current problem (Kolodner, 1993; Schank & Riesbeck, 1989).

2. **REUSE** the cases to attempt to solve the problem:

   During the reuse process, the information and knowledge in the retrieved case(s) is used to solve the new problem. The new problem description is combined with the information contained in the old case to form a solved case.

3. **REVISE** the proposed solution:

   Since the proposed solution could be inadequate, the purpose of the revision process is to rectify the first proposed solution.

4. **RETAIN** the new solution as a part of a new case:

This process enables CBR to learn and create a new solution and a new case that will be added to the case base.

CBR is commonly used for modeling problem solving (Kolodner & Kolodner, 1987) and planning (Hammond, 1989) in many fields. For example, it has been used to support medical diagnosis in psychiatry (Bichindaritz, 1994), audiology (Bareiss et al., 1988), pulmonary diseases (Turner, 1989), eating disorders (Bichindaritz, 1994), dysmorphic syndromes (Evans, 1995), and acute abdominal pain (Fathi-Torbaghan & Meyer, 1994). The technique has also been used for therapy planning in the areas of diagnostic imaging procedure selection (Kahn & Anderson, 1994), radiation therapy (Berger & Roentgen, 1989), and the selection of antibiotics (Schmidt et al., 1995). CBR is also used to enhance the process of automatic knowledge acquisition, automatic update, and integration of environmental information.

Table 2. Summary of a review of the studies which described the factors influencing the return-to-work process of workers suffering from chronic pain

Study	Study type	Statistical Method	Sample	Findings
1. Watson et al. (2004). UK	Prospective study (FU*: 6 months)	Logistic regression	86 chronically unemployed low back pain subjects	Time off work
2. Vowles et al. (2004). USA	Prospective study (FU: 6 months)	Correlation and stepwise discriminant analysis	183 chronic pain subjects	1. Depression 2. Age
3. Casso et al. (2004). Switzerland	Prospective study (FU: 1 year)	Stepwise logistic regression	109 chronic LBP patients	1. Distribution of the pain (Localized vs. diffuse) 2. Overall evaluation by the patient (Disappointment vs. failure) (Satisfaction vs. failure)
4. Koopman et al. (2004). Netherlands.	Prospective cohort study (FU: 1 year)	Logistic regression	68 chronic LBP patients	1. Sex 2. Age 3. Reinterpretation of pain sensations 4. Functional disability pretreatment 5. Trunk flexibility
5. Schultz et al. (2004). Canada.	Prospective study (FU: 3 months)	Logistic regression	253 subacute and chronic pain injured workers	1. Expectations of recovery 2. Perception of health change

6. Cutler et al. (2004). USA	Prospective study (FU: 1-2 years)	Logistic regression	188 chronic pain patients	1. Pain 2. Worker compensation status 3. The functional capacity test of crouching 4. Trait anxiety
7. Tan et al. (1997) USA	Prospective study (FU: 3 months)	Analysis of variance (ANOVA)	59 chronic pain patients	1. Age 2. Marital status 3. Education 4. Time off work 5. Return to work goal (positive and negative)
8. Fishbain et al. (1997). USA	Prospective study (FU: 30 months)	Multivariate analysis	128 chronic pain patients	1. Planning to return to the same type of job 2. Age 3. Dangerousness as a job complaint
9. Hildebrandt et al. (1997). Germany	Prospective study (FU: N/A)	Discriminant analysis	90 disabled patients with chronic low back pain	1. Self-evaluation for predicting return to work 2. The length of absence from work 3. Application for pension 4. A decrease in disability after treatment
10. Robbins et al. (1996). USA	Prospective study (FU: N/A)	T tests	62 chronic pain patients	1. Depression 2. Anxiety 3. Self-efficacy to manage pain 4. Self-efficacy to function

11. Gallagher et al. (1989). USA	Prospective study (FU: 6 months)	Logistic regression	150 chronic LBP patients	1. Age 2. Time off work 3. Ease of changing occupations 4. Ability to do daily activities 5. MMPI Hysteria scale 6. Health locus of control
12. Sandstrom (1986). Sweden	Prospective study (FU: 1-4 years)	Logistic regression	52 chronic LBP patients	1. Sex 2. Duration of sick leave 3. Reported need for analgesics 4. Pain location 5. The patients' attitude to his or her own ADL capacity
13. Krause et al. (2001). USA	Retrospective cohort study (FU: 1-4 years)	Multivariate Cox regression models	433 LBP workers' compensation claimants	Job demand
14. Denney et al. (1998). USA	Prospective study	Discriminant analysis	325 chronic pain injured workers	1. Education 2. Skill level 3. Depression
15. Vendrig. (1999). Netherlands	Prospective study (FU: 6 months)	Repeat-measure MANOVA	147 chronic back pain patients	1. Time off work 2. Previous spinal surgery 3. Pre-program score on the MMPI-2 scale Lassitude-Malaise (Hy3)

16. Rucker and Metzler (1995). USA	Prospective study (FU: 6 months)	Logistic regression	599 Social Security Administration disability applicants with chronic pain	1. Self-reported measures 2. Physical examination results 3. Psychological status 4. Functional limitations 5. Physician subjective appraisal

*FU means follow up.

A review of the Workers' Compensation System between different countries

Workers' compensation system is a system which is designed for protecting workers who suffer from work-related injuries. In most of the countries instituting workers' compensation system, it is a "no fault" system to the workers. It means that injured workers will be eligible to the benefits regardless of who was at fault -- the employee, the employer, a co-worker, a customer or other third party. Different workers' compensation system may impose different effects on the rehabilitation process of injured workers. In this section, the review of the Workers' Compensation System instituting in the United State, Canada, Australia, Chinese Mainland and Hong Kong will be summarized. It is with a view that the comparisons on the policy on work rehabilitation and litigation among these systems sheds light on the workers' return to work phenomenon in Hong Kong, and possible in the Chinese Mainland.

<u>Work rehabilitation / vocational rehabilitation and return to work</u>

In the United States, the Workers' Compensation System is a state-sponsored program and, therefore, varies from state to state. The first system was launched in 1911 in the state of Wisconsin, whilst the last was adopted in 1948 in the state of Mississippi. There are two principal elements of the system: income replacement and rehabilitation. In Wisconsin, one of the basic benefits is the vocational rehabilitation and retraining benefit. This stipulates that, during the early return to work process, employers are required to issue a written offer on whether there are suitable positions available in the company to the injured workers. If there are no suitable positions available, the licensed specialist under the service will determine whether there are suitable employments available for the injured employees in the general labor market of which the injured workers do not need to go through a retraining. In case if there are suitable employments which are likely to be available, the specialist will target to place the injured workers in the positions for at least 90 days. If this fails, the injured workers will be engaged in a retraining program. Throughout the process, the injured workers are to cooperate fully with the specialist and can not refuse to accept the employment placement offered to him/her within the 90-day period. If it fails, the injured workers are eligible to attending retraining program which lasts for 80 weeks (Department of Workforce Development, 2002).

In the state of Minnesota, it offers the most intensive vocational rehabilitation program for injured workers. The retraining program covers formal educational courses for preparing injured workers for taking up a new occupation. The maximum duration of the retraining program is 156 weeks. For most workers, the employers or insurers are stipulated to provide rehabilitation consultation services from a qualified rehabilitation consultant (QRC). These services can be requested from the employee or employer, or from Department of Labor and Industry (DLI). The consultation starts off with a screening process which determines the eligibility of the injured workers for services. The injured workers will be subscribed with a rehabilitation plan which is custom-made to suit the needs of the injured workers. In return, the injured workers are to cooperate throughout the treatment process (Minnesota House of Representatives, 2004).

In Canada, the rehabilitation process occurs early in the claims adjudication process so as to enhance the injured workers to return to work. The initiation of the rehabilitation process is from the officer of the Workers' Compensation Board. In 1994, the Workers' Compensation Board (WCB) commissioned a Task Force on Early Intervention to develop a means of providing health care focused on allowing workers to return to a meaningful working life. The Early Intervention Program (EIP) is designed to assist injured workers on returning to work It engages the workers to resume normal activities — including work — in the most appropriate, timely and safe manner. It offers decentralized, timely and coordinated health care for injured workers, using a network of assessment teams and treatment centres in the province. Research conducted by the Board indicated that early assessment and treatment brought better recovery results, particularly in the treatment of the most common soft-tissue injuries (Saskatchewan's Workers' Compensation Board, 2004).

In Australia, its Workers' Compensation System puts the focus on early and safe return to work. Under the legislation, employers are responsible for managing the return to work of their injured employees. Each employer is responsible for establishing its own return to work policy (Section 41 of the SRC Act and Comcare *Return to Work Policy Guidelines for Employers)*. Under this policy, employees institute their own programs which are "tailored-made" to suit the needs of the employees and the company. The employers are expected to actively participate in the development and implementation of the programs. The customer case manager, who is responsible for managing the return to work programs for the company are required to work closely with the Comcare claims manager to ensure effective and safe early return to work and rehabilitation (Perrin, Thorau and Associates Ltd., 1998). An injury management program may include: 1) treatment of the injury; 2) return to work management; 3) skills retraining; 4) claim management; and 5) employment counseling for employer. All participants are expected to play an active role in the injury management, including employer, injured worker, insurer, treating doctor and all rehabilitation practitioners (WorkCover Authority of New South Wales, 2003).

In Hong Kong, statutory entitlement to indemnity for employees (or their dependants), who sustain work injuries is covered by the Employees' Compensation Ordinance. The Labour Department proposed a pilot scheme on Voluntary Rehabilitation Programme (VRP) for injured workers in March 2003. The Programme first put its focus on construction workers and then on workers in other trades such as catering, transportation and manufacturing. The objective of the Programme is to provide timely and tailor-made rehabilitation services to injured employees for better and speedier recovery and to facilitate their safe and early return to work (Leung, 2004). Different from the systems in the United State, Canada and Australia, the Workers' Compensation system in Hong Kong does not cover return to work, and injury management.

In the Chinese Mainland, the first Workers' Compensation Ordinance was released on 1st January 2004. It emphasizes the importance of compensation, rehabilitation and prevention. The policy does not stipulate a particular model of which rehabilitation and injury management are delivered. Instead, it leaves the decision to provincial and city levels to develop the best model appropriate for the needs of the injured workers, health care service provision, and employers. The Guangzhou Work Rehabilitation Centre, established in 2000, was the first institution providing services to injured workers in Guangzhou and its surrounding regions.

Litigation

In Minnesota, disputes on workers' compensation can be resolved by means of informal, formal, and then judicial proceedings. The parties concerned include Department of Labor and Industry, Office of Administrative Hearings, Workers' Compensation Court of Appeals, and Minnesota Supreme Court. The first step usually begins with informal telephone intervention between the injured worker and the company. This informal means can largely reduce the cases which proceed to the formal process. If the dispute can not be resolved in the informal telephone intervention, an informal conference can be held between the worker and company in case the rehabilitation or medical dispute involving less than $1,500. This type of conference is conducted by compensation specialists, whose jurisdiction is limited to reaching a consensus between the two parties and issuing an order for the case. Any appeal of the decisions can be made to the Office of Administrative Hearings (OAH). For disputes which are not over medical or rehabilitation benefits, or involve more than $1,500, they can be directed to the OAH for a settlement conference or administrative hearing. There are customer assistance teams which provide voluntary mediation services throughout these processes. Mediation is regarded as an essential component in dispute resolution.

In Canada, the workers' compensation boards reveal that all jurisdictions provide at least two levels of appeal. In general, the first level of appeal is internal to the Board, while the second level is external. Within the last decade, the government of Nova Scotia struck two committees to review workers' compensation legislation. Both have examined the appeal system. The purpose of two levels setting was to limit injured workers to appeal for compensation. The internal level of appeal acts as a gatekeeper to remove many appeals from the system (Workers' Compensation Board of Nova Scotia, 2001). A statistical analysis conducted by the Board in December 2000 revealed that Internal Appeals removed 46.5% of appeals from the appeal system (MacDonald, 2000).

In Australia, majority of the disputes over workers' compensation is resolved through conciliation (between 2001 and 2002 in Western Australia). It further indicates that dispute resolution methods such as mediation and conciliation are useful for reducing the chance of disputes to become common law suits (The Workers' Compensation and Rehabilitation Commission, 2003). Besides, the Workers Compensation Reform Act 2004 (WCRA) places limitation on the eligibility of access to common law, the threshold is when workers' whole person impairment (WPI) is higher than 15%.

The review of the Workers' Compensation System and its associated litigation indicates that most of the countries adopt stringent measures to lower the costs incurred from injury at work. The commonest strategies are to promote early rehabilitation, return to work program, and mediation. Nevertheless, the existing system in Hong Kong does not seem to put enough emphasize on these aspects. As a result, workers who are injured stress on compensation settlement rather than active rehabilitation, unemployment rather than returning to work, and pursuing common law rather than mediation. These problems are expected to confound the effectiveness of the existing rehabilitation and return to work programs. More importantly, they are expected to dominate the prediction of workers' return to work.

This study was designed to explore the factors which would influence the return-to-work outcomes of a group of Chinese workers who suffered from chronic pain symptoms. The workers who participated in this study were enrolled in a work resettlement and skill training program sponsored by the Employment Retraining Board which obtained funding directly from the Government of the Hong Kong Special Administrative Region. Unlike those of other developed countries, workers' compensation laws in Hong Kong do not stipulate early rehabilitation and return to work. Instead, they follow a more *laissez-faire* approach with workers' being eligible for workers' compensation benefits for as long as two years. The ultimate goal of workers' compensation is to arrange an assessment by the MAB in which the impairment and loss of earning capacity of the worker are evaluated. This is then followed by a determination of the amount to be compensated by the insurance scheme. It is believed, therefore, that this *laissez-faire* workers' compensation system has a major impact on the return-to-work outcomes of injured workers with chronic pain. It was the intent of this study to investigate this. Moreover, the study would overcome the problems of a small sample size and assumptions of normal distributions of the data by using both conventional logistic regression and CBR. The results obtained would therefore be more informative and robust.

CHAPTER III

METHOD

Research Design

This study adopted a quasi-experimental design which required the participants to attend a six-week return-to-work program. The participants were injured workers who suffered from chronic pain symptoms and had failed to resume gainful employment for at least six months. The six-week standardized work rehabilitation program was offered by the Hong Kong Workers' Health Centre (HKWHC) in collaboration with the Ergonomics and Human Performance Laboratory of The Hong Kong Polytechnic University.

Participants

The selection criteria of the participants were: 1) 20 to 60 years old; 2) history of pain symptoms for more than 24 weeks; 3) unable to resume work for more than 12 weeks; and 4) participating in a return-to-work program. The exclusion criteria were: 1) being subject to intensive pain that necessitates rest; and 2) having chronic pain symptoms due to a tumor, infection, systemic inflammation, and/or cauda equina syndrome. The participants were first screened by a medical doctor who specialized in occupational medicine for any potential physical or psychiatric conditions which might be aggravated by the activities in the six-week work rehabilitation program (Appendix 1).

Data Collection Procedure

The participants were recruited from rehabilitation centers, hospitals, private clinics, and the Labour Department in Hong Kong. Before commencing the work rehabilitation program, all the participants attended a briefing session. In the session, the purposes of the study were explained and the participants' consent to join the study was obtained (Appendix 2).

The work rehabilitation program which the participants joined was a six-week program, with the first three weeks involving training modules and the last three weeks involving job placement. The program was run by a multidisciplinary team at the HKWHC that included doctors specialized in occupational medicine, occupational therapists, and social workers. The details of the work rehabilitation program will be described later on in this chapter. Each participant was assigned a case manager who was either an occupational therapist or a social worker. The briefing session, in which the content, schedule, and precautions were explained by the case manager, took one-and-a-half hours. Information on the participants' demographic characteristics, previous medical and rehabilitation interventions, compensation, and occupational history were obtained via intake interview forms (Appendix 3).

All the participants completed four assessments at admission (first week), three weeks after the commencement of the program (third week), at the end of the program (sixth week), and three months after the completion of the program (follow up). The first-week assessment was conducted to capture the participants' physical, psychosocial, compensation-related, and occupational status before commencing the work rehabilitation program. There were a total of five instruments. An independent assessor who was an occupational therapist was responsible for carrying out all the assessments of the participants. The same assessments were repeated in the third and sixth weeks. The follow-up assessment only collected information on the participants' return-to-work outcomes. This included type of jobs (full-time, part-time, or no job), return to original job (yes or no), and nature of job (occupation title).

Return-to-Work Program

Previous studies indicated that injured workers who suffered from chronic pain experienced significant psychological or psychosocial problems. Pfingsten (2001) proposed that the content of a "functional program" for these injured workers with chronic pain should be multidisciplinary in nature, consisting of integrated physical and ergonomic training, psychological (behavioral) therapy, patient education, and instructions in social and work-related issues. Koopman et al. (2004) proposed a 12-week work resumption program which focuses on education and psychological problem solving for the preparation of workers' return to work.

The work rehabilitation program provided at the HKWHC was a vocational counseling, and individual placement and support program. The duration of the program was six weeks. It included three weeks of training and vocational counseling running for six hours per day and five days per week. This included individual vocational counseling, pain management, stress management, psychosocial adjustment, work adjustment, and computer skills training. The second three weeks involved placement support, whereby the participants engaged in intensive job placement efforts and had access to individual support services, including job finding and matching, and individual placement and support at the work site.

Instrumentation

The five tests used in the first three assessments included one functional capacity test and four clinical instruments. The functional capacity evaluation included the VALPAR #19 (Lee, Chan, & Hui-Chan, 2001) and the DEXTER (Bellace et al., 2000), which assessed general strength and endurance, pain and self-perceived functional limitation (walking, standing, sitting, squatting, stooping, crouching, kneeling, crawling, and climbing); the Lam Assessment of Stages of Employment Readiness (LASER); the Chinese State-Trait Anxiety Inventory (STAI-C); the Loma Linda University Medical Center activity sort (LLUMC); and the Short-Form 36 (SF-36).

Functional Capacity Evaluation (FCE)

FCE is commonly used to evaluate the abilities of injured workers who are preparing to return to work (Gross & Battie, 2004). The results of FCE would indicate the need for training of working skills, work reconditioning, and work hardening; declined work capabilities; and the basis of job exploration (Gross, Battie, & Cassidy, 2004). FCEs are used by employers and workers' compensation organizations in Canada to investigate its usefulness for reducing work disability among injured workers with chronic pain (Strong et al., 2004). In this study, the VALPAR #19 and the DEXTER were used. The modules included were the strength and endurance test (VALPAR), and the grip strength test (DEXTER). The VALPAR #19 lifting and carrying tasks involve walking, standing, sitting, squatting, stooping, crouching, kneeling, crawling, and climbing.

The VALPAR #19 is a test of the Valpar Component Work Sample (VCWS). It measures workers' characteristics which are believed to predict the ability to perform semi-manual and manual jobs. In administering the VALPAR #19, the participants were required to complete the lifting strength module, which involved lifting and carrying a standardized sequence of loads. The tasks also demanded the participants to climb, walk, stoop, and crouch. The endurance module required the participants to lift and carry an optimal load continuously for a maximum of 20 minutes or until the participants were fatigued.

The DEXTER is composed of a computerized Jamar dynamometer, a force transducer, and an analog-to-digital converter (Cedaron Medical Inc., USA). The testing procedure and hand positions followed the protocols used in Fess (1992) and Mathiowetz (1990). The participant sat on a chair with shoulder adducted, elbow flexed at 90°, forearm in a neutral position, and wrist in a 0°-30° extended position. The dynamometer was mounted on a stand which was adjusted to fit the participant's hand. There were five trials each for the right and left hands (second rung position). The means of the five trials were noted if they were within 10% of variation.

Self-perceive Function

This is a self-report questionnaire which required the participants to rate their own physical functions on a three-point Likert scale. The functions were defined as endurance of walking, standing, sitting, squatting, stooping, crouching, kneeling, crawling, and climbing. In assigning the ratings, the participants were asked to compare their own performance at the time when the questionnaire was completed with their preinjury functions. A rating of "3" meant "able" and indicated that the function was the same as that of the preinjury level. A rating of "2" meant "limited" and indicated that the tasks required a longer time to complete. A rating of "1" meant "unable" and indicated that the participants were not able to perform the task.

Loma Linda University Medical Centre (LLUMC) Activity Sort

This is a self-perceived test of an individual's competence in handling different domestic tools to perform household tasks. In the present study, the participants were requested to compare their existing competence with that of their preinjury status for a total of 65 items. They rated their perceived competence on a five-point Likert scale. A rating of "0" meant "no difference than preinjury," "1" meant "reduced speed," "2" meant "extra rest required," "3" meant "can't use," and "4" meant "unknown" (or "not applicable").

Lam Assessment of Stages of Employment Readiness (LASER)

The LASER was developed by Professor Chow Lam at the Illinois Institute of Technology. The instrument is composed of 18 self-reported items which measure the readiness of participants to return to work. The LASER adopted the readiness of change model, which hypothesizes specific stages governing changes within people (Prochaska et al., 1992; Terrence & John, 2003). The validity of its three stage model – pre-contemplation, contemplation, and action was reported by Kristeller et al. in 1992. The LASER has three subscales, namely pre-contemplation, contemplation, and action. The validation of the Chinese version of the LASER was carried out in a concurrent study conducted in the Department of Rehabilitation Sciences of The Hong Kong Polytechnic University. The participants were required to rate each of the 18 work readiness items on a five-point Likert scale. The scale ranged from "1," indicating "strongly disagree," to "5," indicating "strongly agree."

Chinese Version of the State-Trait Anxiety Inventory (STAI-C)

The STAI-C measures individuals' anxiety state. It is widely used in epidemiological studies (e.g. Knight et al., 1983; Ku et al., 2002) and correlational studies (e.g. Duckro et al., 1985). The STAI-C conceptualizes anxiety as two distinct factors: state and trait (Cattell & Scheir, 1958, 1961). Trait or chronic anxiety refers to a relatively stable characteristic of people, whilst state or acute anxiety is regarded as a transient condition which tends to vary from moment to moment (Shek, 1988). The Chinese version of the STAI was developed and its psychometric properties were reported in Tsoi, Ho, and Mak (1986) and Shek (1988, 1993). The instrument is also widely used in other studies of Chinese populations and culture (e.g. Man et al., 2003; Soetanto, Chung, & Wong, 2004; Wong et al., 2001). In this study, the 20 items on the state anxiety subscale were used.

Short Form-36 (SF-36)

This is a 36-item measure of health-related quality of life (Ware et al., 1993). The instrument was selected as the instrument for use in the International Quality of Life Assessment (IQOLA) project (Gandek & Ware, 1998). It is commonly used in studies on chronic pain (Atlas et al., 1996; Lefort et al., 1998; Maruta et al., 1998; Patrick et al., 1995; Solomon et al., 1993; Ware et al., 1995). It has been translated and tested for use in more than 40 countries (Li, Wang, & Shen, 2003). The Chinese version SF-36 was tested in Mainland China, Hong Kong, and Taiwan, and on American Chinese (Fuh et al., 2000; Lam et al., 1998; Li, Wang, & Shen, 2003; Ren et al., 1998). The 36 items can be divided into eight subscales, namely physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). There is also a single health transition item. Each subscale is scored from 0 (poor health) to 100 (optimal health). Higher scores reflect better function. These subscales load onto two principal scales: physical health and mental health.

Validity and Reliability of Instrumentation

VALPAR #19

The validity issue of VALPAR 19 was well supported from literature (Lee, 1998; Barrett et al., 1997). In Hong Kong, the test-retest reliability of the VALPAR #19 was investigated by Lee (1998) and Lee, Chan and Hui-Chan (2001) on healthy adults. The results indicate that the reliability estimates of the VALPAR classification on the strength and endurance level was 0.84 and 0.84 respectively (Spearman rank correlation coefficient). The reliability estimates for the strength and endurance percentiles were 0.73 and 0.87 respectively (ICC, 2,1). The estimates for the time variable of strength and endurance were 0.53 and 0.62 respectively. The estimate for the number of work task parameter was 0.31.

Dexter

The hand grip strength results measured with Dexter were shown to have high correlations with those with the Jamar dynamometer. The validity coefficient estimated from a total of 62 healthy adults was highly reliable (ICC [3,1] = 0.98) and highly valid value (ICC (2,K) = 0.99) (Bellace et al., 2000). Brown et al. (2000) also conducted a study to compare the measurements obtained from Dexter Hand Evaluation and Therapy System with those from various manual goniometers (grip and pinch). The results suggest that high correlations between the two methods in terms of intrarater (ICC=0, 86) and inter-rater reliability (ICC=0.99).

LLUMC Activity Sort

No published information was obtained on the validity of the LLUMC Activity Sort (Innes & Straker, 1999). Ping, Keung and Yee (1996) conducted a case study on investigating the use of the instrument for assessing participants with repetitive strain injuries in Hong Kong. The test was translated into Chinese and the content validity was evaluated by an expert panel composed of 10 occupational therapists.

Chinese version of LASER

Chan et al. (under preparation) conducted a study on testing the validity of the Chinese translated version of the LASER (C-LASER). The validation process included collecting evidence on its content-related, construct and predictive validity. The test-retest reliability of the C-LASER was also estimated based on the results of 91 participants. The panel members assigned “4” (agree) or “5” (mostly agree) ratings on the translation to nine out of the 14 items. Item analysis revealed item difficulty indices ranging from 0.52 to 0.82, and item discriminative indices ranged from 0.24 to 0.56.

The results of the test and retest reliability on the 14 items ranged from 0.55 to 0.79 (intraclass correlation coefficient). There were three items: 7, 10 and 12, which had an ICC values lower than 0.60. Principal component analysis with varimax rotation revealed a two-factor solution which accounted for 64.9% of the total variance. The internal consistency estimated by Cronbach’s alpha for the factor 1 items was 0.94 and that for factor 2 items was 0.80.

STAI-C

The validation study of the Chinese version of State-Trait Anxiety Inventory was conducted by Shek (1988) by administering the instrument to a total of 2,150 Hong Kong secondary-school students. The results indicate that the instrument had a high internal consistency and item-total correlations for each of the two subscales. The Cronbach's alphas for the A-state and A-trait subscales were 0.90 and 0.81 respectively. The psychometric properties were found to be comparable with those reported for the original English version (e.g. Gotlib, 1984; Endler et al., 1976; Ramanaiah et al., 1983; Knight, Waal-Manning, & Godfrey, 1983).

Short Form 36.

Li, Wang and Shen (2003) validated the Chinese version SF-36 in Mainland China based on 1,000 households in 18 communities of Hangzhou. The results reveal that internal consistency of the six subscales ranged from 0.72 to 0.88 (Cronbach's alpha) and test-retest reliability estimates of two weeks between the two administration were between 0.66 and 0.94.

Interrater Reliability

Interrater reliability measures homogeneity by administering the same form to the same people by two or more raters/interviewers so as to establish the extent of consensus on use of the instrument by those who administer it. In this study, one occupational therapist and two researchers who had at least two years of work experience in vocational or medical rehabilitation performed the assessments of the participants. All the assessments were conducted at the HKWHC and the tests were arranged in a fixed sequence to minimize the learning effect and fatigue among the participants. Each assessment session lasted for about one-and-a-half hours. The strategies of managing interrater reliability during the assessment process were set up as follows: 1) All assessments were conducted by occupational therapists at the

HKWHC and by the researchers. 2) Each rater received training in all the assessments. 3) Each new rater was coached by an experienced occupational therapist to ensure standardization of test administration and scoring for all the tests. Debriefing sessions were held after each of the coaching sessions to maximize consistency across the raters.

Data Analysis

There were a total of 39 variables in the preliminary model, of which 11 were demographic or workers' compensation related, 13 were physical related, and 15 were psychosocial related. Logistic regression analysis was used to develop the final model of return to work. Using the rule of 15 subjects per predictor (Field, 2000), the number of participants required for testing the full model would have approached 600. In view of the relatively small sample size in this study, the following strategies were used to lower the number of participants in developing the final model:

1) The participants were divided into two groups: those returning to work and those not returning to work.
2) The differences in the demographic and workers' compensation variables between the returning to work and the not returning to work groups were tested with chi-square statistics. The p values were set at a 0.05 significance level.
3) The differences in the physical- and psychosocial-related variables between the two groups were tested with two-way repeated measure ANOVA. The two independent variables were group (returning to work vs. not returning to work) and testing occasion (admission, third week, or sixth week). The p values were again set at a 0.05 significance level.
4) The relationships between all of the return to work outcome variables (measured at the 12^{th} week after program completion) were tested by

Pearson's product moment correlations. The strength of the correlations and the significance levels were inspected.

5) The results obtained from steps 2 to 4 would indicate the variables to be extracted for the logistic regression analysis in this step. Due to a foreseeable small number of participants, only those variables which consistently appeared to reach a statistically significant level were entered into the logistic regression – forward stepwise method. The Hosmer and Lemeshow goodness-of-fit test was used: if the significant p value was greater than 0.05 (not significant), it indicated a good model fit.

6) Case-based Reasoning design consists of three parts: Primary Case-base, Secondary Case-base, and Predictive Solution. In the first part, the values of all cases on a five-point scale are nominalized. In the second part, a matrix is generated based on three constraints (gender / breadwinner / civil claims). The final process involves searching for the closest cases to the trail case based on a distance metric (matching distance) in the generated matrix and then predicting a solution. The information about the 67 participants was constructed as a database. Thirty-two trail cases were used to test the system.

CHAPTER IV

RESULTS

Participants' Demographic Characteristics

A total of 103 participants were recruited for this study. Among them, only 72 completed all three assessments (69.9%), but five of them (6.9%) did not complete all the instruments. The number of participants whose data were entered into the data analysis was 67. The industry classification developed by the Labour Department of the Government of the Hong Kong Special Administrative Region was used to categorize the preinjury job nature of the participants. This classification is as follows: community, social, and personal services (n=28, 41.8%); construction (n=26, 38.8%); wholesale, retail, and import/export trade (n=6, 9.0%); transport, storage, and communication (n=5, 7.5%); and manufacturing (n=2, 3.0%). Most of the participants were from two major industries: community and personal services, and construction. In other words, 58 participants (86.6%) could be considered blue-collar workers and nine (13.4%) could be considered white-collar workers. The average monthly income of the participants, who were all engaged in full-time jobs, before their injuries was HK$11,645.5 (SD=5,237.4). This is slightly higher than the median monthly employment earnings of the Hong Kong population, which stands at HK$9,500 (Hong Kong Census and Statistics Department, 2004).

The participants were further divided into a return-to-work group (n=44, 65.7%) and a non-return-to-work group (n=23, 34.3%). The demographic characteristics of the participants were compared between the two groups. The variables included were gender, age, education level, marital status, living status, previous monthly income, breadwinner, and type of injury. Chi-square statistics were used to test the significance of the proportions between the return-to-work group and the non-return-to-work group.

Gender. There were more male (n=41, 61.2%) than female (n=26, 38.8%) participants. Sixty-one percent of the male participants had returned to work, compared to 73.1% of the female participants. No significant differences were found in the proportions of participants who returned to work between the male and female groups (Pearson χ^2=1.03, *df*=1, p=0.31).

Age. The mean age of all the participants was 43.0 years (SD=9.35) with a range between 21 and 59 years. The participants were further divided into younger (<45 years old) and older (>45 years old) groups. Among the younger group (n=39, 58.2%), 66.7% of the participants had returned to work, compared to 64.3% for the older group. The differences in the proportions of participants who returned to work between the younger and older groups were not statistically significant (Pearson χ^2=0.04, *df*=1, p=0.84).

Education Level. Three education levels were used to categorize the participants: primary school (P1-P6), junior high school (F1-F3), and high school (F4-F7). Twenty-six of the participants (38.8%) had only attended primary school, another 26 (38.8%) had also attended junior high school, and 15 (22.4%) had attended high school. For these three groups, the return-to-work rates were 73.1, 57.7, and 66.7% respectively. No significant differences were revealed in the proportions of the participants among the three education level groups (Pearson χ^2=1.37, *df*=2, p=0.50).

Table 3. Comparisons of demographic and workers' compensation characteristics between the return-to-work and non-return-to-work groups (N=67)

	Return-to-work Status (%)		
Variables	Did not return to work	Returned to work	Chi-square values
Gender:			
Male	16 (39)	25 (61)	1.03
Female	7 (26.9)	19 (73.1)	
Age:	43.87 ± 9.89	42.05 ± 9.11	
≤45 years	13 (33.3)	26 (66.7)	0.04
>45 years	10 (35.7)	18 (64.3)	
Education level:			
Primary school	7 (26.9)	19 (73.1)	
Junior high school	11 (42.3)	15 (57.7)	1.37
High school or above	5 (33.3%)	10 (66.7)	
Marital status:			
Single	8 (36.4)	14 (63.6)	0.06
Not single	15 (33.3)	30 (66.7)	
Living status:			
Alone	3 (37.5)	5 (62.5)	Nil
Not alone	20 (33.9)	39 (66.1)	
Previous monthly income			
(HK$):	6 (25.0)	18 (75.0)	
≤9,500	5 (26.3)	14 (73.7)	4.08
>9,500 and ≤12,500	12 (50.0)	12 (50.0)	
>12,500			
Breadwinner:			
Yes	16 (36.4)	28 (63.6)	0.06
No	7 (33.3)	14 (66.7)	
Type of injury:			
Low back pain	7 (24.1)	22 (75.9)	2.90
Not low back pain	16 (44.4)	20 (55.6)	

Attorney involvement:			
Yes	17 (48.6)	18 (51.4)	6.59*
No	6 (18.8)	26 (81.3)	
Injury to referral:			
≤12 months	4 (21.1)	15 (78.9)	Nil
>12 months	18 (41.9)	25 (58.1)	
Duration of sick leave:			
≤12 months	4 (23.5)	13 (76.5)	Nil
>12 months	19 (45.2)	23 (54.8)	
Pain intensity:			
1-4	7 (30.4)	20 (45.5)	
5-6	4 (17.4)	10 (22.7)	Nil
7-10	12 (52.2)	14 (31.8)	

* denotes $\underline{p}<0.05$.

Marital Status. Two categories of marital status were used: single and not single. There were 22 participants (32.8%) who were single and 45 (67.2%) who were not single. The proportions of participants in these two groups who had returned to work were 63.6 and 36.4% respectively. The differences in the proportions were not statistically significant (Pearson χ^2=0.06, *df*=1, $\underline{p}$=0.81).

Living Status. Two categories of living status were used: living alone and not living alone. Eight participants (11.9%) were living alone and 59 (88.1%) were living with others. The return-to-work rates for these two groups were 62.5 and 66.1% respectively. Since the rule of a minimum five participants per cell was not met, no Chi-square test was conducted (Julie, 2001).

Previous Monthly Income. The categorization of the participants' previous monthly income was based on the results of the General Household Survey (Hong Kong Census and Statistics Department, 2004). In this survey, the median monthly incomes for the male and female populations were found to be HK$11,000 and

HK$8,000 respectively, with HK$9,500 as the average. These findings were similar to those of the 2003 survey. Thus, the previous monthly income of the participants was classified as: <HK$9,500 (level 1), from HK$9,500 to HK$12,500 (level 2), and >HK$12,500 (level 3). There were 24 (35.8%), 19 (28.4%), and 24 (35.8%) participants in the level 1, level 2, and level 3 groups respectively, and the respective return-to-work rates were 75.0, 73.7, and 50.0%. The differences in the proportions of participants between the three income groups were statistically insignificant (Pearson χ^2=4.08, *df*=2, p=0.13).

Breadwinner. Forty-four of the participants (65.7%) were the breadwinners of their family, whilst 21 (31.3%) were not. The return-to-work rates for these two groups were 63.6 and 66.7% respectively. The differences in the proportions between the two groups were statistically insignificant (Pearson χ^2=0.06, *df*=1, p=0.81).

Type of Injury. The participants were also categorized according to whether they had low back pain or not. Twenty-nine (43.3%) had low back pain, whilst 36 (53.7%) had other injuries. For two participants (3.0%), the values were missing. In the low back pain group, 75.9% managed to return to work, compared to 55.6% in the other group. No statistically significant differences were revealed between the two groups (Pearson χ^2=2.90, *df*=1, p=0.09).

Workers' Compensation-related Characteristics

The participants were involved in different stages of workers' compensation. The variables analyzed were: attorney involvement, time from injury to referral, and duration of sick leave. Chi-square statistics were used to test the differences in the proportions of participants between the return-to-work and non-return-to-work groups.

Attorney Involvement. There were 35 participants (52.2%) who were pursuing a civil claim with their employer and 42 (47.8%) who were not. Among the former group, 51.4% of the participants had returned to work. This was compared with 81.3% among those who had not pursued a civil claim. The differences in the proportions of participants returning to work were statistically significant (Pearson χ^2=6.59, *df*=1, p=0.01).

Time from Injury to Referral. The time from injury to referral was classified into two levels: <12 months and >12 months. A total of 19 participants (28.4%) were referred to the return-to-work program 12 months or before after they were injured at work. There were 43 participants (64.2%) who were referred after 12 months. For five participants, this variable was missing. Among the shorter referral time group, 78.9% managed to return to work. This was compared with 58.1% in the longer referral time group. Since the rule of a minimum of five participants per cell was not met, no Chi-square test was conducted (Julie, 2001).

Duration of Sick Leave. The duration of sick leave was defined as the period from the injury to the date when the participants completed the Medical Assessment Board (MAB) assessment. The duration of sick leave was classified into two groups: <12 months and >12 months. There were 17 participants (25.4%) who had 12 months or less of sick leave, whilst 42 participants (62.7%) had longer than 12 months of sick leave. For eight participants (11.9%), the variable was missing. For those who had a shorter sick leave, the return-to-work rate was 76.5%. This was compared with 54.8% for those who had a longer sick leave. Since the rule of a minimum of five participants per cell was not met, no Chi-square test was conducted (Julie, 2001).

Pain Intensity. The pain intensity of the participants was quantified by the visual analogue scale (VAS) (Lord & parsell, 2003). The results of the VAS were further classified into three subgroups: 0-4.9 cm, 5.0-6.9 cm, and 7.0-10.0 cm. Table 3 summarizes the distribution of the participants in the different subgroups. There were comparatively more participants in the return-to-work group (n=20, 45.5%) who scored 0-4.9 cm. In contrast, there were more participants in the non-return-to-work group (n=12, 52.2%) who scored 7.0-10.0 cm. Since the rule of a minimum of five participants per cell was not met, no Chi-square test was conducted (Julie, 2001).

Measures of Work Capacity

The instruments administered to the participants included the VALPAR #19 strength and endurance test, the grip strength test using DEXTER, the Loma Linda University Medical Center Activities Sort (LLUMC), confidence of returning to work, the Lam Assessment of Stages of Employment Readiness (LASER), the Chinese State-trait Anxiety Inventory (STAI-C), and the Short Form-36 (SF-36). Two-way repeated measure ANOVA was used to explore the effectiveness of the return-to-work program and the differences between subjects (return to work and non-return to work). The results of work capacity measures across three assessment occasions were entered as the within-subject variables and return-to-work status (yes or no) was the between-subject variable. They were tested with repeated measure ANOVA.

VALPAR #19. Table 4 (and Appendix 4) summarizes the results of the VALPAR #19 strength and endurance test. No significant differences were revealed in the group tests ($F(1,57)=0.15-2.49$, $p>0.05$) and the occasion main effects tests (Wilks's $\Lambda=0.93-0.99$, $F(2,56)=2.07$, $p>0.05$) for both strength and endurance. The interaction effects of group * occasion for the strength test were statistically insignificant. In contrast, the interaction effects for the endurance test were statistically significant (Wilks's $\Lambda=0.99$, $F(2, 52)=3.87$, $p=0.027$).

Table 4. Results of the VALPAR #19 strength and endurance tests.

	Mean (SD)		
Variable	Baseline assessment	Second assessment	Third assessment
Strength (lbs)	28.72 (20.57)	29.9 (20.78)	28.54 (21.10)
The number of repeated tasks	12.50 (5.89)	12.79 (5.70)	12.83 (5.65)

DEXTER. Table 5 (and Appendix 4) shows the results of the DEXTER, which is a measure of grip strength. The results indicated no significant group ($F(1,61)=0.46$-2.49, $p>0.05$) or occasion main effects (Wilks's $\Lambda=0.96$-0.97, $F(2,60)=1.08$, $p>0.05$). The interaction effects were also statistically insignificant (Wilks's $\Lambda=0.97$, $F(2,122)=0.04$, $p>0.90$).

Table 5. Grip strength of the participants measured by the DEXTER.

	Mean (SD)		
Variable	Baseline assessment	Second assessment	Third assessment
Average left-hand strength (kg)	21.85 (10.11)	23.07 (10.35)	22.40 (12.30)
Average right-hand strength (kg)	21.97 (12.89)	23.37 (12.91)	22.28 (13.90)

Note: All figures are the average of the left- and right-hand strength measurements.

LLUMC. Table 6 (and Appendix 4) summarizes the participants LLUMC scores. Significant differences were revealed in the occasion effects, which indicated differences in the scores across the three assessment occasions (Wilks's $\Lambda=0.87$, $F(2, 63)=4.92$, $p=0.01$). Multiple comparisons indicated the scores at the baseline were significantly higher than those at the second assessment. However, the main group effects were statistically insignificant ($F(1,64)=3.01$, $p=0.08$), as were the interaction effects (Wilks's $\Lambda=0.98$, $F(2,63)=0.75$, $p>0.47$).

Table 6. Self-perceived work ability measured by the LLUMC.

	Mean (SD)		
LLUMC	Baseline assessment	Second assessment	Third assessment
Scores	73.91 (6.83)	59.64 (6.85)	65.70 (7.10)

Confidence of Returning to Work. Table 7 (and Appendix 4) shows the confidence level reported by the participants in regard to various physical capacities. There were significant time (Wilks's Λ=0.88, F(2, 51)=3.59, p=0.035) and group effects (F(1,52)=9.87, p=0.003). Multiple comparisons indicated that the participants' confidence was the lowest at the baseline assessment. The confidence level at the second assessment was significantly higher than that at the baseline. However, the main group effects were statistically significant (F(2,51)=3.59, p=0.04), as were the group effects (F(1,52)=9.87, p=0.003). The interaction effects of group * time were statistically insignificant (Wilks's Λ=0.99, F(2,104)=0.06, p>0.90).

Table 7. Participants' confidence of returning to work (in terms of functional limitations)

	Mean (SD)		
Confidence in return to work	Baseline assessment	Second assessment	Third assessment
Walking	1.46 (0.53)	1.37 (0.49)	1.33 (0.47)
Standing	1.51 (0.50)	1.40 (0.49)	1.37 (0.49)
Sitting	1.36 (0.48)	1.31 (0.47)	1.30 (0.49)
Squatting	1.67 (0.71)	1.60 (0.72)	1.57 (0.70)
Stooping	1.61 (0.65)	1.45 (0.53)	1.46 (0.56)
Crouching	1.72 (0.77)	1.61 (0.72)	1.58 (0.72)
Kneeling	1.55 (0.74)	1.34 (0.59)	1.28 (0.51)
Crawling	1.76 (0.76)	1.55 (0.68)	1.45 (0.61)
Climbing	1.70 (0.67)	1.46 (0.64)	1.42 (0.55)

LASER. Table 8 (and Appendix 4) summarizes the participants' scores on the LASER. There were three LASER subscales: precontemplation, contemplation, and action. Lower scores on the precontemplation subscale, and higher scores on the contemplation and action subscales indicated higher return-to-work readiness. Significant differences were found in the group main effects for the precontemplation (F(1,63)=8.66, p=0.005) and action subscales (F(1,63)=5.30, p=0.025). Paired-sample t-tests indicated that the LASER precontemplation score at the second assessment was significantly lower than that at the baseline (t=2.09, *df*=64, p= 0.04). The LASER action score at the second assessment was significantly higher than that at the baseline (t=-2.28, *df*=64, p=0.03). The other main and interaction effects were all statistically insignificant.

Table 8. Participants' scores on the LASER

	Mean (SD)		
LASER	Baseline assessment	Second assessment	Third assessment
Precontemplation	14.33 (0.47)	13.26 (0.39)	13.68 (0.44)
Contemplation	15.62 (0.24)	15.82 (0.30)	15.51 (0.38)
Action	14.98 (0.33)	15.68 (0.36)	15.58 (0.37)

STAI-C. Table 9 (and Appendix 4) presents the STAI-C scores of the participants. The group (F(1,65)=0.74, p=0.39) and occasion main effects (Wilks's Λ=0.94, F(2,130)=1.86, p>0.16) were not significant. The interaction effects were also statistically insignificant (Wilks's Λ=0.93, F(2,64)=2.42, p>0.09).

Table 9. Participants' scores on the STAI-C

	Mean (SD)		
STAI-C	Baseline assessment	Second assessment	Third assessment
Scores	55.51 (10.47)	53.27 (11.71)	54.57 (10.32)

SF-36. Table 10 (and Appendix 4) summarizes the participants' scores on eight subscales of the SF-36. A review of the results indicated that there were only a few main effects which were marginally significant. Out of the eight subscales, only the group main effects on the Role-Emotional subscale reached a marginal significance (F(1,65)=3.64, p=0.061). Similarly, the time main effects on the Mental Health subscale reached a marginal significance (Wilks's Λ=0.92, F(2,64)=2.81, p=0.068). The only interaction effects which reached a statistical significance were on the Role-Physical subscale (Wilks's Λ=0.99, F(2,64)=3.23, p=0.046).

Table 10. Participants' scores on the SF-36

SF-36 subscale	Mean (SD)		
	Baseline assessment	Second assessment	Third assessment
Physical Functioning (PF)	21.19 (4.45)	21.54 (4.34)	21.51 (4.8)
Role Physical (RP)	5.09 (1.38)	4.99 (1.35)	5.13 (1.57)
Bodily Pain (BP)	5.53 (1.87)	5.78 (1.92)	5.49 (2.06)
General Health (GH)	15.36 (3.56)	15.22 (3.23)	14.97 (3.13)
Vitality (VT)	12.61 (4.67)	13.19 (4.48)	12.49 (4.50)
Social Functioning (SF)	5.78 (1.97)	5.97 (1.92)	5.76 (1.72)
Role Emotional (RE)	3.91 (1.18)	3.96 (1.12)	3.87 (1.14)
Mental Health (MH)	17.36 (5.83)	17.91 (6.27)	21.51 (5.61)

Return-to-work Outcomes

By end of the three-month follow up, 44 participants (65.7%) had managed to return to work, whilst 23 participants (34.3%) had not. Among those who had returned to work, 14 (31.8%) had secured a full-time job and 30 (68.2%) a part-time job. Eight participants (18.2%) returned to their original jobs and 36 participants (81.8%) changed their jobs. A total of 35 participants (79.5%) took up blue-collar work, whilst nine participants (20.5%) took up white-collar work. The average monthly income of those who returned to work was HK$3,657.5 (SD=3416.2). The average monthly income of those in full-time work was HK$6,904.62 (SD=3062.14), while the figure was HK$240 (SD=113.14) for those in part-time work.

Correlational Analyses of Variables with Return-to-work Status

To further determine the variables to be entered into the final logistic regression analysis of return to work, correlational analysis was used to explore the strength and direction of the relationships between the variables and return-to-work outcomes. The variables that had a higher correlation with the participants' return-to-work outcomes were then tallied with those obtained from the results of the repeated measure ANOVA. Those who popped up as favorable in both analyses were then selected to be entered into the next stage. Such a procedure has been commonly employed in other predictive studies (e.g. Kevin, Richard, & John, 2004; Terry et al., 2003).

Correlation describes the strength and direction of the relationship between two variables. It can be used for both interval and ordinal data (Munro, 2001). This section presents the results of the correlational analysis of the demographic, workers' compensation-related, and work capacity variables in regard to the return-to-work outcomes. Zero-order Pearson's product-moment correlation coefficients were used for the entire analysis.

At the baseline assessment, there was one workers' compensation variable and a few work capacity variables which had significant correlations with the return-to-work outcomes (Appendixes 5, 6, 7, 8). They were: attorney involvement ($r=-0.31$, $p<0.01$), confidence of returning to work (walking) ($r=-0.26$, $p<0.05$), LASER action ($r=0.26$, $p<0.05$), SF-36 role physical ($r=0.25$, $p<0.01$), and SF-36 role emotional ($r=0.24$, $p<0.05$). At the third-week assessment, there were a few work capacity variables which had significant correlations with the return-to-work outcomes (Appendixes 9, 10, 11). They were: the VALPAR #19 endurance test ($r=0.27$, $p<0.05$), confidence of returning to work ($r=0.30$, $p<0.05$), LASER action ($r=0.26$, $p<0.05$), and LASER precontemplation ($r=-0.36$, $p<0.01$). At the sixth-week assessment, there were a few work capacity variables which were significantly correlated with the return-to-work outcomes (Appendixes 12, 13, 14). They were: confidence of returning to work ($r=0.33$, $p<0.05$), self-perceived functioning (LLUMC) ($r=-0.26$, $p<0.05$), LASER precontemplation (r=-0.35, p<0.01), SF-36 social functioning (r=0.25, p<0.05), and SF-36 role emotional (r=0.25, p<0.01).

Table 11 summarizes the variables obtained in the three separate assessment occasions which were considered for entry into the subsequent logistic regression analysis.

Table 11. List of potential predictors which were entered into the logistic regression analysis

	Variables with significant correlations
Compensation-related data	attorney involvement
Baseline assessment	functional limitation (walking), LASER action, SF-36 role physical, SF-36 role emotional
Third-week assessment	VALPAR #19 endurance, confidence of returning to work, LASER precontemplation, LASER action
Sixth-week assessment	LLUMC, confidence of returning to work, LASER precontemplation, SF-36 social functioning, SF-36 role emotional

Logistic Regression Data Analysis Results

Table 12 presents the results obtained from the analyses using Chi-square, two-way repeated measure ANOVA and correlational analysis. A review suggested that the majority of the variables revealed by the Chi-square and ANOVA comparisons overlapped with those revealed by the correlational analysis. As a result, the workers' compensation-related and work capacity variables were entered into the logistic regression analysis.

Table 12. List of potential predictors considered for entry into the logistic regression

Statistical method	Potential predictors of return-to-work status
Chi-square	Attorney involvement
ANOVA	VALPAR #19 endurance task, confidence of returning to work, LASER precontemplation, LASER action, SF-36 role physical, SF-36 role emotional
Correlational analysis	Refer to Table 11.

The forward stepwise (conditional) logistic regression procedure was used to test the significance of the variables which predicted the participants' return-to-work outcomes (i.e. whether they returned to work or not). Logistic regression is a technique that is appropriate for predicting a probability of a binary outcome (Munro, 2001).

A separate logistic regression procedure was conducted on the variables obtained at each of the assessment occasions; that is, the baseline, the third week, and the sixth week. There were two runs of the same analysis. In the first run, all the variables identified as potential predictors were entered (Table 12). These included all the workers' compensation-related and work-related variables. In the second run, the workers' compensation variable, attorney involvement, was removed from the analysis. This method can test the significance of the attorney involvement variable in influencing the structure of the return-to-work model.

The first column, labeled *b*, contains the logit coefficients of the predictor variables. These unstandardized logistic regression coefficients correspond to the *b* coefficients in ordinary least-squares regression (Garson, 2001). These parameter estimates describe the steepness and the direction of the logistical regression curve (Wright, 1995). Unlike ordinary least-squares regression, logistic regression calculates changes in the log odds of the dependent variable. The Wald statistic in the third column tests the significance of the logit coefficient associated with a given independent variable. This corresponds to significance testing of *b* coefficients in ordinary least-squares regression (Garson, 2001). The column labeled Exp(b) containing the odds ratio is an estimate of the increase in the likelihood of returning to work for one unit increase in the predictor variable when the other independent variables in the model are controlled for (Wright, 1995). The odd ratio is always 0 or greater, and it is 1 when membership in the return-to-work and non-return-to-work groups is equally likely. Moreover, the odds are proportional: a variable with an odds ratio of 2 has double the effect of one with an odds ratio of 1.

Table 13 presents the results of the first run; that is, with all potential variables entered into the logistic regression. For the variables obtained at the baseline assessment, the only significant predictor was attorney involvement (b=-1.47, SE=0.57, p=0.01). For the third-week assessment, attorney involvement (b=-1.31, SE=0.65, p=0.04) and LASER action (b=0.32, SE=0.15, p=0.03) became the significant predictors of the participants' return-to-work status. For the sixth-week assessment, only one predictor became significant, namely LASER precontemplation (b=-0.29, SE=0.10, p=0.01). The odd ratios and 95% confidence interval of the significant predictors are presented in Table 14. At the baseline assessment, the participants had a 1.25 increase in the likelihood of returning to work if there was no attorney involved (Wald=6.66, p=0.01). The same variable at the third-week assessment would increase the likelihood to 1.39 (Wald=4.08, p=0.04). At the same assessment occasion, the participants had a 1.41 increase in the likelihood (Wald=4.81, p=0.03) of returning to work if they scored higher on LASER action. At the sixth-week assessment, the participants who scored higher on LASER pre-contemplation would have a 0.75 likelihood of returning to work (Wald=7.95, p=0.01).

Table 13. Results of logistic regression analysis of return-to-work status (with all variables)

	Variable	*b*	*SE*	Wald	*P*	Exp (*b*)
Baseline assessment	Attorney involvement	-1.47	0.57	6.66	0.01	0.23
Third-week assessment	Attorney involvement	-1.31	0.65	4.08	0.04	0.27
	LASER action	0.32	0.15	4.81	0.03	1.38
Sixth-week assessment	LASER Precontemplation	-0.29	0.10	7.95	0.005	0.75

Table 14. Odd ratios and 95% confidence intervals of significant predictors (with all variables)

	Variable	Odds Ratios	95%CI
Baseline assessment	Attorney involvement	0.23	0.08 – 0.70
Third-week assessment	Attorney involvement	0.27	0.08 – 0.96
	LASER action	1.38	1.05 – 1.85
Sixth-week assessment	LASER precontemplation	0.75	0.61 – 0.92

Table 15 presents the results of the second run; that is, with attorney involvement removed from the list of potential predictors. For the variables obtained at the baseline assessment, LASER action became the only significant predictor (b=0.22, SE=0.11, p=0.05). For the third-week assessment, confidence of returning to work (b=0.34, SE=0.17, p=0.05) and LASER action (b=0.33, SE=0.14, p=0.02) were the two significant predictors. For the sixth-week assessment, only LASER precontemplation was a significant predictor (b=-0.29, SE=0.10, p=0.01). The odd ratios and 95% confidence interval of the significant predictors are presented in Table 16. At the baseline assessment, the participants had a 0.23 increase in the likelihood of returning to work if they scored higher on LASER action (Wald=3.97, p=0.046).

The same variable at the third-week assessment would increase the likelihood to 0.27 (Wald=5.25, p=0.020). At the same assessment occasion, the participants had a 1.38 increase in the likelihood (Wald=3.97, p=0.046) of returning to work if they scored higher on confidence of returning to work. At the sixth-week assessment, the participants who scored higher on LASER precontemplation would have a 0.75 likelihood of returning to work (Wald =7.95, p=0.01).

Table 15. Logistic regression analysis of participants' return-to-work status (without attorney involvement)

	Variable	*b*	*SE*	Wald	*P*	Exp (*b*)
Baseline assessment	LASER action	0.22	0.11	3.97	0.046	1.25
Third–week assessment	Confidence of returning to work	0.34	0.17	3.97	0.046	1.41
	LASER action	0.33	0.14	5.25	0.020	1.39
Sixth-week assessment	LASER Precontemplation	-0.29	0.10	7.95	0.005	0.75

Table 16. Odd ratios and 95% confidence interval of significant predictors (without attorney involvement)

	Variable	Odds Ratio	95%CI
Baseline assessment	LASER action	1.25	1.00 – 1.55
Third-week assessment	Confidence of returning to work	1.41	1.01 – 1.97
	LASER action	1.39	1.05 – 1.84
Sixth-week assessment	LASER precontemplation	0.75	0.61 – 0.92

Goodness-of-fit tests were used to determine which of the above models derived from the second run (without attorney involvement) was (or were) the best to describe the return-to-work phenomenon of the participants. The Hosmer-Lemeshow goodness-of-fit test was adopted (Hosmer & Lemeshow, 1989). This procedure has been widely used in prediction modeling studies such as Wang and Guo (2001). A small Hosmer-Lemeshow Chi-square value and high probability (>0.10) test statistics would indicate a reasonable fit between the predicted model and the observed data (Terry et al., 2003). In other words, insignificant results suggest a good model fit whereas significant results suggest a poor model fit (Munro, 2001).

Table 17 summarizes the results of the Hosmer-Lemeshow goodness-of-fit test of three prediction models without attorney involvement. The best prediction model appeared to be Model 1, which had a Chi-square value of 2.81 (p=0.59). This model only included the predictor of LASER action. The percentages of correct prediction of the participants' return to work were 71.2% for Model 1, 78% for Model 2, and 67.9% for Model 3.

Table 18 summarizes the results of the Hosmer-Lemeshow goodness-of-fit test of three prediction models with all variables entered into the logistic regression. The best prediction model appeared to be Model 1, which had a Chi-square value of 0.01 (p=0.99). This model only included the predictor of attorney involvement. The percentages of correct prediction of the participants' return to work were 65.2% for Model 1, 78% for Model 2, and 67.9% for Model 3.

Table 17. Results of the Hosmer-Lemeshow goodness-of-fit test on the logistic regression model of the first run analysis (without attorney involvement)

Model*	Chi-square value	p value	Correct prediction percentage
1	2.81	.59	71.2%
2	9.11	.25	78%
3	5.26	.51	67.9%

*Model 1 represents the baseline assessment model.
*Model 2 represents the second assessment model.
*Model 3 represents the third assessment model.

Table 18. Results of the Hosmer-Lemeshow goodness-of-fit test on the logistic regression model of the first run analysis (with all variables)

Model*	Chi-square value	p value	Correct prediction percentage
1	0.01	0.99	65.2%
2	10.79	0.15	78%
3	5.26	0.51	67.9%

*Model 1 represents the baseline assessment model.
*Model 2 represents the second assessment model.
*Model 3 represents the third assessment model.

Attorney Involvement as a Major Predictor

Further analysis was conducted to investigate the demographic characteristics and other work-related variables which were associated with the participants' tendency to pursue civil claims; that is, attorney involvement. Table 19 summarizes the correlations between attorney involvement and other work-related variables (Appendixes 15, 16, 17, 18). There were moderate to strong and significant correlations among participants' work-related psychosocial status: LASER precontemplation, SF-36 role physical, SF-36 vitality, and SF-36 social functioning (r=-0.44-0.59, $p \leq 0.05$). There were only weak to moderate correlations between attorney involvement and other work-related variables (r=-0.25-0.27, $p \leq 0.05$).

Logistic regression analysis was run to test the significance of using work-related psychosocial status for predicting the participants' attorney involvement. The results are shown in Table 20. Only SF-36 role physical was found to significantly predict attorney involvement (Wald=5.65, p=0.018). The goodness-of-fit test using the Hosmer-Lemeshow Chi-square value was positive (Chi-square value=1.33, p=0.72). This model was found to predict 65.2% of the participants' attorney involvement: 43.8% for those who did not pursue attorney involvement and 85.3% for those who did.

Table 19. The potential predictors of attorney involvement according to the correlation Results

	1	2	3	4	5
(1) Attorney involvement (yes or no)	1	0.27*	-0.27*	-0.25*	-0.26*
(2) LASER precontemplation		1	-0.22	-0.52**	-0.44**
(3) SF-36 role physical			1	0.50**	0.57**
(4) SF-36 vitality				1	0.59**
(5) SF-36 social functioning					1

* r values significant at $p \leq 0.05$.
** r values significant at $p \leq 0.01$.

Table 20. Results of logistic regression analysis of work-related psychosocial status predicting attorney involvement

Variable	*b*	*S.E*	Wald	*p*	Exp (*b*)	95%CI
SF-36 role physical	-0.51	0.215	5.65	0.018	0.6	0.39 – 0.92
LASER precontemplation	0.10	0.09	1.33	0.25	1.11	0.93 – 1.32
SF-36 vitality	-0.04	0.08	0.26	0.61	0.96	0.83 – 1.11
SF-36 social Functioning	-0.09	0.18	0.23	0.63	0.92	0.64 – 1.31

Testing the Case-based Reasoning Algorithm

The objective of this test was to evaluate the usefulness of the case-based reasoning algorithm using a three constraints and 11 variables model for predicting a return-to-work outcome. The database of the algorithm was composed of the same 67 cases who were used in the convention regression analysis. The testing cases were 32 participants who had a similar background and characteristics to those in the database. The only difference was that they enrolled later in the return-to-work program. Different combinations of constraints and variables were used for matching the 32 test cases with the cases in the database. The number of constraints used, the number of matched cases, the percentage of reliability (matching the variables), and the minimum matching distance (standardized differences in the values of each variable) of the best three conditions are presented in Table 21. In condition 1, 13 out of the 32 cases (40.6%) were found to have matching return-to-work outcomes to those in the database. The three constraints and 11 variables model yielded a 40% reliability and a 2.0 minimal matching distance. In condition 2, 20 cases were matched (62.5%). Civil claim as the only constraint together with the other 11 variables yielded a 63%

reliability and a 1.8 minimal matching distance. The best solution was in condition 3, where 20 cases were matched (62.5%). The reliability of this condition was also 63%. However, it yielded a much shorter matching distance of 1.3.

Table 21. Summary of results of testing the case-based reasoning algorithm based on 32 new cases

Condition	Settings of the case-based reasoning algorithm		Results		
	Constraints	Variables (No.)	No. of Matched Cases (N=32)	% of Reliability	Min. MD
1	Gender, BW, CC	Age, EDL, PI, SL, BP, CON, STO, RE, LLUMC, RP, ACT (n=11)	13	40	2.0
2	CC	Age, EDL, PI, SL, BP, CON, STO, RE, LLUMC, RP, ACT (n=11)	20	63	1.8
3	CC or BW or Gender	Age, EDL, PI, SL, BP, CON, STO, RE, LLUMC, RP, ACT (n=11)	20	63	1.3

Note: CC=civil claim; BW=breadwinner; EDL=education level; PI=previous income; SL=sick leave; BP=bodily pain; CON=confidence in returning to work; STO=functional limitation; RE=role emotional; RP=role physical; ACT=LASER action score.

CHAPTER V

DISCUSSION

This study attempted to explore the factors which influenced the rehabilitation and return-to-work outcomes of a group of workers suffering from chronic pain. The findings enabled the development of a model which incorporates the significant variables and predicts the likelihood of workers' returning to work. To further understand the usefulness of the model, both the conventional logistic regression and case-based reasoning methods were used. The models generated from both methods could then be compared.

In this study, a total of 36 participants dropped out either from the return to work program or not able to complete all three assessments, which gives an attrition rate of 35% (original N=103). The demographic characteristics of those who completed the program (and assessments) were compared with those who did not complete the program (or assessments). No significant differences were found in the comparisons such as gender composition, age and education level etc. The differences in the return to work outcomes were also not significant. The return to work rate for those in the completed group was 65.7% when compared with 61.1% for the incomplete group. These suggested that the 36% attrition rate might not have biased the results of the study.

The data collection involved three separate assessments conducted at admission, at the third week, and at the sixth week, and one final outcome survey conducted at three months after the completion of the work rehabilitation program. The 67 participants were divided into return-to-work (n=44, 65.7%) and non-return-to-work groups (n=23, 34.3%). Comparisons of the demographic characteristics and workers' compensation-related variables suggested that the participants in the two groups were generally similar. The only difference was that a higher proportion of participants (48.6%) in the non-return-to-work group than in the return-to-work group (18.8%) had pursued civil claims. The comparisons of the work capacity variables, however, indicated significant differences between the two groups. The participants in the return-to-work group were found to have greater improvements in physical endurance (measured by the VALPAR #19), higher perceived competence in handling tools and tasks (measured by the LLUMC), better confidence of returning to work, higher readiness to return to work (measured by the LASER), and greater improvements in physical functions (measured by SF-36 role physical) than those in the non-return-to-work group. Further analyses showed that not all these variables were important enough to be included in the prediction model of return to work. The single variable of "attorney involvement," which indicated that participants were pursuing civil claims, became the most influential in determining whether a participant was successful in returning to work. The results indicated that the chance of returning to work was significantly lower when the participant was involved in a civil claim. Whether a participant pursued a civil claim seemed to be solely predicted by the physical functions (measured by SF-36 role physical). The lower were the physical functions, the higher would be the chance of a participant's pursuing a civil claim. By entering the "attorney involvement" variable, the prediction model only had LASER action as the second significant variable at the third-week assessment. The higher was the participant's score on LASER action, the higher the chance of the participant's having a positive return-to-work outcome. "Attorney involvement" was not a significant variable at the sixth-week assessment. Instead, it was LASER precontemplation. This suggested that the higher was the participant's score on LASER precontemplation, the lower the chance of the participant's having a positive return-to-work outcome. The accuracy of the prediction models established from the assessment results obtained at different times across the rehabilitation process ranged from 65.2% to 78.0%. The highest accuracy was observed when the third-week assessment results were used. The use of case-based reasoning did not seem to reveal a better result in terms of the accuracy of prediction. The use of three constraints plus 11 variables only yielded an accuracy of 62.5%.

Work Capacity and Return to Work

The results of comparing the work capacities of the return-to-work group with those of the non-return-to-work groups indicated differences between the participants in these groups. The participants who managed to return to work were found to have better physical endurance, fewer perceived physical problems (role physical and limitation of working), and higher confidence of returning to work. These findings were similar to those of other studies on workers' returning to work. Cutler et al. (2004) revealed that physical endurance, particularly crouching, was a strong predictor of employment status in a cohort of chronic pain patients. Vowles et al. (2004) reported that the ability of participants to perform lifting tasks was closely related to their return to work. Casso et al. (2004) found that improvements in general physical conditions as a result of a muscle reconditioning program had positive effects on the return to work of workers suffering from chronic low back pain. Other work-related variables that have been found to enhance the return to work rate include functional limitation and changes in trunk flexibility scores (Koopman et al., 2004), and self-assessed work ability (Reiso et al., 2003). In the Chinese Mainland, there are relatively fewer studies on injured workers returning to work. Rather, majority of the study on this area address the issue of returning to work of unemployed workers. For instance, Shi, Song and Zhang (2001) investigated the workers' behaviors in re-employment among those who were laid off by 24 companies scattered in 12 provinces (N=1080). The results indicated that the cognitive attribution, emotion control, self-confidence of job seeking, and coping skill were the key factors in predictive successful re-employment of these workers.

Self-efficacy has previously been found as a significant predictor of return to work among the patients suffered from chronic pain (Robbins et al., 1996). Nevertheless, this study did not choose to include self-efficacy as a variable to enter into the prediction model. There are two reasons to justify our choice. First, previous studies indicated that self-confidence was a more prominent variable than self-efficacy and self-esteem in predicting return to work (employment of laid off workers) both for Chinese workers (Shi et al., 2001) and for Western workers (Gard & Sandberg, 1998). Under the constraint of number of variables to be put in the prediction model, self-confidence was chosen instead. Second, self-confidence was previously reported to be related to workers' re-engagement in daily activities, faster rate of termination of benefits, and reduction of pain (Cole, Mondloch & Hogg-Johnson, 2002). It would be more specific to the positive outcomes of a return to work program, which support us to include it in this study.

In this study, the participants were suffering from chronic pain. Their pain and residual disabilities had limited their physical capacity for a relatively long period of time: from a few months to more than one year. The physical deconditioning would have greatly lowered their physical capacity (Feuerstein et al., 1993). This would be likely to result in very strong negative emotions due to the loss of work role and to financial hardship (Cutler et al., 2004). The work reconditioning module embedded in the work retraining program offered the participants an opportunity to further improve their physical functions. The experiential pain management module might have positive effects on their confidence toward working (Bendix et al., 1995; Tan et al., 1997). In addition, the counseling and work adjustment module might alleviate some of the psychosocial problems encountered by the participants because of work injury and unemployment (Carosella, Lackner, & Feuerstein, 1994). Due to the design of this study, the ability of the different intervention modules to improve physical and psychosocial problems could not have been known. However, other studies have gathered evidence on the effectiveness of these interventions.

The improvements in their physical condition and confidence would enable the participants to be successful in re-engaging in gainful employment. It is, however, unfortunate that the physical variables – both physical endurance and perceived physical functions – could not be included in the logistic regression return-to-work model. Only confidence of returning to work was found to be significant in the third-week assessment prediction equation. This significance could be due to the fact that the majority of the participants returned to less strenuous jobs such as teaching assistants, office assistants, and security guards. Hence, the physical conditions of the participants were less important than their confidence and readiness (to be discussed in the next section). Our observations were consistent with the findings of other studies that physical capacity is less important for injured workers with chronic pain re-entering the workforce (Tan et al., 1997) than their confidence of returning to work, particularly for those who suffer from chronic pain. It is plausible that there has not been advancement in the treatment of chronic pain (e.g. Bigos et al., 1992). In fact, the causal relationship between increase in physical capacity and successful return to work has not been established (Hildebrandt et al., 1997). In contrast, cognitive behavioral and psychosocial techniques have been found to be effective for enhancing coping with and living with pain. Schultz et al. (2004) concluded that expectation and self-perceived function were the significant predictors of the return to work of injured workers with subacute and chronic pain. Reiso et al. (2003) also found that injured workers with chronic pain who score low on self-perceived work ability are less likely to return to work.

Readiness and Return to Work

In this study, the degree of readiness as measured by the LASER subscales was found to be significantly different for the participants in the two groups. It is worth noting that the LASER subscales were responsive enough to reflect different dimensions of readiness. The test results indicated that lower scores on the precontemplation subscale and higher scores on the action subscale reflected the likelihood of participants' returning to work. Previous studies revealed that there are multiple factors which influence return-to-work outcomes. Persistent pain, loss of function, and associated work disability in patients with work-related upper extremity disorders appear to be affected by many factors, including physical capabilities in relation to work demands; ergonomic risk factors on the job; and psychological factors related to worker traits, psychological readiness to return to work, and ability to manage symptoms. Among these factors, readiness to return to work was found to be one of the most important (Feuerstein et al., 1993).

In the return-to-work context, readiness means willingness or a state of being prepared for return to work (Cambridge Advanced Learner's Dictionary, 2003). Prochaska et al.'s stage of change model describes a sequence of change in behavior whereby one improves readiness to pursue a goal or task. This sequence is from precontemplation, to contemplation, and then to action. The changes in their scores indicated clearly that the participants in the return-to-work group had moved through the different stages of change, from impairment and disability to engagement in gainful employment. In this study, there were significant differences in the LASER profiles of the participants between the two groups. In the return-to-work group, there were significant increases in the scores on the action subscale from the baseline to the sixth-week assessment. This suggested that the participants tended to engage in more activities which led to gainful employment. These activities included looking for jobs on the Internet, in newspapers, or by directly contacting employers. The participants also practiced job interview skills and attending actual interviews with employers. Activities also included taking up job duties and resuming work. In contrast, in the same group, there were significant decreases in the scores on the precontemplation subscale. This suggested that the participants were less likely to deny the importance of resuming work or to claim a lack of ability to return to work. The patterns of change manifested in the participants were similar to those of individuals who undergo stages of change. For instance, in DiClemente et al.'s (1991) study of smoker behavior, those smokers who were classified as being in the preparation (or action) stage were twice as likely to be abstinent at one-month post-treatment as those who were in the contemplation or precontemplation stages. Other studies have found the following proportions of people in the different stages of change: 40% in the precontemplation stage, 40% in the contemplation stage, and 20% in the preparation (preaction) stage (Laforge et al., 1999; Velicer et al., 1995). It is important, then, to match the training strategies for people with the stage of change they are in (Thomas et al., 2002).

In the return-to-work prediction model, the results of the logistic regression revealed the importance of readiness to return to work in predicting the participants' return-to-work outcomes. In both models (the one that included attorney involvement and the one that did not), the LASER action and LASER precontemplation variables were significant predictors. In the first prediction model (with attorney involvement), using the third-week assessment results, LASER action was one of the two significant variables for predicting the outcomes. LASER precontemplation was the only significant variable for predicting the outcomes when using the sixth-week assessment results. These findings suggested that workers would be more likely to return to work if they engaged in more job-hunting and work activities in the early phase of the work rehabilitation program. Conversely, in the latter phase of the work rehabilitation process, if workers demonstrated less involvement in these activities, and at the same time, still denied the importance of returning to work, they would be less likely to achieve positive return-to-work outcomes. In the second prediction model (without attorney involvement), the two LASER subscale variables were even more important than in the first model. LASER action was the only significant variable for predicting the outcomes when the baseline assessment results were used. LASER action and confidence of working were the two significant variables when the third-week assessment results were used. Similar to the first model, LASER precontemplation was the only significant variable when the sixth-week assessment results were used.

Our findings further supported the usefulness of adopting the stage of change model in describing the behavioral changes of workers suffering from chronic pain who underwent the six-week training and job placement program offered by the Hong Kong Workers' Health Centre (HKWHC). In the first three weeks of the program, the participants received counseling, and work and psychosocial adjustment training. The counseling component was geared toward helping the participants to re-establish their work-oriented goals and developing appropriate coping strategies for work injury and return to work. The work and psychosocial adjustment training, meanwhile, provided opportunities for the participants to learn and practice the skills required to adjust to the changes brought about by the resumption of a work role and by re-entering the open work force (Marhold, Linton, & Melin, 2001; Pfingsten et al., 1997). Though the design of this study did not enable us to draw a conclusion on the effectiveness of these training components, the changes in the readiness of the participants to return to work were likely to be associated with what they engaged in during the first three weeks of the work rehabilitation program they undertook at the HKWHC. Indeed, our findings were consistent with other studies. For example, Heather et al. (2004)

reported that readiness to change was a predictor of the functional outcomes of patients suffering from chronic pain. In their study, the outcomes were work status, worst pain, and depression. The results also showed that the precontemplation and action scores strongly correlated with the functional outcomes at the three-month follow up. Hernandez-Avila, Burleson, and Kranzler (1998) used the stage of change model to describe abstinence among alcoholics. They found that readiness for action contributed significantly to the prediction model in that individuals with a higher predisposition toward action were more likely to be abstinent. Several studies have suggested that self-efficacy also plays an important role in enhancing workers' return to work (Fitzgerald et al., 1989; Sandstrom & Esbjornsson, 1986). This was reflected in the significance of the confidence of returning to work variable in the prediction model.

Attorney Involvement – Gain and Loss Analysis

Our findings consistently revealed that attorney involvement was the strongest factor influencing the participants' return-to-work outcomes. First of all, the results indicated a significant difference in the proportions of participants who were pursuing civil claims between the two groups. A much higher proportion of participants (73.9%) in the non-return-to-work group were doing so than in the return-to-work group (40.9%). In fact, the attorney involvement variable was obtained at the baseline assessment. What this means is that the participants decided to pursue civil claims before they entered into the work rehabilitation program provided by the HKWHC. There were no participants who had not engaged in a civil claim at the time they entered the program but did engage in one after they commenced the program. Under the Hong Kong Employees' Compensation Ordinance, monetary compensation is determined after an injured worker undergoes an assessment by the Medical Assessment Board (MAB). The amount of the compensation depends on the loss of earning capacity, the worker's age, and his or her previous monthly income. Most of the participants' compensation was between HK$50,000 and HK$100,000. According to the system, injured workers can file civil claims by hiring a lawyer after the MAB assessment. There are in general two purposes of the legal proceedings: one is to appeal against the results of the assessment, while the other is to sue the company for negligence. If the civil claim is successful, it is very likely that the injured workers will get more monetary compensation, since the key factor in the civil claim is the loss of earning capacity. The consequence of making a civil claim, namely monetary return, can act as a significant incentive to injured workers. It is not surprising that the involvement of an attorney would have a negative effect on returning to work.

Our findings were consistent with other studies carried out in other parts of the world that found positive relationships between benefit levels and the occurrence of injury at work or the number of workers' compensation claims. In the United States, Hirsch et al. (1997) conducted a longitudinal survey of 109,913 injured workers and found significant positive relationships between the generosity of benefits and the filing of workers' compensation claims. In two earlier studies conducted by Butler and Worrall (1985) and Chelius (1976) which examined state-level claims and work injury cases, it was found that higher workers' compensation benefits were associated with a higher rate of reporting injury. These studies further explained that the tendency to file workers' compensation claims was likely to be due to the economic incentives involved in the process. Claim severity and frequency both tend to increase as the benefits increase.

The results revealed by all these studies indicate that the higher the level of compensation benefits, the higher would be the injury or claims rates. Such a phenomenon can be explained by the gain and loss theory proposed by Mayer, Gatchel, and Polatin (2004). Under the gain and loss theory, the benefits, particularly the financial assistance, which workers receive as a result of their injuries at work can be regarded as the "gain." In contrast, when the injured workers undergo work rehabilitation and recover from the residual disabilities, they would anticipate the "loss" of the workers' compensation benefits which they are entitled to and have been receiving. These "gain" and "loss" forces would work against each other and hence impact on the effectiveness of the work rehabilitation program and the return-to-work outcome (Mayer & Gatchel, 1988). The "gain" would be the resumption of gainful employment such as a full-time job and the generation of monthly income, whilst the "loss" would be a reduction in the benefits obtained from workers' compensation. Interestingly, the former scenario requires much effort and commitment from workers to combat their residual disabilities and improve their work capacity. In contrast, the latter scenario involves what the injured workers are eligible for and what is stipulated under the workers' compensation system. This gain and loss theory may further suggest that injured workers are always dilemmatic when they progress through the workers' compensation process. The outcomes of return to work, therefore, depend very much on how individual workers perceive the situation and weigh up the gains and losses. In Hong Kong, workers are not prevented from launching civil claims after receiving the compensations which they are eligible for such as sick leave and a lump-sum payment. This is different from the system in other countries such as the United States where injured workers cannot launch a claim after they opt to receive workers' compensation benefit. As a result, the amount of effort that workers need to put in to generate a successful return-to-work outcome will impact on their perceived "gain." This includes the severity of the injury and hence loss of work capacity, motivation, financial hardship, available of ready employment, and income generated from returning to work. The amount of compensation obtained after completing a civil claim and other potential benefits would impact on the "loss" of the workers. It seems that the workers' compensation system in Hong Kong imposes an imbalanced "gain" and "loss" on the work rehabilitation process and return-to-work outcomes. It is likely that workers would be inclined to put their focus on what they "lose" rather than what they "gain" from the work rehabilitation process. This was reflected in our results.

Besides the level of compensation benefits, the duration for which the workers are out of work after injury is another major factor that has been found to relate to the rate at which workers launch civil claims (Butler, 1983; Worrall & Appel, 1987). Rainville et al. (1997) found that workers' compensation seems to positively reinforce injured workers' perception of having a severe disability. They further explained that this phenomenon could be due to the fact that showing improvements would lead to reduced compensation benefits. As a result, injured workers with chronic pain are less likely to report improvements. However, this study did not attempt to explain whether this tendency is intentional or not. Other studies have reported that the benefit replacement rate is positively correlated with the post-injury duration of work absence (Baldwin, 2004; Butler et al., 2001).

Toward a Prediction Model

The prediction model developed in this study involved three equations which were based respectively on the assessment results obtained at admission, at the third week, and at the sixth week. The third-week point occurred at the end of the completion of three weeks of training in the six-week work rehabilitation program. The sixth-week point occurred at the end of the work rehabilitation program, at which point the participants underwent a three-week placement program. As a result, the first equation uses the admission status of the participants to predict their return-to-work outcomes three months after completing the work rehabilitation program. The second equation uses the status of the participants after receiving work skills and readiness training to predict the return-to-work outcomes. The third equation uses the status of the participants at the end of the work rehabilitation program to predict the same outcomes. At this stage, the participants had undergone both the training and job placement programs. The analysis generated two models, the first of which included the attorney involvement variable and the second of which did not. The interpretations of the two models are outlined in separate paragraphs below.

In the model with the attorney involvement variable entered into the logistic regression, the attorney involvement factor became significant in both the first and second equations. What this means is that whether the participants pursued civil claims or not largely determined their return-to-work outcomes. To be specific, the participants who were pursuing civil claims were found to have a lower chance of not returning to work. The odds ratios for the attorney involvement factor were 0.23 and 0.27 for the first (baseline) and second (third-week) equation respectively. In the second equation, in addition to the attorney involvement factor, the LASER action factor was a significant factor influencing return to work. Unlike with attorney involvement, those who scored higher on LASER action – that is, those who were more ready to engage in job hunting and interviews – were found to have a higher chance of returning to work. The odds ratio for readiness to return to work was 1.38. The baseline and third-week equations are:

Baseline:

Return to Work = 1.47 – 1.47 (attorney involvement)

Third week:

Return to Work = -3.58 – 1.31 (attorney involvement) + 0.32 (LASER action)

The differences in the predictors between the first and second equations are not surprising. Readiness of action means that the participants revealed their engagement in job-seeking and working activities. These are supposed to be the goal of the three-week training in the work rehabilitation program. It is therefore logical to assume that, after receiving the training, those who progressed well in the program would more readily look for a job and work in gainful employment. This would be reflected in their successful return-to-work outcomes. However, the design of this study did not allow a more conclusive interpretation to be drawn about the effectiveness of the program.

It is worth noting that the third equation (sixth week) only has one significant predictor which is LASER precontemplation. The odds ratio for readiness of precontemplation was 0.75. The regression equation is:

Return to Work = 4.45 – 0.29 (LASER precontemplation)

What this indicates is that if the participants reported that they still did not see the importance of returning to work, or perceived themselves as not having the abilities and skills to engage in work, the chances of their returning to work would be low three months after they completed the program. This again is logical in that if the participants, after six weeks of training and placement, did not change their attitude toward returning to work, it is very unlikely that they would change it when there were no more rehabilitation programs available to them. Their return-to-work outcomes would therefore tend to be negative.

In the model without the attorney involvement variable entered into the regression analysis, readiness of action was the major predictor. The first (baseline) equation only included readiness of action with an odds ratio of 1.25. This indicated that the more the participants were engaged in job-seeking and working activities, the more likely it would be that they would return to work after three months. The second equation (third week) was more or less the same, except that the confidence of returning to work factor also became a significant predictor. But this time, the odds ratios were higher: 1.41 and 1.39 for the confidence and readiness factors respectively. The third equation (sixth week) was similar to the first model (that included attorney involvement). The only significant factor was readiness of precontemplation. The odds ratio was 0.75, which again is comparable with the first model. The three regression equations are:

Baseline:

Return to Work = -2.63 + 0.22 (LASER action)

Third week:

Return to Work = -6.34 + 0.34 (confidence) + 0.33 (LASER action)

Sixth week:

Return to Work = 4.45 – 0.29 (LASER precontemplation)

Our findings were partially consistent with other prediction model studies of return to work. Terry et al. (2003) conducted a return-to-work study of 502 injured workers with chronic pain in Montana. The prediction model for return-to-work outcomes included age, education, attorney involvement, mandated vocational rehabilitation, and time from injury to referral. This five-factor prediction model correctly predicted 64.5% of return-to-work outcomes. Van der Giezen et al. (2000) also developed a five-factor model which predicted the tendency of injured workers suffering from low back pain to return to work. These factors included better general health status, better job satisfaction, being a breadwinner, being of a lower age, and reporting less pain. With a cut-off point of 0.65, the model generated an overall accuracy of 74% in predicting which workers would succeed in returning to work and which would not. There are three plausible explanations for the differences in the factors of the prediction models. As alluded to earlier, the inclusion of the readiness variable in our prediction model reflected the content of the work rehabilitation which the participants received. When the participants showed changes in their LASER action and precontemplation scores, these became two major factors of the prediction model. Another reason the prediction models could be that our prediction model depends heavily on the workers' compensation system. Like the workers in Terry et al.'s study, injured workers in Hong Kong are eligible to launch civil claims after they complete the workers' compensation process. In contrast, civil claims are not allowed in some other systems. Finally, the differences in the factors of the prediction models could be due to the study design and demographic characteristics of the participants. In our case, we used a three-stage prediction model and the participants were workers with chronic low back pain.

The Effect of the Workers' Compensation System in Hong Kong on the Prediction Model

In Hong Kong, statutory entitlement to indemnity for employees (or their dependants) who sustain work injuries is covered by the Employees' Compensation Ordinance (Hong Kong Labour Department, 2004). Under this ordinance, which was drafted in 1953, the compensations for work injuries are covered by private insurers, and all companies are required to join private insurance schemes. At the time of the drafting of the bill, the content made reference to the Workmen's Compensation Ordinance (East and West Africa) produced by the United Kingdom Colonial Office in 1937. In 1946, the legislation related to workers' compensation underwent a drastic change in the form of the National Insurance (Industrial Injuries) Acts. Under the new Acts, all compensations related to work injuries were covered by a centrally administered national insurance. Though the Employees' Compensation Ordinance of Hong Kong has been revised more than 15 times, the private compensation system by which individual employers and insurers are responsible for covering the compensations to employees remains unchanged (Albert & Ng, 1987).

Under the Hong Kong Ordinance, the Labour Department is vested with the authority to settle undisputed claims in work-related injury cases. In the case of disputed claims, the authority goes to the District Courts. It is here where injured workers have the right to launch litigation or civil claims against employers, particularly in regard to the negligence and liability associated with the injury (or accident). It is believed that the long litigation process has greatly hampered the motivation of workers and has led to their experiencing excessive psychological distress (Derebery et al., 1983; Schultz et al., 2004). This is one explanation for the strong influence of attorney involvement in the prediction model.

Though the existing Workers' Compensation Ordinance makes it possible for employees to launch litigation, it does not stipulate the importance of rehabilitation or return to work. It only stresses the importance of a medical consultation and assessment. As a result, the majority of workers are granted sick leave due to their injuries. However, sick leave does not necessarily mean that workers actively engage in work rehabilitation programs and return to work. Thus, those who receive appropriate rehabilitation services would have better return-to-work outcomes in a much shorter time. Those who do not receive appropriate rehabilitation services would end up having less favorable return-to-work outcomes. This would in turn weaken the contribution of other factors such as the age of workers and the duration of sick leave. Finally, the lack of incentives encouraging employers to actively participate in the return-to-work process also weakens the prediction model.

Comparisons between Logistic Regression and Case-based Reasoning Models

Case-based reasoning offers a different method of testing the usefulness of the same dataset for predicting the return-to-work outcomes of the participants. Case-based reasoning differs from conventional logistic regression in a number of ways. First of all, it does not need to fulfill the normal distribution assumption of the data. Its algorithm is similar to the actual clinical reasoning in that analysis of a case (new case) is based on the extent to which it matches the cases (old cases) which are known to the clinician. Case-based reasoning possesses a learning ability in that the rules and parameters can be further refined as more and more cases accumulate in the database. The more cases there are in the database, the better is the domain knowledge and hence the better is the matching and predicting of cases (Hatzilygeroudis, 2004).

The results of this study indicate that case-based reasoning using three constraints and 11 other matching variables does not better predict workers' return-to-work outcomes than the conventional logistic regression method. The best accuracy of prediction generated by case-based reasoning was 62.5% (63% reliability). This is compared to 71.2% derived from the logistic regression model (based on the admission assessment results). To further compare the usefulness of the two methods, additional logistic regression analyses were performed on the 32 new cases used for testing the case-based reasoning algorithm. The logistic regression equation derived for the baseline assessment results and excluding the attorney involvement was used:

Return to Work = -2.63 + 0.22 (LASER action),

where Return to Work denotes the likelihood of injured workers' returning to work and LASER action denotes the scores on the LASER action test.

The LASER-action scores of the 32 participants were between 4 and 20 (Mean=12). The return to work values were between -0.43 to 1.77 (Mean=0.01). The mean return to work value, i.e. 0.01 was used as the cut-off of which the predicted return to work outcome was predicted. Any values equal to or above 0.01 were regarded as positive return to work. In reverse, any values below 0.01 were regarded as negative outcomes. There were 19 participants who were predicted as having positive return to work outcome, whilst the other 13 were predicted as negative outcomes (Table 22). The accuracy of this prediction when compared with the actual outcomes was 59.4% (n=19). This is found similar to that of the case-based reasoning. The consistency of predicting positive return to work outcomes between the two models was 37.5% (n=12). The consistency between the negative outcome cases was 15.6% (n=5). To further explore the consistency between the prediction models, the cut-offs of the return to work scores were moved between -0.42 and 0.67. The results indicate that the accuracy of the predictions were largely comparable with that of 0.01. The accuracy of prediction began to drop to 50% if the cut-off score was set at $\geq$ 0.68, and 37.5% at $\geq$ 0.90. The consistency of the predictions between the two models remained stable.

Table 22. Comparisons of prediction of return to work based on logistic regression (use 0.01 as cut off) and case-based reasoning

Case Number	Predicted return to work outcome scores	Outcomes predicted by logistic regression (0.01 as cut off)	Outcomes predicted by case-based reasoning	Actual RTW*
15	-0.43	1	0	0
7	0.01	0	1	0
26	0.01	1	1	1
27	0.23	1	0	1
3	0.45	0	0	0
5	0.67	1	1	1
8	0.67	1	1	1
13	0.67	1	1	1
4	0.89	0	1	0
6	0.89	1	1	1
18	0.89	1	1	1
20	0.89	1	1	1
22	0.89	0	0	0
23	0.89	1	0	1
25	0.89	1	1	1
29	0.89	1	0	1
31	0.89	0	1	0
32	0.89	1	0	1
12	1.11	0	1	0
14	1.11	0	1	0
17	1.11	1	1	1
24	1.11	0	1	0
16	1.33	0	0	0
19	1.33	1	1	1
28	1.33	0	0	0
1	1.55	1	0	1
10	1.55	1	0	1
21	1.55	1	1	1
2	1.77	0	1	0
9	1.77	0	1	0
11	1.77	1	1	1
30	1.77	0	0	0

* Actual RTW denotes actual return to work outcomes of the participants; “1” represents positive return to work, whilst “0” represents not return to work.

The usefulness of the logistic regression and case-based reasoning models was compared. The results of the additional analyses presented in this section suggest that the two models are comparable to each other in terms of their accuracy. However, the consistency between the predicted outcomes generated from the two models seems to be low. In view of the small sample size, this observation is rather inconclusive. Further studies with larger sample size should therefore be conducted to further test the usefulness of these prediction models.

CHAPTER VI

CONCLUSION

This study is the first attempt to develop a prediction model on return to work for a group of Chinese injured workers who suffered from chronic pain in Hong Kong. The injured workers are all in the workers' compensation process and receiving a work rehabilitation program at the Hong Kong Workers' Health Centre. At the time of the study, a good proportion of them were in the process of launching civil claim against the employers for negligence or further compensation.

Our main findings are that after completing a six-week work rehabilitation program, about 70% of the workers were able to return to work. The majority of those who returned to work did not return to the pre-injured job and employer. Analyses of the demographic, and workers' compensation-related, and capacity-related variables indicate differences between the workers who returned to work and those who did not. Among them, the most significant discrepancy between the two groups of workers is proportion of workers launching a civil claim. This further reflects the problems in the existing workers' compensation system and that civil claim could unnecessary lengthen the time of which injured workers re-engage in gainful employments. Other factors which showed differences are: physical endurance, readiness, confidence, and perceived limitation. These differences properly indicate the changes which injured workers would experience after participating in a work rehabilitation program which focus on enhance the readiness of their returning to work. Two prediction models using conventional regression and case-based reasoning methods were developed. The results indicate that, with the use of logistic regression, the most significant factors for predicting workers' returning to work are attorney involvement (civil claim) and readiness of workers for action. The case-based reasoning requires many more variables. Nevertheless, both prediction models give fairly accurate prediction of workers' returning to work status which is around 60%.

The results of this study provide further evidence on the importance of work-related and psychosocial factors to influencing the return to work outcomes of injured workers. They also shed light on the notion that the return to work phenomenon can be closely related to the workers' compensation system and provision of work rehabilitation program. The findings inform the needs for make changes to the existing workers' compensation system, and design and delivery of work rehabilitation program. The two prediction models developed in this study are useful for clinicians to incorporate in their clinical reasoning on predicting individual worker's return to work outcomes. However, it is important to note that due to the small sample size, the accuracy and consistency of the prediction has not been optimized. The results are to be interpreted with caution.

There are several limitations to this study. First, the data was collected from a single group of injured workers who received intervention from a single service provider of work rehabilitation. This would weaken the generalization of the results to other groups of injured workers (not suffered from chronic pain) and other work rehabilitation interventions. Further studies can be conducted on workers in different stages of rehabilitation and/or with different impairments. The focus can also be put on different work rehabilitation interventions such as work reconditioning and work hardening, or early return to work program. Second, the sample size of this study is rather small. However, due to the time constraint set on the study, 67 participants were the maximum which were accumulated in the data base. This would hamper the power of the statistical analyses conducted in particularly the logistic regression and case-base reasoning. As a result, variables which might have been statistically significant could end up showing insignificance in the logistic regression. The accuracy of the case-based reasoning might have been largely lowered due to the small sample size. Future studies should target at using a large sample size and their results can be compared with those reported in this thesis. Third, most of the participants went through the workers’ compensation process and ended up launching a civil claim. Information on their progresses in terms of work-related capacity and readiness variables prior to admitting into the present work rehabilitation program is not complete. There could be variables important to the return to work outcome missing in this study. A few of them are prior work seeking experience and outcomes, changes in work-related variables in the early phase of the worker’s compensation system etc. More studies should be conducted on studying how these variables are changed throughout the entire return to work process.

Work rehabilitation is a new concept in the Chinese Mainland. The results of this study are believed to contribute to the future development of work rehabilitation in the Chinese Mainland. The findings provide evidence that enhancement of readiness of returning to work is the main thrust of a successful rehabilitation for injured workers. The notion that litigation is a major obstacle on return to work provides insight to rehabilitation workers and policy workers to device early return to work program and mediation strategies so as to minimize the negative impact of injured at work.

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APPENDICES

Appendix 1

Medical Assessment for Vocational Rehabilitation Project

Filled by Staff:

Name: ___________________ (________________) Age: ________ Sex: M / F

Occupational Record:____.

Work Injury / Occupational Disease:____.

Treatment / Rehabilitation Record:____.

Filled by Doctor:

1. Any special treatment further requested? Yes / No

____

____

2. Any special movement / types of occupation should be avoided due to the injury?

____

____

3. Any special exercise should be further practiced so as to strengthen the physical fitness?

____

4. Is the patient fit for job searching or finding? Yes / No

5. Other Remarks: ____

Date: ______________________ Signature of doctor:__________________________.

Appendix 2

香港工人健康中心

香港理工大學

項目：工傷及職業病患者康復就業支援服務

同意書

本人同意參與香港工人健康中心及香港理工大學康復治療科學系共同開發的康復就業支援服務及研究計畫。本人知道參與這個計畫會接受在能力、態度、心理及健康狀況的評估。評估的過程中需要利用簡單的器材、面試或問卷調查。評估的時間每次大概兩個半小時。本人明白在評估過程中可能感覺疲倦，但這感覺是短暫的，即在休息後會恢復正常。

本人有權在課程任何時間內提出終止服務及停止參與研究。本人也有權在評估過程中不回答認爲敏感的問題。本人知道在這個服務/研究中取得的資料是絕對保密的。本人同意給予香港工人健康中心及香港理工大學有限度地利用這些資料。這包括在培訓課程及就業輔導的個案安排，或在學術及教學的用途。但如作學術及教學之用時，本人的身份及背景將不會被披露，而本人也有權知道自己的資料及這些資料的用途。

學員簽署：____________________ 日期：__________

學員姓名：______________________

職員/研究人員姓名：____________________________

證人簽署：__________________ 日期：________________

證人姓名：_________________

Appendix 3

香港工人健康中心	姓名：____________ 身份證號碼：____________ 檔案號碼：____________ 檔案負責人：____________ 日期：____________
職業傷病康復者再培訓及就業服務 學員資料	

性別：	1. 男	2. 女
年齡：	1. 20 歲或以下 2. 21-30 歲 3. 41-50 歲	4. 31-40 歲 5. 51-60 歲 6. 61 歲或以上
教育程度：	1. 小六或以下 2. 中一至中三 3. 中四 至中五	4. 中六或以下 5.大專或以上 6. 特殊教育
婚姻狀況：	1. 未婚 2. 已婚	3. 離異 4. 喪偶
居住狀況：	1.獨居 2.配偶 3 子女 4. 父親	5. 母親 6. 兄弟姐妹 7. 其他
入息來源：	1. 就業 2. 病假期薪金 3. 儲蓄 4. 綜援 5. 傷殘津貼 6. 贍養費	-自己 - 配偶 - 子女 - 雙親 - 兄弟姐妹

工傷：
1. 眼
2. 上肢
3. 腰背
4. 腳
5. 其他

職業病類:
1. 手部腱鞘炎
2. 腕管綜合征
3. 職業性失聰
4. 皮膚病

已接受治療:
1. 藥物
2. 骨科
3. 手術
4. 物理治療
5. 職業治療

現時復診:
1. 每星期兩次
2. 每星期一次
3. 每四星期一次
4. 每六星期一次

5. 其他

5. 每三個月一次
6. 每六個月一次
7. 其他________

是否判傷： 1. 是 （結果:_______ %） 3. 未清楚 （估計日期:______ ）
2. 排期中 （日期:_______） 4. 其他 （___________________）

就業評估：

分類	正常	有困難	不能	不知道	備註
視覺	☐	☐	☐	☐	
聽覺	☐	☐	☐	☐	
說話	☐	☐	☐	☐	
舉起	☐	☐	☐	☐	
提起	☐	☐	☐	☐	
推移	☐	☐	☐	☐	
拿起	☐	☐	☐	☐	
站立	☐	☐	☐	☐	
步行	☐	☐	☐	☐	
久坐	☐	☐	☐	☐	
手腳協調	☐	☐	☐	☐	
談話應對	☐	☐	☐	☐	
數位理解	☐	☐	☐	☐	
文字理解	☐	☐	☐	☐	

技能：

1. 駕駛執照
2. 打字
3. 電腦
4. 會計
5. 電力裝置/維修
6. 語言
7. 其他

最近的三種工作經驗

職位： 收入： 日期： 離職原因：

____

____

____

有何工作要求：

行業	形式	時間	薪金
________________	1. 自雇	1. 固定日班	每月$__________
________________	2. 家庭或作業	2. 固定夜班	每日$__________

________________	3. 全職	3. 輪班	每時$__________
________________	4. 兼職 / 散工	4. 彈性時間	

地區要求:

1. 香港　　2. 九龍　　3. 新界

需避免的工作環境:		**氣氛要求:**
1. 戶內	6. 地面不平	1. 能單獨工作
2. 戶外	7. 空間狹窄	2. 能與他人共事
3. 嘈雜	8. 地滑 / 潮濕	3. 能與外界接觸
4. 悶熱	9. 不清潔地方	
5. 空氣污濁		

轉介來源:	
1. 醫生 / 護士	7. 中心宣傳海報
2. 物理治療師 / 職業治療師	8. 中心同事推介
3. 醫院社工 / 病人資源中心	9. 勞工團體
4. 其他服務團體社工	10. 工會
5. 勞工處資料	11. 議員
6. 雇員再培訓局資料	12. 其他

參加服務目的：	
1. 就業服務	5. 職業輔導
2. 技能提升	6. 其他
3. 轉業準備	
4. 職能評估	

<u>職員填寫</u>

其他資料：____

____

Appendix 4. Comparison of Work capacity between return to work and did not return to work

Variables	Mean (SD)											
	Baseline assessment				2nd assessment				3rd assessment			
	RTW	Not RTW	*t*	*p*	RTW	Not RTW	*t*	*p*	RTW	Not RTW	*t*	*p*
Strength (lbs)	28.46 (18.43)	28.33 (24.56)	0.02	0.98	31.79 (19.03)	26.52 (23.71)	0.98	0.33	29.30 (20.92)	27.05 (21.86)	0.41	0.69
The number of Repeated Tasks	12.44 (5.67)	12.62 (6.30)	-0.11	0.92	13.90 (5.69)	10.73 (5.22)	2.17	**0.03**	13.44 (5.17)	11.64 (6.46)	1.22	0.23
Average Left Hand Strength(Kg)	22.46 (10.60)	20.74 (9.27)	0.64	0.52	23.68 (11.02)	21.93 (9.10)	0.65	0.52	23.17 (11.44)	20.91 (13.96)	0.71	0.48
Average Right Hand Strength (Kg)	23.32 (12.19)	19.44 (14.06)	1.15	0.26	24.78 (12.87)	20.68 (12.84)	1.24	0.22	23.94 (12.06)	19.10 (16.70)	1.36	0.18
LLUMC	67.61 (55.4)	86.50 (54.61)	-1.31	0.19	53.09 (54.32)	72.17 (58.36)	-1.33	0.19	54.84 (57.12)	86.48 (55.39)	-2.18	**0.03**
Walking*	1.36 (0.49)	1.65 (0.57)	-2.17	**0.03**	1.34 (0.48)	1.34 (0.48)	-0.75	0.46	1.30 (0.46)	1.39 (0.50)	-0.79	0.44
Standing*	1.50 (0.51)	1.52 (0.51)	-0.17	0.87	1.41 (0.50)	1.41 (0.50)	0.14	0.89	1.34 (0.48)	1.43 (0.51)	-0.75	0.46
Sitting*	1.32 (0.47)	1.43 (0.51)	-0.94	0.35	1.30 (0.46)	1.30 (0.46)	-0.43	0.67	1.23 (0.42)	1.43 (0.59)	-1.66	0.10
Squatting*	1.68 (0.71)	1.61 (0.72)	0.40	0.69	1.57 (0.73)	1.57 (0.73)	-0.45	0.65	1.55 (0.70)	1.61 (0.72)	-0.35	0.73
Stooping*	1.70 (0.67)	1.43 (0.59)	1.63	0.11	1.39 (0.54)	1.39 (0.54)	-1.32	0.19	1.43 (0.59)	1.52 (0.51)	-0.62	0.54
Crouching*	1.80 (0.79)	1.57 (0.73)	1.16	0.25	1.59 (0.73)	1.59 (0.73)	-0.33	0.74	1.55 (0.73)	1.65 (0.71)	-0.57	0.57
Kneeling*	1.61 (0.81)	1.43 (0.59)	0.93	0.35	1.36 (0.61)	1.36 (0.61)	0.39	0.70	1.23 (0.42)	1.39 (0.66)	-1.24	0.22

Crawling*	1.70 (0.79)	1.87 (0.69)	-0.84	0.40	1.45 (0.66)	1.45 (0.66)	-1.65	0.11	1.36 (0.57)	1.61 (0.66)	-1.58	0.12
Climbing*	1.63 (0.75)	1.83 (0.49)	-1.10	0.28	1.41 (0.69)	1.41 (0.69)	-0.95	0.34	1.34 (0.53)	1.57 (0.59)	-1.59	0.12
LASER Pre-contemplation	14.05 (4.00)	14.87 (3.42)	-0.84	0.41	12.43 (2.92)	14.78 (3.13)	-3.03	< **0.01**	12.76 (3.64)	15.35 (2.79)	-2.96	< **0.01**
LASER Contemplation	15.84 (1.76)	15.22 (2.24)	1.24	0.22	16.21 (2.13)	15.09 (2.76)	1.84	0.07	15.71 (3.32)	15.13 (2.46)	0.74	0.46
LASER Action	15.49 (2.04)	14.04 (3.38)	2.17	**0.03**	16.24 (2.74)	14.65 (3.07)	2.14	**0.04**	15.93 (3.20)	14.96 (2.59)	1.25	0.22
STAI-C	55.43 (10.14)	55.65 (11.32)	-0.08	0.94	52.89 (12.49)	54.00 (10.29)	-0.37	0.72	52.89 (9.83)	57.78 (10.69)	-1.88	0.07
Physical Functioning (PF)	21.25 (4.72)	21.09 (3.98)	0.14	0.89	21.70 (4.65)	21.22 (3.75)	0.43	0.67	22.32 (5.01)	19.96 (4.04)	1.95	0.06
Role Physical (RP)	5.34 (1.40)	4.61 (1.23)	2.12	**0.04**	5.00 (1.31)	4.96 (1.46)	0.12	0.90	5.32 (1.70)	4.78 (1.24)	1.34	0.19
Bodily Pain (BP)	5.58 (1.98)	5.44 (1.67)	0.29	0.77	6.01 (2.07)	5.34 (1.52)	1.36	0.18	5.61 (2.28)	5.26 (1.58)	0.66	0.51
General Health (GH)	15.50 (3.86)	15.09 (2.97)	0.45	0.66	15.30 (3.43)	15.09 (2.88)	0.25	0.80	15.02 (3.22)	14.87 (3.04)	0.19	0.85
Vitality (VT)	21.25 (4.72)	21.09 (3.98)	1.39	0.17	21.70 (4.65)	21.22 (3.75)	0.48	0.63	22.32 (5.01)	19.96 (4.04)	1.76	0.08
Social Functioning (SF)	5.34 (1.40)	4.61 (1.23)	0.37	0.71	5.00 (1.31)	4.96 (1.46)	0.71	0.48	5.32 (1.70)	4.78 (1.24)	2.08	**0.04**
Role Emotional (RE)	5.58 (1.98)	5.44 (1.67)	2.00	**0.05**	6.01 (2.07)	5.34 (1.52)	0.45	0.65	5.61 (2.28)	5.26 (1.58)	2.06	**0.04**
Mental Health (MH)	15.50 (3.86)	15.09 (2.97)	0.36	0.72	15.30 (3.43)	15.09 (2.88)	-0.16	0.87	15.02 (3.22)	14.87 (3.04)	1.61	0.11

* represents confidence of working (functional limitation)

Appendix 5. Correlations among work status and demographic measures

	1	2	3	4	5	6	7	8	9	10	11	12
1.RTW (yes or no)	1	0.12	-0.03	-0.07	0.03	0.04	-0.22	0.06	-0.10	**-0.31****	-0.22	-0.20
2.Gender (male or female)		1	0.07	0.13	-0.10	0.02	-0.51**	0.30*	0.13	0.15	-0.13	0.06
3.Age (<45, >45)			1	-0.33**	0.34**	-0.06	-0.07	0.27*	-0.02	-0.16	-0.19	0.05
4.Education Level (3 levels)				1	-0.23	-0.02	-0.21	-0.25	0.05	-0.01	0.00	-0.10
5.Marital status(single or not)					1	0.25	0.15	0.37**	0.02	-0.03	0.18	0.26
6.Members Living with (alone or not)						1	-0.17	0.24	0.10	0.00	-0.04	-0.14
7. Previous monthly income (3 levels)							1	-0.15	-0.03	0.04	0.15	0.18
8. Breadwinner (yes or not)								1	-0.03	0.12	0.07	0.07
9. Type of injury (LBP or not)									1	-0.07	0.07	0.13
10. Attorney involvement (yes or not)										1	0.04	0.06
11. Injury to referral (<12 m or >12 m)											1	0.49**
12. Duration of sick leave (<12 m or >12 m)												1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Appendix 6. Correlations among work status and functional capacity measures at baseline assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.RTW (yes or no)	1	0.00	-0.02	0.08	0.14	**-0.26***	-0.02	-0.12	0.05	0.20	0.14	0.12	-0.10	-0.14
2.Valpar 19 - strength		1	0.38**	0.53**	0.46**	-0.10	-0.16	-0.10	-0.18	-0.14	-0.17	-0.09	-0.23	-0.40**
3.Valpar 19 - Endurance tasks			1	0.05	-0.06	-0.06	-0.04	-0.18	0.07	-0.16	-0.04	-0.12	-0.06	-0.08
4.Average left grip strength				1	0.48**	-0.15	-0.05	-0.10	-0.20	-0.18	-0.16	-0.16	-0.18	-0.16
5.Average right grip strength					1	-0.06	0.04	0.04	-0.06	-0.03	0.00	-0.02	-0.03	-0.18
6.Walking						1	0.75**	0.58**	0.63**	0.35**	0.58**	0.38**	0.32**	0.39**
7.Standing							1	0.55**	0.71**	0.38**	0.65**	0.49**	0.36**	0.41**
8.Sitting								1	0.50**	0.40**	0.44**	0.41**	0.32**	0.29*
9.Squatting									1	0.66**	0.90**	0.62**	0.38**	0.54**
10.Stooping										1	0.74**	0.61**	0.39**	0.49**
11.Crouching											1	0.67**	0.40**	0.47**
12.Kneeling												1	0.58**	0.48**
13.Crawling													1	0.45**
14. Climbing														1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 7: Correlations among work status and clinical measures at the baseline assessment

	1	2	3	4	5	6	7	8
1.RTW (yes or no)	1	-0.16	0.24	-0.10	0.15	**0.26***	-0.01	-0.19
2.LLUMC		1	-0.32*	0.25*	-0.46**	-0.46**	0.15	-0.08
3.Confidence of RTW			1	-0.35**	0.23	0.23	-0.49**	-0.11
4.LASER pre-contemplation				1	-0.42**	-0.28*	0.31*	0.41**
5.LASER contemplation					1	0.69**	-0.25*	-0.17
6.LASER action						1	-0.13	-0.14
7.STAI – C							1	0.12
8.Pain intensity (1-4, 5-6, 7-10)								1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 8. Correlations among work status and SF36 measures at the baseline assessment

	1	2	3	4	5	6	7	8	9
1.RTW (yes or no)	1	0.02	**0.25***	0.04	0.06	0.17	0.05	**0.24***	0.05
2.Physical functioning		1	0.29*	0.51**	0.33**	0.37**	0.54**	0.23	0.47**
3.Role physical			1	0.45**	0.15	0.50**	0.57**	0.79**	0.41**
4.Bodily pain				1	0.31*	0.51**	0.61**	0.53**	0.56**
5.General health					1	0.47**	0.36**	0.26*	0.41**
6.Vitality						1	0.59**	0.53**	0.69**
7.Social functioning							1	0.54**	0.63**
8.Role emotional								1	0.54**
9.Mental health									1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 9. Correlations among work status and functional capacity measures at the second assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.RTW (yes or no)	1	0.12	**0.27***	0.08	0.15	-0.09	0.02	-0.05	-0.06	-0.16	-0.04	0.05	-0.20	-0.12
2.Valpar 19 - strength		1	0.34**	0.58**	0.60**	-0.08	-0.25*	-0.35**	-0.33**	-0.24	-0.31*	-0.16	-0.34**	-0.23
3.Valpar 19 - Endurance tasks			1	0.16	0.04	-0.17	-0.16	-0.35**	-0.20	-0.03	-0.12	-0.12	-0.13	-0.01
4.Average left grip strength				1	0.43**	-0.15	-0.23	-0.24	-0.361**	-0.11	-0.24	-0.19	-0.16	-0.06
5.Average right grip strength					1	-0.06	-0.10	-0.18	-0.18	-0.05	-0.11	-0.09	-0.13	-0.05
6.Walking						1	0.69**	0.61**	0.44**	0.46**	0.42**	0.29*	0.19	0.32**
7.Standing							1	0.69**	0.55**	0.52**	0.49**	0.40**	0.23	0.27*
8.Sitting								1	0.52**	0.46**	0.50**	0.32**	0.26*	0.22
9.Squatting									1	0.52**	0.90**	0.72**	0.37**	0.48**
10.Stooping										1	0.58**	0.42**	0.52**	0.50**
11.Crouching											1	0.71**	0.45**	0.57**
12.Kneeling												1	0.50**	0.62**
13.Crawling													1	0.63**
14. Climbing														1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 10. Correlations among work status and clinical measures at the second assessment

	1	2	3	4	5	6	7	8
1.RTW (yes or no)	1	-0.16	**0.30***	**-0.36****	0.23	**0.26***	-0.05	-0.07
2.LLUMC		1	-0.30*	0.27*	-0.51**	-0.43**	0.17	0.14
3.Confidence of RTW			1	-0.38**	0.30*	0.40**	-0.36**	-0.13
4.LASER pre-contemplation				1	-0.45**	-0.47**	0.31*	0.25*
5.LASER contemplation					1	0.75**	-0.13	-0.30*
6.LASER action						1	-0.28*	-0.36**
7.STAI – C							1	0.26*
8.Pain intensity (1-4, 5-6, 7-10)								1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 11. Correlations among work status and SF36 measures at the second assessment

	1	2	3	4	5	6	7	8	9
1.RTW (yes or no)	1	0.05	0.02	0.17	0.03	0.06	0.09	0.06	-0.02
2.Physical functioning		1	0.51**	0.59**	0.33**	0.51**	0.47**	0.44**	0.37**
3.Role physical			1	0.50**	0.11	0.52**	0.54**	0.65**	0.38**
4.Bodily pain				1	0.35**	0.58**	0.68**	0.57**	0.52**
5.General health					1	0.43**	0.36**	0.24*	0.36**
6.Vitality						1	0.68**	0.59**	0.58**
7.Social functioning							1	0.68**	0.68**
8.Role emotional								1	0.64**
9.Mental health									1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 12: Correlations among work status and functional capacity measures at the third assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.RTW (yes or no)	1	0.05	0.15	0.09	0.17	-0.10	-0.09	-0.20	-0.04	-0.08	-0.07	-0.15	-0.19	-0.19
2.Valpar 19 - strength		1	0.33**	0.48**	0.48**	-0.23	-0.18	-0.37**	-0.17	-0.23	-0.28*	-0.27*	-0.38**	-0.39**
3.Valpar 19 - Endurance tasks			1	0.13	0.06	-0.10	-0.03	-0.34**	-0.03	0.12	-0.02	-0.02	-0.19	-0.18
4.Average left grip strength				1	0.66**	-0.19	-0.14	-0.13	-0.26*	-0.32**	-0.28*	-0.19	-0.23	-1.30*
5.Average right grip strength					1	-0.10	-0.10	-1.13	-0.22	-0.28*	-0.21	-0.11	-0.03	-0.31*
6.Walking						1	0.78**	0.42**	0.53**	0.39**	0.54**	0.48**	0.22	0.57**
7.Standing							1	0.41**	0.52**	0.52**	0.49**	0.54**	0.30*	0.59**
8.Sitting								1	0.29*	0.37**	0.27*	0.38**	0.41**	0.42**
9.Squatting									1	0.67**	0.87**	0.64**	0.25*	0.71**
10.Stooping										1	0.56**	0.59**	0.23	0.54**
11.Crouching											1	0.53**	0.19	0.67**
12.Kneeling												1	0.55**	0.64**
13.Crawling													1	0.47**
14. Climbing														1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 13: Correlations among work status and clinical measures at the third assessment

	1	2	3	4	5	6	7	8
1.RTW (yes or no)	1	**-0.26***	**0.33***	**-0.35****	0.09	0.16	-0.23	-0.04
2.LLUMC		1	-0.10	0.31*	-0.28*	-0.25*	0.27*	0.16
3.Confidence of RTW			1	-0.34*	-0.02	-0.03	-0.24	-0.08
4.LASER pre-contemplation				1	-0.35**	-0.37**	0.42**	0.28*
5.LASER contemplation					1	0.92**	-0.41**	-0.18
6.LASER action						1	-0.38**	-0.14
7.STAI – C							1	0.16
8.Pain intensity (1-4, 5-6, 7-10)								1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 14. Correlations among work status and SF36 measures at the third assessment

	1	2	3	4	5	6	7	8	9
1.RTW (yes or no)	1	0.24	0.16	0.08	0.02	0.21	**0.25***	**0.25***	0.20
2.Physical functioning		1	0.55**	0.53**	0.45**	0.41**	0.54**	0.49**	0.42**
3.Role physical			1	0.56**	0.42**	0.61**	0.61**	0.76**	0.48**
4.Bodily pain				1	0.45**	0.52**	0.56**	0.50**	0.55**
5.General health					1	0.53**	0.51**	0.38**	0.41**
6.Vitality						1	0.62**	0.59**	0.67**
7.Social functioning							1	0.57**	0.54**
8.Role emotional								1	0.45**
9.Mental health									1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 15. Correlations among attorney involvement and demographic measures

	1	2	3	4	5	6	7	8	9	10	11
1. Attorney involvement	1	0.15	-0.16	-0.01	-0.03	0.00	0.04	0.12	-0.07	0.04	0.06
2. Gender (male or female)		1	0.07	0.13	-0.09	0.02	-.507**	0.29*	0.13	-0.13	0.06
3. Age (<45, >45)			1	-0.33**	0.34**	-0.06	-0.07	0.27*	-0.02	-0.19	0.05
4. Education level (three levels)				1	-0.23	-0.02	-0.21	-0.25	0.05	0.00	-0.10
5. Marital status (single or not)					1	0.25	0.15	0.37**	0.02	0.18	0.26
6. Living status (alone or not)						1	-0.17	0.24	0.09	-0.04	-0.14
7. Previous monthly income (three levels)							1	-0.15	-0.03	0.15	0.18
8. Breadwinner (yes or no)								1	-0.03	0.07	0.07
9. Type of injury (LBP or not)									1	.07	0.13
10. Injury to referral (<12 months or >12 months)										1	0.49**
11. Duration of sick leave (<12 months or >12 months)											1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix 16. Correlations among attorney involvement and functional capacity measures at the baseline assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Attorney involvement	1	-0.02	0.09	-0.16	-0.23	0.16	0.19	0.03	0.13	-0.21	0.04	-0.09	-0.03	0.02
2. VALPAR #19 – strength		1	0.38**	0.53**	0.46**	-0.09	-0.16	-0.09	-0.18	-0.14	-0.17	-0.09	-0.23	-0.40**
3. VALPAR #19 – endurance tasks			1	0.05	-0.06	-0.06	-0.04	-0.18	0.07	-0.16	-0.04	-0.12	-0.06	-0.08
4. Average left-hand grip strength				1	0.48**	-0.15	-0.05	-0.09	-0.20	-0.18	-0.16	-0.16	-0.18	-0.16
5. Average right-hand grip strength					1	-0.06	0.04	0.04	-0.06	-0.03	0.00	-0.02	-0.03	-0.18
6. Walking						1	0.75**	0.58**	0.63**	0.35**	0.58**	0.38**	0.32**	0.39**
7. Standing							1	0.55**	0.71**	0.38**	0.65**	0.49**	0.36**	0.41**
8. Sitting								1	0.50**	0.40**	0.44**	0.41**	0.32**	0.29*
9. Squatting									1	0.66**	0.89**	0.62**	0.38**	0.54**
10. Stooping										1	0.74**	0.61**	0.39**	0.49**
11. Crouching											1	0.67**	0.39**	0.47**
12. Kneeling												1	0.58**	0.48**
13. Crawling													1	0.45**
14. Climbing														1

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Appendix 17. Correlations among attorney involvement and clinical measures at the baseline assessment

	1	2	3	4	5	6	7	8
1. Attorney involvement	1	0.21	-0.16	0.27*	-0.21	-0.24	0.18	0.09
2. LLUMC		1	-0.32*	0.25*	-0.46**	-0.46**	0.15	-0.08
3. Confidence of RTW			1	-0.35**	0.23	0.23	-0.49**	-0.11
4. LASER precontemplation				1	-0.42**	-0.28*	0.31*	0.41**
5. LASER contemplation					1	0.69**	-0.25*	-0.17
6. LASER action						1	-0.13	-0.14
7. STAI-C							1	0.12
8. Pain intensity (1-4, 5-6, 7-10)								1

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Appendix 18. Correlations among attorney involvement and SF-36 measures at the baseline assessment

	1	2	3	4	5	6	7	8	9
1. Attorney involvement	1	-0.24	-0.27*	-0.24	0.00	-0.25*	-0.26*	-0.23	-0.19
2. Physical functioning		1	0.29*	0.51**	0.33**	0.37**	0.54**	0.23	0.47**
3. Role physical			1	0.45**	0.15	0.50**	0.57**	0.79**	0.41**
4. Bodily pain				1	0.31*	0.51**	0.61**	0.53**	0.56**
5. General health					1	0.47**	0.36**	0.26*	0.41**
6. Vitality						1	0.59**	0.53**	0.69**
7. Social functioning							1	0.54**	0.63**
8. Role emotional								1	0.54**
9. Mental health									1

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).