Psychological influences on return to work outcomes: The central role of recovery expectancies

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Abstract

Research suggests that pain-related psychological variables such as depression, pain catastrophizing, fear of movement and perceived injustice are associated with work disability following musculoskeletal injury. However, little is known about the mechanisms underlying the relationships between pain-related psychological variables and return-to-work (RTW) outcomes. Evidence from several lines of research suggests that recovery expectancies may be one of the final common pathways by which pain-related psychological variables impact on RTW outcomes. The purpose of this thesis was to examine whether recovery expectancies mediate the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury.

Study 1 examined the mediating role of recovery expectancies on the relationship between depressive symptoms and RTW outcomes. This prospective study reported on 109 individuals with work-related musculoskeletal injuries who participated in a 7-week physiotherapy rehabilitation program. Within one week of entering the program, participants reported on their recovery expectancies, depressive symptoms and pain intensity. At 1-year follow-up, participants provided details about their work status. Receiver Operating Characteristic curve analyses were used to identify the expectancy cut-score that best distinguished between individuals who returned to work and those who remained work-disabled at 1-year follow-up. The results revealed that recovery expectancies significantly mediated the relationship between depressive symptoms and RTW outcomes following work-related musculoskeletal injury.

Study 2 investigated the mediating role of recovery expectancies on the relationships between pain catastrophizing and RTW outcomes, and fear of movement and RTW outcomes.

This prospective study reported on 154 individuals with whiplash-associated disorders who participated in a 7-week multidisciplinary rehabilitation program. At baseline, participants reported on their recovery expectancies, pain catastrophizing, fear of movement and pain intensity. At 1-year follow-up, participants provided details about their work status. Receiver Operating Characteristic curve analyses were used to identify the expectancy cut-score in relation to work status at 1-year follow-up. The results revealed that recovery expectancies partially mediated the relationship between pain catastrophizing and RTW outcomes, and fully mediated the relationship between fear of movement and RTW outcomes following whiplash injury.

Results from Study 1 and 2 provided strong evidence for the mediating role of recovery expectancies on the relationships between pain-related psychological variables and work disability. The goal of Study 3 was to extend these findings and to examine the mediating role of expectancies on the relationship between perceived injustice and RTW outcomes. Several investigations have shown that high levels of perceived injustice are associated with prolonged work disability following musculoskeletal injury. However, little is currently known about the processes by which perceived injustice impacts on RTW outcomes. Study 3 utilized the same sample of individuals with whiplash-associated disorders as in Study 2. The results revealed that recovery expectancies significantly mediated the relationship between perceived injustice and RTW outcomes following whiplash injury.

Taken together, the findings from the present thesis provide evidence for the central role of recovery expectancies on the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury. Our findings argue for greater attention to recovery expectancies as risk factors for work disability and as potential targets of intervention

following musculoskeletal injury. The theoretical and clinical implications of our findings are discussed.

Résumé

La recherche démontre que les facteurs psychologiques liés à la douleur, tels que la dépression, la pensée catastrophique, la peur du mouvement et les sentiments d'injustice sont associés avec l'incapacité au travail suite à une blessure musculosquelettique. Cependant, nous en connaissons peu sur les mécanismes qui sous-tendent les relations entre les facteurs psychologiques liés à la douleur et le retour au travail. Les résultats provenant de plusieurs lignes de recherche suggèrent que les attentes envers le rétablissement pourraient représenter l'une des voies communes finales par laquelle les facteurs psychologiques liés à la douleur influencent le retour au travail. Le but de cette thèse était d'examiner si les attentes envers le rétablissement jouent un rôle médiateur sur les relations entre les facteurs psychologiques liés à la douleur et le retour au travail suivant une blessure musculosquelettique.

La première étude a examiné le rôle médiateur des attentes envers le rétablissement sur la relation entre les symptômes de la dépression et le retour au travail. Cette étude prospective comprenait un échantillon de 109 individus ayant des blessures musculosquelettiques liées au travail ayant participé à un programme de physiothérapie d'une durée de 7 semaines. Durant la première semaine du programme, les participants ont indiqué leurs attentes envers le rétablissement, de même que leurs symptômes de la dépression et leur intensité de douleur. Lors du suivi annuel, les participants ont fourni des détails sur leur statut de travail. Une analyse de la fonction d'efficacité du récepteur (courbe ROC) a été utilisée pour identifier le résultat des attentes envers le rétablissement qui permettait au mieux de distinguer les personnes qui ont retournées au travail et celles qui ont demeurées en arrêt de travail. Les résultats ont révélé que les attentes envers le rétablissement expliquent comment les symptômes de la dépression influencent le retour au travail suivant une blessure musculosquelettique liée au travail.

La deuxième étude a examiné le rôle médiateur des attentes envers le rétablissement sur la relation entre les pensées catastrophiques et le retour au travail, ainsi que sur la relation entre la peur du mouvement et le retour au travail. Cette étude prospective comprenait un échantillon de 154 individus atteints de blessures cervicales qui participaient à un programme de réadaptation multidisciplinaire d'une durée de 7 semaines. Dès le début du programme, les participants ont indiqué leurs attentes envers le rétablissement, de même que leurs niveaux de pensées catastrophiques, de leur peur du mouvement et de leur intensité de douleur. Lors d'un suivi annuel, les participants ont fourni des détails sur leur statut au travail. Des analyses de la courbe ROC ont été utilisées pour identifier le score d'attentes envers le rétablissement en fonction du statut de travail. Les résultats ont révélé que les attentes envers le rétablissement ont partiellement influencé la relation entre la pensée catastrophique et le retour au travail, et ont entièrement expliqué la relation entre la peur du mouvement et le retour au travail suite à une blessure cervicale.

Les résultats des études 1 et 2 ont fourni des preuves consistantes du rôle médiateur des attentes envers le rétablissement sur la relation entre les variables psychologiques liées à la douleur et l'incapacité au travail suivant une blessure musculosquelettique. L'objectif de l'étude 3 visait donc à développer les recherches précédentes et à examiner le rôle médiateur des attentes envers le rétablissement sur la relation entre les sentiments d'injustice et le retour au travail. Plusieurs recherches ont démontré que les sentiments d'injustice élevés sont associés avec une absence de travail prolongée. Cependant, nous en connaissons très peu sur les processus par lesquels les sentiments d'injustice influencent le retour au travail. L'étude 3 a utilisé le même échantillon d'individus ayant des blessures cervicales que dans l'étude 2. Les résultats ont révélé

que les attentes envers le rétablissement expliquent de quelle manière les sentiments d'injustice influencent le retour au travail suivant une blessure une blessure cervicale.

Dans l'ensemble, les résultats obtenus dans cette thèse mettent en lumière le rôle central des attentes envers le rétablissement sur les relations entre les variables psychologiques liés à la douleur et le retour au travail suivant une blessure musculosquelettique. Les résultats soulignent l'importance de porter attention aux attentes envers le rétablissement comme étant des facteurs de risque pour l'incapacité au travail et comme étant des cibles d'intervention potentielles suivant une blessure musculosquelettique. Les implications théoriques et cliniques de nos résultats seront discutées.

Contribution of authors

This thesis consists of three multi-authored manuscripts. The author of this thesis, Mrs. Junie Carriere, was the primary author on each of these manuscripts. Study 1 was co-authored with Dr. Pascal Thibault and Dr. Michael Sullivan, Mrs. Carriere's PhD supervisor. Study 2 was co-authored with Dr. Pascal Thibault, Mrs. Maria Milioto and Dr. Michael Sullivan. Study 3 was co-authored with Dr. Pascal Thibault, Mrs. Heather Adams, Mrs. Maria Milioto, Dr. Blaine Ditto and Dr. Michael Sullivan. As lead author of all three studies, Mrs. Carriere planned and performed all data analyses, wrote the manuscripts, and responded to reviewers following submission of the manuscripts. Dr. Michael Sullivan provided guidance and support for all studies with respect to study design, data analysis, manuscript preparation and revisions. Dr. Pascal Thibault assisted with study design, data collection, and revisions for all three studies. Mrs. Maria Milioto assisted with data collection for all three studies. Mrs. Heather Adams and Dr. Blaine Ditto assisted with manuscript preparation and revisions for Study 3. The studies presented in this thesis represent original scholarship and distinct contributions to knowledge.

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Chapter 1: General introduction

Musculoskeletal disorders are considered to be among the most costly health conditions currently affecting the working age population. Musculoskeletal disorders include a number of conditions, such as back pain, neck pain, shoulder pain, whiplash injury, carpal tunnel syndrome, and osteoarthritis. These conditions have been associated with high rates of healthcare utilization, prolonged periods of sick leave and work disability following injury (Young, Besen, & Choi, 2015). In North America, musculoskeletal disorders are associated with higher rates of work disability than any other health condition (Woolf & Pfleger, 2003). In Canada alone, the annual direct costs associated with musculoskeletal disorders have been estimated to be in excess of 25 billion dollars (Coyte, Asche, Croxford, & Chan, 1998).

Common causes of musculoskeletal conditions include traumatic injuries sustained in the workplace or in motor-vehicle accidents. Musculoskeletal conditions can arise from activities or incidents involving repetitive movements, forceful movements, postural strain, overuse, prolonged immobilization, falls and contact with objects or equipment (Gatchel & Schultz, 2014; Gunta & Hightower, 2010; Levy, Wagner, Rest, & Weeks, 2005). Work-related musculoskeletal conditions involving the spine (e.g. back and neck conditions) represent the single largest category of injury for which time-loss claims are made (Bureau of Labor Statistics, 2007; Sullivan, Simmonds, & Velly, 2011b). Recent Canadian statistics report that in 2015, 55 237 time-loss claims were accepted by work injury insurers for back and spine injuries. In the same year, 8 428 time-loss claims were accepted for motor-vehicle accidents, 80% of which are typically due to whiplash injury (Association of workers compensation boards of Canada, 2016; Cassidy et al., 2000).

Considerable research has been conducted on trajectories of recovery following

musculoskeletal injury. Although approximately 50% of individuals who sustain a work-related musculoskeletal injury return to work within weeks, a significant proportion of individuals remain work-disabled for prolonged periods of time. Individuals who remain work-disabled at 3-months post-injury have a high likelihood of permanent disability (Spitzer, 1995; Turner et al., 2004). A similar pattern of recovery trajectories has been reported in samples of individuals who have sustained work-disabling whiplash injuries (Carroll et al., 2008; Sterling, Jull, & Kenardy, 2006).

The high costs associated with musculoskeletal disorders have been discussed from multiple perspectives. From an individual perspective, work disability can lead to suffering, loss of purpose, financial difficulty, social isolation, and mental health issues (Cancelliere et al., 2016). From an economic perspective, work disability entails losses related to productivity and tax revenue, and replacement costs of absent workers (Stewart, 2013). The economic impact has also been addressed from a healthcare perspective. Healthcare-related costs can include medical services, hospitalizations, diagnostic tests, medications and other treatments (Buckle & Jason Devereux, 2002; MacKay, Canizares, Davis, & Badley, 2010). As a result of the enormous costs associated with prolonged work disability, considerable research has been devoted to the identification of risk factors that distinguish between individuals who will return to work and those who will remain work-disabled following musculoskeletal injury (Hallegraeff, Krijnen, van der Schans, & de Greef, 2012; Iles, Davidson, & Taylor, 2008).

Early research in this area focused on the physiological determinants of work disability. Studies examined the potential role of pain intensity, restricted motion, physical tolerance and functional capacity on recovery following musculoskeletal injury (Schultz, Crook, Fraser, & Joy, 2000). Surprisingly, physical variables such as restricted motion, physical tolerance and

functional capacity emerged as poor predictors of work disability following musculoskeletal injury (Fishbain et al., 1993; Hildebrandt, Pfingsten, Saur, & Jansen, 1997). The most consistent finding was that pain intensity was significantly associated with prolonged work disability following musculoskeletal injury (Fishbain et al., 1993). However, the magnitude of the relation between pain intensity and prolonged work disability was found to be modest at best. The results of numerous studies revealed that pain intensity accounted for only approximately 10% of the variance in prolonged work disability (Dionne et al., 2007; Gauthier, Sullivan, Adams, Stanish, & Thibault, 2006; Shaw, Pransky, Patterson, & Winters, 2005; Sullivan & Rothfels, 2012). The failure to identify reliable physiological predictors of prolonged work disability prompted consideration of the non-medical variables that might be influencing return-to-work (RTW) outcomes following musculoskeletal injury (Engel, 1977).

Over the past two decades, biopsychosocial models of work disability have emerged as the dominant conceptual frameworks guiding research and treatment on work disability associated with musculoskeletal conditions (Feuerstein, 1991; Gatchel, 2004). The first biopsychosocial model of work disability following musculoskeletal injury was proposed by Michael Feuerstein in 1991 (Feuerstein, 1991). In this model, Feuerstein suggested that work disability following musculoskeletal injury could be construed as the consequence of the interaction of medical factors, physical capabilities, work demands and psychological factors. According to Feuerstein, psychological factors such as worker's traits, psychological readiness, coping and emotional distress play an important role in the degree and duration of disability that an individual might experience following injury (Feuerstein, 1991; Feuerstein & Thebarge, 1991; Feuerstein et al., 1993). Since the early work of Feuerstein, several elaborations and extensions of biopsychosocial conceptualizations of work disability have been put forward (Gatchel, Peng,

Peters, Fuchs, & Turk, 2007; Gatchel, Polatin, & Kinney, 1995; Jensen, Stengaard-Pedersen, Jensen, & Nielsen, 2013; Schultz et al., 2004; Schultz, Stowell, Feuerstein, & Gatchel, 2007). These models share in common the view that a complete understanding of work disability requires consideration of physical, psychological and social factors.

Biopsychosocial models have been important in drawing attention to the role of psychological variables on RTW outcomes following musculoskeletal injury. For example, numerous studies suggest that depressive symptoms associated with musculoskeletal disorders may increase the risk for prolonged work disability (Gatchel & Schultz, 2014; Sullivan & Stanish, 2003; Sullivan, Adams, Thibault, Corbière, & Stanish, 2006b; Vowles, Gross, & Sorrell, 2004). Individuals with musculoskeletal injuries who have elevated symptoms of depression report a sick leave duration that is twice as long as individuals with musculoskeletal injuries who do not have depressive symptoms (Currie & Wang, 2004; Waddell, Burton, & Main, 2003). Research has also shown that depressive symptoms are predictive of poor RTW outcomes following a multidisciplinary rehabilitation program (Sullivan & Stanish, 2003), and account for up to 28% of the variance RTW outcomes (Vowles et al., 2004).

Several pain-related psychological risk factors have also been associated with problematic RTW outcomes following musculoskeletal injury. Pain-related psychological risk factors are considered distinct from mental health problems such as depression, as well as other clinical conditions with diagnosable psychopathologies. Pain-related psychological factors might include predispositions such as attitudes or beliefs, or emotional reactions such as fear or distress (Sullivan, Feuerstein, Gatchel, Linton, & Pransky, 2005a). Psychological risk factors are not considered mental disorders nor would they necessarily be considered indices of mental dysfunction in the absence of musculoskeletal symptoms. Some of the pain-related psychological

variables that are strongly associated with adverse RTW outcomes include pain catastrophizing, fear of movement and perceived injustice. In previous research, these variables have been shown to be associated with heightened risk of prolonged work disability associated with musculoskeletal conditions, even after accounting for medical status variables (Sullivan et al., 2008; Sullivan, Adams, Martel, Scott, & Wideman, 2011a; Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998; Sullivan, Ward, Tripp, French, Adams, & Stanish, 2005b; Turner et al., 2006). It has also been shown that reductions in pain catastrophizing and fear of movement are significant determinants of return to work following rehabilitation for musculoskeletal conditions (Sullivan, Adams, Rhodenizer, & Stanish, 2006a; Sullivan, Ward, Tripp, French, Adams, & Stanish, 2005b).

Recovery expectancies have emerged as one of the strongest pain-related psychological predictors of RTW outcomes (Cole, Mondloch, & Hogg-Johnson, 2002; Gross & Battié, 2005; Iles et al., 2008; Schultz et al., 2005a). Recovery expectancies have been broadly conceptualized as a person's prediction of the likelihood of recovery following injury. Findings have been consistent in showing that less positive, or more negative recovery expectancies are strong predictors of who will and who will not return to work following a debilitating musculoskeletal injury (Hallegraeff et al., 2012; Iles et al., 2008; Iles, Davidson, Taylor, & O'Halloran, 2009).

Interestingly, expectancies are discussed as a core component of several pain-related psychological variables, including depression, pain catastrophizing, fear of movement and perceived injustice. According to Aaron Beck, depression is characterized by a negative triad consisting of a negative view of the self and world, and about the future (Beck, Rush, Shaw, & Emery, 1979). Sullivan et al. proposed that individuals who catastrophize have negative pain schemas that, once activated, increase the accessibility of thoughts of previous negative pain

experiences and lead them to expect negative pain experiences in the future (Sullivan, Thorn, Haythornthwaite, Keefe, et al., 2001b). Expectancies are also embedded within conceptual models of pain-related fear (Leeuw et al., 2007). The item content of several measures of pain-related fear include anticipations of pain exacerbations and functional limitations (Kori, Miller, & Todd, 1990; McCracken, Zayfert, & Gross, 1992; Waddell, Newton, Henderson, Somerville, & Main, 1993). Similarly, the item content of injury-related perceptions of injustice contains references to the anticipated permanence of losses associated with injury (Sullivan et al., 2008).

It is possible that expectancies might be an important vehicle through which a number of psychological variables impact on RTW outcomes. The study of the mediating role of expectancies provides an opportunity to clarify the pathways by which pain-related psychological variables influence RTW outcomes. Advancing knowledge of the interrelations among these variables might have important implications for conceptual models of work disability following musculoskeletal injury. Identification of the processes by which psychological variables impact on RTW outcomes might also contribute to the development of interventions that promote more successful recovery following musculoskeletal injury.

The current thesis aims to extend previous research by examining the mediating role of recovery expectancies on the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury. The Introduction will provide an overview of current conceptualizations of expectancy constructs. Subsequently, research linking recovery expectancies to adverse RTW outcomes will be presented. The final section of the Introduction will discuss the potential mediating role of recovery expectancies on the relationship between pain-related psychological variables and RTW outcomes following musculoskeletal injury.

Conceptualizations of expectancies

Theorists have appealed to the concept of expectancies in efforts to explain a wide range of phenomena. Expectancies have been a pivotal construct in conceptual models addressing the underpinnings of learning, motivation, education, and drinking. Three distinct forms of expectancies have been discussed; response expectancies, self-efficacy expectancies and outcome expectancies. The term *response expectancies* refers to beliefs regarding the occurrence of non-volitional responses. The term *self-efficacy expectancies* refers to an individual's level of confidence in his/her ability to perform a specific behavior in order to achieve a specific outcome. Finally, the term *outcome expectancies* has been used to refer to beliefs regarding the likelihood of a future outcome.

Response expectancies

Irving Kirsch (1985) defined response expectancies as the anticipation of one's automatic or non-volitional responses to specific situations, behaviors or stimuli. Non-volitional responses include emotional reactions (e.g. fear, sadness, elation), physiological arousal, and pain. It has been suggested that response expectancies emerge from direct and vicarious experiences (Kirsch, 1999). For example, repeated experience with the therapeutic effects of a drug can lead individuals to develop expectancies that future ingestion of that drug will yield similar therapeutic effects. Similarly, being told that a drug has a particular effect or observing its effect on others can produce an expectancy of that effect when the drug is ingested. According to Kirsch, the expectancy of therapeutic effects is often sufficient to yield reductions in symptom severity (Kirsch, 1985a).

Placebo effects have been discussed in terms of response expectancies. Placebos are substances that are administered in the guise of active drugs, but that do not have the

pharmacological properties attributed to them (Kirsch, 1985a). Kirsch argues that the placebo effect may account for as much as 80% of the treatment response seen in antidepressant drugs (Kirsch, Moore, Scoboria, & Nicholls, 2002). Response expectancies have been shown to affect a wide variety of subjective, behavioral and physiological responses (Kirsch, 1997).

Self-efficacy expectancies

Albert Bandura refers to self-efficacy expectancies as the confidence that individuals have in their ability to perform a behavior required to produce a particular outcome (Bandura, 1977). One of the factors that distinguishes self-efficacy expectancies from response expectancies is that the outcome of interest is under volitional control. According to Bandura, self-efficacy expectancies in a given domain of activity emerge as a result of multiple influences including performance accomplishments, vicarious experiences, social persuasion and emotional arousal. Performances are hypothesized to offer the most valid information for formulating self-efficacy expectancies. In general, repeated successes raise self-efficacy expectancies, whereas failures lower them. Self-efficacy theory maintains that self-efficacy expectancies determine whether coping behavior is initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles (Bandura, 1977). According to self-efficacy theory, individuals with low self-efficacy expectancies for a given behavior may attempt to avoid it, whereas those with high self-efficacy expectancies might participate more eagerly. Similarly, individuals with high self-efficacy expectancies tend to expend greater effort and persist longer than those who doubt their capabilities (Bandura, 1977).

Outcome expectancies

Julian Rotter defined expectancies as "the probability held by the individual that a particular reinforcement will occur as a function of a specific behavior on his part in a specific

situation or situations" (Rotter, 1954). In his descriptions of expectancies, Rotter did not refer to these as 'outcome expectancies'. The term *outcome expectancies* was later employed by Bandura when he distinguished between self-efficacy expectancies and Rotter's conceptualization of expectancies (Bandura, 1977). According to Rotter, expectancies are based on previous experiences where an individual observes repeated associations between his/her behavior and an outcome. When the outcome is perceived as not being contingent upon the individual's own behavior, its occurrence will not increase expectancies as much as when it is perceived as contingent (Rotter, 1966). Once an expectancy is formed, the failure of the outcome to occur will reduce or extinguish the expectancy. Regardless of the value of the outcome, if the behavior repeatedly fails to associate with the outcome, the individual will no longer expect the behavior to lead to the outcome and will therefore eventually cease efforts directed towards achieving the outcome. An expectancy regarding the relationship between one's own behavior and its outcome, along with the value of the outcome, affect a variety of behavioral choices (Rotter, 1966).

Distinct processes or a unitary construct

Proceeding on the basis of defining criteria, response expectancies would be considered distinct from self-efficacy and outcome expectancies. Response expectancies refer to beliefs regarding non-volitional responses, whereas both self-efficacy and outcome expectancies refer to beliefs regarding outcomes that are under volitional control. Although self-efficacy expectancies and outcome expectancies have been discussed as independent constructs, it is not clear to what degree they might be distinct. Bandura has argued that self-efficacy and outcome expectancies are distinct, on the basis that self-efficacy expectancies involve the perceived ability to perform behavior, whereas outcome expectancies involve judgments about the likelihood of outcomes that flow from behavior (Bandura, 1977). However, James Maddux has argued that from an

operational point of view, the manner in which self-efficacy and outcome expectancies have been addressed in the literature suggests the possibility of a conceptual overlap among these constructs (Maddux, 1995). Similarly, Kirsch has suggested that there is little difference between the belief that one has the ability to successfully perform a task (self-efficacy expectancy) and the belief that one will be successful at attempting a task (outcome expectancy) (Kirsch, 1985b). In fact, it has been suggested that any assessment about the likelihood of success at a task must take into account not only one's own estimation of ability but also an assessment of what likely outcomes may occur (Marzillier & Eastman, 1984; Williams, 2010).

Recovery expectancies and return-to-work outcomes

Research on the role of expectancies on return to work following debilitating injury has proceeded in the relative absence of a guiding conceptual framework. In this area of research, the term 'recovery expectancies' has been used to characterize employment-relevant predictions of injured individuals. The operational definition of recovery expectancies has varied widely across studies. In some studies, questions such as "Do you think that you will be *able* to return to work eventually?" (Kapoor, Shaw, Pransky, & Patterson, 2006) have been used to assess recovery expectancies. In other studies, researchers commonly ask about certainty of return to work. For example, Heymans et al. asked individuals "How *certain* are you about full work resumption at 6-months?" (Heymans et al., 2006). These varying operationalizations of recovery expectancies indicate that essential elements of expectancies for recovery might map onto both self-efficacy expectancies and outcome expectancies. In spite of variations in the operational definitions of recovery expectancies reflected in the item content used to assess employment-relevant expectancies, findings have been consistent in showing that recovery expectancies are important prognostic indicators of RTW outcomes.

Several investigations have examined the prospective association between recovery expectancies and RTW outcomes in individuals suffering from a wide range of musculoskeletal conditions. In a systematic review, Hallegraef et al. examined the relationship between low expectancies and work disability across 10 studies of individuals with low back pain (Hallegraeff et al., 2012). Results revealed that individuals with low recovery expectancies were more than twice as likely to be work-disabled than those with high recovery expectancies 3 months or more following the onset of pain (OR 2.17 (95% CI 1.61-2.91)). In addition to the studies that were included in the systematic review, Heymans et al. reported that low recovery expectancies predicted prolonged work absence at 6-month follow-up in a sample of individuals with low back pain (HR 1.12 (95% CI 1.01-1.24)) (Heymans et al., 2006). In a similar study, Shaw et al. reported that workers with low recovery expectancies were 1.2 times more likely to be work-disabled at 3-month follow-up (Shaw et al., 2013). In another prospective study of workers with low back pain, low recovery expectancies were significantly associated with longer duration of work disability at 6-month and 1-year follow-up (Truchon et al., 2012). Finally, in a systematic review of individuals with low back pain, recovery expectancies emerged as the most potent predictor of work disability, over and above depression, fear avoidance, anxiety, psychological strain, job satisfaction, and the effect of compensation (Iles et al., 2008).

The relationship between recovery expectancies and RTW outcomes has also been reported in individuals with whiplash injury, Carpel Tunnel syndrome, and individuals undergoing lumbar disk surgery. For example, in a prospective study of individuals with whiplash injury, low recovery expectancies predicted affected working ability at 1-year follow-up (OR 3.92 (95% CI 1.5-10.27)) (Gehrt et al., 2015). In a prospective study of individuals with Carpel Tunnel syndrome, those who reported low recovery expectancies experienced over 5

times longer durations of sick leave (OR 5.87 (95% CI 3.73-9.25)) (Turner et al., 2007). In a similar study, Cowan et al. reported that recovery expectancies explained approximately 36% of the variance in time to return to work with modified duties, and 18% of the variance in time to a full return to work (Cowan, Makanji, Mudgal, Jupiter, & Ring, 2012). Finally, in a prospective study of individuals who were undergoing lumbar disk surgery, low pre-surgical recovery expectancies were significantly associated with being on sick leave 1 year following surgery (OR 19.5 (95% CI 2.1-179.2)) (Johansson, Linton, Rosenblad, Bergkvist, & Nilsson, 2010). The same pattern of results has also been demonstrated in individuals with musculoskeletal conditions and psychological problems (Audhoe et al., 2012; Heijbel, Josephson, Jensen, Stark, & Vingård, 2006; Wåhlin, Ekberg, Persson, Bernfort, & Öberg, 2012).

There is a basis for suggesting that recovery expectancies mediate the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury. First, numerous investigations have shown that pain-related psychological variables prospectively predict RTW outcomes (Sullivan et al., 1998; 2008; Sullivan, Adams, Martel, Scott, & Wideman, 2011a; Sullivan, Ward, Tripp, French, Adams, & Stanish, 2005b; Turner et al., 2006). Second, research has shown that pain-related psychological variables are associated with recovery expectancies (Besen, Gaines, Linton, & Shaw, 2017; Ozegovic, Carroll, & Cassidy, 2010a; Sullivan, Tanzer, Reardon, Amirault, Dunbar, & Stanish, 2011c). Finally, based on the literature reviewed above, there is strong evidence that recovery expectancies are prospectively associated with RTW outcomes across various musculoskeletal conditions. Little is currently known about the processes by which pain-related psychological variables such as depressive symptoms, pain catastrophizing, fear of movement and perceived injustice impact on RTW outcomes. It is possible that recovery expectancies may be an important pathway by which

these pain-related psychological variables impact on RTW outcomes following musculoskeletal injury. Research addressing this knowledge gap has the potential to advance both our theoretical and clinical understanding of recovery following musculoskeletal injury.

Thesis objectives

The present thesis examined whether recovery expectancies are the vehicle through which pain-related psychological variables impact on RTW outcomes following musculoskeletal injury. To this end, three investigations were conducted. The first study examined the mediating role of recovery expectancies on the relationship between depressive symptoms and RTW outcomes following work-related musculoskeletal injury. The second study examined the mediating role of recovery expectancies on the relationships between pain catastrophizing and RTW outcomes, and fear of movement and RTW outcomes, following whiplash injury. The final study examined the mediating role of recovery expectancies on the relationship between perceived injustice and RTW outcomes following whiplash injury. Discussions of study-specific results are addressed in each of the three manuscripts, while the broad theoretical and clinical implications are presented in the General discussion.

Chapter 2: The mediating role of recovery expectancies on the relation between depression and return to work

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Abstract

Depression has been identified as a significant risk factor for prolonged disability, however, little is known about the process by which depression impacts recovery following work-related musculoskeletal disorders. The primary objective of this study was to examine whether recovery expectancies mediate the relation between depression and return-to-work status. A sample of 109 patients with work-related musculoskeletal disorders were recruited from one of 6 primary care physiotherapy clinics. Participants completed measures of pain intensity, depressive symptoms and recovery expectancies. Return-to-work status was assessed by telephone interview one year after the initial assessment. Consistent with previous research, more severe depressive symptoms and low recovery expectancies were associated with a lower probability of return to work. Logistic regression analyses revealed that recovery expectancies completely mediated the relation between depression and return-to-work status at 1-year follow-up. The results suggest that interventions specifically targeting recovery expectancies in individuals with work-related musculoskeletal disorders and depressive symptoms might improve return-to-work outcomes.

Introduction

Work-related musculoskeletal disorders (WRMDs) are considered one of the leading causes of disability. In the United States, over 70 million physician visits each year can be attributed to WRMDs (Sobeih, Salem, Daraiseh, Genaidy, & Shell, 2010). In North America, WRMDs are the most expensive non-malignant health condition affecting the working-age population (Sullivan, Rodgers, & Kirsch, 2001a). In 2002, the *Commission de la santé et la sécurité du travail* of Quebec (CSST; provincial work injury insurer) reported that indemnity and treatment-related costs associated with WRMDs were in excess of 1.2 billion dollars. From 2001-2005, WRMDs accounted for 50% of all time-loss claims in Quebec alone (Duguay, Massicote, & PrudHomme, 2008).

Depression has been identified as a risk factor for poor recovery outcomes following WRMDs (Marhold, Linton, & Melin, 2002; Nieuwenhuijsen, Verbeek, de Boer, Blonk, & van Dijk, 2006; Söderman, Lisspers, & Sundin, 2003). Surveys indicate that approximately 20% to 50% of individuals with musculoskeletal conditions show evidence of elevated depressive symptoms (Campbell, Clauw, & Keefe, 2003; McWilliams, Cox, & Enns, 2003; Rush, Polatin, & Gatchel, 2000; Sullivan, Reesor, Mikail, & Fisher, 1992). Individuals with WRMDs and elevated depressive symptoms report sick leave durations that are twice as long as sick leaves of individuals with WRMDs who do not have depressive symptoms (Currie & Wang, 2004; Druss, Rosenheck, & Sledge, 2000). Depressive symptoms in individuals with WRMDs have also been associated with longer duration of wage replacement benefits following injury or surgical intervention (Dozois, Dobson, Wong, Hughes, & Long, 1995; Lötters, Franche, Hogg-Johnson, Burdorf, & Pole, 2006; Schade, Semmer, Main, Hora, & Boos, 1999). Sullivan and Stanish reported that high levels of pre-treatment depression in individuals enrolled in a rehabilitation

program were predictive of poorer RTW outcomes (Sullivan & Stanish, 2003). Vowles et al. reported that 28% of the variance in RTW outcomes was accounted for by post-treatment depression scores (Vowles et al., 2004). Little is known about the process by which depression impacts on RTW outcomes in individuals with WRMDs.

Numerous investigations have shown that recovery expectancies are prognostic indicators for poor recovery following the onset of WRMDs (Cole et al., 2002; Gross & Battié, 2005; Schultz et al., 2005a). In this domain of research, recovery expectancies have been broadly conceptualized as the injured individual's prediction of the likelihood of recovery (Du Bois & Donceel, 2008; Jensen, Turner, & Romano, 1991; Williams, Anderson, & Winett, 2005). Cole et al. reported that injured workers' expectancies of slower recovery were consistently associated with longer duration of time loss claims (Cole et al., 2002). Du Bois et al. reported that work-disabled individuals who were less than 100% certain that they would return to work within the next 6 months, were 4 times less likely to return to work during that time period (Du Bois & Donceel, 2008). A study by Turner et al. showed that injured workers who reported 'low certainty' of return to work within the next 6 months had over 12 times the number of disability days than those who were 'extremely certain' of returning to work (Turner et al., 2006). Although there have been considerable cross-study variations in the manner by which expectancies have been assessed, findings have been consistent in showing that more negative, or less positive, recovery expectancies have been associated with poorer RTW outcomes (Kuijer, Groothoff, Brouwer, Geertzen, & Dijkstra, 2006; Mondloch, Cole, & Frank, 2001).

It is possible that recovery expectancies may be the vehicle by which depression influences RTW outcomes in individuals with WRMDs. For example, cognitive models of depression have discussed negative expectancies (e.g. negative views of the future) as a central

component of the phenomenology of depression (Beck, 1967). In addition, the item content of several measures of depression includes statements assessing the patient's prediction of future negative outcomes (Lackner, Carosella, & Feuerstein, 1996; Millward, Lutte, & Purvis, 2005; Muijzer, Brouwer, Geertzen, & Groothoff, 2012; Nieuwenhuijsen et al., 2006). It has been suggested that expectancies might represent the final common pathway of a number of psychological influences on health and recovery outcomes (Edwards, Haythornthwaite, Smith, Klick, & Katz, 2009; Kirsch, 1985a; Kirsch et al., 2014; Sullivan, Rodgers, & Kirsch, 2001a).

There are important clinical implications to elucidating meditational relations among psychological predictors of RTW outcomes. The realities of clinical practice place limits on the number of questionnaires that can be included in assessment protocols. Identification of the key processes by which psychological factors impact on RTW outcomes would permit streamlining assessment protocols of focus on variables with the highest predictive value. In addition, research examining the processes by which psychological variables impact on RTW outcomes might also help identify key targets for psychosocial interventions designed to improve recovery trajectories following work injury.

The primary objective of the present study was to examine whether recovery expectancies mediate the relation between depression and return to work outcomes in individuals with WRMDs. Participants were initially assessed within 5 months of a work-related injury. Return-to-work status was assessed one year following initial assessment. Consistent with previous research, it was predicted that initial depressive symptom severity would predict prolonged work disability. Also consistent with previous literature, it was predicted that high recovery expectancies would be significant determinants of successful return to work. Logistic regressions were used to test whether recovery expectancies mediated the relation between

depressive symptom severity and return to work.

Methods

Participants

The study sample consisted of 140 consecutive referrals to 6 primary care physical therapy clinics who met the following inclusion criteria: currently work-disabled with a primary diagnosis of lumbar or cervical sprain, receiving wage indemnity benefits from the CSST at the time of enrolment in the study, and pain symptoms of mild or greater severity. Of the 140 individuals who met inclusion criteria, 109 were successfully contacted for follow-up interview one year later. Analyses were conducted to compare participants who were and were not successfully contacted for follow-up interview. The results of analyses revealed that the two groups did not differ significantly on any of the study variables. The final sample thus consisted of 109 participants (47 men and 62 women). The mean age of the sample was 36.08 years (*SD* = 9.70 years), and the mean duration of work disability at the time of enrolment was 13.39 weeks (*SD* = 2.71 weeks). The majority of the participants had completed high school (83%).

Procedure

The research program was approved by the research ethics committee of the *Centre de Recherche Interdisciplinaire en Réadaptation du Montréal Métropolitain*. Participants were not considered for participation if they had been diagnosed with disc herniation, vertebral fracture, ankylosing spondylitis, infectious disease or any medical condition for which physical activity was contra-indicated. The referral source in all cases was a primary care physician. The physical therapy treatment aimed to reduce the pain and disability associated with participants' soft-tissue injuries. Although individual interventions varied at the discretion of the treating clinician, the treatments focused on early mobilization and physical activity, consisting of joint manipulation

and progressive strengthening exercises. All treatments were consistent with the clinical practice guidelines for functional rehabilitation following a sub-acute musculoskeletal injury and with the reimbursement policies of the CSST. Participants were scheduled for three physical therapy sessions per week. Participants received physical therapy treatment until they returned to work or to a maximum of 7 weeks. Following consent, participants completed self-report measures of depressive symptoms, pain intensity, recovery expectancies, and demographic information.

Participants were asked for a contact telephone number and mailing address so that they might be contacted for a follow-up telephone interview. Twelve months after the initial testing session, a research assistant telephoned each participant. If the research assistant was not successful in contacting the participant by telephone, a letter was sent to the participant requesting that he or she contact the research assistant to complete the telephone interview. If no communication was received from the participant after one month, the participant was removed from the study sample. The follow-up interview consisted of questions addressing RTW status and pain intensity. Participants were also asked whether or not they had received additional treatments. The response categories included physiotherapy, massage therapy, psychotherapy, medication and other. A frequency count was computed to reflect the number of additional treatments received. The number of treatments received was not associated with depression or return to work. All participants were compensated $25 for completing the self-report questionnaire and $25 for participating in the follow-up interview.

Measures

Pain intensity and distribution

The Pain Rating Index of the McGill Pain Questionnaire (MPQ-PRI) was used as a measure of pain. The MPQ-PRI is a weighted index of pain adjectives that were endorsed by the

participant. Scores on the MPQ-PRI range from 0 to 78, where higher scores reflect more severe pain (Melzack, 1975). The number of body sites where participants reported experiencing pain was also recorded.

Symptoms of depression

The Beck Depression Inventory-II (BDI-II) was used as a measure of depressive symptom severity (Beck, Steer, & Brown, 1996). The BDI-II consists of 21 items describing different symptoms of depression. Scores on the BDI-II can range between 0 and 63 where higher scores reflect more severe symptoms of depression. The BDI-II has been shown to be a reliable and valid measure of depressive symptoms for individuals with pain (Harris & D'Eon, 2008), and has been frequently used in studies using patients with back and/or neck pain (Bishop, Edgley, Fisher, & Sullivan, 1993; Çakıt, Genç, Altuntaş, & Erdem, 2009; Gurcay et al., 2009; Turner & Romano, 1984). A cut-score of 14 has been suggested to classify individuals experiencing clinically significant depressive symptoms (Beck et al., 1996; Hiroe et al., 2005; Sprinkle et al., 2002; Steer, Brown, Beck, & Sanderson, 2001; Titov et al., 2011). Participants with BDI-II scores equal or greater than 14 were classified in the high depressive symptom group, while participants with scores lesser than 14 were classified in the low depressive symptom group.

Recovery expectancies

Participants were asked to evaluate the likelihood that they would have resumed some form of employment over the next month ("How likely is it that within the next month you will have resumed some form of employment?"). Participants indicated their responses on a percentage scale from *not at all likely* (0%) to *extremely likely* (100%). A Receiver Operating Characteristic (ROC) analysis was conducted to identify the expectancy cut-scores that best

distinguished between participants who returned to work and those who remained work-disabled at 1-year follow-up. The Area Under the Curve (AUC) was significant, and indicated that 85.8% of the time, individuals who had not returned to work had obtained an expectancy score lower than 62.5%. Participants with expectancy scores equal or greater than 62.5% were classified in the high recovery expectancy group, while participants with scores less than 62.5% were classified in the low recovery expectancy group. The sensitivity was 0.861, the specificity was 0.722 and the mean predictive value (specificity + sensitivity) / 2) for predicting RTW status at follow-up was 0.792.

Demographic information and follow-up interview.

Participants were asked to provide information about their age, marital status, education, employment and duration of work disability. At the 1-year follow-up interview, participants were asked if they had successfully returned to full time work (yes/no).

Approach to data analysis

SPSS version 21.0 was used to conduct all data analyses. Initial analyses were conducted to compare participants who were and were not successfully contacted for follow-up interview. The results of analyses revealed that the two groups did not differ significantly on any of the study variables. Analyses were also conducted to examine whether study variables differed across the different clinics from which participants were recruited. These analyses revealed that none of the study variables differed significantly as a function of the clinic where participants were recruited. As such 'clinic' is not included as a variable in further analyses.

Means and SDs were computed on sample characteristics and questionnaire scores. T-tests for independent samples were used to compare women and men on study measures. Logistic regression analyses were performed to evaluate the mediating role of expectancies for

RTW status at the 1-year follow-up. Prior to conducting the logistic regressions, all tolerance coefficients were examined to ensure no problem of multicollinearity.

Mediation analyses were conducted according to procedures outlined by Baron and Kenny (Baron & Kenny, 1986). Four conditions had to be met to confirm a mediated relation: (A) the independent variable (e.g. depressive symptoms) must be significantly associated with the dependent variable (e.g. RTW status); (B) the independent variable (e.g. depressive symptoms) must be significantly associated with the hypothesized mediator (e.g. expectancies); (C) the hypothesized mediator (e.g. expectancies) must be significantly associated with the dependent variable (e.g. RTW status); and (D) the contribution of the independent variable to the prediction of the dependent variable must significantly decrease after controlling for the effect of the hypothesized mediator.

Results

Demographic information and mean scores on measures of pain intensity, depressive symptoms and recovery expectancies are presented in Table 1. The distribution of depression scores is comparable to that which has been reported in previous research with participants with WRMDs (Boersma & Linton, 2006; Scott & Sullivan, 2010; Sullivan, Adams, Thibault, Corbière, & Stanish, 2006b). T-tests revealed no significant differences between men and women on measures of pain intensity (t (107) = 1.176, p = .242). There were significant gender differences in RTW status at follow-up (χ^2 = 5.352, p = .021), and there were marginally significant gender differences in recovery expectancies (χ^2 = 3.711, p = .054). More women than men scored above the cut-score on the BDI-II (χ^2 = 3.842, p = .050).

Expectancies as a mediator of the relation between depression and RTW

Following the conditions proposed by Baron and Kenny (Baron & Kenny, 1986), a chi-

square analysis was conducted to test the association between depressive symptoms and RTW status at follow-up. Higher BDI-II scores were associated with a lower probability of return to work at follow-up ($\chi^2 = 6.251$, $p = .012$; Condition A). The same procedure was used to test the association between depressive symptoms and recovery expectancy scores, which was also significant ($\chi^2 = 6.923$ $p = .009$; Condition B). A third chi-square was used to test the relation between recovery expectancy scores and RTW status at follow-up, which was also significant ($\chi^2 = 36.750$, $p < .001$; Condition C). Individuals with higher recovery expectancies and individuals with lower depressive symptoms were more likely to have returned to work (Cross-tabulation results are presented in Table 2).

A logistic regression was conducted to examine whether recovery expectancies mediated the relation between depression and RTW status at follow-up (Condition D). As shown in Table 3, age and sex were entered in the first step and contributed significantly to the prediction of RTW status at follow-up ($\chi^2 = 8.640$, $p = .013$). Duration of work disability and pain intensity were entered in the second step, but did not add significant variance to the prediction of RTW status at follow-up ($\chi^2 = .775$, $p = .679$). Number of pain sites was entered in the third step, but did not contribute significantly to the model ($\chi^2 = 2.323$, $p = .128$). The measure of depressive symptoms was entered in the fourth step, and contributed significantly to the prediction of return to work ($\chi^2 = 9.862$, $p = .002$, OR = 1.094, 95% CI = 1.031- 1.161, $p = .030$).

A second logistic regression was conducted with age and sex in the first step, duration of work disability and pain intensity in the second step, and injury site in the third step. Recovery expectancies were entered in the fourth step and contributed significantly to the prediction of RTW status at follow-up ($\chi^2 = 31.510$, $p < .001$, OR = .958, 95% CI = .938 - .977, $p < .001$). Once expectancies were statistically controlled, depression no longer made a significant

contribution to the prediction model ($\chi^2 = 2.988$, $p = .083$, OR = 1.064, 95% CI = .990 - 1.144, $p = .094$). The pattern of results suggests that recovery expectancies fully mediated the relation between depression and RTW status at follow-up. Sobel's test revealed that mediating role of recovery expectancies was statistically significant (Sobel test = -2.46, $p = .01$).

The Nagelkerke pseudo R^2 indicated that the final model accounted for approximately 48.5% of the total variance. Classification success for the cases based on a classification cut-off value of .500 for predicting membership in the successful RTW group was moderately high, with an overall prediction success rate of 82.4%.

Discussion

Numerous investigations have reported findings highlighting the negative influence of depressive symptoms on rehabilitation outcomes following musculoskeletal injury (Marhold et al., 2002; Nieuwenhuijsen et al., 2006). Elevated depressive symptoms in individuals with health conditions have been associated with more severe back pain, neck pain, orthopedic pain, and coronary artery disease (Bair, Robinson, Katon, & Kroenke, 2003; Carroll et al., 2008; Söderman et al., 2003; Watson, Booker, Moores, & Main, 2004). Research has also shown that depressive symptoms consequent to musculoskeletal injury contribute to poorer functional outcomes such as physical performance deficits, higher scores on self-rated disability measures and longer periods of work absence (Carroll et al., 2008; Leino & Magni, 1993). The findings of the present study are consistent with previous research showing that individuals with clinically significant depressive symptoms (BDI-II > 14) were significantly less likely to have returned to work at 1-year follow-up.

On the basis of research linking expectancies to poor recovery outcomes, as well as research and theory linking depression to low expectancies, the present study sought to examine

whether expectancies mediated the relation between depression and RTW outcomes in work-injured individuals with musculoskeletal pain. Consistent with previous research, our findings indicated that low recovery expectancies were associated with a low probability of return to work at follow-up (Cole et al., 2002; Gross & Battié, 2005; Holm, Carroll, Cassidy, Skillgate, & Ahlbom, 2008). Our findings also revealed that high scores on depression were associated with low recovery expectancies. When recovery expectancies were statistically controlled, depression no longer accounted for significant variance in RTW status at follow-up. Results of the present study suggest that recovery expectancies are the vehicle through which depression impacts RTW outcomes. In the current study, an ROC analysis revealed that a recovery expectancy score of 62.5% best distinguished between individuals who did and did not return to work.

The findings of the present study join a growing literature highlighting the significant predictive value of expectancies in determining disability outcomes. For example, Schultz et al. reported that recovery expectancies were the strongest predictor of duration of disability (Schultz et al., 2004). Du bois et al. reported that expectancies were associated with a 5.2 OR in the prediction of successful return to work (Du Bois & Donceel, 2008). Turner et el. reported that recovery expectancies were associated with a 3.09 OR in the prediction of work disability 6-months following injury. Similar findings were reported by Sears et al. (Sears, Rolle, Schulman, & Wickizer, 2014) and Holm et al. (Holm et al., 2008). Boersma et al. reported that after controlling for age, gender, pain intensity and negative affect, expectancies accounted for an additional 15% of the variance in functional disability at 1-year follow-up (Boersma & Linton, 2006). The consistency with which expectancies have been linked to RTW outcomes argues for the inclusion of measures of recovery expectancies in assessment protocols of individuals who have sustained musculoskeletal injuries and for considering recovery expectancies as important

targets of intervention.

According to Bandura, negative expectancies can have a detrimental impact on behavior or performance by interfering with the investment of effort or motivational resources that are required to achieve certain outcomes (Bandura, 1978; 1997). In the case of individuals who are recovering from a musculoskeletal injury, low expectancies for recovery might reduce the likelihood that individuals will initiate behaviors or participate fully in treatments conducive to return to work. Alternately, low expectancies for recovery might negatively influence individuals' persistence and effort in the face of challenges or obstacles in their goal pursuits (Lackner et al., 1996). Carver and Scheier explain that people strive towards goals as long as they feel the goals can be attained. As a result, high expectancies predict persistent effort, and low expectancies predict self-detachment towards the goal (Carver & Scheier, 2001).

At the present time, multidisciplinary approaches are advocated as the treatment of choice for individuals presenting with WRMDs with concomitant depression (Campbell et al., 2003; Eccleston & Morley, 2009). Such programs typically include education, activation or exercise, and various cognitive-behavioral techniques (e.g. thought monitoring, cognitive re-structuring, self-management skills). Unfortunately, research reports rarely provide information on the distribution of depressed and non-depressed individuals in their study samples, or the degree to which depression was successfully treated (Campbell et al., 2003). It is equally unclear whether the treatment techniques used within multidisciplinary treatment are effective in changing depressed individuals' recovery expectancies. Although a pessimistic outlook is considered to be part of the phenomenology of depression, not at all depressed individuals report low recovery expectancies. In the present study, more than half of participants with high levels of depression reported high recovery expectancies. As such, treatments designed

to reduce the severity of depressive symptoms might not be sufficient to change recovery expectancies. Recent reviews highlighting the modest or negligible impact of cognitive-behavioral therapy interventions on RTW outcomes suggest that multidisciplinary interventions currently do not comprise effective expectancy-change techniques (Eccleston & Morley, 2009).

Little is currently known about how low recovery expectancies develop in individuals with depression or how expectancies can be manipulated for therapeutic benefit. It is possible that communication from health care professionals might play a significant role in the development in individuals' recovery expectancies. Medical professionals who voice their opinions about a patient's inability to resume occupational tasks might inadvertently be setting in motion the conditions for a self-fulfilling prophecy. It is also possible that information obtained through media, internet or significant others might play a role in the development of negative recovery expectancies. There are indications that individual difference variables such as catastrophizing or optimism might also influence recovery expectancies (Peters, Sommer, Rijke, & Kessels, 2007). As research accumulates elucidating the determinants of recovery expectancies, it might be possible to develop intervention techniques specifically designed to modify expectancies in a manner that will improve RTW outcomes following occupational injury.

At present, there are significant cross-study variations in how recovery expectancies are assessed. A review by Iles, Davidson and Taylor (Iles et al., 2008) enumerates the various methods of assessing recovery expectancies that have been used. These include: likelihood of working in 6 months (0-10) (Hazard, Haugh, Reid, Preble, & MacDonald, 1996; Turner et al., 2006), expectancies of returning to normal work in 3 months (yes/no) [67], perceived risk of not recovering (0-10) (Karjalainen et al., 2003), expected duration of sick leave (1-10 days, >10

days) (Steenstra et al., 2005), responses to an expectancies of recovery scale (7-8 items) (Schultz et al., 2005a; Schultz, Crook, Berkowitz, Milner, & Meloche, 2005b), and probability of returning to work without restriction in 1 month (5-point scale) (Shaw et al., 2005). From a clinical or claims management perspective, the lack of consistency in the measurement of recovery expectancies poses problems in terms of risk identification. Significant advance in this area of research will likely require the development and adoption of standardized measures of expectancies for functional outcomes following WRMDs. In the present study, recovery expectancies, defined in terms of the probability of return to work within 4 weeks, of less than 62% were indicative of heightened risk of prolonged work disability. More research will be needed to determine the reliability of this expectancy score as an indicator of risk.

Caution must be exercised when interpreting the findings of this study. The design of this study limits the nature of conclusions that can be drawn about the causal and sequential relations between depression, expectancies and RTW outcomes. Future research using paradigms where expectancies are experimentally manipulated through treatment might shed further light on the antecedent of causal status of expectancies for problematic RTW outcomes in injured workers. The study was conducted in a no-fault system and participants were recruited from physiotherapy clinics. These contextual factors have implications for the generalizability of the study findings. The exclusion criteria used in the present study coupled with the modest sample size also limit the generalizability of findings. In addition, return to work is an outcome that is influenced by numerous social, workplace and economic factors that were not assessed in this study. Finally, depression was operationalized on the basis scores on a self-report measure of depressive symptom severity. Although most of the research on depression associated with musculoskeletal pain has relied almost exclusively on self-report measures (Geisser, Roth, &

Robinson, 1997), the BDI-II is not a clinical diagnostic measure for major depressive disorder. Replication of the present findings in a sample where depression is assessed through diagnostic interview will be needed before strong statements can be made about the relations among depression, recovery expectancies and return to work.

In spite of these limitations, this study stands to advance our understanding of how psychological factors influence the relation between depressive symptoms and return to work. The findings suggest that low recovery expectancies have an important influence on the trajectory of recovery in individuals with clinically significant depressive symptoms who have sustained WRMDs. Interventions specifically targeting low recovery expectancies in individuals with WRMDs and depressive symptoms might improve RTW outcomes.

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Tables

Table 1. Characteristics of the study sample.

Characteristics	N (%) or Mean (SD)
Work disability	13.39 (2.71)
Pain intensity	20.18 (12.58)
Successful return to work	72 (66.1%)
Education	
Less than high school	19 (17.4 %)
High school	29 (26.6 %)
Trade school	29 (26.6 %)
College	20 (18.3 %)
University	12 (11.0 %)
Occupation	
Laborer	37 (33.9 %)
Nursing	27 (24.8 %)
Clerical	17 (15.6 %)
Driver	8 (7.3 %)
Trade	8 (7.3 %)
Sales	5 (4.6 %)
Pain site	
Back	97 (89.0 %)
Neck	74 (67.9 %)
Upper	54 (49.5 %)
Lower	29 (26.6 %)
Depressive symptoms	
Low	65 (59.6 %)
High	44 (40.4 %)
Recovery expectancies	
Low	36 (33.9 %)
High	72 (66.1 %)

Note. N = 109. SD = Standard deviation; Work disability = Duration of work disability, Pain intensity = McGill Pain Questionnaire; Depressive symptoms = Beck Depression Inventory-II, Recovery expectancies. Pain site categories are not mutually exclusive.

Table 2. Crosstabulation of depressive symptoms and return to work at follow-up, recovery expectancies and return to work at follow-up, and depressive symptoms and recovery expectancies.

		RTW at follow-up			
		Yes	No	χ^2	*p*
Depressive symptoms	Low	49	16	6.251	.012
	High	23	21		
Recovery expectancies	Low	10	26	36.750	.001
	High	62	10		
		Recovery expectancies			
		Low	High	χ^2	*p*
Depressive symptoms	Low	15	49	6.923	.009
	High	21	23		

Note. High recovery expectancies > 62.5 %; High depressive symptoms > score of 14 on the Beck Depression Inventory-II; RTW at follow-up = Return-to-work at follow-up.

Table 3. Logistic regression testing the mediating role of recovery expectancies.

		Model	β	S.E	Wald	Sig	OR	95% CI
Regression 1	Step 1	Age	-.035	.023	2.364	.124	.966	.924 - 1.010
		Sex	1.465	.500	8.560	.003	4.329	1.624 - 11.540
	Step 2	Work disability	-.019	.083	.054	.816	.981	.834 - 1.154
		Pain intensity	-.017	.019	.851	.356	.983	.947 - 1.020
	Step 3	Nb sites	-.066	.217	1.807	.179	1.339	.875 - 2.048
	Step 4	Depressive symptoms	.090	.030	8.737	.003	1.094	1.031 - 1.161
Regression 2	Step 1	Age	-.043	.027	2.563	.109	.958	.909 - 1.010
		Sex	1.055	.625	2.853	.091	2.872	.844 - 9.772
	Step 2	Work disability	-.025	.098	.064	.800	1.025	.845 - 1.243
		Pain intensity	-.016	.024	.487	.485	.984	.939 - 1.030
	Step 3	Nb sites	-.149	.251	.354	.552	1.161	.710 - 1.899
	Step 4	Recovery expectancies	-.043	.010	17.388	.000	.958	.938 - .977
	Step 5	Depressive symptoms	.062	.037	2.803	.094	1.064	.990 - 1.144

Note. The dependent variable was return to work as the target category and non-return to work as the reference category. Pain intensity = McGill Pain Questionnaire; Work disability = Duration of work disability; Nb sites = Number of pain sites; Depressive symptoms = Beck Depression Inventory-II; 95% CI = 95% Confidence intervals.

Preface to Chapter 3

Study 1 aimed to examine the mediating role of recovery expectancies on the relationship between depressive symptoms and RTW outcomes in individuals with work-related musculoskeletal disorders. The results of this study revealed that low recovery expectancies significantly predicted work disability at 1-year follow-up. Results provided support for the mediating role of recovery expectancies on the association between depressive symptoms and RTW outcomes following work-related musculoskeletal injury. Also, our findings indicated that a recovery expectancy score of 62.5% best distinguished between individuals who returned to work and those who remained work-disabled.

The results of Study 1 join a growing body of literature suggesting that expectancies may be the mechanism by which pain-related psychological factors impact on RTW outcomes. Research on pain-related psychological risk factors for prolonged work disability has identified pain catastrophizing and fear of movement as important predictors of RTW outcomes following musculoskeletal injury. However, little is known about the process by which these psychological factors impact RTW outcomes. The goal of Study 2 was to investigate the mediating role of recovery expectancies on the relationships between 1) pain catastrophizing and RTW outcomes, and 2) fear of movement and RTW outcomes. In order to expand on previous research, Study 2 was conducted in a sample of individuals with whiplash-associated disorders. Findings from this investigation were expected to provide further evidence of the mediating role of recovery expectancies on the relationship between pain-related psychological factors and RTW outcomes following musculoskeletal injury.

Chapter 3: Expectancies mediate the relations among pain catastrophizing, fear of movement, and return to work outcomes after whiplash injury

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Abstract

Pain catastrophizing and fear of movement have been identified as key predictors of prolonged work disability following whiplash injury. However, little is known about the processes by which pain catastrophizing and fear of movement impact on return to work outcomes. This study investigated the mediating role of expectancies on the relations between pain catastrophizing and return to work, and fear of movement and return to work following whiplash injury. The study sample consisted of 154 individuals with whiplash injury who were enrolled in a multidisciplinary pain rehabilitation program. Participants completed measures of pain catastrophizing, fear of movement and return-to-work expectancies following admission to a rehabilitation program. A follow-up telephone interview was used to assess work status 1 year following discharge. Consistent with previous research, analyses revealed that expectancies, pain catastrophizing and fear of movement were significant predictors of return to work at 1-year follow-up. Regression analyses (bootstrapping) revealed that expectancies partially mediated the relation between catastrophizing and return to work. Expectancies completely mediated the relation between fear of movement and return to work. The significant predictive and mediating role of expectancies on return to work argues for the inclusion of expectancies as a specific target of intervention for individuals with whiplash injury.

Introduction

Whiplash-associated disorders (WAD) are the most common injury associated with rear-collision motor vehicle accidents (Buitenhuis, de Jong, Jaspers, & Groothoff, 2008). Currently, WAD account for 80% of accident-related soft tissue injuries (SAAQ, 2005). Epidemiological studies indicate that the recovery trajectory following WAD can be prolonged, with as many as 50% of individuals reporting symptoms of neck pain 1 year after injury (Côté, Cassidy, Carroll, Frank, & Bombardier, 2001; Kamper, Rebbeck, Maher, McAuley, & Sterling, 2008). As a function of persistent debilitating symptoms, 15-25% of individuals who sustain WAD remain permanently disabled (Buitenhuis, de Jong, Jaspers, & Groothoff, 2009; Gun et al., 2005; Suissa et al., 2006).

Pain catastrophizing and fear of movement have been associated with problematic recovery outcomes following WAD (Buitenhuis & de Jong, 2011; Carroll et al., 2008; Sterling, Jull, Vicenzino, Kenardy, & Darnell, 2005). Pain catastrophizing has been defined as an exaggerated negative orientation to an actual or anticipated painful experience (Sullivan, Thorn, Haythornthwaite, Keefe, et al., 2001b). Pain catastrophizing has been shown to predict greater disability in individuals with WAD, even when controlling for pain intensity (Thompson, Oldham, Urmson, & Woby, 2010). Several studies have also shown that high levels of catastrophizing in individuals with WAD are associated with poorer response to rehabilitation interventions (Söderlund, Olerud, & Lindberg, 2000; Sullivan, Adams, Rhodenizer, & Stanish, 2006a). Fear of movement refers to the avoidance of movement based on fear, and has also been associated with problematic recovery following WAD (Vangronsveld, Peters, Goossens, & Vlaeyen, 2008; Vangronsveld, Peters, Goossens, Linton, & Vlaeyen, 2007; Vlaeyen & Linton, 2000). Prospective studies have shown that high scores on measures of fear of movement impede

progress and recovery through the course of rehabilitation interventions (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Philips, 1987).

Recent studies have pointed to the important role of expectancies as determinants of recovery trajectories following WAD (Carroll, Jones, Ozegovic, & Cassidy, 2012; Ferrari & Louw, 2011; Gehrt et al., 2015; Ozegovic, Carroll, Carroll, Cassidy, & Cassidy, 2010b). Holm et al. found a 4-fold increase in disability in individuals with WAD who did not expect to fully recover, as compared to those who did expect to fully recover (Holm et al., 2008). Gehrt et al. reported that individuals with WAD who did not expect to return to work in 6 weeks had 3-fold greater odds of being work-disabled at 1-year follow-up than those who expected to return to work (Gehrt et al., 2015).

There is a basis for proposing that expectancies might be the vehicle through which pain catastrophizing and fear of movement influence return-to-work (RTW) outcomes in individuals with WAD. For example, it has been suggested that high catastrophizers possess "pain schemas" consisting of negative cognitions regarding pain experiences, pain beliefs and ability to cope with pain. Once activated, the pain schema of high catastrophizers are said to contribute to the development of negative expectancies about pain-related outcomes (Leung, 2012; Sullivan, Thorn, Haythornthwaite, Keefe, et al., 2001b). Fear-avoidance models of pain and disability suggest that fear may contribute to the emergence of low expectancies, which may in turn contribute to avoidance of activity (Boersma & Linton, 2006; Fritz & George, 2002; Suissa et al., 2006; Vlaeyen & Linton, 2000). Several investigations have shown that pain catastrophizing and fear of movement are correlated with various types of expectancies, such as pain expectancies, injury expectancies, and work-related expectancies (Boersma & Linton, 2006; Sullivan, Bishop, & Pivik, 1995).

There are important clinical implications to the study of mediational relations among psychological predictors of RTW outcomes in individuals with WAD. Identification of the key processes by which psychological factors impact on RTW outcomes would permit streamlining assessment protocols to focus on variables with the highest predictive value. In addition, research examining the processes by which psychological variables impact on RTW outcomes might help identify key targets for psychosocial interventions designed to improve recovery trajectories following WAD.

In the present study, individuals with WAD completed measures of pain intensity, pain catastrophizing, fear of movement and RTW expectancies within one week of their admission to a rehabilitation program. Return-to-work status was assessed 1-year following treatment termination. Pearson correlations, independent-samples t-tests and bootstrapping mediation analyses were conducted to assess the role of expectancies as mediators of the relations between pain-related psychological variables (e.g. catastrophizing, fear of movement) and RTW status at 1-year follow-up.

Methods

Participants

The study sample consisted of 198 consecutive referrals recruited from 6 physiotherapy clinics. Participants were considered eligible if they had a primary diagnosis of WAD and were currently work-disabled. All participants had been employed prior to their injury and were receiving salary indemnity through a no-fault provincial insurance system (*Société de l'assurance automobile du Québec* (SAAQ)). Of the 198 individuals who met inclusion criteria, only 154 were successfully contacted for follow-up interview. The final sample consisted of 154 participants (81 men and 73 women). The age of participants ranged from 20 to 60 years (M =

36.4, *SD* = 9.2). The mean duration of work disability at the time of enrolment was 15.30 weeks (*SD* = 9.64).

Procedure

Participants were enrolled in a standardized 7-week multidisciplinary rehabilitation program. The intervention team consisted of a physiotherapist, an occupational therapist, and a psychologist. The interventions within the multidisciplinary program included exercise, education, and instruction in self-management skills. The exercise intervention was individually tailored to participants' needs, whereas the education and instruction in self-management interventions were offered in a standardized group format. Potential participants received a letter describing the study procedures, and those who were interested were asked to contact a clinic coordinator. Participants were invited to sign a consent form as a condition for participating in the study. Participants provided demographic information and completed self-report measures of pain intensity, pain catastrophizing, fear of movement and RTW expectancies. Participants were contacted by telephone one year after program completion and asked to rate their current pain intensity and to report their current RTW status. Other variables were assessed which were not included in this study. The research program was approved by the research ethics committees of the *Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain*. Participants were compensated $25 for completing the questionnaires.

Measures

Pain intensity and distribution

The Pain Rating Index of the McGill Pain Questionnaire (MPQ-PRI) was used as a measure of pain (Melzack, 1975). The MPQ-PRI is a weighted index of pain adjectives that were endorsed by the participant. Scores on the MPQ-PRI range from 0 to 78, where higher scores

reflect more severe pain. The MPQ-PRI has been shown to be a reliable and valid index of an individual's pain experience (Turk, Rudy, & Salovey, 1985). Participants completed a body drawing to indicate the distribution of their pain symptoms. The number of body sites where participants reported experiencing pain was also recorded.

Pain catastrophizing

The Pain Catastrophizing Scale (PCS) was used as a measure of catastrophic thinking related to pain (Sullivan et al., 1995). The PCS is a 13-item questionnaire that describes different thoughts and feelings that individuals may experience when they are in pain. The PCS yields a total score that ranges from 0 to 52, with high scores indicating higher levels of catastrophizing. Research indicates the PCS has high internal consistency (coefficient $\alpha = 0.87$) (Sullivan et al., 1995), and is associated with heightened pain intensity and reduced likelihood of returning to work (French et al., 2005; Sullivan & Stanish, 2003).

Fear of movement

The Tampa Scale for Kinesiophobia (TSK) was used as a measure of pain-related fear of movement (Kori et al., 1990). The TSK is a 17-item questionnaire that contains statements reflecting worries or concerns about the consequences of participating in physical activity. Scores range from 17 to 68, with higher scores indicating a higher degree of fear of movement. The TSK has been shown to be internally consistent (coefficient $\alpha = 0.77$) (Vlaeyen, Kole-Snijders, Rotteveel, Ruesink, & Heuts, 1995), and to be associated with behavioral avoidance and disability (Crombez et al., 1999; Sullivan & Stanish, 2003).

Return-to-work expectancies

Participants were asked to rate the likelihood that they would resume some form of employment over the next month ("How likely is it that within the next month you will have

resumed some form of employment?"). Participants indicated their responses on a scale with the endpoints (0%) *not at all likely* to (100%) *extremely likely*.

Demographic information and follow-up interview

Participants provided information regarding their age, marital status, level of education, duration of work disability and employment. At the 1-year follow-up interview, participants were asked if they had returned work, whether they had been able to maintain employment, and about the type of employment in which they were currently involved. Participants were classified as having successfully returned to work if they had returned to work after their injury and maintained work at 1-year follow-up.

Approach to data analysis

Means and standard deviations were computed on the sample characteristics and variables related to the study hypotheses. Initial analyses were conducted to compare participants who were and were not successfully contacted for the follow-up interview. The results of analyses revealed that the groups did not differ significantly on any of the study variables. T-tests for independent samples were used to compare women and men on study measures. Pearson correlations and t-tests for independent samples were conducted to assess the relationship of the key study variables (pain catastrophizing, fear of movement, expectancies and RTW status). To assess the mediating role of expectancies, a series of regression analyses were conducted following Preacher and Hayes' bootstrapping methodology for testing indirect effects (Preacher & Hayes, 2004; 2008).

The mediation hypotheses of this study proposed that the pathway between pain catastrophizing and return to work, and the pathway between fear of movement and return to work, would be mediated by expectancies. To test the meditational hypotheses, the following

relations were examined (see Fig. 1): (1) the relation between the predictors (e.g. pain catastrophizing and fear of movement) on the proposed mediator (expectancies; path a), (2) the relation between the proposed mediator (e.g. expectancies) on the outcome (e.g. RTW status) while controlling for the predictors (e.g. pain catastrophizing and fear of movement; path b), (3) the total effect of the predictors (e.g. pain catastrophizing and fear of movement) on the outcome (e.g. RTW status; path c), and (4) the direct effect of the predictors (e.g. pain catastrophizing and fear of movement) on the outcome (e.g. RTW status) after controlling for the proposed mediator (e.g. expectancies; path c'). The mediation analyses controlled for age, sex, pain intensity, duration of disability and number of injury sites. Sobel mediation tests were used to determine whether the indirect effect of the predictors on the outcome, through the proposed mediator, was significant (Sobel, 1982).

In the current study, bootstrapping procedure was used to produce 95% confidence intervals of the indirect effects obtained with 5000 bootstrap resamples (Preacher & Hayes, 2008). Bootstrapping is a nonparametric resampling technique used to estimate indirect effects without the requirement of distributional assumptions (Preacher & Hayes, 2004). In bootstrapping, the indirect effect is significantly different from 0 at $p < .05$ (2-tailed) if 0 is not within the 95% confidence intervals. The 95% bias-corrected and accelerated confidence intervals are considered the most stringent test for computing indirect effects. All variables were standardized before performing any statistical analysis. Data analysis was performed using SPSS version 21.0 (IBM Corp., 2012).

Results

Sample characteristics

Demographic information and mean scores on measures of pain intensity, pain catastrophizing, fear of movement and expectancies are presented in Table 1. The mean scores on pain catastrophizing, fear of movement and expectancies were comparable (within 1 *SD*) to those reported in previous research (Buitenhuis & de Jong, 2011; Denison, Åsenlöf, & Lindberg, 2004; Sterling et al., 2005). Women had significantly higher RTW expectancies than men (t (152) = 3.0, p = .003). Men and women did not differ significantly with respect to pain catastrophizing (t (152) = .35, p = .772), fear of movement (t (152) = -.98, p = .329), pain intensity (t (152) = -.51, p = .610), or duration of disability at the time of enrolment (t (152) = -.065, p = .948). At 1-year follow-up, 63% of men and 70% of women had returned to work (χ^2 = .616, p = .443). The majority (90%) of participants who returned to work returned to their pre-injury employment.

As shown in Table 2, correlational analyses among continuous variables revealed a significant positive relationship between pain catastrophizing and fear of movement. Results also showed that expectancies were significantly negatively correlated with both pain catastrophizing and fear of movement. T-tests were used to examine the relationship between the binary variable (RTW status), and the key study variables (pain catastrophizing, fear of movement and expectancies). As presented in Table 3, results showed that lower scores on pain catastrophizing and fear of movement, and higher expectancy scores were associated with successful return to work.

Mediation analyses

Multiple regression analyses were conducted to assess the first three components of the proposed mediation models. All paths within the model (Fig. 2) were significant; a negative relationship was found between pain catastrophizing and expectancies and between fear of

movement and expectancies (path c), and expectancies had a positive association with RTW status (path b). Finally, both pain catastrophizing and fear of movement were negatively associated with RTW status, indicating that as levels of pain catastrophizing and fear of movement increase, successful return to work was less likely (path c).

Results of the first mediation analysis confirmed the indirect effect of RTW expectancy on the relation between pain catastrophizing and RTW status at follow-up (β = -.53; CI = -.86 to -.23). In addition, results indicated that the direct effect of pain catastrophizing on RTW status at follow-up remained significant (β = -.74, t (254) = -2.92, p = .004) (path c') when controlling for RTW expectancies, suggesting partial mediation. Sobel test of mediation effect (path c') was significant for the mediation of pain catastrophizing (Sobel test = -3.50, $p < .001$) on RTW status by expectancies.

Results of the second mediation analysis confirmed the indirect effect of RTW expectancy on the relation between fear of movement and RTW status at follow-up (β = -.39; CI = -.64 to -.11). Results indicated that the direct effect of fear of movement on RTW status at follow-up became non-significant (β = -.30, t (254) = -1.26, p = .21) (path c') when controlling for RTW expectancies, suggesting full mediation. Sobel test of mediation effect (path c') was significant for the mediation of fear of movement (Sobel test = -2.90, p = .001) on RTW status by expectancies.

Identification of cut-off score for RTW expectancies scores

A Receiver Operating Characteristic (ROC) analysis was conducted to identify the expectancy cut-score that best associated with successful return to work at 1-year follow-up. The Area Under the Curve (AUC) was significant, and indicated that 80.2% of the time, individuals who had not returned to work had obtained an expectancy score lower than 77.5%. Participants

with expectancy scores equal or greater than 77.5% were classified in the high expectancy group, while participants with scores less than 77.5% were classified in the low expectancy group. The sensitivity was 0.745, the specificity was 0.712 and the mean predictive value (specificity + sensitivity) / 2) for predicting RTW status at follow-up was 0.729. Results were similar to those reported by Carriere et al. in a sample of individuals with work-related musculoskeletal injuries (Carriere, Thibault, & Sullivan, 2015a).

Discussion

This study joins a growing literature pointing to the important role of psychological factors in the prediction of recovery and rehabilitation trajectories following WAD (Buitenhuis et al., 2008; Sterling et al., 2005). We replicated previous research showing that psychological variables such as pain catastrophizing and fear of movement are significant predictors of return to work in individuals with WAD (Boersma & Linton, 2006; Sullivan, Ward, Tripp, French, Adams, & Stanish, 2005b; Wideman & Sullivan, 2011)

Our findings are also consistent with previous research showing that expectancies significantly predict return to work following WAD. The findings extend previous research in showing that expectancies partially mediate the relation between pain catastrophizing and return to work, and fully mediate the relation between fear of movement and return to work. An expectancy cut-score off 77.5% best distinguished those who had successfully returned to work at 1-year follow-up.

The findings of the present study suggest that expectancies might be the vehicle through which fear of movement impacts on RTW outcomes in individuals with WAD. Fear-avoidance models predict that fear leads individuals to expect that physical activity will result in the exacerbation of symptoms; in turn, these expectancies lead to activity avoidance (Leeuw et al.,

2007; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000). The mediating role of expectancies on the relation between fear of movement and RTW outcomes has not yet been investigated in individuals with WAD. However, several investigations have addressed the predictions of the fear-avoidance models using measures of self-efficacy, which may be considered a proxy for expectancies (Denison et al., 2004). Self-efficacy has been defined as the degree of confidence that an individual has about ability to execute particular behavior in order to achieve desired outcomes (Stewart, Polak, Young, & Schultz, 2011). It has been suggested that self-efficacy beliefs and expectancies are associated with outcome expectancies and influence behavior (Stewart et al., 2012). Soderlund et al. found that self-efficacy fully mediated the relation between fear of movement and pain-related disability in individuals with WAD (Söderlund et al., 2000). Similarly, Woby et al. also found that self-efficacy fully mediated the relation between fear and pain-related disability in individuals with low back pain (Woby, Urmston, & Watson, 2007). The emerging body of literature is consistent in showing that fear of movement impacts on disability through its influence on expectancies.

The findings of the present study showed that RTW expectancies partially mediated the relation between pain catastrophizing and RTW status. To our knowledge, no previous study has examined the mediating role of expectancies on the relation between catastrophizing and return to work in individuals with WAD. However, studies have examined the mediating role of expectancies on the relation between catastrophizing and other pain-related outcomes. For example, Sullivan et al. reported that expectancies partially mediated the relation between pain catastrophizing and disability following total knee arthroplasty (Sullivan, Tanzer, Reardon, Amirault, Dunbar, & Stanish, 2011c). Another study showed that expectancies mediated the relation between catastrophizing and pain experience in a sample of undergraduate students

undergoing an experimental pain procedure (Sullivan, Rodgers, & Kirsch, 2001a).

In the present study, catastrophizing remained a significant predictor of RTW outcomes, even when controlling for expectancies. These findings suggest catastrophizing might also impact on RTW outcomes through processes that are unrelated to expectancies. In previous research, catastrophizing has been shown to be associated with disability-relevant variables, such as heightened pain behaviors (Thibault, Loisel, Durand, Catchlove, & Sullivan, 2008), pain intensity (Severeijns, Vlaeyen, van den Hout, & Weber, 2001), increased analgesic use (Weissman-Fogel, Sprecher, & Pud, 2008) and misuse (Martel, Wasan, Jamison, & Edwards, 2013), longer hospital stays (M. K. Jensen, Thomsen, & Højsted, 2006), and prolonged bed rest (Verbunt, Sieben, Vlaeyen, Portegijs, & André Knottnerus, 2008). These factors, potentially triggered by high catastrophizing, might impact on RTW outcomes, independent of their influence on expectancies.

Little is currently known about how RTW expectancies develop in work-disabled individuals who have sustained whiplash injuries. Conceptual models addressing the ontology and influence of expectancies have distinguished between response expectancies and behavioral outcome expectancies (Bandura, 1977; Kirsch, 1985a). Response expectancies refer to predictions about the probability of occurrence of non-volitional responses such as pain, sleep and emotional reactions (Kirsch, 1985a). Although non-volitional responses are considered to occur automatically, the expectancy of their occurrence can have a significant impact on experience (Kirsch, 1985a; Kirsch et al., 2014). Recent theorizing suggests that response expectancies might be inextricably linked to emotions such as anxiety or fear (Dymond & Roche, 2009). For individuals with high pain-related fears, response expectancies for increased pain or injury exacerbation might be automatically elicited following exposure to a fear-relevant stimulus (Vangronsveld et al., 2007).

Behavioral outcome expectancies are distinguished from response expectancies in that they involve responses that are under volitional control. According to Stewart et al., RTW expectancies might be constructed on the basis of work-disabled individuals' perceived lack of control over the RTW process, concerns about the inability to perform occupational tasks, perceived lack of workplace accommodations, lack of recognition of the impact of injury and fear of movement and re-injury (Stewart et al., 2012). If fear plays a central role in emergence of RTW expectancies, and if expectancies for increased pain are inextricably linked to fear, this might explain the relation between fear of movement and return to work was completely mediated by expectancies. Given the consistency with which RTW expectancies have been shown to predict actual RTW outcomes, more research is needed to clarify how RTW expectancies emerge and how they relate to other domains of expectancies that are linked to emotions such as anxiety and fear (Schultz et al., 2007).

Bandura has suggested that expectancies impact behavior by interfering with the investment of effort and motivation required to achieve an outcome (Bandura, 1977; 1978). Low expectancies might also diminish an individual's persistence or efforts towards goal pursuits (Lackner et al., 1996). In individuals with WAD, low expectancies might lead to reduced motivation for participating in rehabilitation interventions. Low motivation consequent to low expectancies could also take the form of non-compliance, non-adherence, or missed appointments to treatments intended to promote recovery. In addition, clients' verbalizations of low expectancies might have a negative impact on the quality of the working alliance with the treating clinician.

Clinical investigators have suggested that expectancies should be a target of intervention in individuals with WAD (Carroll, Holm, Ferrari, Ozegovic, & Cassidy, 2009; Ferrari & Louw, 2011; Holm et al., 2008; Ozegovic et al., 2010b; Ozegovic, Carroll, & David Cassidy, 2009). To

date, no research has been conducted addressing the most effective means of modifying RTW expectancies. The results of the present study suggest that intervention techniques designed to reduce catastrophic thinking and fear of movement might be effective in modifying RTW expectancies. Experienced-based, and informational techniques have also been discussed as potentially useful techniques for changing expectancies (Carroll et al., 2009; Stewart et al., 2012). Vlaeyen et al. have suggested that patients may learn to alter their expectancies of pain through graded exposure (Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2001). Others have suggested that early educational interventions that include reassurance and encouragement to resume activity may be beneficial in changing RTW expectancies (Brison et al., 2005; Carroll et al., 2009). In order to advance clinical practice in this area, more research is needed on the effectiveness of interventions aimed at modifying RTW expectancies.

Caution must be exercised in the interpretation of these findings. The design of this study places limits on the nature of conclusions that can be drawn about the causal and sequential relations among study variables. A number of inclusion criteria (e.g. previously employed, participating in a multidisciplinary rehabilitation intervention) were used to maximize the homogeneity of the study sample. The inclusion criteria used in the study necessarily impact on the generalizability of the findings. In addition, data for this study were derived from patients enrolled in a multidisciplinary rehabilitation program. Multidisciplinary treatment is part of the repertoire of services made available to a minority of individuals with WAD. Moreover, the data were collected in a region operating under a ‘no fault’ system and might not be generalizable to regions operating under a ‘tort’ system. It must also be noted that return to work is an outcome that is influenced by numerous social, workplace and economic factors that were not assessed in this study.

Despite these limitations, the current study stands to advance knowledge regarding the mediating role of expectancies on RTW outcomes following WAD. The results showed that expectancies fully mediated the relation between fear of movement and RTW outcomes, and partially mediated the relation between pain catastrophizing and RTW outcomes. The significant predictive role of expectancies for RTW outcomes argues for the inclusion of measures of expectancies in the standard assessment protocols for individuals who have sustained WAD, and for the inclusion of expectancies as a specific target of intervention.

Tables

Table 1. Characteristics of the study sample.

	N (%) or Mean (SD)
Pain intensity	15.18 (12.08)
Successful return to work	102 (66.2 %)
Work disability (weeks)	15.30 (9.64)
Education	
Less than high school	15 (9.7 %)
High school	45 (29.2 %)
Trade school	25 (16.2 %)
College	44 (28.6 %)
University	25 (16.2 %)
Occupation	
Laborer	43 (27.9 %)
Driver	10 (6.5 %)
Nursing	31 (20.1 %)
Trade	26 (16.9 %)
Sales	7 (4.5 %)
Admin/clerical	37 (24.0 %)
Injury site	
Back	126 (81.8 %)
Neck	121 (78.6 %)
Upper	89 (57.8%)
Lower	31 (20.1 %)
Pain catastrophizing	14.27 (10.77)
Fear of movement	39.40 (7.29)
Expectancies	75.81 (29.46)

Note. $N = 154$. SD = Standard deviation; Pain intensity = McGill Pain Questionnaire; Work disability = Duration of work disability; Expectancies = Return-to-work expectancies. Injury site categories are not mutually exclusive.

Table 2. Correlations between pain catastrophizing, fear of movement and expectancies.

Scales	Pain catastrophizing	Fear of movement	Expectancies
Pain catastrophizing	-	-	-
Fear of movement	.481**	-	-
Expectancies	-.489**	-.303**	-

**$p < .001$

Table 3. T-test results for RTW status on pain catastrophizing, fear of movement and expectancies and RTW status.

Scales	RTW		non-RTW		
	M	SD	M	SD	*t*-test
Pain catastrophizing	10.64	8.91	21.40	10.62	6.63**
Fear of movement	38.09	7.41	41.96	6.37	3.38**
Expectancies	85.98	20.60	52.88	31.99	-7.76**

***p* < .001, DF = 152, RTW = Return to work

Figures

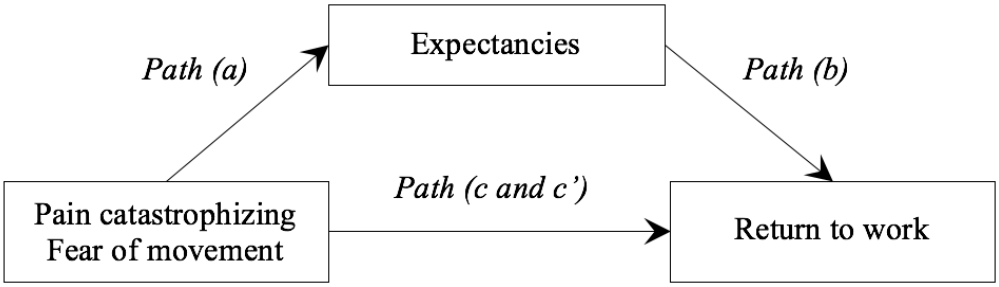

Figure 1. Mediation model of pain catastrophizing, fear of movement and return to work by expectancies. Analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites.

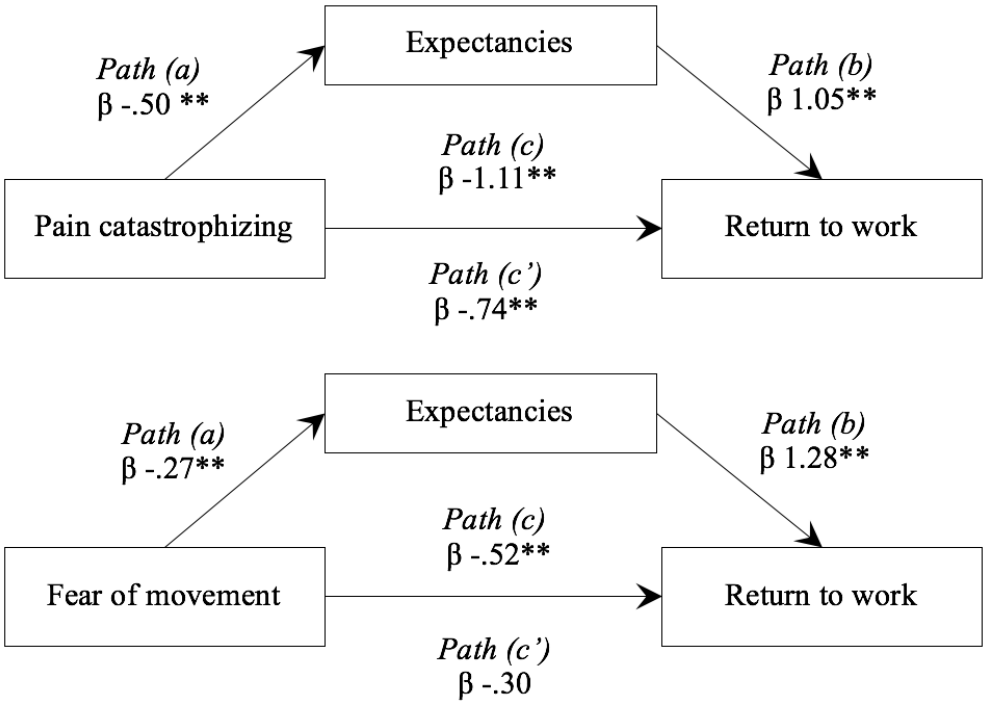

Figure 2. Mediation models of pain catastrophizing and fear of movement on return to work by expectancies (*N*=154). Analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites. β = Standardized coefficients.

Preface to Chapter 4

The results of studies 1 and 2 provide evidence for the mediating role of recovery expectancies on the relationships between pain-related psychological factors and RTW outcomes. The findings from Study 2 indicated that recovery expectancies partially mediated the relationship between pain catastrophizing and RTW outcomes, and fully mediated the relationship between fear of movement and RTW outcomes, following whiplash injury. In addition, our findings indicated that a recovery expectancy score of 77.5% best distinguished between individuals who returned to work and those who remained work-disabled, following whiplash injury. When considered together, results from Study 1 and Study 2 provide strong evidence for recovery expectancies as an explanatory variable in the relationship between pain-related psychological factors and RTW outcomes following musculoskeletal injury.

The next study sought to extend findings from studies 1 and 2 by examining the mediating role of recovery expectancies on the relationship between perceived injustice and RTW outcomes following whiplash injury. Several investigations have shown that high levels of perceived injustice are associated with prolonged work disability following musculoskeletal injury. However, little is currently known about the processes by which perceived injustice impacts on RTW outcomes. The goal of Study 3 was to investigate whether recovery expectancies are a vehicle by which perceived injustice impacts on RTW outcomes. Study 3 utilized the same sample of individuals with whiplash-associated disorders as in Study 2. When considered with the previous results, support for the mediating role of recovery expectancies on the perceived injustice-RTW outcomes relationship would have important theoretical and clinical implications. These are presented in the General discussion.

Chapter 4: Expectancies mediate the relationship between perceived injustice and return to work following whiplash injury: A 1-year prospective study

Carriere JS, Thibault P, Adams H, Milioto M, Ditto B, Sullivan MJL. Expectancies mediate the relationship between perceived injustice and return to work following whiplash injury: A 1-year prospective study. *European Journal of Pain* 2017;21(7):1234-1242. doi: 10.1002/ejp.1023

Abstract

Emerging evidence suggests that perceived injustice is a risk factor for work disability in individuals with whiplash injury. At present, however, little is known about the processes by which perceived injustice impacts on return to work. The purpose of this study was to examine whether expectancies mediated the relationship between perceived injustice and return to work in patients with whiplash injury. One hundred and fifty-four individuals (81 men, 73 women) with a primary diagnosis of whiplash injury completed self-report measures of pain intensity, perceived injustice and return-to-work expectancies following admission to a rehabilitation program. Work status was assessed 1 year after discharge. Consistent with previous research, high scores on a measure of perceived injustice were associated with prolonged work disability. Results indicated that high perceptions of injustice were associated with low return-to-work expectancies. Mediation analyses revealed that expectancies fully mediated the relationship between perceived injustice and return to work. The findings suggest that intervention techniques designed to target expectancies could improve return-to-work outcomes in patients with whiplash injury. The Discussion addresses the processes by which expectancies might impact on return-to-work outcomes and the manner in which low return-to-work expectancies might be modified through intervention.

Introduction

In North America, it is estimated that over 1 million individuals sustain whiplash injuries every year (Holm et al., 2009). Research suggests that the trajectory of recovery following whiplash injury can be prolonged, with as many as 50% of individuals remaining symptomatic 1 year post-injury (Côté et al., 2001; Kamper et al., 2008). Approximately 15-20% of individuals who have sustained whiplash injury will remain permanently disabled (Buitenhuis et al., 2009; Gun et al., 2005; Sterling et al., 2005; Suissa et al., 2006).

Recent investigations have drawn attention to the role of perceived injustice as a determinant of pain and disability following injury (Sullivan, Scott, & Trost, 2012; Trost et al., 2012). In the context of painful injury, perceived injustice has been conceptualized as a cognitive appraisal comprising of elements of severity of loss, perceived irreparability of loss, a sense of unfairness, and external attributions of blame (Scott et al., 2013b; Sullivan et al., 2008). In both cross-sectional and prospective studies, perceived injustice has been associated with the experience of more severe pain, more pronounced disability and prolonged work disability (Brown, Bostick, Lim, & Gross, 2012; Ferrari, 2015; Ferrari & Russell, 2014; Rodero et al., 2012; Scott & Sullivan, 2012; Sullivan et al., 2012; Sullivan, Davidson, Garfinkel, Siriapaipant, & Scott, 2009). In a prospective study of individuals with whiplash injury, perceived injustice predicted return to work at 1-year follow-up, after controlling for pain intensity (Scott et al., 2013b). In another prospective study of individuals with musculoskeletal injuries (including whiplash injury), perceived injustice predicted prolonged work disability, independently of pain intensity, catastrophizing, depression, and pain-related fear (Sullivan et al., 2008).

Patient's expectancies regarding their recovery have also been shown to play and important role in their prognosis (Carroll et al., 2012; Ferrari & Louw, 2011; Gehrt et al., 2015;

Holm et al., 2008; Ozegovic et al., 2010b). Gehrt et al. found that individuals with whiplash injury who reported low return-to-work (RTW) expectancies were 3 times more likely of being work-disabled at 1-year follow-up (Gehrt et al., 2015). Holm et al. similarly reported that whiplash patients who did not expect to return to work were 4 times less likely to recovery fully, compared to those who expected to make a full recovery (Holm et al., 2008).

It has been suggested that many psychological factors exert their effects on health and disability outcomes, at least in part, through expectancies (Carriere, Thibault, & Sullivan, 2015a; Carriere, Thibault, Milioto, & Sullivan, 2015b; Kirsch, 1985a; Milling, Reardon, & Carosella, 2006; Sullivan, Rodgers, & Kirsch, 2001a; Sullivan, Tanzer, Reardon, Amirault, Dunbar, & Stanish, 2011c). Emerging research suggests that pain-related psychological factors such as catastrophizing and fear of pain exert their influence on return to work through expectancies. For example, in a sample of work-injured individuals (neck and back pain), expectancies mediated the relationship between depressive symptoms and return to work (Carriere, Thibault, & Sullivan, 2015a). Similarly, in a sample of individuals with whiplash injury, expectancies mediated the relationship between fear of movement and return to work, and partially mediated the relationship between pain catastrophizing and return to work (Carriere, Thibault, Milioto, & Sullivan, 2015b). It is possible that expectancies might be the vehicle through which perceived injustice influences return to work in patients with whiplash injury.

At present, there is no established conceptual framework to guide hypotheses about the relationships between perceptions injustice and adverse recovery outcomes. Greater understanding of the processes by which perceived injustice impacts on return to work may facilitate the implementation of strategies to mitigate the effects of perceived injustice on recovery outcomes. In fact, evidence suggests that perceived injustice may be more resistant to

change than other pain-related psychological variables, such as catastrophizing and pain-related fear (Sullivan et al., 2008), and that current multidisciplinary rehabilitation interventions have a negligible effect on reducing perceptions of injustice. It is possible that treatment outcomes might be improved if the processes by which perceived injustice impacts on recovery were identified and specifically targeted in rehabilitation interventions.

This study examined whether RTW expectancies mediate the relationship between perceived injustice and return to work in individuals with whiplash injury. Consistent with previous research, it was hypothesized that perceived injustice and expectancies would be prospectively associated with return to work. It was hypothesized that expectancies would mediate the relationship between perceived injustice and RTW outcomes.

Methods

Participants

One hundred and fifty-four individuals (81 men, 73 women) with a primary diagnosis of Whiplash-Associated Disorder, Grade I or II participated in this study. All participants were receiving salary indemnity through a no-fault provincial insurance system (*Société de l'assurance automobile du Québec*). Participants had a mean age of 36.4 years with a range of 20 to 60 years. The mean duration of work disability was 15.30 weeks with a range of 4 to 48 weeks. The majority of patients (55%) had completed at least 12 years of education. Approximately half the sample (58%) was married or living with a common-law partner.

Procedure

The Research Ethics Board of the *Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain* approved the present study. Participants were recruited from one of 6 rehabilitation clinics in the Montreal region. All patients who were enrolled in a standardized

7-week multidisciplinary rehabilitation program aimed primarily at returning individuals to work following whiplash injury. The rehabilitation program included interventions focusing on exercise, education, and instruction in self-management skills. Patients who were interested in participating in the research were instructed to contact the project coordinator. Individuals were considered eligible to participate if they had received a diagnosis of a Whiplash-Associated Disorder Grade I or II and remained work-disabled 4 weeks post-injury. Potential participants received a letter describing the study procedures and interested individuals contacted a clinic coordinator. Volunteer participants were invited to sign a consent form as a condition of participating in the study.

Participants provided demographic information and completed self-report measures of pain intensity, perceived injustice and RTW expectancies during the first week of the treatment program (pre-treatment). The initial assessment also included assessment of active neck range of motion. One year later, participants were contacted by telephone and were asked to respond to questions about their employment status. Participants received a 25$ compensation for completing the study.

Of the 198 individuals who met inclusion criteria, only 154 were successfully contacted for follow-up interview (77% of total sample). Information regarding the cause of the missing data was not available. Mean comparisons between participants who had complete (N = 198) and incomplete data (N = 154) were conducted for the following variables: age, sex, pain intensity, pain duration, RTW expectancies, perceived injustice and RTW outcomes. All comparisons were non-significant ($p > .05$). Therefore, the two groups appeared homogenous, and the 44 cases with incomplete data were not used in the study sample.

Measures

Pain intensity and distribution

The Pain Rating Index of the McGill Pain Questionnaire (MPQ-PRI) was used as a measure of pain (Melzack, 1975). The MPQ-PRI is a weighted index of pain adjectives that were endorsed by the participant. Scores on the MPQ-PRI range from 0 to 78, with higher scores reflecting more severe pain. The MPQ-PRI has been shown to be a reliable and valid index of an individual's pain experience (Turk et al., 1985). Participants completed a body drawing to indicate the distribution of their pain symptoms. The number of painful body sites was also recorded.

Perceived injustice

Perceived injustice was measured with the Injustice Experience Questionnaire (IEQ) (Sullivan et al., 2008). The IEQ asks respondents to rate how frequently they experience each of 12 injustice-related thoughts (e.g. "Nothing will ever make up for what I have gone through"). Each item is rated on a 5-point scale, ranging from 0 ("never") to 4 ("all the time"). A total IEQ score is computed by summing the 12 items, with high scores reflecting high levels of perceived injustice. The IEQ contains two correlated factors labeled "severity of loss/irreparability of loss" and "blame/unfairness". The IEQ has shown to have good internal consistency and test-retest reliability. The reported coefficient alpha for the total IEQ is 0.92 (Sullivan et al., 2008), which is consistent with our data.

Return-to-work expectancies

Participants were asked to rate the likelihood that they would resume some form of employment over the next month ("How likely is it that within the next month you will have resumed some form of employment?"). Participants indicated their responses on a scale with the end points (0%) "not at all likely" to (100%) "extremely likely".

Neck range of motion

The maximum active Cervical Range of Motion (CROM; flexion and extension, left and right lateral flexion, and left and right rotation) was assessed with a CROM device (Hole, Cook, & Bolton, 1995). Measurement of active CROM has high intra- and inter-rater reliability and has been shown to predict long-term outcomes in patients with whiplash injuries (Hendriks et al., 2005; Sterling et al., 2005).

Demographic and injury-related variables.

Participants were asked to respond to questions concerning their age, sex, duration of disability, marital status, education, pre-injury employment type, medication use, and characteristics of the motor vehicle accident that precipitated their injury (e.g. speed of collision, use of head rest, use of seat belt).

Follow-up interview

At the 1-year telephone follow-up interview, participants were asked if they had returned work and whether they had been able to maintain employment. Participants were classified as having successfully returned to work if they had returned to work after their injury and maintained work at 1-year follow-up.

Approach to data analysis

Given the prospective nature of this study, the sample consisted only of patients for whom complete data were available at baseline and follow-up (77% of total sample). Initial analyses were conducted to compare participants who were and were not successfully contacted for the follow-up interview. The results of the analyses revealed that the groups did not differ significantly on any of the study variables. Means and standard deviations were computed on sample characteristics and questionnaire scores. T-tests for independent samples and chi-square

analyses were used to compare women and men on study measures. Correlation analyses and t-tests for independent samples were used to examine whether RTW outcomes and duration of disability were related to pain intensity, perceived injustice and expectancies. Partial correlation was used to examine the association between perceived injustice and expectancies, controlling for pain intensity. Data analysis was performed using IBM SPSS Statistics version 21.0 (IBM, Armonk, NY).

In order to examine whether expectancies mediated the association between perceived injustice and return to work, we used the R package for causal mediation by Tingley et al. (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). A bootstrapped nonparametric mediational analysis (b = 1000) was conducted, using least squares regression to fit the mediator to the binary outcome (Tingley et al., 2014). Mediation analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites (see hypothesized model in Fig. 1).

Results

Baseline characteristics

Demographic information on the study sample appears in Table 1. Participants had a mean pain intensity score of 15.18 (*SD* = 12.08), a mean perceived injustice score of 16.15 (*SD* = 8.29), a mean duration of disability of 15.30 weeks (*SD* = 9.64; Range = 4-48), and a mean RTW expectancy score of 75.81 (*SD* = 29.46). These values are comparable to the mean scores on measures of perceived injustice obtained in samples of individuals with whiplash injury (Scott, Trost, Bernier, & Sullivan, 2013a), and to the mean pain intensity and expectancy score obtained in a sample of patients with work-related musculoskeletal injuries (Carriere, Thibault, & Sullivan, 2015a). A Shapiro-Wilk's test ($p > .05$) (Shapiro & Wilk, 1965; Razali & Wah, 2011). A visual inspection of their histograms showed that the RTW expectancy and perceived injustice

scores were approximately normally distributed, with a skewness of -.975 (SE = .197) and a kurtosis of -.226 (.391) for expectancies, and a skewness of .303 (SE = .197) and a kurtosis of -.752 (.391) for perceived injustice. At the 1-year follow-up, 66% of participants had returned to work and 90% of those had returned to their pre-injury employment.

T-tests were used to compare men and women on study variables. Men and women did not differ on the measure of pain intensity (t (152) = -.51, p = .610). There were no significant differences in perceived scores between men and women (t (152) = -.389, p = .700). Men and women did not differ with respect to RTW outcomes at 1-year follow-up (χ^2 = .616, p = .443). However, women (M = 82.04, SD = 28.15) had higher RTW expectancies than men (M = 68.21, SD = 29.46, t (152) = 3.0, p = .003).

Associations between study variables

Correlational analyses revealed that perceived injustice was significantly associated with RTW expectancies, while controlling for pain intensity (r = -.316, p < .001). T-tests were used to compare RTW outcomes on all study variables. Results revealed that individuals who successfully returned to and maintained work reported higher RTW expectancies (t (152) = 7.77, p < .001), and lower perceived injustice (t (152) = -2.903, p = .005) than individuals who remained work-disabled. Pain intensity did not vary as a function of RTW outcomes (t (152) = -1.405, p = .163).

Correlational analyses and t-tests examined whether duration of disability was associated with the study variables. Duration of disability was not significantly associated RTW expectancies (r = -.061, p = .454), perceived injustice (r = .024, p = .772), pain intensity (r = .038, p = .639) and RTW outcomes (t (152) = -.975, p = .332).

Mediation analyses

The mediating role of expectancies on the association between perceived injustice and return to work was examined using causal mediation analyses for binary outcomes. The total effect of perceived injustice on RTW outcomes was significant (estimate = -.007, $p = 0.04$). The indirect effect of perceived injustice on RTW outcomes through expectancies was also significant (estimate = -.006, $p < .001$). The direct effect of perceived injustice on RTW outcomes was not significant (estimate = -.001, $p = .64$), suggesting that perceived injustice impacts on RTW outcomes through expectancies. Return-to-work expectancies accounted for 74% of the total effect. The findings indicate that expectancies fully mediate the relationship between perceived injustice and RTW outcomes following whiplash injury. Analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites (See Table 2).

Discussion

The present study adds to a growing body of research supporting an association between perceived injustice and pain-related disability. Consistent with previous research, perceived injustice was significantly associated with prolonged work disability following musculoskeletal injury (Scott et al., 2013b; Sullivan et al., 2008). This study provides an important extension of previous research by showing that perceptions of injustice are significantly associated with expectancies for returning to work, even after controlling pain intensity. To our knowledge, the current study is the first to demonstrate that expectancies are the vehicle through which perceived injustice influences RTW outcomes following whiplash injury.

There is a growing literature highlighting the negative impact of perceptions of injustice on pain outcomes. Studies have shown that high perceived injustice scores are related to less rehabilitation progress, and lower probably of return to work following musculoskeletal injury (Ferrari, 2015; Scott et al., 2013b; Scott, Trost, Milioto, & Sullivan, 2015; Sullivan et al., 2008).

The unique predictive value of perceived injustice has also been shown in relation to various pain-related mental health outcomes, pain behavior, self-reported disability, and opioid use (Carriere, Sturgeon, Kao, Sullivan, & Darnall, 2017; Sturgeon, Carriere, Rico, Kao, Darnall, & Mackey, 2016; Rodero et al., 2012; Scott et al., 2013b; Sullivan et al., 2009). Despite the apparent relevance of perceived injustice in the experience of, and recovery from injury, concepts of blame and unfairness are not discussed in the predominant psychological conceptualizations of pain-related disability (Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012; Vlaeyen & Linton, 2012). In fact, many pain-related psychological constructs are comprised of appraisals regarding the magnitude or threat value of pain, whereas the phenomenology of injustice is comprised of elements of blame, loss, and irreparability of loss (Sullivan et al., 2008). Perceived injustice has also been shown to be more strongly related to work disability, whereas constructs such as pain catastrophizing are a better predictor of pain intensity (Sullivan et al., 2008). Based on the accumulating evidence, perceived injustice distinguishes itself from other psychological variables and may warrant clinical attention as an important risk factor for adverse pain-related outcomes.

Perceived injustice has been shown to be significantly associated with other pain-related factors (e.g. pain catastrophizing, fear of movement, self-reported disability) which are predictive of RTW outcomes (Scott et al., 2013b; Scott & Sullivan, 2012; Sullivan, Adams, Martel, Scott, & Wideman, 2011a; Trost et al., 2015), raising the possibility of shared mechanisms of influence on work disability. A central objective of this research was to address whether expectancies mediated the relationship between perceived injustice and return to work. Our results revealed that high perceptions of injustice were associated with low RTW expectancies and that low RTW expectancies were associated with lower likelihood of returning

to work at 1-year follow-up. Results of our mediation analyses indicated that expectancies fully mediate the relationship between perceived injustice and return to work.

Little is currently known about how expectancies contribute to prolonged work disability (Stewart et al., 2012). According to Bandura, negative expectancies have a detrimental impact on behavior by compromising the effort that will be invested in the pursuit of desired goals or outcomes (Bandura, 1977; 1978). In the case of individuals with whiplash injury, low expectancies for the resumption of occupational activities may reduce the motivation to actively engage in the behaviors necessary to make progress in rehabilitation. In addition, research has shown that individuals preferentially process information that is consistent with expectancies and discount information that is inconsistent with expectancies (Petrie & Pennebaker, 2004). In the context of debilitating injury, low expectancies might lead individuals to discount information relevant to recovery and improvement, focusing instead attention on expectancy-consistent information such as symptom severity, and functional losses. In turn, expectancy-consistent cognitions might interfere with goal setting or goal pursuit related to occupational re-engagement.

A novel finding of the present study was the strong association between high perceived injustice and low expectancies regarding return to work. It is possible that some of the underlying cognitive dimensions of perceived injustice might lead to increased susceptibility to developing negative RTW expectancies. Sullivan et al. (2008) discussed appraisals of the irreparability and permanence of loss as defining features of perceived injustice. An individual's belief or appraisal of their losses as permanent might prevent them from seeing successful return to work as a likely outcome of rehabilitation interventions, and in turn might contribute to

disability. Alternatively, perceived injustice might contribute to an excessive focus on pain and loss, thereby contributing to negative thoughts and negative expectancies regarding the future.

At the present time, intervention approaches for the management of whiplash injuries are comprised of various symptom reduction techniques (e.g. medication, modalities, and relaxation), functional restoration techniques (e.g. mobilization and exercises), and self-management techniques (Seferiadis, Rosenfeld, & Gunnarsson, 2004; Teasell et al., 2010). Current approaches to the management of whiplash injury do not include techniques specifically designed to reduce perceptions of injustice, nor do they include techniques specifically designed to change RTW expectancies (Sullivan et al., 2008). Incorporating techniques that target perceptions of injustice and RTW expectancies in rehabilitation programs holds promise of improving occupational outcomes for patients with whiplash injury.

Bandura has suggested that expectancies can be modified through expectancy-disconfirming experiences (Bandura, 1977). In the context of rehabilitation, experienced-based interventions and informational techniques may provide the opportunity to disconfirm individuals' predictions and therefore may be beneficial for changing expectancies (Carroll et al., 2009; Crombez et al., 1999). For example, experience-based techniques such as graded activity and exposure been shown to alter expectancies for pain exacerbations (Crombez et al., 2002; Vlaeyen et al., 2001). Goal setting techniques designed to expose individuals to success and achievement experiences might also be useful in fostering positive RTW expectancies. Other techniques, such as early educational interventions comprised of elements of reassurance and encouragement towards activity reengagement may also be beneficial in modifying expectancies (Brison et al., 2005; Carroll et al., 2009; Robinson, Theodore, Dansie, Wilson, & Turk, 2013).

It is possible that the success of many workplace interventions is due, in part, to their

influence on modifying RTW expectancies. Workplace interventions often take the form of gradual resumption of occupational responsibilities, assignment of light duties or reduced hours (Franche, Baril, Shaw, Nicholas, & Loisel, 2005). Common across many workplace interventions is that an individual will be asked to perform activities related to his or her employment, but modified in a manner that maximizes the probability that the activities will be successfully executed. The experience of success in the completion of modified or simulated workplace activities might lead the individual to revise his or her RTW expectancies.

It is also worth considering how the development of low RTW expectancies might be prevented. Communication from health care professionals can play a significant role in the development of RTW expectancies (Stewart et al., 2012; Sullivan, Tanzer, Reardon, Amirault, Dunbar, & Stanish, 2011c). Individuals who are told that they will not be able to return to their pre-injury employment will likely develop low expectancies. Professionals involved in the treatment of individuals with debilitating pain conditions need to be made aware of their role in shaping negative RTW expectancies, and the adverse impact these can have on recovery and re-employment outcomes (Stewart et al., 2012). Of course, various other factors are also likely to influence the formation of RTW expectancies. For example, intrapersonal factors (e.g. health status, severity of illness, anticipation about returning to work), interpersonal factors (e.g. familial roles, employer's attitudes), or system-level factors (e.g. barriers to employment, sociodemographic factors, cultural factors) (Franche, Corbière, Lee, Breslin, & Hepburn, 2007; Schultz et al., 2007; Stewart et al., 2012; Young et al., 2005). A better understanding of these factors and how they contribute to RTW expectancies may facilitate clinical strategies targeting those with poorer expectancies.

The results of this study should be considered in light of several limitations. The sample

consisted of patients with persistent pain following whiplash injury who were attending a rehabilitation facility. Therefore, present findings may not be generalizable to patients with pain of different duration and etiology, and who are not attending a similar treatment setting. In addition, the data were collected under a no-fault system. It is unclear whether similar findings would emerge in a 'tort' system where individuals are able to take legal action to address the losses they have sustained. Finally, the modest number of participants necessitates replication with larger samples to increase the validity and reliability of the present findings.

The important role of expectancies is becoming clearer with advances in research. The results of the present study provide further support for the mediating role of expectancies on the relationship between pain-related psychological variables and return to work in individuals with persistent pain. Specifically, our findings suggest that expectancies are the vehicle through which perceived injustice impacts return to work following whiplash injury. In an effort to increase the effectiveness of rehabilitation programs that aim to foster occupational re-engagement, more efforts will need to be invested in developing interventions specifically designed to alter RTW expectancies. A combination of cognitive (re-appraisal), experiential (exposure to work-related activity) and preventive (changing communication of health care professionals) strategies might be required to exert meaningful change in low RTW expectancies.

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Tables

Table 1. Sample demographics and accident characteristics.

	Mean (SD) or N (%)	
Age	36.4	(9.27)
Sex		
Men	81	(52.6)
Women	73	(47.4)
Duration of work disability (weeks)	15.30	(9.64)
Pain site		
Back	126	(81.8)
Neck	121	(78.6)
Speed at time of crash (km/h)	31.74	27.49)
Position in vehicle		
Passenger	145	(95.4)
Driver	6	(3.9)
Seatbelt use		
Yes	147	(96.7)
No	5	(3.3)
Headrest use		
Yes	108	(71.1)
No	44	(28.9)
Medication use		
Yes	132	(86.8)
No	20	(13.2)
Cervical range of motion		
Flexion	48.66	(11.18)
Extension	54.36	(16.4)
Right lateral	38.26	(9.12)
Left lateral	40.37	(8.48)
Right rotation	58.91	(13.58)
Left rotation	58.25	(14.07)
Education		
Less than high school	15	(9.7)
High school	45	(29.2)
Trade school	25	(16.2)

College	44	(28.6)
University	25	(16.2)
Occupation		
Laborer	43	(27.9)
Driver	10	(6.5)
Nursing	31	(20.1)
Trade	26	(16.9)
Sales	7	(4.5)
Administration/clerical	37	(24.0)
Marital status		
Single	39	(25.7)
Common law	49	(32.3)
Married	40	(26.3)
Separated/divorced	22	(14.5)
Widowed	2	(1.3)

Note. $N = 154$. Pain site categories are not mutually exclusive.

Table 2. Causal mediation for the role of expectancies on the association between perceived injustice and return to work.

	Estimate	*p*	CI _95$_{lower}$	CI_95$_{upper}$
Direct effect	-.00124	.64	-.00705	.00806
Indirect effect	-.00606	< .001	-.01062	-.00294
Total effect	-.00733	.04	-.01161	-.00089
Proportion mediated	.74306	.04	.27096	5.71209

Note. These mediation analyses test the potential mediating paths: IV (perceived injustice) → mediator (expectancies) → DV (return to work at 1-year follow-up). Mediation analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites. CI_95 = 95% Confidence intervals.

Figure

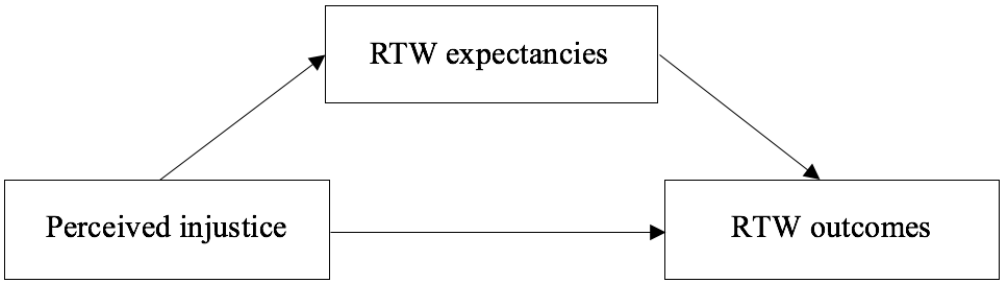

Figure 1. Model of the mediating role of RTW expectancies on the relationship between perceived injustice and RTW outcomes at 1-year follow-up. Analyses controlled for age, sex, pain intensity, duration of disability and number of pain sites.

Chapter 5: General discussion

Research over the past two decades has revealed that pain-related psychological variables can contribute significantly to prolonged periods of work disability following musculoskeletal injury (Adams, Ellis, Stanish, & Sullivan, 2007; Gatchel et al., 2007; Suissa, 2003; Sullivan, 2003; Sullivan, Adams, Rhodenizer, & Stanish, 2006a). Factors such as depression, catastrophic thinking, fear of movement and perceived injustice have been identified as contributing to poor RTW outcomes in individuals who have sustained musculoskeletal injuries (Leeuw et al., 2007; Lötters et al., 2006; Sullivan, Feuerstein, Gatchel, Linton, & Pransky, 2005a; Sullivan, Yakobov, Scott, & Tait, 2014). The current thesis sought to better understand the processes by which these pain-related psychological factors impact work disability.

The central objective of this thesis was to examine the potential mediating role of recovery expectancies on the relationship between pain-related psychological factors and RTW outcomes following musculoskeletal injury. The present thesis included three studies. The objective of Study 1 was to examine the mediating role of recovery expectancies on the relationship between depressive symptoms and RTW outcomes following work-related musculoskeletal injury. The objective of Study 2 was to examine the mediating role of recovery expectancies on the relationships between pain catastrophizing and RTW outcomes, and fear of movement and RTW outcomes, following whiplash injury. The objective of Study 3 was to examine the mediating role of recovery expectancies on the relationship between perceived injustice and RTW outcomes, following whiplash injury.

In the following sections, a brief summary of the findings of the three studies and their context within related research will be presented. Given that the three manuscripts included in the present thesis already offered a detailed interpretation of our findings based on previous work

in the area, the following discussion will emphasize the general contribution of our findings to the existing literature. The theoretical and clinical implications of these findings will be discussed.

Findings from these three studies relate to several postulates of models of disability following musculoskeletal injury. First, each of these studies lends support for the importance of psychological variables addressed within biopsychosocial models of disability. Considered together, these studies revealed that measures of recovery expectancies, depressive symptoms, pain catastrophizing, fear of movement and perceived injustice were prospectively associated with RTW outcomes following musculoskeletal injury, even after accounting for age, sex, pain intensity, duration of disability and number of injury sites.

In most conceptual models of work disability, recovery expectancies are regarded as significant determinants of RTW outcomes following musculoskeletal injury. However, these models have yet to specify the interrelations between pain-related psychological variables, recovery expectancies and RTW outcomes. Moreover, current conceptual models of disability have yet to integrate perceived injustice into an explanation of how pain-related psychological variables might impact RTW outcomes. The three studies in this thesis extend previous research by demonstrating that recovery expectancies mediate the relationships between depression (Study 1), pain catastrophizing and fear of movement (Study 2) and perceived injustice (Study 3) and RTW outcomes following musculoskeletal injury. Our findings suggest that recovery expectancies might explain how several pain-related psychological factors impact on RTW outcomes after musculoskeletal injury.

Theoretical implications

As noted earlier, the important role of recovery expectancies is addressed either explicitly or implicitly in conceptual models that have been put forward to examine the negative impact of pain-related psychological variables such as depression, pain catastrophizing, fear of movement and perceived injustice. The results of the studies reported in this thesis support the associations between pain-related psychological factors and recovery expectancies, even after accounting for medical status variables. The prospective association between depression and recovery expectancies was $\beta = .39$. The prospective association between catastrophizing and recovery expectancies was $\beta = .50$, and the prospective association between fear of movement and recovery expectancies was $\beta = .27$. Finally, the prospective association between perceived injustice and recovery expectancies was $\beta = .32$ (standardized betas).

Cognitive models have appealed to schema-based cognitive accessibility as a process by which these variables might contribute to expectancies. Although cognitive models of depression suggest that depression increases accessibility to negative information (Beck, 1976), research is most consistent in showing that depression reduces accessibility to positive information (MacLeod & Byrne, 1996; MacLeod, Tata, Kentish, & Jacobsen, 1997). Considerable research has also shown that fear increases access to information relevant to the target of fear (Van Damme, Crombez, Eccleston, & Roelofs, 2004a; Vlaeyen & Linton, 2000). Although research has yet to address the relationship between catastrophizing and variations of cognitive-accessibility of pain-related information, there is evidence that catastrophizing associates with deficits in attentional disengagement (Van Damme, Crombez, & Eccleston, 2002; Van Damme, Van Damme, Crombez, & Eccleston, 2004b). To date, no research has addressed whether perceived injustice impacts on accessibility of pain-related information. Also lacking in the

available literature is evidence supporting a link between cognitive accessibility to negative information and low recovery expectancies. Future research is needed to determine whether indices of cognitive accessibility mediate the relationships between pain-related psychological variables and recovery expectancies.

Additional analyses were conducted to examine the percentage of variance in recovery expectancies that was accounted for by depression, pain catastrophizing, fear of movement and perceived injustice (see Appendix 1). This allowed us to examine the magnitude of the relation between each of the pain-related psychological variables and recovery expectancies. The results of these analyses revealed that pain-related psychological variables accounted for up to 31% of the variance in recovery expectancies. Pain-related psychological variables predicted recovery expectancies over and above the variance accounted for by age, sex, pain intensity, duration of disability and number of injury sites. Little is currently known about the other variables that might influence recovery expectancies. There is a basis for suggesting that there are multiple influences involved in the formation of expectancies, which include informational influences, experiential influences and contextual influences.

Expectancy theories suggest that information plays a significant role in the formation of expectancies (Kirsch, 1985a; Olson, Roese, & Zanna, 1996). Informational influences can bias expectancies in either a positive or negative direction. For example, information about the high probability of clinical improvement communicated by health care professionals might play a role in the development of high recovery expectancies. Conversely, negative results from diagnostic studies, divergent opinions expressed by different treating professionals, sensationalized media or communication from legal counsel emphasizing the prospect of long term suffering and

disability might promote a pessimistic view of the future and impact negatively on recovery expectancies (Sullivan, Stanish, Sullivan, & Tripp, 2002).

Experience-related factors, such as history of injury and/or past treatment experiences (e.g. successes, failures) might also play a role in the formation of recovery expectancies. Studies have shown that individuals with a prior history of musculoskeletal problems are more likely to report lower recovery expectancies than individuals without a prior history of injury (Ozegovic et al., 2010b; Perrot, Allaert, Concas, & Laroche, 2009; Venkataramanan, Gignac, Mahomed, & Davis, 2006). Similarly, individuals who experience a prolonged length of disability might be alarmed to the possibility that their condition might become permanent, and in turn, develop maladaptive belief-systems, including low recovery expectancies (Asih, Neblett, Mayer, & Gatchel, 2017).

It has also been suggested that contextual factors, such as the availability of workplace accommodations and the existence of transitional work problems, might impact on recovery expectancies. Research has shown that perceived uncertainty regarding workplace accommodations is associated with low recovery expectancies and a passive approach towards rehabilitation (Stewart et al., 2012). Employer reluctance to provide accommodations may lead injured workers to believe that it will be difficult to return to work. Other systems-related factors such as litigation may also impact the formation of recovery expectancies. For example, when the litigation process puts undue emphasis on the magnitude and permanence of physical limitations and disability, individuals may be more likely to develop low recovery expectancies. The present study did not include an assessment of informational, experiential and contextual exposures, and as a result, the role of these influences could not be addressed. Future research

should examine how these variables interact in contributing to the formation of recovery expectancies.

There remain important knowledge gaps concerning the processes by which recovery expectancies impact on RTW outcomes following musculoskeletal injury. To date, no study has specifically examined the processes linking recovery expectancies to RTW outcomes. It is possible that expectancies might exert their influence on motivation. According to Bandura, expectancies have a detrimental impact on motivation by compromising the amount of effort that will be invested in the pursuit of desired goals or outcomes (Bandura, 1977; 1978). Similarly, Rotter suggested that expected outcomes strongly influence motivation to engage in a particular behavior (Rotter, 1954). However, the relation between motivation and effort has been shown to rely on many other factors, such as reinforcement value, skills and abilities, and anxiety (Kirsch, 1982).

Although the area of motivation and return to work following musculoskeletal injury has not been systematically investigated, numerous clinicians have commented on the relation between motivation and occupational reengagement (Yunhee Choi, Asih, & Polatin, 2014; Grahn, Ekdahl, & Borgquist, 2009; Hansen, Edlund, & Henningsson, 2006; Lydell, Hildingh, Månsson, Marklund, & Grahn, 2011). For example, it is common for clinicians to believe that the majority of individuals with prolonged work disability are not motivated to return to their employment (Main, Sullivan, & Watson, 2008). Similarly, writers on topics of malingering and compensation neurosis have suggested that individuals who are work-disabled for long periods of time are more motivated by financial gains than by return to work (Miller, 1961). Despite the frequency by which these clinical opinions have been offered, no data is currently available to suggest that prolonged disability is the result of poor motivation.

There is research showing that job satisfaction is linked with RTW outcomes (Costa-Black, Loisel, Anema, & Pransky, 2010; Crook, Milner, Schultz, & Stringer, 2002; Hoogendoorn et al., 2002; Schultz, Chlebak, & Stewart, 2016; Shaw, Main, & Johnston, 2011). Proceeding from the assumption that job satisfaction can be construed as a proxy for the reinforcement value of return to work, the results of several studies would indicate that several motivational factors play an important role in RTW outcomes. The reinforcement value of an outcome is considered to be a key element underlying goal attainment motivation (Roessler, 1988). To date, however, no study has examined the relationship between recovery expectancies, job satisfaction and RTW outcomes.

The focus of the papers included in this thesis has been on construing expectancies as one of the final steps in the sequence of psychological influences on pain-related outcomes. That is, depression, pain catastrophizing, fear of movement and perceived injustice have been discussed as antecedents to the development of recovery expectancies. However, it is likely that the relations among these variables are bidirectional. There is research to suggest that negative expectancies lead to negative mood (Boersma & Linton, 2006), that the anticipation of pain increases catastrophizing (Quartana, Campbell, & Edwards, 2014; Sullivan, Thorn, Haythornthwaite, Keefe, et al., 2001b), and that the anticipation of a feared object or situation increases fear (De Peuter, Van Diest, Vansteenwegen, Van den Bergh, & Vlaeyen, 2012). In this manner, having low expectancies might also lead to increases in depression, pain catastrophizing, fear of movement and perceived injustice.

The results of the studies included in this thesis highlight the central role of recovery expectancies on the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury. However, important knowledge gaps still remain

concerning the variables involved in the formation of expectancies, the interactions between these variables, and the pathways by which expectancies impact on RTW outcomes. These knowledge gaps will need to be addressed by future research.

Clinical implications

Over the past two decades, there has been a growing emphasis on the clinical assessment of psychological factors in patients with musculoskeletal injuries. Measures of psychological factors, such as pain catastrophizing and pain-related fear are now routinely included in the assessment protocols of pain clinics and rehabilitation centers around the world (Sullivan, 2013; Wideman et al., 2012). Our findings argue strongly for the inclusion of measures of recovery expectancies in addition to measures of pain and disability, and other routinely assessed psychological factors included in current assessment protocols.

To date, no intervention has been developed specifically designed to influence recovery expectancies following debilitating injury. With the increasing recognition of the significant role played by recovery expectancies on pain-related outcomes, researchers have expressed the need understand how expectancies can be modified in order to maximize treatment outcomes (Schrooten & Linton, 2017; Wiech, 2016). It has been suggested that response expectancies can be modified using interventions with strategic information exposure (Peerdeman et al., 2016). However, there is currently no evidence that *recovery* expectancies can be manipulated for therapeutic benefit. The development of effective expectancy-change interventions is currently impeded by the important knowledge gaps concerning the emergence of recovery expectancies and the nature of influences on recovery expectancies.

Concluding remarks

Numerous investigations have examined the relationships between pain-related psychological variables and recovery expectancies. The results of the studies reported in this thesis advance current understanding of psychological influences on RTW outcomes in showing that recovery expectancies mediate the relationships between pain-related psychological variables and RTW outcomes following musculoskeletal injury. Numerous knowledge gaps still exist concerning the formation of expectancies, the processes by which expectancies impact RTW outcomes and the modifiability of expectancies. Further research addressing these knowledge gaps will be important in contributing in the development of interventions aimed at modifying expectancies for therapeutic benefit. Biopsychosocial conceptualizations of disability have played a significant role in drawing attention to the complex interplay among physical, psychological and social factors that contribute to pain-related disability. However, the predictive utility of these models has been limited by the dearth of evidence specifying the relations that govern the influence of various model components on disability. The findings from this thesis might contribute to future model building or the testing of process-related hypotheses addressing how pain-related psychological variables summate or interact to influence disability associated with musculoskeletal injury.

Appendix

Additional analyses were conducted to examine the magnitude of the relation between pain-related psychological variables and recovery expectancies. We conducted four stepwise multiple regressions which examined the independent contributions of depressive symptoms, pain catastrophizing, fear of movement and perceived injustice to recovery expectancies. All analyses controlled for age, sex, pain intensity, duration of work disability and number of injury sites. These analyses were not published in the three manuscripts that are included in this thesis.

In the first sample of individuals with work-related musculoskeletal injuries, we examined the magnitude of the relation between depressive symptoms and recovery expectancies. Age and sex were entered first, but did not add significant variance to the prediction of recovery expectancies (F (2,107) = 3.03, p = .053). Pain intensity, duration of work disability and number of injury sites were entered second, but also did not add significant variance to the model (F (5,107) = 1.67, p = .148). Finally, depressive symptoms were entered into the model and contributed significantly to the prediction of recovery expectancies (F (6,107) = 3.832, p = .002). The final model accounted for 18.5% of the variance in recovery expectancies.

In the second sample of individuals with whiplash injury, we examined the magnitude of the relation between pain catastrophizing and recovery expectancies. Age and sex were entered first and contributed significantly to the prediction of recovery expectancies (F (2,152) = 5.169, p = .007). Pain intensity, duration of work disability and number of injury sites were entered second, and contributed significant variance to the model (F (5,152) = 3.175, p = .009). Finally, pain catastrophizing was entered into the model and contributed significantly to the prediction of recovery expectancies (F (6, 152) = 11.162, p < .001). The final model accounted for 31.3% of

the variance in recovery expectancies.

Next, we examined the magnitude of the relation between fear of movement and recovery expectancies in the sample of individuals with whiplash injury. As in the previous analysis, age, sex, pain intensity, duration of work disability and number of injury sites were entered in the first steps of the regression and contributed significantly to the model. Fear of movement was entered in the final step of the model and contributed significantly to the prediction of recovery expectancies (F (6,152) = 4.573, $p < .001$). The final model accounted for 15.7% of the variance in recovery expectancies.

Finally, we examined the magnitude of the relation between perceived injustice and to recovery expectancies in the sample of individuals with whiplash injury. Once again, age, sex, pain intensity, duration of work disability and number of injury sites were entered in the first steps of the regression and contributed significantly to the model. Perceived injustice was entered into the model and contributed significantly to the prediction of recovery expectancies (F (6,152) = 5.234, $p < .001$). The final model accounted for 17.6% of the variance in recovery expectancies.

Results from our additional analyses suggest that pain-related psychological variables account for between 16% and 31% of the variance in recovery expectancies, even after controlling for age, sex, pain intensity, duration of disability and number of injury sites. In both samples of individuals with musculoskeletal injuries, pain-related psychological variables were more important determinants of recovery expectancies than pain itself and other medical status variables. These findings have implications that are presented in the General discussion.

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