Occupational Rehabilitation

Studies and Research Projects

REPORT **R-675**

Pain, Depression, Disability and Rehabilitation Outcomes

Revised version

Michael J.L. Sullivan
Maureen Simmonds
Ana Velly

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SUMMARY

The primary objective of this research was to evaluate the prospective relation between depressive symptoms and rehabilitation outcomes in individuals who had sustained work-related musculoskeletal injuries. Methods: A sample of 225 individuals with musculoskeletal injuries completed measures of depression, pain severity, catastrophizing, and fear of movement at admission, mid-treatment and discharge from a 4 to 7 week rehabilitation intervention. Participants also completed a follow-up telephone interview 12-months following treatment termination. Results: The prevalence of clinically significant levels of depression was 40% at initial assessment and 20% at treatment termination. Depressed participants were more likely than non-depressed participants to drop out of treatment. Pre-treatment levels of depression and catastrophizing predicted the persistence of pain at 1-year follow-up. Depression also prospectively predicted return to work status. Reductions in catastrophizing, but not depression, were associated with higher probability of return to work. Depression was associated with higher probability of using narcotics for pain, and a lower probability of work retention. Conclusions: The findings of this study indicate the depression impacts negatively on response to rehabilitation treatment and return to work outcomes. Discussion addresses the processes through which depression might impact on disability and rehabilitation outcomes. The clinical implications of the findings are also addressed.

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1. INTRODUCTION

Persistent musculoskeletal pain is currently the most expensive non-malignant health condition affecting the North American working-age population [9; 19; 28; 62]. In 1998, the cost of lost production due to disability associated with musculoskeletal disorders in Canada was estimated to be in excess of 12 billion dollars. In Québec, expenditures of the CSST on wage loss benefits and health care services for occupational injury are in excess of 1 billion dollars annually [25]. Musculoskeletal conditions involving the spine (i.e., back and neck conditions) represent the single largest category of injury for which time loss claims are made. The prevalence of pain-related disability has been increasing steadily in spite of numerous policy, prevention and intervention initiatives that have been launched to date [73; 25].

Over the past two decades, research has accumulated indicating that traditional biomedical variables cannot fully account for presenting symptoms of pain and disability following work injury [19; 22; 75]. Biopsychosocial models of work disability have emerged as the dominant conceptual frameworks used to explain and treat work disability associated with musculoskeletal disorders [18; 65; 73]. These models proceed from the view that successful re-integration of the injured worker into the workplace will require consideration of biomedical, psychological, behavioral, organizational and workplace factors [18; 30].

Considerable research activity has been devoted to discerning the variables that distinguish between individuals who return to work and those who remain disabled following occupational injury [21; 37; 75]. There has been particular interest in identifying modifiable risk factors for persistent pain and disability. Several investigators have argued that the identification of modifiable risk factors could lay the foundation for risk factor targeted interventions that might prevent the development of chronic disability following injury [30; 29; 59].

Recent studies suggest that depressive symptoms associated with musculoskeletal disorders may increase the risk for prolonged work disability [59; 71; 41; 50]. Surveys indicate that approximately 20% to 50% of individuals with musculoskeletal conditions show evidence of elevated depressive symptoms [56; 43; 8; 34]. Individuals with pain-related musculoskeletal conditions with elevated depressive symptoms have sick leave duration that is twice as long as individuals with musculoskeletal conditions who do not have depressive symptoms [15; 11]. Depressive symptoms in individuals with musculoskeletal conditions have also been associated with longer duration of wage replacement benefits following work injury or surgical intervention [14; 45; 32].

The evidence that has accumulated strongly suggests that depressive symptoms can be considered a risk factor for poor rehabilitation outcome [75; 50]. Indeed, the World health Organization (WHO) predicts that within 10 years, depression will rank as the second major cause of disability in industrialized countries [69]. To date, the relation between depressive symptoms and rehabilitation outcome has been studied only in individuals whose musculoskeletal condition has already become chronic. Little is currently known about the relation between depressive symptoms and rehabilitation outcomes for individuals with acute or

subacute musculoskeletal conditions. If individuals at risk for prolonged work disability can be identified before the problem becomes chronic, individuals' suffering might be prevented or reduced to a significant degree. In addition, the identification of individuals at risk for poor rehabilitation outcomes would facilitate the implementation of interventions that might increase the probability of successful re-integration into the workplace.

The purpose of the present study was to examine the predictive value of depressive symptoms for poor rehabilitation outcomes in individuals who had recently (i.e., less than 12 weeks) sustained a work-related musculoskeletal injury. Depressive symptoms were assessed at the time of admission to a rehabilitation intervention and were used to predict symptomatic and functional outcomes at treatment termination and 12-month follow-up. Of interest was whether initial symptoms of depression prospectively predicted improvement through the course of the rehabilitation program, return to work and work retention. The predictive value of initial depressive symptoms was assessed while controlling for other psychosocial risk factors for persistent pain and disability.

2. METHOD

2.1 Participants

The participant sample consisted of 225 individuals (138 women, 87 men) with work-related musculoskeletal conditions who were referred for treatment at one of 6 pain rehabilitation clinics in the province of Quebec, Canada. At the time of evaluation, all participants were receiving wage indemnity benefits from the provincial worker's compensation board (Commission de la santé et de la sécurité du travail (CSST)). Sample characteristics are presented in Table 1.

2.2 Procedure

The research program was approved by the research ethics committees of the *Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain* (CRIR). Individuals were considered for participation if they had been referred to one of the 6 collaborating centres for the treatment of a disabling musculoskeletal injury. Individuals were only considered for participation if they had sustained their injury no more than 12 weeks prior to the date of referral. Participants signed a consent form prior to completing the study procedures. Participants were asked to complete several questionnaires as part of their initial assessment (Week 1). Measures of physical and psychological functioning were re-administered at Week 4 and Week 7 of treatment. Data from all three assessment points were available for 187 participants. Treatment consisted primarily of physical therapy and medical management. One year following the initial assessment, participants were contacted by telephone and were asked to answer questions relevant to their current symptoms and occupational status. Participants were compensated $25 for completing the questionnaires and the telephone interview.

Physical therapy intervention. The content of the physical therapy interventions varied at the clinician's discretion. However, all interventions conformed to practice guidelines for early intervention for musculoskeletal problems consistent with reimbursement policies of the workers' compensation board emphasizing mobilisation and activity [42]. All interventions were characterized by a functional restoration orientation consisting primarily of joint manipulation, active range of motion exercises and strengthening exercises, progressively increasing in intensity.

2.3 Measures

2.3.1 Pain Severity

The McGill Pain Questionnaire (MPQ) [35] was used to assess current pain severity. On this measure, participants are asked to endorse adjectives that best describe their current pain experience. The Pain Rating Index (PRI) is a weighted sum of all adjectives endorsed, and is considered one of the more reliable and valid indices of an individual's pain experience [67].

2.3.2 Depression

The Beck Depression Inventory II (BDI-II; [2] was used to measure severity of depressive symptoms. The BDI-II consists of 21 items describing various symptoms of depression. Respondents are asked to endorse phrases that best describe how they have been feeling during the past two weeks. The BDI-II has been shown to be a reliable and valid index of depressive symptoms in chronic pain patients [59; 72; 39].

2.3.3 Catastrophizing

The Pain Catastrophizing Scale (PCS) [51] consists of 13 items describing different thoughts and feelings that individuals may experience when they are in pain. The PCS has been shown to have high internal consistency (coefficient alpha = .87), and to be associated with heightened pain, disability as well as employment status [51; 58; 59].

2.3.4 Fear of Movement/Re-Injury

The Tampa Scale for Kinesiophobia (TSK) [27] is a 17-item questionnaire that assesses fear of (re)injury due to movement. The TSK has been shown to be internally reliable (coefficient alpha = .77)[70]. The TSK has been associated with various indices of behavioral avoidance and disability [10; 36; 59].

2.3.5 Self-Reported Disability

The Pain Disability Index (PDI) [38] assesses the degree to which respondents perceive themselves to be disabled in 7 different areas of daily living (home, social, recreational, occupational, sexual, self-care, life support). For each life domain, respondents are asked to provide perceived disability ratings on 11-point scales with the endpoints (0) *no disability* and (10) *total disability*. The PDI has been shown to be internally reliable and significantly correlated with objective indices of disability [64; 63].

2.3.6 Return to Work Expectancies

At each assessment point, participants were asked to rate the likelihood that they would return to work within the next month using a scale with the endpoints (0%) not at all likely and (100%) extremely likely. Participants responded to two questions : How likely it is that within the nextmonth you will have returned to full time work? How likely is it that within the next month you will have resumed some form of employment?

2.3.7 Brief Functional Assessment

A 5-minute fast walk was used as a brief assessment of physical function. Participants were asked to walk at a quick pace between two markers on the floor, 10 meters apart. The total distance walked, in feet, in 5 minutes was recorded. This test has been shown to have high inter-

rater reliability, high test-retest reliability, and to correlate significantly with other indices of disability [47; 46].

2.3.8 Ability to Meet Pre-Injury Work Demands

At each assessment point, a physical therapist conducted an evaluation of the degree to which a client was able to meet his or her pre-injury occupational demands. The physical therapist rated the number of hours per day that the client would be able to perform the predominant type of activities associated with his or her pre-injury employment. Clients' performance was rated on the following scale: 0) unable to perform occupational tasks, 1) able to perform occupational tasks 1 hour per day, 2) able to perform occupational tasks 2 hours per day, 3) able to perform occupational tasks 3 hours per day, 4) able to perform occupational tasks 4 hours per day, and 5) able to perform occupational tasks more than 4 hours per day. Although this form of assessment is ideographic and cannot be discussed in terms of the same metric characteristics as standardized measures, the measure does provide information that is more directly relevant to an individual's ability to resume pre-injury occupational activities.

2.3.9 Premature Termination of Treatment (Dropouts)

Treatment was discontinued once an individual had returned to work. As such, not all participants were available to complete the three assessments (Week 1, Week 4, Week 7). Individuals who discontinued prior to 7 weeks and returned to work are not considered treatment dropouts since the goals of treatment would have been attained. For the purposes of the present study, only individuals who discontinued treatment prior to 7 weeks and did not return to work were considered dropouts.

2.3.10 Follow-up and Return to Work

A subsample of 207 participants were successfully contacted by telephone 12 months following treatment termination. The telephone interview included questions concerning current level of pain, current treatment involvement, current occupational status and, for patients who had returned to work, the number of days missed since returning to work.

2.3.11 Analytic Approach

On the basis of pre-treatment scores on the Beck Depression Inventory-II (1), patients were classified as either not depressed (BDI-II < 16) or depressed (BDI-II ≥ 16). T-tests for independent samples were used to compare depressed and non-depressed participants on demographic, psychological and physical function variables. Pearson correlations were used to examine the relation between change in depression scores and changes in physical and psychological functioning through the course of treatment. Multiple and logistic regressions were used to assess the predictive value of depression scores on follow-up measures of pain severity and return to work. Regression analyses were also used to examine the relation between depression and clinicians' judgments about the participants' readiness to return to work. Q-Q plots on continuous variables revealed no significant divergences from normality. In the

regression results reported, all tolerance coefficients were greater than .60 such that no problem of multicollinearity was indicated. All analyses were conducted with SPSS Version 16.

3. RESULTS

3.1 Sample Characteristics

Demographic and injury-related information for depressed and non-depressed participants is summarized in Table 1. Ninety-one participants (40%) scored in the depressed range of the BDI-II at the time of initial assessment. Women (46%) were more likely than men (32%) to be depressed, $\chi^2 = 4.01$, $p < .05$. Depressed participants were significantly younger than non-depressed participants, $t(223) = 2.3$, $p < .05$.

The majority (93%) of participants listed back pain as their primary pain site. Depressed participants did not differ from non-depressed participants in the probability of reporting back pain, $\chi^2 = .03$, $p = .89$, or neck pain, $\chi^2 = 2.7$, $p = .09$. Depressed participants were more likely than non-depressed participants to report upper body pain, $\chi^2 = 6.4$, $p < .01$, and lower body pain, $\chi^2 = 4.8$, $p < .05$. Depressed participants reported more painful sites than non-depressed participants, $t(223) = 3.1$, $p = .002$. Occupation categories did not vary significantly as a function of level of depression, $\chi^2 = 1.4$, not significant (Table 1).

Means and standard deviations for scores on physical and psychological variables are presented in Table 2. Scores on measures of pain, depression, catastrophizing, fear of movement and self-reported disability are similar to those that have been reported in previous research on individuals who have sustained work-related injuries [55; 54]. Depressed participants obtained higher scores on measures of pain severity, $t(223)_{MPQ} = 5.2$, $p < .001$, catastrophizing, $t(223)_{PCS} = 6.9$, $p < .001$, fear of movement and re-injury, $t(223)_{TSK} = 5.1$, $p < .001$, and self-reported disability, $t(223)_{PDI} = 4.6$, $p < .001$. Depressed participants also had lower expectancies than non-depressed participants for returning to fulltime work within one month, $t(223) = 4.4$, $p < .001$, and returning to some form of employment within one month, $t(223) = 3.5$, $p < .001$. Walking speed did not vary significantly as a function of level of depression, $t(223) = 1.0$, $p = .35$.

Table 1 - Sample Characteristics: Demographic and Injury Variables

	Not Depressed		Depressed			
Characteristic	N = 134		N = 91		Total	p
Sex						
Male	59	68%	28	32%	87	
Female	75	54%	63	46%	138	.05
Age	38.2 (10.5)		35.1 (8.9)			.05
Primary Pain Site						
Back	126	94%	85	93%	211	.89
Neck	94	70%	73	80%	167	.09
Upper body	67	50%	61	67%	128	.01
Lower body	28	21%	31	34%	59	.02
Number pain sites	2.3 (.9)		2.7 (.9)			.002
Occupation						
Labor	58	43%	44	48%	102	
Health	35	26%	22	24%	57	
Food	20	15%	12	13%	32	
Transportation	8	6%	6	6%	14	
Clerical/Admin	13	10%	7	8%	20	ns

Table 2 - Scores on Pre-Treatment Measures

	Not Depressed	Depressed	p
	N = 134	N = 91	
MPQ – PRI	18.1 (11.5)	27.0 (13.5)	.001
BDI-II	8.4 (4.2)	23.6 (6.7)	.001
PCS	17.6 (10.5)	27.2 (9.2)	.001
TSK	40.6 (7.7)	45.9 (7.1)	.001
PDI	24.1 (10.0)	30.2 (9.3)	.001
Expectancies- Full time employment	64.4 (32.2)	44.1 (32.8)	.001
Expectancies- Some employment	67.7 (31.9)	52.1 (33.4)	.001
Walking Distance	354.4 (141.9)	356.4 (149.1)	ns

Numbers in parentheses are standard deviations.

3.2 Premature Termination of Treatment

For the purposes of this study, a participant would be considered to have dropped out of treatment if he or she attended treatment for less than 7 weeks and did not return to work. Twelve individuals (6%) discontinued treatment prior to the final (Week 7) and did not return to work. Eleven of the twelve participants who dropped out of treatment (92%), scored in the depressed range of the BDI-II at initial assessment, $\chi^2 = 16.4$, $p < .001$. Women were slightly more likely (67%) than men to drop out of treatment but the difference was not significant, $\chi^2 = 1.9$, $p = .38$.

3.3 Changes in Physical and Psychological Function

Figure 1 shows the prevalence of depression at each of the assessment periods. The prevalence of depression decreased from 40% at the Week 1 assessment to 20% at Week 7 assessment.

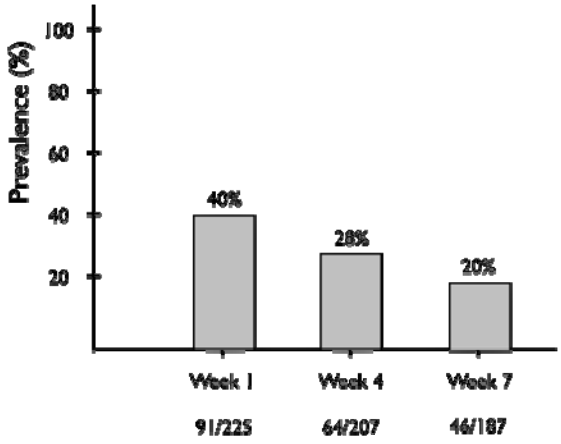

Figure 1 - Prevalence of Depression through the Course of Rehabilitation

Means and standard deviations for scores on pain-related measures at all three assessment points are shown in Table 3. Consistent with previous research, significant reductions in pain severity were observed through the course of the rehabilitation program, $F(2, 374)_{MPQ} = 30.5$, $p < .001$, depression, $F(2, 374)_{BDI} = 51.5$, $p < .001$, catastrophizing, $F(2, 374)_{PCS} = 98.5$, $p < .001$, fear of movement and re-injury, $F(2, 374)_{TSK} = 59.9$, $p < .001$, and self-reported disability, $F(2,374)_{PDI} = 105.4$, $p < .001$. Significant increases in expectancies for full time work, $F(2, 374) = 6.7$, $p < .001$ and some form of work, $F(2, 374) = 31.6$, $p < .001$, were also obtained. Significant improvement in walking distance was also observed, $F(2, 374) = 35.1$, $p < .001$.

Table 3 - Changes on Pain-Related Measures

		Week 1	Week 4	Week 7	Eta^2
MPQ – PRI	Non-Dep	18.1 (11.5)	14.7 (10.1)	11.1 (9.8)	.21
	Dep	26.9 (13.5	24.9 (13.9)	21.8 (16.1)	.14
BDI-II	Non-Dep	8.3 (4.2)	7.2 (5.4)	6.0 (5.5)	.13
	Dep	23.6 (6.6)	19.2 (8.4)	16.8 (9.3)	.26
PCS	Non-Dep	17.3 (9.9)	10.2 (8.4)	8.4 (8.4)	.42
	Dep	26.8 (9.0)	21.9 (10.8)	18.0 (11.9)	.30
TSK	Non-Dep	40.7 (7.9)	36.4 (7.6)	35.2 (8.7)	.28
	Dep	45.4 (7.2)	42.5 (7.5)	40.4 (8.7)	.23
PDI	Non-Dep	24.0 (10.1)	17.7 (8.8)	13.7 (8.4)	.36
	Dep	30.0 (9.7)	25.9 (10.6	20.8 (11.4)	.40
Exp-rtwF	Non-Dep	63.9 (32.5)	67.3 (31.3)	71.4 (31.9)	.03
	Dep	46.5 (32.2)	54.3 (30.5)	56.4 (32.4)	.04
Exp-rtwS	Non-Dep	68.5 (30.6)	78.2 (26.07)	82.9 (27.1)	.11
	Dep	53.0 (32.8)	72.3 (31.5)	73.5 (31.4)	.18
Walking distance	Non-Dep	354.4 (141.9)	415.5 (123.8)	444.7 (133.2)	.13
	Dep	356.4 (149.1)	414.5 (133.5)	432.4 (138.5)	.14

Note: N = 187. MPQ-PRI = McGill Pain Questionnaire – Pain Rating Index; PDI = Pain Disability Index; PCS = Pain Catastrophizing Scale; TSK = Tampa Scale for Kinesiophobia; BDI-II = Beck Depression Inventory II; Exp-rtwF = Expectancies for resumption of full time employment; Exp-rtwS = Expectancies for resumption of some form of employment. Numbers in parentheses are standard deviations.

Significant main effects for level of depression were obtained on measures of pain severity, $F(1, 187)_{MPQ} = 38.3$, $p < .001$, depression, $F(1, 187)_{BDI} = 232.2$, $p < .001$, catastrophizing, $F(1, 187)_{PCS} = 66.1$, $p < .001$, fear of movement and re-injury, $F(1, 187)_{TSK} = 24.7$, $p < .001$, and self-reported disability, $F(1, 187)_{PDI} = 33.1$, $p < .001$. Main effects for level of depression were also obtained for expectancies for return to full time work, $F(1, 187) = 14.8$, $p < .001$, and expectancies for some form of work, $F(1, 187) = 8.4$, $p < .001$.

The only significant interaction was found for scores on the BDI where participants in the depressed group showed greater reductions in depression than participants in the non-depressed group, $F(2, 374) = 12.8$, $p < .001$. This finding was due primarily to lower initial values in the non-depressed group contributing to floor effects in the analyses.

Change scores were computed for each pain-related variable by subtracting scores on Week 7 assessment from scores on Week 1 assessment. Correlations among change scores were computed on the subsample (N = 187) of participants who completed all three assessments (see Table 4). Reductions in depression were significantly associated with concurrent reductions in pain catastrophizing, fear of movement and self-reported disability. Reductions in depression were also associated with increases in expectancies for return to work. Reductions in depression were not associated with changes in walking speed.

Table 4 - Correlations Among Indices of Change

Variable	1	2	3	4	5	6	7
1. ch-BDI-II							
2. ch-PCS	.45**						
3. ch-TSK	.32**	.47**					
4. ch-PDI	.32**	.37*	.25**				
5. ch-MPQ	.29**	.45**	.23**	.42**			
6. ch-XrtwF	-.15*	-.18**	-.19**	-.23**	-.19**		
7. ch-XrtwS	-.19**	-.21**	-.21**	-.13	-.12	.54**	
8. ch-Walk	-.11	-.12	-.15*	-.12	-.12	.11	.12

Note: N = 187. Change score were computed by subtracting Week 7 scores from Week 1 scores. * $p < .05$, ** $p < .01$.

3.4 Predicting Persistence of Pain at 1-year follow-up

The majority of participants (85%) reported ongoing pain symptoms consequent to their injury at 1-year follow-up, with 40% of the sample reporting levels of pain of 5/10 or greater. Table 5 shows the results of a hierarchical regression analysis examining predictors of pain severity at 1-year follow-up. Age, sex and duration of pain were entered in Step 1 of the analysis but did not contribute significant variance to the prediction of pain severity at 1-year follow-up. Initial pain severity (MPQ-PRI) was entered in Step 2 of the analysis and contributed significant variance to the prediction of pain severity at 1-year follow-up. Measures of depression, catastrophizing, and fear of movement/re-injury, were entered in Step 3 of the analysis, and contributed significant variance to the prediction of pain severity at 1-year follow-up. Examination of the beta weights from the final regression equation revealed that depression ($\beta = .16$, $p < .05$) and catastrophizing ($\beta = .23$, $p < .01$) contributed significant unique variance to the prediction of pain severity at 1-

year follow-up. The regression model accounted for 22% of the variance in pain severity ratings at 1-year follow-up, R = .46, F (7, 199) = 7.5, p < .001.

Table 5 - Multiple Regression Analysis Predicting 1-Year Follow-up Pain Severity

Dependent = Pain severity (0 – 10) at one-year follow-up

		β	R^2_{change}	F_{change}	p	r
Step 1						
	Age	.05				.04
	Sex	-.10				-.10
	Pain duration	-.13	.03	2.1 (3, 203)	.09	-.13*
Step 2						
	MPQ-PRI (Week 1)	.02	.03	7.1 (1, 202)	.01	.18**
Step 3						
	BDI-II (Week 1)	.16*	.15	12.1 (3, 199)	.001	.34**
	PCS (Week 1)	.28**				.40**
	TSK (Week 1)	.06				.25**

Note: N = 207. For each regression, standardized beta weights are from the final regression equation. * p < .05, ** p < .01.

3.5 Depression and Return to Work

Of the 207 participants who were successfully contacted 1-year following termination of treatment, 143 (69%) were working in some capacity. Depressed participants were less likely (56%) to have returned to work than non-depressed participants (78%), $\chi^2 = 10.9$, p < .001. Of the participants that had returned to work (N = 143), depressed participants were less likely (38%) than non-depressed participants (63%) to be working full time, $\chi^2 = 7.2$, p < .01.

Three separate logistic regressions were conducted to examine the contribution of depression to return to work. The first regression examined the prognostic value of initial levels of depression (Week 1) to the prediction of return to work at 1-year follow-up. The second regression examined the prognostic value of end-of-treatment (Week 7) levels of depression to the prediction of return to work at 1-year follow-up. The third regression examined the prognostic value of change in depression (Week 1 – Week 7) to the prediction of return to work at 1-year follow-up. For the third regression, only participants in the depressed group were included. In each regression analysis, age, sex, pain duration were entered as covariates. The results of the logistic regression examining the prognostic value of pre-treatment depression levels are presented in Table 6. The final regression model was significant (Nagelkerke $R^2 = .15$), $\chi^2(7) = 23.2$, p < .001, yielding correct classification of 70%. Initial pain severity, catastrophizing and fear of movement did not contribute significant unique variance to the prediction of follow-up return to work status. Only depression made a significant unique contribution to the prediction of return to work (OR = 1.11, 95% CI = 1.0 – 1.1). Higher pre-treatment depression scores were associated with a lower probability of returning to work.

Table 6 - Logistic Regression Examining Pre-Treatment Predictors of Return to Work at 1-Year Follow-up.

Dependent variable = Return to Work (0 = no, 1 = yes)

	Wald	OR	95% CI
Age	1.2	.98	.94 – 1.0
Sex	2.5	1.70	.87 – 3.9
Pain Duration	.16	.97	.87 – 1.1
MPQ-PRI (Week 1)	.30	.99	.96 – 1.0
BDI-II (Week 1)	9.0	1.11**	1.0 – 1.1
PCS (Week 1)	2.6	1.03	.99 – 1.1
TSK (Week 1)	.96	.97	.93 – 1.0

Note: N = 207. OR = Odds ratio; 95% CI = 95th percentile confidence interval. ** $p < .01$.

The results of the logistic regression examining the prognostic value of post-treatment depression levels are presented in Table 7. The final regression model was significant (Nagelkerke R^2 = .21), $\chi^2(7) = 26.6$, $p < .001$, yielding correct classification of 76%. Demographic variables and post-treatment pain severity did not contribute significant unique variance to the prediction of follow-up return to work status. Although post-treatment psychological variables, as a block, had significant incremental value for the prediction of return to work, $\chi^2(3) = 9.8$, $p < .05$, none of the psychological variables made significant unique contribution to the prediction of return to work.

Table 7 - Logistic Regression Examining Post-Treatment Predictors of Return to Work at 1-Year Follow-up.

Dependent variable = Return to Work (0 = no, 1 = yes)

	Wald	OR	95% CI
Age	2.3	.97	.93 – 1.0
Sex	1.0	1.51	.87 – 3.5
Pain Duration	.18	1.02	.90 – 1.1
MPQ-PRI (Week 7)	1.3	1.01	.96 – 1.0
BDI-II (Week 7)	.99	1.00	.97 – 1.1
PCS (Week 7)	2.6	1.01	.98 – 1.1
TSK (Week 7)	.34	1.02	.96 – 1.0

Note: N = 187. OR = Odds ratio; 95% CI = 95th percentile confidence interval.

The results of the logistic regression examining the prognostic value of change in depression levels in the prediction of return to work are presented in Table 8. As noted above, this analysis was conducted only in the group of participants who scored in the depressed range at the pre-treatment assessment. The final regression model was significant (Nagelkerke $R^2 = .42$), $\chi^2(7) = 22.9$, $p < .01$, yielding correct classification of 79%. Demographic variables and the changes in pain severity did not contribute significant unique variance to the prediction of follow-up return to work status. Longer duration of pain was associated with a lower probability of returning to work (OR = 1.2, 95% CI = 1.0 – 1.2). Of the change scores for psychological variables entered in the third block (i.e., catastrophizing, fear of movement, depression), only change in catastrophizing made a significant unique contribution to the prediction of return to work (OR = .87, 95% CI = .78 - .97). Greater reductions in catastrophizing scores from Week 1 to Week 7 were associated with a greater probability of returning to work.

Table 8 - Logistic Regression Examining Change Scores as Predictors of Return to Work at 1-Year Follow-up

Dependent variable = Return to Work (0 = no, 1 = yes)

	Wald	OR	95% CI
Age	.58	.97	.89 – 1.5
Sex	1.4	2.6	.54 – 13.2
Pain Duration	4.3	1.2*	1.0 – 1.2
Ch-MPQ-PRI	.04	.99	.92 – 1.0
Ch-BDI-II	.01	1.0	.92 – 1.0
Ch-PCS	6.3	.87**	.78 – .97
Ch-TSK	1.9	.92	.82 – 1.0

Note: N = 64. OR = Odds ratio; 95% CI = 95th percentile confidence interval. * $p < .05$, ** $p < .01$

3.6 Depression and Readiness to Return to Work

Three separate multiple regressions were conducted to examine the contribution of depression to clinician's judgments of participants' readiness to return to work. The first regression examined the prognostic value of initial levels of depression (Week 1) to the prediction of readiness to return to work. The second regression examined the prognostic value of end-of-treatment (Week 7) levels of depression to the prediction of readiness to return to work. The third regression examined the prognostic value of change in depression (Week 1 – Week 7) to the prediction of readiness to return to work. For the third regression, only participants in the depressed group were included.

Table 9 shows the results of the regression analysis examining pre-treatment predictors of readiness to return to work. Age, sex and pain duration were entered in Step 1 of the analysis but did not contribute significant variance to the prediction of readiness to return to work. Pre-treatment pain severity was entered in Step 2 of the analysis but did not contribute significant variance to the prediction of readiness to return to work. Psychological variables were entered in Step 3 of the analysis but did not contribute significant variance to the prediction of return to work. Examination of the beta weights for the final regression equation revealed that none of the variables in the regression model contributed significant unique variance to the prediction of readiness to return to work. The regression model accounted for 7% of the variance in readiness to return to work ratings, $R = .23$, $F(7, 179) = 1.6$, $p = .13$.

Table 9 - Multiple Regression Examining Pre-Treatment Predictors of Readiness to Return to Work

Dependent = Readiness to return to work (0-5)

		β	R^2_{change}	F_{change}	p	r
Step 1						
	Age	-.11				-.10
	Sex	.05				.07
	Pain duration	.11	.04	2.1 (3, 183)	.06	.11
Step 2						
	MPQ-PRI (Week 1)	.01	.01	.60 (1, 182)	.43	-.06
Step 3						
	BDI-II (Week 1)	-.13	.02	1.2 (3, 179)	.28	-.13
	PCS (Week 1)	-.07				-.09
	TSK (Week 1)	-.04				-.02*

Note: N = 187. For each regression, standardized beta weights are from the final regression equation. * $p < .05$.

Table 10 shows the results of the regression analysis examining post-treatment predictors of readiness to return to work. Age, sex and pain duration were entered in Step 1 of the analysis but did not contribute significant variance to the prediction of readiness to return to work. Post-treatment pain severity was entered in Step 2 of the analysis and contributed significantly to the prediction of readiness to return to work. Psychological variables were entered in the final step of the analysis and contributed significantly to the prediction of readiness to return to work. Examination of the beta weights from the final regression equation revealed that only post-treatment depression contributed to clinician's ratings of readiness to return to work ($\beta = -.30$, $p < .001$). The regression model accounted for 17% of the variance in readiness to return to work ratings, $R = .41$, $F(7, 179) = 4.9$, $p < .001$.

Table 10 - Multiple Regression Examining Post-Treatment Predictors of Readiness to Return to Work

Dependent = Readiness to return to work (0-5)

	β	R^2_{change}	F_{change}	p	r
Step 1					
Age	-.13				-.10
Sex	.05				.07
Pain duration	.10	.04	2.1 (3, 183)	.06	.11
Step 2					
MPQ-PRI (Week 7)	.01	.03	6.1 (1, 182)	.01	.18**
Step 3					
BDI-II (Week 7)	-.30**	.10	6.8 (3, 179)	.001	-.36**
PCS (Week 7)	-.11				-.29**
TSK (Week 7)	-.06				-.20**

Note: N = 187. For each regression, standardized beta weights are from the final regression equation. ** $p < .01$.

Table 11 shows the results of the regression analysis examining change score predictors of readiness to return to work. Age, sex and pain duration were entered in Step 1 of the analysis but did not contribute significant variance to the prediction of readiness to return to work. Post-treatment pain severity was entered in Step 2 of the analysis and contributed significantly to the prediction of readiness to return to work. Change scores for psychological variables were entered in the final step of the analysis and contributed significantly to the prediction of readiness to return to work. Examination of the beta weights from the final regression equation revealed that only change in depression scores contributed to clinician's ratings of readiness to return to work ($\beta = .36$, $p < .001$). Greater reductions in depression scores were associated with higher ratings of readiness to return to work. The regression model accounted for 27% of the variance in readiness to return to work ratings, $R = .53$, $F(7, 56) = 3.1$, $p < .01$.

Table 11 - Multiple Regression Examining Change Score Predictors of Readiness to Return to Work

Dependent = Readiness to return to work (0-5)

		β	R^2_{change}	F_{change}	p	r
Step 1						
	Age	-.16				-.15
	Sex	-.03				.01
	Pain duration	.01	.03	.76 (3, 60)	.52	.10
Step 2						
	Ch-MPQ-PRI	.01	.07	5.0 (1, 59)	.05	.31**
Step 3						
	Ch-BDI-II	.36**	.17	4.3 (3, 56)	.008	.44**
	Ch-PCS	.24				.40**
	Ch-TSK	-.01				.26**

Note: N = 64. For each regression, standardized beta weights are from the final regression equation. ** $p < .01$.

3.7 Depression and Work Retention

The majority of participants (92%) who returned to work resumed their occupational activities within 4 weeks of treatment termination. Of these, 89% were still at work at 1-year follow-up. Non-depressed individuals (at pre-treatment) were significantly more likely to maintain employment (97%) than depressed individuals (87%), $\chi^2 = 3.2$, $p < .05$. Non-depressed individuals (at post-treatment) were significantly more likely to maintain employment (95%) than depressed individuals (77%), $\chi^2 = 7.5$, $p < .01$.

3.8 Depression and Health Service Utilisation

During the 1-year follow-up period, depressed participants were more likely (66%) than non-depressed participants (43%) to report ongoing use of pain medication, $\chi^2 = 7.4$, $p < .01$. Depressed participants were twice as likely (27%) than non-depressed participants (13%) to report ongoing use of narcotics for the management of pain, $\chi^2 = 4.9$, $p < .05$. Depressed and non-depressed individuals did not differ in their use of NSAIDs, $\chi^2 = 1.4$, $p = .28$, or anti-inflammatory medication, $\chi^2 = .03$, $p = .87$. Depressed participants did not differ from non-depressed participants in the likelihood of continued medical treatment, $\chi^2 = .88$, $p = .64$, or physiotherapy, $\chi^2 = .26$, $p = .61$.

Depressed participants did not differ from non-depressed participants in their use of psychotropic medication, $\chi^2 = .80$, $p = .37$, or their involvement in psychotherapy, $\chi^2 = 3.9$, $p = .14$. Only 7% of depressed participants were taking psychotropic medication and 9% were involved in psychotherapy.

4. DISCUSSION

The results of the present study indicate that the prevalence of depression in individuals referred for rehabilitation of work-related musculoskeletal injury is as high as 40%. Participants who scored above clinical threshold on a measure of depressive symptoms scored higher on measures of catastrophizing and fear of movement, and had lower expectancies for resuming occupational activities. Participants who scored above clinical threshold on a measure of depressive symptoms at initial assessment were more likely to report ongoing pain at 1-year follow up, and were less likely to return to work.

These findings join a growing literature highlighting the deleterious effects of depression on recovery outcomes following musculoskeletal injury [48; 11; 54]. In previous research, depression has been shown to contribute to longer periods of work absence following injury and lower probability of return to work [31]. This study extends previous findings in showing that depression, assessed in the subacute period has prognostic value for rehabilitation outcomes. The findings of the present study also extend previous findings in showing that depression contributes to poor return to work outcomes even when controlling for pain severity and other known psychosocial risk factors such as catastrophizing and fear of movement.

In this study, depression and catastrophizing made independent contributions to the persistence of pain. Although catastrophizing has traditionally construed as the cognitive precursor to depression, the present results suggest that catastrophizing might be partially distinct from depression in terms of the processes by which it contributes to chronic pain [61; 68].

Numerous explanations have been put forward to account for the deleterious impact of catastrophizing on pain outcomes [61]. It has been suggested that pain catastrophizing might impact on pain experience by increasing attention to pain sensations [51; 40]. It has long been established that increased attention to pain sensations augments the intensity of perceived pain [1; 33; 16; 7]. Research findings also suggest that coping strategies are less effective when used by pain catastrophizers [26; 51]. There are some indications that pain catastrophizing might have a direct impact on endogenous pain modulation mechanisms. It has been suggested that pain catastrophizing might interfere with descending pain-inhibitory systems, and might facilitate neuroplastic changes in the spinal cord during repeated painful stimulation, subsequently promoting sensitization in the CNS [17].

There have also been numerous discussions about the mechanisms by which depression might impact on the persistence of pain [12; 8]. Biopsychosocial models have emphasized the role of catastrophizing as one mechanism by which depression might impact on pain. However, the results of the present study suggest that depression might impact on pain through processes independent of catastrophizing. It is possible that depression might lead to problematic pain outcomes by contributing to activity withdrawal [55]. Depression is associated with pessimistic views of the future, low expectancies for positive outcomes, motivation deficits and general withdrawal from social, recreational and occupational activities [3]. It is possible that depressed individuals might have difficulty mobilizing the motivational resources to maintain involvement in activities that could potentially improve their recovery. It is interesting to note that depressed participants were more like than non-depressed participants to drop out of treatment prematurely.

Consistent with behavioural models of depression, reduced activity might result in fewer opportunities to experience success or mastery experiences [41, 42]. Since activity participation is considered to be critical to successful recovery from musculoskeletal injury, the activity withdrawal of depressed clients might interfere with recovery processes.

The results of the present study are consistent with previous investigations showing that reductions in symptoms of pain and depression do not necessarily yield reductions in disability [59; 52]. As such, disability associated with musculoskeletal injury and concurrent depression poses a particularly significant challenge. Whether addressed from personal, social, occupational or societal perspectives, the costs of disability associated with pain and depression are of staggering proportion. Findings such as these have led policy makers, researchers and clinicians to call for more research specifically addressing the determinants of disability in individuals suffering from symptoms of depression and pain [76; 60; 75; 44]. Clearly, increased prescription of anti-depressant medication will not likely have a significant impact on return to work rates.

There are different processes by which depression might impact on pain-related disability. Depression might add to the burden of disability associated with pain by accentuating the negative impact of the pain symptoms that ensue from whiplash injury [4]. This 'amplification of pain' model of the relation between depression and pain-related disability would be consistent with theoretical frameworks that argue for a common physiological substrate to depression and pain [6; 20; 53]. This perspective would suggest that there would be little unique about the manner in which depression impacts on pain-related disability; pain with concurrent depression would simply represent a more severe condition that pain without depression. The 'amplification of pain' model predicts that depression will contribute to increases in spontaneous or evoked pain, and that all other dimensions of observed disability would be the direct consequence of experiencing more intense pain.

Alternately, a 'cummulative disability model' might provide a better account of the relation between depression and pain-related disability. From this perspective, depression might impact on pain-related disability through pathways partially distinct from those associated with pain symptoms. For example, psychomotor alterations have been associated with depression, even in the absence of pain [49]. It is possible that disability-relevant factors such as expressive pain displays, motor functions, motivational deficits and fatigue might be behavioural dimensions of depression that can be partially distinguished from those associated with pain severity.

The results of the present study do not support an 'amplification of pain' model of the relation between depression and disability. Even though depression and pain were correlated, depression predicted work absence even when controlling for pain severity. These findings suggest that interventions aimed at reducing pain severity will not necessarily impact on aspects of depression that are contributing to work disability. Although a 'cummulative disability model' might provide an adequate account of the relation between depression and work disability in individuals with musculoskeletal conditions, the measures used in this study do not elucidate the processes by which depression might contribute to disability.

Of interest is that 50% of participants who scored above clinical threshold on a measure of depressive symptoms at the beginning of treatment, scored below clinical threshold at the end of

treatment, even though rehabilitation treatment did not include psychological intervention. One implication of this finding is that obtaining a high score on a measure of depression following musculoskeletal injury does not necessarily indicate need for psychological (or pharmaco-therapeutic) intervention. One possibility is that non-specific factors involved in physical therapy such as goal setting, activity mobilization and social encouragement might have anti-depressant properties. Another possibility is that individuals' whose depression recovers in response to physical therapy have a different form of depression than individuals whose depressive symptoms do not respond to physical therapy. Unfortunately, it is not possible to address this possibility on the basis of the data collected in the present study.

Traditionally, when clients with musculoskeletal conditions have shown evidence of depressive symptoms, practice has been to refer clients to a mental health professional that will offer pharmacotherapeutic or psychotherapeutic treatment. Clearly, treatment must be offered to reduce the client's level of emotional suffering. However, current treatment approaches for depression might not necessarily contribute to disability reduction. Side effects of certain antidepressant medication can impede an individual's ability to participate fully in physical rehabilitation programs (e.g., nausea, drowsiness, fatigue). Psychotherapeutic interventions can extend over significant periods of time, increasing rather than decreasing the period of disability. It is interesting to note that most intervention approaches to the management of depressive symptoms are passive or palliative in orientation. There is a vast literature that speaks to the deleterious effects of passive or palliative interventions in the management of pain-related disability [74].

It is possible that physical therapy in combination with an activity-oriented mental health intervention might represent the best approach to managing the disability associated with concomitant pain and depressive symptoms. Recent evidence suggests that behavioural activation interventions for depression might be more effective than traditional cognitive-behavioral approaches or even pharmacotherapy [13]. To date, no research has been conducted to evaluate the effectiveness of a behavioural activation treatment for depression in combination with physical therapy for the management of disability associated with depression and pain. This appears to be a fruitful direction for future research.

The clinical implications of the study must be regarded with caution in light of the modest effect sizes associated with the predictive value of depression scores. Zero-order relations indicated that the presence of depression at initial assessment was associated with a 28% reduction in the probability of being employed at one-year follow-up. However, when considered in multivariate analyses, controlling for demographic variables, pain and other psychosocial variables, depression accounted for only 11% of the variance in return to work outcomes. The magnitude of this relation is consistent with that which has been reported in other research examining the relation between psychological variables and return to work outcomes. The consistency of the findings suggests that depression should be part of a comprehensive approach to assessment and intervention for individuals with musculoskeletal injuries, even at the subacute stage of recovery. However, the data do not warrant considering depression as a primary focus of assessment and intervention.

One important limitation of the present study is that depression was operationalised as a high score on a self-report measure of depressive symptoms as opposed to diagnostic interview. To date, the bulk of research on depression associated with musculoskeletal conditions has been conducted with self-report measures such as the Beck Depression Inventory-II or the Centre for Epidemiological Studies Scale for Depression, or various other emotional distress scales [24].

Considerable research attests to the validity of the BDI-II as an index of depressive symptoms associated with pain [39]. However, there is research to suggest that self-report measures of depressive symptoms have high sensitivity for diagnoses of Major Depressive Disorder (MDD) but low specificity [5; 23]. As such, it is not possible to determine which participants met diagnostic criteria for MDD (or other mental health conditions). It is also important to note that certain symptoms of depression overlap with symptoms of pain-related conditions (e.g., psychomotor slowing, fatigue, sleep disturbance) which might contribute to inflated depression scores in individuals with musculoskeletal conditions. Unfortunately, at this time, there is no validated procedure for unambiguously attributing overlapping symptoms to depression or pain. Future research will need to address with greater precision, the assessment of duration of depressive symptoms and the degree to which high levels of depressive symptoms reflect a diagnosable mental health condition.

In spite of limitations, the present study showed that individuals who enter rehabilitation treatment with high levels of depression are less likely to return to work following treatment. Of the individuals who returned to work, depressed individuals were also less likely to maintain employment. Future research will need to identify the processes by which depression impacts on disability and the intervention approaches that are most effective in targeting disability associated with depression and pain.

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