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Effectiveness of a Multidisciplinary Rehabilitation Program Following Shoulder Injury

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Effectiveness of a Multidisciplinary Rehabilitation Program Following Shoulder Injury

Abstract
Background: Shoulder injuries in working age adults result in a major cost to the health care system. The purpose of this study was to examine the effectiveness of a new multidisciplinary rehabilitation program and to explore factors that affected a successful return to work (RTW) in injured workers with shoulder problems who received this program.

Methods: This was a prospective longitudinal study. The patient-oriented outcome measures were the Numeric Pain Rating Scale (NPRS) and the Disabilities of the Arm, Shoulder, and Hand (DASH). Range of motion (ROM) in flexion, abduction, and external rotation and strength in lifting and push/pull were documented. All outcomes were measured before and at the completion of the program.

Results: Data of 68 patients were used for analysis. All outcomes showed a statistically significant improvement over time.

Conclusions: Multidisciplinary rehabilitation programs help to improve pain, disability, ROM, strength, and facilitate RTW. Higher stress and a fast-paced work environment increased the risk of not progressing in work status.

Comments
The authors have nothing to disclose.

Keywords
Shoulder, Worker's Compensation, Interdisciplinary Rehabilitation

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The importance of timely assessment and an active rehabilitation program following work-related injuries cannot be overemphasized. Since being absent from work for long periods of time is associated with more chronic disability (Hogg-Johnson & Cole, 2003; Kuijpers et al., 2006; Loisel et al., 2002; Luime et al., 2004), the Provincial Workers' Compensation Boards, including the Workplace Safety and Insurance Board (WSIB) in Ontario, have implemented certain strategic plans to improve accessibility, quality of care, and successful return to work (RTW). One of these strategies is to facilitate multidisciplinary rehabilitation programs in publicly funded facilities. These programs involve a multidisciplinary evaluation and treatment program using the skills of orthopedic surgeons, physical therapists, and occupational therapists. Patients are involved in decision making about their management throughout the treatment process.

The literature on multidisciplinary rehabilitation programs for general musculoskeletal conditions shows significant success in getting compensation claimants back to work (Lemstra & Olszynski, 2004; Taylor, Simpson, Gow, & McNaughton, 2001). In addition to improving physical function, pain, and the ability to return to work (Fritz, Cleland, & Brennan, 2007; Janak et al., 2017; Ostelo et al., 2005), multidisciplinary programs reportedly assist with reducing emotional distress (Gagnon, Stanos, van der Ende, Rader, & Harden, 2013). There is information on overall recovery following shoulder surgery in injured workers (Cuff & Pupello, 2012; Henn, Kang, Tashjian, & Green, 2008; Holtby & Razmjou, 2010). However, the literature on the impact of multidisciplinary rehabilitation programs on improving disability in injured workers with shoulder problems is limited.

The purpose of this study was to (a) examine the impact of a multidisciplinary rehabilitation program on pain, disability, range of motion (ROM), strength, and work status following a work-related shoulder injury and (b) explore the role of demographic (age, sex, symptom duration, marital status, level of education, dominate hand involvement, etc.) and patient characteristics (pre-treatment level of pain and disability and psychosocial work-related factors) on a successful RTW.

Methods

Patient Population

This was a prospective longitudinal study of injured workers who received a comprehensive multidisciplinary rehabilitation program funded by the Ontario WSIB. The inclusion criteria for the study was (a) an active work-related shoulder injury, (b) referral from an orthopedic surgeon at a shoulder and elbow specialty clinic, (c) aged ≥ 18 years, and (d) the ability to read and write English. Patients with referred cervical spine pain and other coexisting peripheral joint involvement were excluded. Approval for use of human subjects was obtained from the Research Ethics Board of the Sunnybrook Health Sciences Centre.

Outcome Measures

The outcome measures used to document patient pain and disability prior to and after treatment were the Numeric Pain Rating Scale (NPRS); the Disabilities of the Arm, Shoulder, and Hand (DASH) (Beaton et al., 2001); active range of

motion (ROM); and strength and work status. To express the amount of clinically important change made by the patients, we calculated the minimal clinically important difference (MCID) of the self-report outcome measures. The MCID, the smallest change in the treatment outcome that patients would identify as important, was calculated. A MCID of 1.1 is recommended for the NPRS (Mintken, Glynn, & Cleland, 2009). The MCID of 10 is suggested for the DASH (Sorensen, Howard, Tan, Ketchersid, & Calfee, 2013). The NPRS is reported to be valid and reliable for clinical practice (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011; Williamson & Hoggart, 2005), and the DASH has shown reliability and validity in patients with shoulder problems (Roy, MacDermid, & Woodhouse, 2009; Staples, Forbes, Green, & Buchbinder, 2010). All outcome measures were collected prior to treatment, during treatment, and at the time of discharge from the rehabilitation program. Agreement with overall satisfaction with quality of care was rated on a 5-point Likert scale as *strongly agree*, *agree*, *neutral*, *disagree*, and *strongly disagree*.

Demographics and Clinical Data

The demographic information, such as age, sex, marital status, dependent children/parents, level of education, affected side, injury on the dominant side, symptom duration (date of injury to initial date of visit), type of occupation, and length and type of treatment was documented. Clinical examination included active ROM in flexion, abduction and external rotation, general observation, chief complaints, working diagnosis, strength testing in lifting, and pushing and pulling. Clinical outcomes were documented at the initial, progress, and discharge assessment sessions. For this study, only initial and final evaluations were analyzed.

Rehabilitation Components

The multidisciplinary team included an orthopedic surgeon, an occupational therapist (OT), and a physical therapist (PT). The referral was received from the orthopedic surgeon who had seen the patient in a shoulder and elbow specialty clinic. The patients were then seen in the treatment arm of the program where the discipline's team members (PT and OT) performed their individual consultations. The patients were seen 3 times per week and spent 45 min with the PT and 45 min with the OT. The patients completed a disability outcome measure and a pain scale prior to initiation of treatment and at the final visit. The patients were asked to formulate their goals to identify individual issues and deficits. The goals had to be specific, measurable, attainable, realistic, and timely (SMART). All of the patients were educated on their diagnosis, treatment, and prognosis. The team members met regularly to discuss new findings and future directions for the patients' care. The patients were encouraged to participate in clinical decision-making throughout the treatment program.

Physical Therapy

The physical therapy component involved general observation of the posture and presence of muscle wasting. The PT examined active ROM in flexion, abduction, and external rotation with a goniometer prior to the initial treatment and at the final visit. The treatment included modalities to improve pain, general conditioning for strength and endurance, manual therapy, and stretching.

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Occupational Therapy

The occupational therapy component involved measurement of the patients' current physical abilities. Strength testing was performed at the initial, progress, and final visits using a digital force Chatillon gage to measure kilograms of force and involved lifting (low lift and high lift based on baseline range, tolerance to activity, and compensatory movements identified), carrying (bilateral and unilateral carrying), pushing/pulling (upper extremity push/pull and whole body push/pull), and reaching (waist level reaching and vertical reach [height dependent on baseline ROM and functional capacity]). Lifting/carrying baseline was established through maximum effort observed (e.g., increased respiratory rate, use of accessory muscles) and ensuring compensatory movements were not masking the findings.

In addition, the initial assessment included an informal scan of sensory and cognitive issues. These abilities were then correlated with their physical job demands. A treatment program was developed that included simulated functional activities (replicating movements/tasks required for return to regular duties, practice and progress moving, handling skills/tolerances, construction workers [progressing heavy heights, sustained movements, ladder work]) related to work, home, and leisure to increase strength, endurance, and overall function. The barriers to progress were discussed with the patients throughout the rehabilitation process. The patients were educated on the difference between hurt and harm, good body postures, and proper lifting techniques. The patients were encouraged to return to modified or regular duties as their medical restrictions were reduced, lifted, or they met their full or partial job requirements as their work tolerances improved.

Work-Related Psychological Factors

Information on psychosocial factors was collected using a questionnaire that was developed by Nahit et al. (2003) based on Karasek's demand–support–control model (1979). The participants were asked about seven aspects of their job demands on a Likert scale: The amount of job support (from colleagues and supervisors), level of monotony, work pace, level of stress and worry, autonomy (ability to make own decisions), having the opportunity to learn new things, and the overall job satisfaction. The work-related psychological questionnaire score has been shown to be associated with prevalent musculoskeletal pain (Andersen, Fallentin, Thorsen, & Holtermann, 2016; Nahit et al., 2003; Neupane, Pensola, Haukka, Ojajärvi, & Leino-Arjas, 2016; Pieper, LaCroix, & Karasek, 1989). The predictive validity of the questionnaire has been established in patients with shoulder, forearm, knee, and low back pain (Ghaffari et al., 2008; Harkness, Macfarlane, Nahit, Silman, & McBeth, 2004; Jones et al., 2007; Leino & Hanninen, 1995; Macfarlane, Hunt, & Silman, 2000; Papageorgiou et al., 1997).

Statistical Analysis

To identify predictors of successful RTW using multiple regressions and the rule of thumb of 10 observations for each parameter in the model (one df for continuous data and one df-1 for each category of categorical data), a minimum of 60 patients with complete data were required to examine up to six covariates together.

Descriptive statistics were calculated for all variables. Change over time was documented in the DASH, the NPRS, ROM, and strength scores by paired student's *t*-tests and in work status by chi-square statistics as appropriate. The number of patients who exceeded the MCID of 10 points for the DASH (Sorensen et al., 2013), 1.1 for the NPRS (Mintken et al., 2009), and satisfaction with treatment were reported on descriptive bases.

The dependent variable was the success in RTW and included three categories: (a) improved—those who progressed from not working prior to treatment to working part time or full time at the time of discharge, and from working part time to working full time; (b) no change in work status; and (c) worsened—patients whose work status changed from working to not working or working full time to working part time. The predictors of successful RTW were age (in years), sex (women vs. men), injury of dominant side (yes vs. no), job demands reflected by the type of occupation in six categories (construction, manufacturing, hospitality, transportation, health care, and retail), pre-treatment work status (unable to work vs. part time vs. full time), and work-related psychosocial factors (seven categories).

The value of predictor factors on successful RTW (dependent variable) was examined through univariable and multivariable logistic regressions. Only variables that were significant at $p < 0.05$ in the univariable analyses were entered into the multivariable logistic regression. As noted, the sample size was sufficient for six simultaneous parameters in the multivariable logistic regression.

Results

Seventy patients were approached to participate in the study; two patients did not complete their follow-up visits. The final cohort included 68 patients (16 women and 52 men, mean age = 51, *SD* = 10); 54 of those patients had rehabilitation following a shoulder-related surgery with 14 undergoing conservative treatment. The demographic characteristics of the patients are shown in Table 1.

Table 1
Characteristics of the Sample (N = 68)

Variable		N (%) or Mean (SD)
Sex	Women	16 (24%)
	Men	52 (76%)
Age (Mean, SD)		51 (10)
		Range 24-68
Marital Status	Never married	7 (10%)
	Common law/Married	46 (68%)
	Separated	2 (3%)
	Divorced/Widowed	13 (19%)
Dependent children/parents	Yes	38 (56%)
	No	30 (44%)
Education	Grade 8-11	9 (13%)
	High school degree	24 (35%)
	One or two years of college, no degree	5 (7%)
	College degree	20 (29%)
	Bachelor's degree	9 (13%)
	Master's degree	1 (2%)

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Type of industry	Construction	13 (19%)
	Manufacturing	11 (16%)
	Hospitality	9 (13%)
	Transportation	11 (16%)
	Health care	6 (8%)
	Retail	6 (8%)
	Other	12 (16%)
Affected side	Left	21 (31%)
	Right	47 (69%)
Dominate side involvement	Yes	49 (72%)
	No	19 (28%)
Symptom duration (months)	Date of injury to date initial visit	16 (23), 15 days to 174 months
Treatment time frame	6-8 weeks	22 (32%)
	8-10 weeks	5 (8%)
	>12 weeks	41 (60%)
Type of treatment	**Conservative (14)**	
	Full rotator cuff tear (massive, irreparable)	2 (14%)
	Full rotator cuff tear (refused to have surgery)	1 (7%)
	Partial rotator cuff tear	4 (29%)
	Impingement/tendonitis	7 (50%)
	Surgical (54)*	
	Rotator cuff decompression	26 (48%)
	Rotator cuff repair	36 (67%)
	Rotator cuff repair and decompression	16 (30%)
	Stabilization of glenohumeral joint	3 (5%)
Work-related psychosocial factors (N = 66)	**Support from colleagues**	
	Satisfied	41
	Neither	17
	Dissatisfied	8
	Work pace being hectic	
	Never/Occasionally	13
	Half the time	16
	Always/most of the time	37
	Stressful work	
	Never/Occasionally	14
	Half the time	20
	Always/most of the time	32
	Work autonomy (able to decide)	
	Often/very often	28
	Sometimes	26
	Seldom/very seldom	12
	Learn new things	
	Often/very often	26
	Sometimes	16
	Seldom/very seldom	24
	Overall satisfaction with job	
	Satisfied	42
	Neither satisfied nor dissatisfied	18
	Dissatisfied	3
	Missing	3

Note: *Some surgical categories overlapped.

Change Over Time

Table 2 demonstrates change in outcome measures and work status. There was a statistically significant improvement in the DASH, the NPRS, active ROM, lifting, and push/pull abilities over the period of treatment ($p < 0.0001$). The number of patients who returned to full-time work after treatment improved from 18 (26%) to 40 (59%).

The number of patients who were not working prior to treatment decreased from 34 (50%) to 15 (22%) ($p < 0.0001$).

Predictors of Successful RTW

The dependent variable (successful RTW) included 29 patients in the improved work status category, 37 in the no change category, and one patient in the worse category (see Table 2). The patient in the worse category and one patient who retired at the time of final assessment were excluded from further analysis to avoid having a small cell number that affects the accuracy of logistic regression. The patient who was in the worse category was a 28-year-old woman with calcified rotator cuff tendinopathy whose contract was finished with the employer at the time of final assessment and who did not have a job to which to return. Therefore, the dependent variable was a binominal variable of improved and no change in work status.

Table 2

Change in Outcomes over Time

Variables **Mean, (SD), or N(%)**	**Pre-treatment**	**Post-treatment**	**Statistics for change**
DASH (1-100)	47 (18)	29 (18)	9.73, $p < 0.0001$
Exceeded MCID (Yes/No)	_____	49(72%)/19(28%)	_____
NPRS (1-10)	5 (2)	3 (2)	7.03, $p < 0.0001$
Exceeded MCID (Yes/No)		37(54%)/31(46%)	_____
Range of motion			
Flexion	133 (31)	155 (19)	6.95, $p < 0.0001$
Abduction	123 (39)	155 (26)	7.60, $p < 0.0001$
External Rotation	52 (17)	63 (15)	5.59, $p < 0.0001$
Lifting (floor to waist in Kg)	12 (4)	18 (7)	10.35, $p < 0.0001$
Push/pull(bilateral, in Kg)	10 (5)	15 (7)	8.63, $p < 0.0001$
Work status			
Full time	**18**	**40**	
Regular duties	3	11	
Modified duties	15	29	
Part time	**15**	**11**	
Regular duties	1	1	
Modified	14	10	
Off work	**35**	**16**	
Medically restricted	17	2	FET < 0.0001, $p < 0001$
Other medical conditions	1	2	
Unsuitable tasks	15	5	
Unavailable work	2	3	
Other	0	4	
Retired	0	1	
Change in work status			
Improved		29	_____
No change		36	
Worse		1	
Satisfied with treatment			
Strongly agree		62	
Agree		2	
Neutral		0	_____
Disagree		0	
Strongly disagree		0	
Missing		2	

Note: DASH: The Disabilities of the Arm, Shoulder and Hand; NPRS: The Numeric Pain Rating Scale.

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Table 3 shows the results of univariable analysis. Age, sex, pre-treatment disability and pain, injury on the dominant side, pre-treatment work status, symptom duration, level of education, marital status, or length of treatment did not affect a successful RTW, indicating that the demographics did not play an important role in progressing work status. Although work status was affected by type of industry before and after surgery with higher job demand being associated with a higher number of patients being absent from work both prior to treatment ($p = 0.0001$) and after treatment ($p < 0.0001$), type of industry was not associated with a successful RTW ($p = 0.74$).

Table 3

Results of Univariable Logistic Regressions (Dependent Variable: Improved, No Change in Work Status)

Predictor variables	Wald X^2	*P* value
Age	0.51	0.48
Sex	0.60	0.44
Dominate side involvement	0.001	0.99
Symptom duration	0.001	0.98
Marital status	2.28	0.32
Level of education	3.97	0.14
Length of treatment	4.66	0.10
Surgical vs. non-surgical	***4.75***	***0.03***
Pre-op work status	0.43	0.80
Type of industry	1.75	0.88
Initial pain score	0.07	0.78
Initial DASH score	0.93	0.34
Work-related psychosocial factors		
Support from colleagues	1.98	0.37
Monotonous work	3.95	0.14
Work pace	7.08	***0.03***
Work stress	4.54	***0.03***
Work autonomy	4.06	0.13
Learn new things	3.24	0.19
Overall satisfaction with job	2.03	0.36

Note: DASH: The Disabilities of the Arm, Shoulder and Hand; NPRS: The Numeric Pain Rating Scale.

The patients who had treatment following surgery were more likely to be in the improved work status category than the nonsurgical patients who received conservative treatment following their injury (surgical: 27/29, 93% vs. non-surgical: 2/29, 7%, $p = 0.03$). The extent of pathology in the surgical and conservative groups did not affect a successful RTW among surgical patients—those who had a rotator cuff repair were as successful as patients who underwent a more minor surgery, such as rotator cuff decompression. Similar types of pathology (partial or full tear vs. tendonitis or bursitis) did not affect a successful RTW in the non-surgical group.

Successful RTW showed a statistically significant relationship with the level of stress at work ($X^2 = 4.23$, $p = 0.04$) and work pace ($X^2 = 5.07$, $p = 0.02$), indicating that those who suffered from more stress and a faster pace at work were less likely to progress in their work status. The multivariable logistic regression that included all three significant predictors (extent of pathology requiring surgery, stress, and fast-paced work), maintained only the extent of pathology, indicating that after adjusting for important psychological factors at work, the patients who underwent surgery still had a more successful RTW than those who received conservative treatment ($X^2 = 3.89$, $p = 0.048$).

Discussion

The findings of the present study confirm that multidisciplinary treatments with a patient-centered management strategy improve perceived pain and disability at a statistical and clinical level. Major goals of multidisciplinary treatments involve education, improved function of the shoulder-related structures, general conditioning, job-specific strengthening, and facilitating a prompt and safe

RTW. Most importantly, these programs improve patient ability to progress at work. Our results are consistent with a comparative study that has examined patients with neck and shoulder conditions. Storrø, Moen, and Svebak (2004) showed that patients who received a multidisciplinary rehabilitation program had superior results as compared with a control group who received a usual treatment.

Recovery in injured workers is multifactorial and a variety of demographic, clinical, and work-related factors are known to explain a successful treatment (Gross, Haws, & Niemelainen, 2012). There is evidence that in the general population, gender (Bassey, Morgan, Dallosso, & Ebrahim, 1989; Razmjou, Davis, Jaglal, Holtby, & Richards, 2009; Razmjou, Davis, Jaglal, Holtby, & Richards, 2011; Romeo, Hang, Bach, & Shott, 1999), age (Kim et al., 2014; Razmjou et al., 2011), an injury to the dominant side (Keener, Steger-May, Stobbs, & Yamaguchi, 2010), heavy job demands (Bugajska et al., 2013), and psychosocial factors (Menendez et al., 2015; Widanarko, Legg, Devereux, & Stevenson, 2014) have a negative impact on recovery. Selander Marnetoft, Bergroth, and Ekholm (2002) reported that RTW following vocational rehabilitation for problems in the neck, back, and shoulders was associated with age, level of education, and income. In the present study, neither demographic characteristics nor type of industry affected a successful RTW. It is possible that a comprehensive and appropriate treatment program can minimize the role of demographics and social factors.

In the present study, psychological factors contributed to successful RTW with the higher stress and faster pace at work being associated with a lack of progress in work status. Consistent with our study, the literature suggests that injured workers suffer a wider range of mental health consequences, including stress, anxiety, and depression (Keogh, Nuwayhid, Gordon, & Gucer, 2000; Kim, 2013; Mason, Wardrope, Turpin, & Rowlands, 2002; Rosenbloom, Khan, McCartney, & Katz, 2013; Stansfeld et al., 1995). A systematic review in 2013 indicated that psychological factors are the frequently cited predictive factors for persistent pain after traumatic musculoskeletal injuries (Rosenbloom et al., 2013). Kim (2013), who examined the data of a large number of workers (N = 35,155) who had been followed for about 18 months, showed that workers with a history of an occupational injury had a higher chance of developing depression over time than workers without occupational injuries. In a qualitative study by Soklaridis, Ammendolia, and Cassidy (2010), participants who had suffered a back injury revealed psychosocial factors as the product of larger systemic and organizational issues. This study (Soklaridis, Ammendolia, & Cassidy, 2010) described how a complex interplay between different components of organizational structures affected injured workers' psychological well-being and contributed directly or indirectly to worker's RTW. Our study was not designed to examine the complex relationship between psychological issues and employment policies or work-place structures, but this relationship deserves further study and future research should explore the

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role of the rehabilitation team in reducing psychological factors via continuous communication with the employers and other stakeholders.

The importance of keeping injured workers connected to their place of work by providing lighter duty jobs, shorter work hours, and/or graded work exposure has been emphasized (Durand, Berthelette, Loisel, & Imbeau, 2012; Stay-at-Work and Return-to-Work Process Improvement Committee, 2006). Early participation at work in any capacity helps maintain physical conditioning, quality of life, and function (Hogg-Johnson & Cole, 2003; Kuijpers et al., 2006; Loisel et al., 2002; Luime et al., 2004). Apart from the financial loss that both workers and employers endure due to a worker's prolonged absence from work, being away from the workplace is reported to be associated with poor outcomes and increased morbidity (Roelfs, Shor, Davidson, & Schwartz, 2011). In our study, 17 patients felt that they did not have access to suitable tasks before initiation of treatment. This number reduced to eight at the time of discharge (see Table 2). The remaining patients had access to part-time or modified duties before and after treatment. Availability of these positions may have contributed to improvement in work status in the present study.The other factor that was a significant predictor of successful RTW was the severity of pathology (pathologies requiring surgery). The patients who had surgery did better than non-surgical patients who had a conservative treatment for more minor pathologies. Type of pathology (surgical vs. nonsurgical) remained significant after psychological factors (stress and fast-paced work) were considered. Limited research in this area has shown that patients with minor shoulder pathologies, such as impingement syndrome, express more emotional disability both prior to (0.007) and after (0.004) surgery as compared to patients with major pathologies, such as full thickness rotator cuff tear (Razmjou, Athwal, & Holtby, 2012). In a study that examined the specific impact of adaptation to disability, it was shown that patients with more severe pathological involvement reported better results after surgery (Razmjou, Schwartz, & Holtby, 2010). The authors concluded that this discrepancy was related to a psychological phenomenon called the "response shift," which appears to occur more effectively in patients with more significant pathologies (e.g., tear vs. tendonitis).

Reporting poorer outcome by the non-surgical group may be related to a less effective adaptation to disability behavior in this group. Surgical interventions are used for more significant pathologies with an expectation that following a repair of a torn tendon or decompression of an arthritic acromioclavicular joint symptoms resolve. This expectation may not be as concrete for patients with the diagnoses of minor conditions, such as tendonitis or bursitis. In any case, the present study highlights the importance of multidisciplinary rehabilitation programs following shoulder surgery.

In summary, our multidisciplinary treatment improved perceived pain and disability, functional tolerances, and ability to work. Factors that affected a successful RTW included the extent of pathology requiring surgery and the level of perceived stress and pace at work. The extent of

pathology and subsequent treatment received depends on the severity of injury. However, stress and work pace are modifiable, and by improving these factors, the WSIB and employers may be able to improve injured workers' RTW success. Future studies should explore strategies to reduce psychological factors, particularly when occupational related stress and work pace impede the worker's progress in work status.

Conclusions

The results of the present study suggest that multidisciplinary rehabilitation programs contribute to recovery of pain, disability, functional range of motion, and strength following a shoulder injury, more so when the pathology is serious enough to require surgery. Higher stress and a fast pace at work were among important psychological factors that placed the worker at an increased risk of not progressing in his or her work status. The patients who underwent surgery had a more successful RTW after accounting for all other predictors.

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