# External Validation of the Orebro Musculoskeletal Pain Screening Questionnaire within an Injured Worker Population: A Retrospective Cohort Study

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## Abstract

**Purpose:**

The purpose of this study was to determine what cut-off of the Orebro Musculoskeletal Pain Screening Questionnaire score will best differentiate workers with acute musculoskeletal injuries at-risk for delayed return to work (greater than 3 months), in a population of workers of less than 3 weeks injury duration.

**Study Design:**

Retrospective cohort design, using a sample of convenience.

**Methods:**

A sample of 259 consecutive WCB patients seeking assessment and treatment at a multidisciplinary rehabilitation facility were reviewed, with 152 meeting the inclusion criteria of having sustained a soft tissue injury within 3 weeks of initial assessment. Descriptive statistics, tests of difference between Time 1 and Time 2 OMPSQ scores and Receiver Operator Characteristic curves were generated. The method of determining predictive ability of the OMPSQ at two points in time was by means of ROC analysis.

**Results:**

This study determined that the OMPSQ is moderately predictive of failure to achieve timely return to work (RTW) in a population of injured workers with acute musculoskeletal soft tissue injuries, when assessed two-weeks after treatment is initiated, and less predictive at the initial intake into treatment. Delayed RTW was defined as those workers who had not returned to their pre-injury job full time by 90 days, due to reduced functional ability as it related to their pre-injury occupation.

**Conclusions:**

This study demonstrates that there is variability in cut-off scores across studies. Future research should attempt to define cut-off scores as they relate to the population , outcome, condition and time-frame of interest .

**Key Words:** Orebro Musculoskeletal Pain Screening Questionnaire, delayed recovery, return to work

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## Chapter 1.

## Screening for Delayed Recovery in Acute Worker Related Injuries: A Review of the Orebro Musculoskeletal Screening Questionnaire

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**Work-related injuries and delayed recovery**

Musculoskeletal disorders, such as strain/sprain injuries to the spine or repetitive strain injuries of the upper limbs, account for 40-60% of time-loss claims in Canada.[1] The majority of individuals with acute musculoskeletal soft tissue injuries or "sprain/strain injuries" recover rapidly, however a proportion of these soft tissue injuries result in longer term disability and delayed return to work. Musculoskeletal injuries occur as a result of soft tissue damage to muscles, tendons and/or joint support structures such as ligaments and include a broad spectrum of diagnoses of the spine and extremities.[2] Such injuries are considered a deviation from a homeostatic health state that negatively influences health-related resources.[3] Significant research has been performed, on understanding the long-term burden that these injuries have to industrialized countries.[3]

In particular, musculoskeletal injuries to the spine have been a major area of study within the literature. It is estimated that 3-10% of individuals with low back pain, go on to experience chronic low back pain. Chronic low back pain has been defined in the literature as low back pain lasting longer than 3-6 months.[4] The impact of this injury related disability can have serious repercussions on a worker's quality of life[5] and accounts for 50-60% of the associated costs.[6,7] There is evidence to suggest that the prevalence and costs of chronic LBP are increasing.[8] A systematic review performed by Chou and Shekelle in 2010 found that when poor outcome was defined as work absenteeism or compensation status, the median proportion of low back pain patients with a poor outcome was 11%, 3 to 6 months and one year following injury.[9] Preventing disability that results from musculoskeletal pain problems in even a small percentage of individuals will result in significant reduction in the economic burden of managing these cases.[10]

Returning injured workers back to work after sustaining a soft tissue injury presents many challenges to healthcare providers, employers and insurers. Although there has been growing evidence with respect to strategies to reduce work disability duration,[10] implementation of this evidence has been slow.[11] Reasons for this relate to the complex nature of how acute pain conditions become chronic, as well as the involvement of multiple environmental and social factors, such as healthcare systems, legal, administrative, social, political, and cultural issues.[12] Early occupational management of work-related soft-tissue injuries is often a major theme in programs focused on returning the worker to back to work. This includes case management, healthcare provision, temporary assignment to transitional duties or suitable work, ergonomic interventions and rehabilitation programs.[5] Optimizing outcomes in this area would reduce the economic and personal burden for both society and the injured worker, while improving the efficiency of the healthcare system.

Psychological factors have been identified as a primary determinant of pain and disability, and to be associated with longer duration off work for individuals with soft tissue injuries.[13] Identifying which individuals will go on to develop a chronic, disabling musculoskeletal condition is of primary interest to the clinician wishing to assist their patient back to regular participation in life activities. The concept of "yellow flags" was termed by Kendall et al. (1997), to describe psychosocial risk factors, as well as environmental risk factors present in those with musculoskeletal conditions, that were associated with prolonged disability and failure to return to work.[14] These psychological risk factors include fears about pain or injury, unhelpful beliefs about recovery, and anxiety. Environmental and social factors include the worker's perception of the workplace and job satisfaction.[11] Yellow flags have been adopted by certain guidelines addressing work-related low back injuries.[15,16] These guidelines advise clinicians to address identified factors within the plan of management. The guidelines promote early identification of these flags, in order to direct frequency and intensity of follow-up visits and to guide alternate interventions.[9]

Chou and Shekelle (2010) conducted a systematic review that examined individual risk factors for identifying patients more likely to develop persistent disabling low back pain.[9] This review looked at 20 studies that included 10,842 patients. When poor outcome was defined as work absenteeism or compensation status, the median proportion of patients with a poor outcome was 11% at 3 to 6 months and continued out to one year. When poor outcome was defined as pain and functional status, the median range proportions of patients with a poor outcome at 3 to 6 months was 26% and at one year was 21%. Notably, receiving compensation at baseline was associated with slightly increased likelihood of worse outcomes at 1 year. Higher work dissatisfaction and higher physical work demands did not predict work outcomes at 3 months but did at 1 year. Interestingly, patients who had higher scores on scales that measured fear avoidance or pain coping behaviour (such as on the Fear Avoidance Beliefs Questionnaire) were more likely to have worse outcomes at 3 to 6 months and at 1 year. They summarized their findings indicating that levels of fear avoidance and baseline functional impairment are the most helpful items for predicting chances of recovery.

**Understanding delayed recovery through the biopsychosocial model of pain/disability**

Biopsychosocial models of occupational disability have been developed to provide practical frameworks for studying factors that predict disability, in order to validate barriers to recovery beyond lengthy lists of yellow flags.[17] Research suggests that there are very few physical status variables that can reliably differentiate between patients who will return to work and those who continue to remain off work for durations longer than 3 to 6 months due to soft tissue injuries.[18] The biopsychosocial model takes into consideration that pain conditions, such as those seen broadly in musculoskeletal injuries, are affected by more than just physical

body functions. The model also takes into consideration the effects of psychological and social factors, and their interaction with physical parameters.

Schultz et al. (2002) studied 253 worker compensation patients with sub-acute and chronic low back pain with the intent of validating a biopsychosocial model for the prediction of disability, over a three month period.[17] Workers were evaluated using three different methods: 1) self-report questionnaires, 2) physical examination, and 3) behavioural pain observation. The use of certain factors (medical, pain behaviour and environmental factors) from the three measurement approaches significantly improved the predictive accuracy of the model, compared to using independent factors in isolation. Results determined an overall correct prediction of prolonged disability at a rate of 77.6%. The model correctly classified 80.5% of those who returned to work and 74.4% of those who were not able to return to work. They concluded that a cognitive-behavioural model with an "adaptation" focus, rather than a physical "pathology-oriented" focus was more appropriate when assessing and managing this population.

Pransky (2006) identified prognostic factors in occupational low back pain within the context of a multidimensional model of low back pain and work disability.[19] The author developed a multifactorial causal model of work disability using a list of questions and administrative data. Although the model only explained 12% of the variance in length of disability, high risk and low risk populations were identified. They found that prolonged duration of disability was associated with older age, shorter job tenure, female gender, presence of language barriers, comorbidity, prior work absence, delayed referral, attorney involvement, a non-supportive of return to work environment and low return to work motivation.[19] Notably, factors such as work environment and return to work motivation may be modifiable and addressed within a treatment plan of management.

Therefore, within the biopsychosocial model, external or environmental psychosocial factors must also be considered. Hartvigsen et al.(2004) examined the prognosis of low back pain in working populations as related to psychosocial factors at work.[20] Nachemson et al. (1992) suggested that within an optimal work environment, workers may tolerate occurrences of low back pain. Whereas when exposed to a stressful psychosocial environment, they may be more likely to report an injury.[21] This study critically assessed 40 prospective cohort studies, grouping work factors, such as perception of work, organisational aspects of work, social support at work and stress at work. Interestingly, they identified no significant associations between the relationship of work-related psychosocial factors and low back pain. They suggested that perhaps both physical and psychological work characteristics affect workers differently depending on factors such as job type, income or ethnicity; and that perhaps the constructs developed within the tools used to evaluate job satisfaction required an alternate approach.[20]

**Relating prognostic factors to predicting long term disability and delayed recovery**

The biopsychosocial model provides a conceptual framework to understand how various psychosocial factors, whether they are internal or external, modifiable or non-modifiable, interact. If present, psychosocial issues may be considered as prognostic indicators with respect to outcomes of recovery and return to work. Improved individualized prognostication can inform decision making[22] and identifying the prognostic factors that can most accurately predict poor outcome is important for clinicians who manage these individuals. Risk prediction tools can assist in triaging patients into the most appropriate management streams. Carefully assessing risk for each patient, using a model that includes validated prognostic factors, informs decisions regarding interventions, triaging and providing the most appropriate level of care.[23] Risk prediction tools

should provide accurate and valid predictions on whether an individual will recover, in order to improve patient outcomes and cost-effectiveness of care.[24]

**Identifying prognostic risk factors in patients**

Early identification of patients with acute musculoskeletal pain who are at risk for developing chronic problems may reduce time lost from work. As mentioned, screening may provide an estimate of the risk the patient runs of developing longer term disability and may help guide the appropriate allocation of treatment resources. Such screening methods are useful, they assist the clinician in early identification, determining those patients who may need to be assessed more closely or be provided with a multimodal treatment approach.[25] The literature presents various screening tools, developed to identify patients who are likely to have delayed recovery. Examples of such tools would include the Orebro Musculoskeletal Pain Screening Questionnaire[10] (OMPSQ),the Vermont Disability Prediction Questionnaire[27], and the Start-back Tool.[28] These tools are becoming more prominent in clinical practice, and the external validation of such tools is important in order to understand their appropriate application within various populations of patients.

There are different methods for measuring the predictive ability of prognostic tools. Beyond likelihood ratios, receiver operator curves are a useful means of assessing the predictive value of such instruments. They may also assist in the development of a decision rule that can be utilized by the clinician early in the course of care to triage patients to secondary services. These clinical rules can be used to categorize patients into different levels of risk and then used to guide patient management.[26] It is important to consider that rules to categorize patients validly in one population may perform differently when applied to another group. Therefore external validation of the tool within different populations is important.[23]

ROC curves can be compared to determine which tool forecasts a more accurate prediction of disease or adverse event outcome. Comparison of these curves between two different times in a patient's clinical recovery would also be useful in order make recommendations on when best to apply the decision rule. The more accurate the prognosis in terms of understanding whether a worker will have delayed recovery, the better able clinicians are to make appropriate recommendations, mitigating the costs of false-positives (i.e. identifying individuals as those at risk of developing chronic problems when they are not) may incur over the longer term. For instance, falsely labelling a case as low risk may produce significant costs in extended compensable durations. Conversely, identifying it accurately as high risk, targeted low costs efforts can be implemented to support identified psychological issues.[19]

Concomitant with the development of screening methods, there has also been an emergence of studies that have compared various screening instruments. Beyond individual risk factors, Chou and Shekelle's (2010) systematic review also examined risk prediction instruments for identifying patients more likely to develop persistent disabling low back pain.[9] The researchers examined 6 different risk assessment instruments/predictive items: 1) Vermont Disability Prediction Questionnaire[27] , 2) Acute Low Back Pain Screening Questionnaire (also called the Orebro Musculoskeletal Pain Questionnaire)[29], 3) Return-to-work clinical prediction rule/algorithm [30], 4) A 3-item questionnaire on function work status and radicular symptoms[31], 5) 8 factor model/predictive items [32], and 6) 6-item instrumen[33]. Multi-dimensional scale components, outcomes (mainly return to work status and compensation status), method of using the instrument (mainly scores), likelihood ratios and area under the receiver operating curve characteristics were examined. They concluded that while a number of risk prediction instruments may be of use to the clinician for predicting outcomes, there was no tool that had been extensively evaluated for validity. In addition, some instruments showed likelihood ratios similar to estimates for individual risk factors.

**The need for validated prediction tools**

Musculoskeletal injuries account for large proportion of time-loss injuries within Canadian Worker's Compensation Boards.[35] Policy-makers are particularly interested in prognostic instruments and their ability to guide treatment planning, using risk prediction instruments to triage workers earlier from unimodal interventions into multidisciplinary treatment regimens that include psychological counselling.[34,36] Workers' Compensation Boards (WCB), employers and clinicians share a common goal of desiring to make accurate decisions in this regard. For workers compensation cases, identifying at risk patients early could have significant economic impact on reducing time-loss days, by providing appropriate treatment early.

**Orebro Musculoskeletal Pain Screening Questionnaire (OMPSQ)**

The OMPSQ is currently used in a variety of clinical settings.[36,37] In addition, clinical guidelines have included the use of the OMPSQ for acute low back pain.[38] From its inception in 1997 it has been used for individuals with acute low back pain conditions in primary care practice through to broader utilization, assessing those with sub-acute and chronic pain conditions.[38] As the utility of the questionnaire gains acceptance, Workers Compensation Boards have also implemented its use in case management to assist clinicians and case workers in identifying patients at risk of delayed return to work.[39] Understanding its validity and the evidence around how it should best be applied in clinical practice, is extremely important in order to appropriately implement its use and to create parameters as to which populations and conditions it best suits.

The OMPSQ (also known as the Acute Low Back Pain Questionnaire (ALBPQ)[37,40] is a self-report measure that was developed to screen for psychosocial issues and prolonged disability in patients with musculoskeletal disorders.[29] It typically takes between 5-10 minutes to complete the 24 item questionnaire

(21 items are scored, 3 record baseline demographic characteristics). In summary, it is considered a reference standard in terms of screening for psychosocial variables that may impact disability outcomes in musculoskeletal pain conditions[36] and it has been validated across multiple clinical settings and cultures.[34,36,38,41,42] Within the OMPSQ, scores range from 0-210. Clinical cut-off scores have been associated with increased risk for delayed return to work and have been used to assist clinical decisions around triaging patients to the most appropriate treatment regimens. Higher scores on the questionnaire indicate a greater presence of biopsychosocial factors and have been linked to delayed recovery, specifically functional recovery.[36] Individual item responses are provided using a 0-10 numeric rating scale, with scale anchors specific to the content of each item. There are 8 reverse-scored items. Total scores are summed to derive a total scale score. The scored items assess pain location, work absence, pain duration, pain intensity, control over pain, frequency of pain episodes in the past 3 months, functional ability, mood, perceptions of work, patients estimate of prognosis and fear-avoidance.[43] Table 1 provides a description of the variables and the various domains of the OMPSQ questionnaire.

**Table 1. OMPSQ Domains and Psychosocial Factors by Question (modified from Heneweer, 2010)[37]**

| Question No. | Domain | Factor | Response scale |
|---|---|---|---|
| **1** | Pain | Pain sites | 5 categories |
| **2** | Disability | Sick Leave | 10 categories |
| **3** | Pain | Duration | 10 categories |
| **4** | Work demands | Work Characteristics | 0 - 10 |
| **5** | Pain | Current Pain | 0 - 10 |
| **6** | Pain | Average Pain | |
| **7** | Pain | Frequency of Pain | |
| **8** | Psychological | Coping | 0 - 10 |
| **9** | | Tense and anxiety | |
| **10** | | Depression | |
| **11** | | Risk of Persistency | |
| **12** | | Restart work | |
| **13** | Work | Job satisfaction | 0 - 10 |
| **14** | Fear avoidance beliefs | Physical activity | 0 - 10 |
| **15** | | Increase pain | |
| **16** | | Performing work | |
| **17** | Function | Light work | 0 - 10 |
| **18** | | Walking | |
| **19** | | Household chores | |
| **20** | | Shopping | |
| **21** | | Sleeping | |

## Original Development of the OMPSQ

The OMPSQ (Appendix A) exists today under the name OMPSQ and the ALBPQ; both are the same version of the questionnaire. Originally, the OMPSQ was developed by S.J. Linton, as a means to flag those individuals who require early intervention with secondary (multi-modal) prevention.[29] The instrument was intended to be used as an adjunct to the clinical examination, in a primary or secondary care setting, where patients with acute or subacute pain might seek out care. The authors identified that the process by which patients transition from being acute to chronic, is multidimensional, and that a host of prognostic factors come to play in a patient's recovery. They acknowledged that these factors are most likely inter-correlated and that summing items to include all known risk factors may not linearly increase the predictive power of an instrument attempting to capture level of risk. Additionally they cautioned that specific cut-off points

validated within some populations to identify high risk patients, may be very specific to that population and not generalizable across others.

Linton and Hallden published their hallmark research paper on the Orebro questionnaire in 1998.[29] The objective of their initial validation study was to examine the predictive ability of the OMPSQ as a screening instrument, identifying those patients who had a poor prognosis. Poor outcome was determined by accumulated sick absenteeism as an end-point measure. The cohort study looked at patients presenting among 19 primary health care settings within Sweden with acute or subacute pain from the back or neck area. Multiple pain sites could be recorded. 137 participants completed the initial and follow-up assessments. With respect to test-retest reliability within the larger study, a pilot study of 27 patients participated in a test-retest interval of 1 week and demonstrated an acceptable association of 0.83 using Pearson Product Moment between the two scores. It is interesting that the questionnaire held such high agreement considering the presumed lack of clinical "stability" in an acute or sub-acute pain population.

To detect how well the questionnaire discriminated among those recovering and not recovering, a series of discriminant analyses were performed. Sick absenteeism was grouped into three ranges (0 days, 1-30 days and greater than 30 days). Five significant variables were isolated: the belief that one should not work with current pain levels; the perceived chance of working in 6 months; light work; stress; and the previous number of sick leave days. Results demonstrated 72.6% were correctly classified as not recovered after 30 days using these variables. A total score analysis (possible scores ranging from 0 - 210) was also performed to evaluate its use as a screening tool. The authors provided examples of various cut-off scores from 90 to 120 to demonstrate the effect of different cut-off scores on prediction outcomes. They determined that with a cut-off score of 105, more than 85% with a poor prognosis would be identified. This study was the first

prospective cohort study performed on the OMPSQ. Its results help to validate the tool, but also, as the authors acknowledge, they were able to further refine its scoring and dimensions. Understanding the methods and outcomes of this preliminary research, lays the ground work for appreciating the origins of the questionnaire, and also how subsequent validation studies have been improved or modified to further assess the instruments predictive abilities in various patient populations.

Boersma et al. (2005) looked at profiles of scores within the OMPSQ specifically to identify subgroups of individuals with similar response patterns, aiming to examine how these patterns related to longer term functional level and pain.[25] They chose to focus on "fear avoidance" as this psychological variable has shown relevance in the prediction of long term disability. They looked at those with a variety of risk indications (mainly neck and back) for those off for less than 3 months and followed up with them one year later. Four variables were investigated: pain intensity; fear avoidance beliefs; depressed mood; and functional ability. They found depressed mood and fear avoidance behaviour as significant mechanisms in the progression of persistent pain and disability. The fear avoidance cluster demonstrated double the rate of long term sick leave, underscoring the importance of the "fear avoidance model" in reduced function. The role of providing education and treatment interventions to address this variable within treatment planning was stressed.

Since then, various other validation cohort studies have been done to further evaluate the instrument. Hockings et al. (2008) performed a systematic review on the predictive ability of the OMPSQ.[38] Inclusion criteria ensured that the review examined studies that included subjects with acute or sub-acute spinal pain. Inclusion also required that participants must have completed the OMPSQ at baseline when they first initiated the study and that the outcome measures were of at least one of the following: sick leave, disability

pain level and/or perceived recovery. Additionally the study's design must have been prospective and the source and method of acquiring participants must have been described.

Within this systematic review seven studies were considered high enough quality and met the standards to be included. [29,37,44,45,46, 47-49] The authors extracted specific study characteristics in order to gain better insight into the populations studied and the methodology used to externally validate the questionnaire (Table 2.) The review analysed the predictive ability of the OMPSQ by calculating the area under the receiver operator characteristic curve (AUC), either presented in the study or by calculating it themselves using primary data extracted from the original research paper, using 95% confidence intervals. For reference, AUC values of 0.5 indicates that the predictive ability is no greater than chance compared to 1.0 indicating a perfect prediction.[38]

**Table 2. Study Characteristics and Types of Outcome Data Extracted to Evaluate Predictive Ability of the OMPSQ in Hockings Systematic Review (2008)[38]**

| Study Characteristics | Outcome Data Extracted |
|---|---|
| Target population | Pain |
| Sample size | Functional disability |
| Duration of pain at intake | Sick leave |
| Description of interventions | Global recovery |
| Duration of follow-up | |
| Outcome measures | |
| Measures of predictive ability of the OMPQS | |

Hockings et al. reported that based on 5 of the 7 studies meeting the criteria for review, the OMPSQ had moderate predictive ability in determining long term pain, disability and sick leave in patients with acute or sub-acute spinal pain.[38] The review highlighted the importance of including an inception cohort in the evaluation of the questionnaire, to correctly predict outcome in patients. This issue was cited as a methodological weakness in the majority of studies evaluated.

Within original studies examining the OMPSQ, the populations were more broadly assessed and included those with both back and neck pain, acute and subacute.[29] As evidenced by Hocking's systematic review, the populations examined within cohort studies became more narrow and assessment on the instrument focused on those suffering from acute low back pain. The questionnaire took on a new name as the Acute Low Back Pain Questionnaire (ALBPQ). It is uncertain as to which publication coined the questionnaire under a new name, but it first appears within the literature after Hurley's study taking place in Northern Ireland.[50] In that study, a cut-off score of 112 was calculated to predict 80% of patients not back to work at the end of treatment. The unique aspect of this study was that it included both General Practitioner (GP) visits and a course of physiotherapy treatment. Interestingly this was not included or discussed in the systematic review.

Since Hockings' review, other studies have been presented within the literature. For example, a modified version of the OMPSQ was examined for use with a whiplash population. Gabel et al. (2008) investigated outcome predictors in a general practitioner practice population of Whiplash Associated Disorder (WAD) patients.[41] This pilot study examined whether long-term functional impairment after a WAD could be predicted in a GP population. Among other self-administered patient report outcomes, they looked at a modified version of the OMPSQ and whether the score was predictive of non-recovery (assessed using a self –report recovery scale and defined as greater than 6 months). When applying a cut-off score of $\geq$ 109 there was 78% sensitivity and 86% specificity of non-recovery. When adding the clinical feature of cervical rotation at impact, with a cut-off score > 109, the sensitivity improved to 100% and specificity improved to 87% for moderate/severe impairment. The authors supported the utility of taking into consideration other variables when using the OMPSQ score, noting that using the tool in isolation, may not be as informative as

when taking further clinical information into account. This study was a pilot study whereby the sample size was limited to only 30 cases, reducing the generalizability of this study.

In 2009, external validation of the predictive validity in low back pain patients across two different cultures was examined. Maher and Grotle (2009) looked at the accuracy of the OMPSQ in two settings, Norway and Australasia.[43] The Australasia cohort were those suffering from subacute low back pain of 3 to 6 months duration. The Norwegian cohort examined those suffering from first time onset low back pain of less than 3 weeks duration. They examined 133 patients seeking care in Australasia and 97 patients seeking care in Norway. They used a variety of outcomes including the numeric pain rating scale and the Roland Morris low back pain questionnaire, at baseline, at 6 weeks, at 3 months and at 1 year follow-up. The research found that there was a significant interaction between the OMPSQ score and nationality with respect to short and long term disability outcomes for the Australasian cohort. They also found that the OMPSQ tended to be a stronger predictor in Norway when disability was used as an outcome. Overall, the study concluded that the predictive ability of the OMPSQ was similar across both cultures when considering pain as an outcome. However, when considering disability as an outcome, the OMPSQ had better predictive ability in Norway. This study highlights the notion that the utility of the questionnaire may be population-based and perhaps "culture" specific.

Heneweer et al. (2010) examined a Dutch Language version of the questionnaire in a population of 69 sub-acute low back pain patients.[44] The goal of this validation study was to externally validate this version of the questionnaire and to determine its internal consistency. They prospectively followed newly referred low back pain patients to a physical therapy clinic. The duration was less than 12 weeks and they were followed to 3 months. Internal consistency of this version of the OMPSQ was 0.81 and convergent validity was

confirmed as moderate to good using correlation coefficients between the score on the subscales of pain, disability, fear-avoidance beliefs, kinesiophobia and coping (r=0.38-0.64). They indicated that the internal consistency of this version was comparable to the Norwegian version studied by Grotle et al.(2006)[44]

**Worker's Compensation Studies**

The OMPSQ is advocated for use in Australia within their workers' compensation system.[38,51] Dunstan et al. (2005), assessed the utility of the OMPSQ in a workers' compensation population.[36] They examined injured workers in the sub-acute phase of their injury (between 4-12 weeks after injury). They examined whether the OMPSQ differentiated between persons who did and did not return to work by the sub-acute phase (Time 1) and whether the OMPSQ predicted return to work at 6 months follow-up (Time 2). The study looked at 196 injured workers who suffered a strain/sprain injury, whereby approximately 66% were male. At the time of screening 29.6% had not returned to work. They examined the scores of workers at Time 1 for those who had returned to work versus those who had not returned to work and found that they were significantly different, where those who had not returned to work had higher scores. They then looked at the workers who had not returned to work and followed them to Time 2 (6 months post injury) and compared those who did return to work from this group (n= 24) compared to those who did not (n=31) and analysed the OMPSQ scores at this time. They found that the score for those not having returned to work was higher, with a "medium" effect size. The small sample size only allowed for a difference of p valued at 0.10. Interestingly they found that at Time 1 "expectancy about outcome" had a strong relationship with return to work (P=0.001). The main limitation of this study was the small sample size, however the study began evaluation of the tool in a workers' compensation population.

Margison and French (2007) suggested that more research was needed in the area of injured workers to further externally validate the OMPSQ as a screening tool in identifying workers who are at risk for delayed return to work.[34] As such, they performed a study using a cohort of injured workers, from New Brunswick Canada. Their aim was to further contribute to research on the predictive power and clinical utility of the OMPSQ as a screening tool in compensated injured workers in a sub-acute musculoskeletal injury group. Their study evaluated clinical data and outcomes of injured workers and assessed how the tool was used by case managers to flag those workers who are at risk of delayed recovery, due to elevated psychosocial factors. Once flagged, they would have the opportunity to be re-routed to programs that were augmented to address identified psychosocial barriers. This study looked at who would do well with work conditioning alone versus an 8 week multidisciplinary program, with psychological counselling. Specifically, they looked at initial OMPSQ scores at assessment and related these scores to post-treatment discharge status, for example were they "fit to return to work " or not "fit to return to work" after a standardized 6 week work conditioning program. Participants within this study had a broad range of primary injury sites and occupations.

The New Brunswick study examined both an English language and French language population. The two sample populations were used to assess the ability of the derived cut-off scores to correctly classify discharge status at the completion of treatment. Upon analysis they were able to combine both French and English into a single validation sample as the analysis revealed that the groups did not differ significantly. The results of this study showed that the predictive ability of the OMPSQ was sensitive to variances in treatment delivery and that the study's findings supported further generalizability to the compensable injured worker population. "Not fit to return to work" at discharge was the target variable for ROC analysis. From the researchers perspective they felt that the most clinically practical cut-off point was to determine a score that gave the highest true-positive (sensitivity) and the lowest false positive rate (specificity). From a case

management point of view, the objective was to identify workers with a total score greater than the cut-off, to be triaged into the augmented (more costly) program. In fact, specificity was valued more, as it would be very costly to treat someone in this pathway, who wasn't at risk in the first place. Through their analysis, they determined a cut-off score was 147. This score was higher than other studies and was explained by the fact that the researchers modified the questionnaire to include pain sites other than "other". The study recommended that future research include broader groups of patients beyond spine, and to include a diverse set of injuries and pain sites, to further understand the utility of the questionnaire.

Vos et al. (2009) recently examined acute neck pain patients between 0 - 6 weeks duration, presenting to a primary GP setting in the Netherlands.[40] This prospective cohort study had a follow-up period of 1 year. The objective of the study was to assess the OMPSQ's ability (entitled the ALBPQ in this study) to assess future sick leave. They also assessed the reliability of the instrument, which, after review of the literature, has not been consistently performed in other trials examining this questionnaire. They found the test-retest reliability in 44 patients, who were considered clinically stable, as acceptably high with an interclass correlation coefficient (ICC) at 0.85 (95% confidence interval 0.73-0.92). They also determined an optimal cut-off score in this population as 72, which provided adequate consensus between predicting long-term sick leave and the absence of long-term sick leave at a s sensitivity of 81% and specificity of 57%. The area under the curve (AUC) was 0.66 and this interestingly was evaluated as "doubtful". The authors did not elaborate on this outcome, to defend or explain it further.

Acute and sub-acute pain populations have been examined to determine delayed recovery beyond 6 months. Westman et al. (2008) performed a validation study to validate the OMPSQ for patients with non-acute pain problems, while also comparing the OMPSQ to other psychosocial screening questionnaires.[52] The main

objective was to study the relationship between risk levels predicted by the OMPSQ, sick leave and perceived health, 3 years after baseline measures were taken. The study involved patients off sick between 30-180 days, who may have had primary pain sites in a sample of 158 patients. This study considered a cut-off score of 105 for future "at risk" for sick leave, with 88% sensitivity and 75% specificity, quoting Linton and Hallden's work in 1998.[29] They also established that psychosocial factors measured by the OMPSQ are related to work disability and perceived health 3 years after treatment in primary care. As well, the screening tool had discriminative power even for patients with non-acute or recurrent pain problems. When compared to the other questionnaires (Tampa Scale for Kinesiophobia, Pain Catastrophizing Scale, The Short Form -36 Health survey) the OMPSQ had better predictive power. This study demonstrated that pain and function factors are most strongly related to sick leave after 3 years. They determined a cut-off score of 117 and explained that the higher score (compared to 105 in earlier work) may be related to the patient population having had longer term pain and recurrent problems.

Beyond the OMPSQ there are other instruments identified within the literature that have been evaluated as useful in identifying clinically inherent risk factors for chronicity.[27,53] The Start Back Tool (SBT) is another instrument considered to provide information regarding patients to identify prognostic risk factors in those with low back pain.[53] Essentially its objective is to detect subgroups of patients who are at risk for chronicity and to bring to light prognostic indicators that may be addressed and modified during treatment. The SBT is a short (9 items) administered questionnaire with validated cut-off scores, that sub groups patients into low, medium and high risk groups.[53] Research by Hill et al. (2010) evaluated the SBT in a cross-sectional cohort design study, that examined the concurrent validity of the SBT scores at a single point in time compared to OMPSQ scores. The OMPSQ was set as the reference standard for this study and was regarded as the "most widely used tool in clinical practice".[28] Within a group of 244 patients in a primary care setting, they found that both the questionnaires identified subgroups of at risk patients equally well in

terms of predicting delayed recovery, although the SBT was a faster method for patients to complete and for clinicians to score. The main difference between the two questionnaires was the proportion of patients that each instrument assigned to the high risk group. The SPT allocated 25% as high risk and the OMPSQ as 38% at high risk, demonstrating that the OMPSQ may have a higher sensitivity rate. However, overall the study demonstrated that the SBT's discriminative abilities were at least equivalent to the OMPSQ. They used ROC curves to analyze the ability of the 2 instruments using their total scores to discriminate cases using reference standards. The major limitation with this study was that it looked at scores at one point in time (cross-sectionally) that did not allow for comparison of the predictive ability of the instruments. In addition, the SPT was specific only to low back pain.

**Summary**

There are a variety of clinical tools that may be useful in identifing sub-groups of injured workers at risk of developing chronic musculoskeletal conditions. Early use of these tools enables clinicians to identify and provide specific, targeted interventions for those at greater risk.[54] The OMPSQ has gained acceptance by a variety of compensation boards, within the scientific literature and among main stream health care providers, all with the interest in further understanding and best predicting how a worker/patient, might progress and recover after having sustained a soft tissue injury. There are several different stated cut-off scores suggested when using the OMPSQ to identify injured workers at risk of the developing chronicity and delayed return to work; ranging from 90 (medium risk of chronicity) to 147 (high risk for chronicity), depending on the population studied.[29,50,44]

Of importance are those "potentially modifiable" prognostic indicators that can be identified and addressed within the care plan for individual patients.[36] Clinicians seek guidance to understand which tool might be

most appropriate in identifying those most at "risk" for becoming chronic. Validation of the OMPSQ is needed across broader populations of conditions than just acute low back pain, especially if it is being used in clinical settings where it is administered to patients with various soft tissue injuries, that occur as a result of work related events.[38] Development of such scores is thought to be important as they reflect the specific clinical environments in which they are used.[43] The following study was designed to examine the OMPSQ in the context of a Workers Compensation population, and its predictive ability as it applies to a population of workers who have sustained a recent onset work-related soft tissue injury.

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**Appendix A**

## Orebro
## Activity Screening Questionnaire

Name: _____ Gender: __Male __Female

*Please read and answer each of the following questions. We are concerned with how your injury may be affecting your daily activities, and hope to make your outcome a safe, and efficient one. This questionnaire will help us outline and gain perspective with each individual situation.*

1. How many days of work have you missed because of pain you've experienced during the past 18 months? Please check the most appropriate time span:

__0 days(1) __1-2 days(2) __3-7 days(3) __8-14 days(4) __15-30 days(5)
__1 Month(6) __2 Months(7) __3-6 Months(8) __6-12 Months(9) __Over 1 year(10)

2. Where do you experience pain? Please check all the appropriate sites:

__Neck __Shoulders __Upper back __Lower back __Leg(s)
__Arm(s) __Wrist/hand __Ankle/foot __Head __Other

3. How long have you been experiencing this pain problem? Please check most appropriate time period:

__0-1 Weeks(1) __1-2 Weeks(2) __3-4 Weeks(3) __4-5 Weeks(4) __6-8 Weeks(5)
__9-11 Week(6) __3-6 Months(7) __6-9 Months(8) __9-12 Months(9) __Over 1 Year(10)

4. Please rate the pain that you have experienced within the last week. Circle most appropriate number on scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = No pain 10 = Pain as bad as it could be

5. On average, during the past three months, how severe was your pain?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = No pain 10 = Pain as bad as it could be

6. On average, during the past three months, how frequent were the episodes of pain that you experienced? Please circle most appropriate rating on scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Never 10 = Always

7. Are you able to deal or cope with your pain in any way, to decrease it? This would be based on an average day, doing average things. Please circle the number that best describes the amount you can decrease your daily pain:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not decrease pain at all  10 = Can decrease pain completely

*The following is a short list of activities done on a daily basis. Please circle the most appropriate number on the scale(s), according to your ability to do each task.*

8. I can do light work for an hour:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not do because of pain  10 = Can do without pain causing problems

9. I can walk for an hour:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not do because of pain  10 = Can do without pain causing problems

10. I can do ordinary household chores:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not do because of pain  10 = Can do without pain causing problems

11. I can go shopping:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not do because of pain  10 = Can do without pain causing problems

12. I can sleep at night:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Can not do because of pain  10 = Can do without pain causing problems

13. Is your work monotonous (dull, boring)? Please circle best rating on scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Not at all  10 = Extremely

14. In the past week, how tense or anxious have you been feeling? Please circle most appropriate rating on scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Absolutely calm and relaxed  10 = As tense and anxious as I've ever felt

15. Have you felt depressed at all in the past week? Please circle which best describes how you have been feeling:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Not at all 10 = Extremely

16. In your opinion, do you feel there is a risk of your pain not going away?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = No risk 10 = Very large risk

17. In your opinion, do you feel there is a chance you will be working in 6 months?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = No chance 10 = Very large chance

18. While taking into consideration your work routine, management, your salary, the possibility for promotion, and your co-workers, how satisfied are you with your current job situation?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|

0 = Not at all satisfied 10 = Completely satisfied

# External Validation of the Orebro Musculoskeletal Pain Screening Questionnaire within an Injured Worker Population: A Retrospective Cohort Study

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## Chapter 2. Methods and Results

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**External Validation of the Orebro Musculoskeletal Pain Screening Questionnaire within an Injured Worker Population: A Retrospective Cohort Study**

## Study Background and Research Question

The Orebro Musculoskeletal Pain Screening Questionnaire (OMPSQ) is administered to workers who have suffered acute soft tissue injuries as a result of a work related incident and are receiving rehabilitative treatment within the Nova Scotia Workers' Compensation Board (WCB) return-to-work treatment model. Although not developed as an outcome measure that is sensitive to change over time, the questionnaire is typically administered every 2 weeks over the course of care, until the worker is discharged from treatment or back to full work duties and hours. With this method of questionnaire administration, local rehabilitation clinicians use the instrument to better understand the patient's attitudes around fear-avoidance behavior and to assess whether further psychological intervention may be warranted. It appears from clinical observation, that OMPSQ scores change as a patient progresses through a course of treatment; it would be useful to study this empirically. For example, are scores at entry into treatment within the acute phase, more predictive of successful return-to-work than scores that are acquired within the sub-acute phase of clinical recovery, or vice versa?

## Nova Scotia's WCB Return to Work Treatment Model

The Nova Scotia (NS) WCB system has an injury management model that aims to reduce long-term disability, specifically work disability, using strategies directed at identifying injured workers who are at risk of developing chronic problems. Risk prediction tools developed by researchers, attempt to help clinicians triage patients into the "right" type of treatment program, for example, programs that are augmented to include psychological counseling or behavioral modification therapies.[1,2] Stephans and Gross (2007) suggest

that predicting risk for chronicity may help clinicians to select the most appropriate treatment for the appropriate patient type, at the appropriate time, in order the maximize the benefits of treatment. [3]

The NS WCB "Return to Work Model", implemented in 2006, was aimed at containing costs, particularly those associated with long term disability claims. The model is a coordinated approach to healthcare delivery, case management and employer engagement. The healthcare service component of the model includes the physical and functional assessment of the worker, treatment guided by the Medical Disability Guidelines[4] and case conference meetings that include the treating clinician (physiotherapist or chiropractor), a WCB case worker and an employer representative. Psychosocial factors are captured though the administration of the OMPSQ and are required documentation on the initial clinical WCB submission and follow-up forms. The OMPSQ score is required for every two week assessment update. Treatment is typically delivered in an out-patient private clinic (community setting). A worker's stage of recovery and treatment approach is taken into consideration in the initial evaluation. Appropriate continuity of services is encouraged within the system, which may include psychological services and/or vocational rehabilitative services.

Similar models have been implemented in other provinces. The WCB-Alberta has a similar model that includes a "continuum of healthcare services for soft tissue injuries".[3] It involves a "staged delivery" of an assortment of rehabilitation services, depending on the worker`s recovery outcomes.[3] This staged delivery of service is similar to the NS model, that relies on a variety of factors to determine whether a worker will be streamed into a Tier 1, Tier 2 or Tier 3 treatment regimens. Each Tier involves a different layer of therapeutic involvement. Tier 1 is unimodal therapy provided by a health care service provider, where return

to work planning is done mainly by the provider, the worker and the employer. In these cases, return to work is expected within the 8-week treatment period.

Workers who may be appropriate for an augmented Tier 2 program including psychological treatment and work-conditioning programs are identified within the first 4 weeks of Tier 1 treatment. Factors that are considered in making this decision include the OMPSQ score, the workload demands of the worker's pre-injury job compared to their current capabilities (i.e. the "gap" between current capabilities and the essential functional demands), the number of failed attempts to return to work, age, concurrent co-morbidities and whether the injury itself involves only one versus multiple anatomical sites. Although the factors discussed are important to consider, it is not unusual for the WCB case manager to make decisions based on the OMPSQ score. Tier 3 programming is for those workers who have failed to return to work typically beyond 6 months, have elevated OMPSQ scores (above 130 according to NS WCB service provider agreement) and have identified barriers, beyond their soft tissue injury diagnosis, that inhibit their return to work.

The OMPSQ is administered in other Canadian WCB jurisdictions and has been studied under a similar return to work treatment model.[7] This particular study examined a cohort of injured workers, from New Brunswick Canada. Their aim was to further contribute to research on the predictive power and clinical utility of the OMPSQ as a screening tool in compensated injured workers in a sub-acute musculoskeletal injury group. Their study evaluated clinical data and outcomes of injured workers and assessed how the tool was used by case managers to flag those workers who are at risk of delayed recovery, due to elevated psychosocial factors. Once flagged, they would have the opportunity to be re-routed to programs that were augmented to address identified psychosocial barriers. This study looked at who would do well with work

conditioning alone versus an 8 week multidisciplinary program, with psychological counselling. Specifically, they looked at initial OMPSQ scores at assessment and related these scores to post-treatment discharge status, for example were they "fit to return to work " or not "fit to return to work" after a standardized 6 week work conditioning program. Participants within this study had a broad range of primary injury sites and occupations.

The results of this study showed that the predictive ability of the OMPSQ was sensitive to variances in treatment delivery and that the study's findings supported further generalizability to the compensable injured worker population. "Not fit to return to work" at discharge was the target variable for ROC analysis. From the researchers perspective they felt that the most clinically practical cut-off point was to determine a score that gave the highest true-positive (sensitivity) and the lowest false positive rate (specificity). From a case management point of view, the objective was to identify workers with a total score greater than the cut-off, to be triaged into the augmented (more costly) program. In fact, specificity was valued more, as it would be very costly to treat someone in this pathway, who wasn't at risk in the first place. Through their analysis, they determined a cut-off score was 147. This score was higher than other studies and was explained by the fact that the researchers modified the questionnaire to include pain sites other than "other". The study recommended that future research include broader groups of patients beyond spine, and to include a diverse set of injuries and pain sites, to further understand the utility of the questionnaire.

**Study Objective**

Clinical measures such as examination findings, functional ability and self-report questionnaires, inform decision making around treatment provision and RTW recommendations. Given that the OMPSQ score is increasingly being used to contribute to decisions around health care management, it is important to

understand the extent to which the tool is predictive of RTW and also its relevant measurement properties. Beyond external validation of the risk prediction ability of the tool in this population, it would be also important to examine whether its predictive ability changes over the course of a workers` clinical recovery and healthcare management. If the scores do change, is one point in their recovery, more predictive than another? For example, is the instrument useful in predicting delayed recovery at the inception of service provision, as it is two weeks into treatment? Review of the literature related to the OMPSQ reveals that there is a lack of research examining this aspect of the questionnaires predictive ability. Much of the research continues to focus on external validation in various populations, such as examining patients within different cultural contexts[5] or examining patients within either a GP population or worker compensation population.[6]

The purpose of the following study was to determine the predictive ability of the OMPSQ at 2 different time points in a population of injured workers with a variety of musculoskeletal disorders who were being managed by a single payer (NS WCB)).

**Research Question**

1) What cut-off of the OMPSQ score will best differentiate workers with acute musculoskeletal injuries at-risk for delayed return to work (greater than 3 months), in a population of workers of less than 3 weeks injury duration?

2) To describe the predictive ability of the OMPSQ in the above population at intake into treatment and again at two weeks later.

## METHODS

### Design

Retrospective cohort design, using a sample of convenience.

### Sample

We selected a sample of consecutive WCB patients seeking assessment and treatment at a multidisciplinary rehabilitation facility within NS. A typical WCB intake visit includes an assessment involving a clinical history and physical examination performed by either a physiotherapist or chiropractor; and resulting in a diagnosis. The diagnosis was coded and entered into a database. This code was as used to identify patients where the assigned diagnosis was recorded as a strain/sprain type injury. Data for individuals with a diagnosis recorded as a strain/sprain type injury to the neck, back, thoracic spine, shoulder, upper or lower those within 21 days of injury (i.e. recent onset), were included.[8] Workers with neurological impingement syndromes, those who were pregnant, post-surgical, experienced headaches, fractures, infection, tumors, full thickness muscle tears, suspected inflammatory arthritis, and those requiring referral for further medical specialist opinion were excluded from the study.[5] Additional exclusion criteria included those individuals who required only occupational therapy intervention, referred for second opinion assessments (i.e. assessment only) and Tier 2 or Tier 3 assessments. Consecutive files between January 1, 2008 and June 30, 2010 were reviewed by one researcher to determine eligibility.

### Intake Assessment and Clinical Information Submission

As dictated by the funder, a standardized intake data collection form was used to record assessment findings. The information collected included: worker demographics, diagnosis, OMPSQ score, and treatment plan

recommendations (Appendix A). This form also requires details regarding the worker`s pre-injury occupation-related physical demands, their current functional ability and recommendations regarding the level at which they would be safe to work (if transitional duties were available). To establish functional capabilities, each worker completed an initial "functional scan" which is comprised of a 30 minute self-limiting functional assessment that provides a "snap shot" of the worker's material handling abilities at the time of the assessment (Appendix B). This information was collected to describe the populations' work capabilities compared to actual essential job demands. They then completed an OMPSQ and this score was recorded on the Form B. The results of all evaluation components are reviewed by the physiotherapist or chiropractor and recommendations regarding treatment triage were made. Only workers from Tier 1 were included for this study.

Workload classifications for this study were determined by guidelines based on National Occupational Classifications and the Medical Disability Advisory (refer to Appendix C).[4,9] Five work classifications were used to rate the amount of physical effort needed to perform their general job tasks. These were Sedentary, coded as 1, Light coded as 2, Medium coded as 3, Heavy coded as 4 and Very Heavy coded as 5.

After two weeks, a re-assessment was performed which included completions of the OMPSQ. Clinical information was recorded on Form C (Appendix D). Return to work dates that indicate when the worker went back to full hours and duties are recorded by the clinician on the Discharge Form D (Appendix E) under work status. Work status is variable and depends on whether the patient demonstrates that they are a functional match to their required job demands. The variables under review, such as duration of injury and date of return to work, were those variables reported by the clinician. Accuracy of such dates was dependent on the patient for date of injury and the clinician for date of return to work.

The quality of clinical data, in terms of completeness of data was considered excellent as these forms are routinely submitted to the WCB for review and less than 10% of files needed to be reviewed secondarily to capture missing data. Of note, research supports that review by a second party (such as an insurance company) has been considered to increase accuracy of file documentation.[10] Clinicians were trained on how to complete these forms. In addition, accurate completion of forms are mandatory in order to meet contract obligations with the WCB.

**Data Abstraction Instrument**

The process for this retrospective chart review and data abstraction was informed by Jansen et al. (2005), "Guidelines for data collection from medical records for use in retrospective analyses".[10] A standardized chart review data abstraction instrument was developed by the researchers of this study. This consisted of a paper form that the reviewer could use to abstract clinical data in a consistent manner (Appendix F). The form was developed in several stages. Initially it was piloted on 10 files and then modified to ensure that it followed the flow of the chart forms and also improved ease of use. A legend for coding nominal and ordinal data was listed on the abstraction sheet. Along with the data abstraction sheets, the reviewer kept a log book that tallied cases included and excluded in the study. For cases where information was missing on the WCB form, the information was retrieved from the cases clinical paper file. Although the data entry of chart forms was robust, there were 18 cases where the reviewer needed to retrieve data from the hard copy file because data entry was incomplete.

Intra-rater agreement was assessed by randomly selecting a percentage of files and abstracting key outcome data for a second time. Variables examined were those variables examined to determine the predictive ability

of the OMPSQ. These included the number of days to RTW full hours and duties and the OMPSQ scores at time one and time two. Outcome data was divided into those cases that had returned to work in less than 90 days (n=134) and those cases who took greater than 90 days to return to work (n=18). Within the first group 10% of files were randomly selected (n=13) and within the second group, considered our main outcome of interest, 50% of files were randomly selected (n=18). Cases were selected using a random number generator. Intra-rater reliability was assessed by determining the Interclass Correlation Coefficient. Table 1 demonstrates an acceptable level of agreement.

**Table 1. Table of Intra-rater Agreement for File Data Abstraction**

| **Outcome** | **Percentage Agreement** |
|---|---|
| **Sample of RTW (less 90 days)** | **n=13** |
| OMPSQ at Time 1 | 98.1% |
| OMPSQ at Time 2 | 100.0% |
| # days to RTW | 95.1% |
| | |
| **Sample of RTW (greater 90 days)** | **n=9** |
| OMPSQ at Time 1 | 100.0% |
| OMPSQ at Time 2 | 99.4% |
| # days to RTW | 100.0% |
| | |
| **Average agreement** | **98.8%** |

## Variables/Outcomes of Interest

Table 2 outlines a summary of the demographic, clinical, functional and work related variables that were collected during the data abstraction process. Table 3 describes and operationalizes variables utilized within this research project.

**Table 2. Summary of variables collected with the Data Abstraction Form**

| |
|---|
| **Gender** |
| **Age** |
| **Date of Injury** |
| **Date of first assessment** |
| **Currently working?** |
| **Occupation** |
| **Transitional duties available?** |
| **Diagnosis** |
| **Pain sites (back, neck, shoulders, thoracic spine upper extremity, lower extremity, other pain site)** |
| **Number of pain sites** |
| **Pain intensity** |
| **OMPSQ score (time 1)** |
| **OMPSQ score (time 2)** |
| **Date of Orebro time 1 and time 2** |
| **Occupational workload classification** |
| **Current functional ability (classified/rated)** |
| **Date return to work full hours and duties** |
| **Secondary services recommended?** |
| **Physiotherapy or Chiropractic therapy** |

Abstracted data that were considered the main variables of interest were: diagnosis as it related to inclusion and exclusion criteria, duration of injury at intake to clinic, work status, OMPSQ baseline (Time 1) and OMPSQ at two-weeks after baseline (Time 2), and duration to return to work full hours and duties. Other variables were included in order to more accurately describe the patient population.

## Ethical Considerations

This study was approved by the Hamilton Health Sciences Research Ethics Board/Health Records via an application and approval process for retrospective review of medical charts/health records. The REB project number assigned is 11-294-C.

As this study was a retrospective chart review, there was low risk of harm to patients reviewed. Only indirect identifiers were collected. Extra caution was taken to secure all patient files within the clinical environment. When abstracting data, each file was recorded as a subject number and was not directly linked to the data on the abstraction form. All abstraction sheets were locked in a filing cabinet with only the primary investigator having access to the data. Electronic files that contained the abstracted data was encrypted with password protection.

**Benefits of proposed study**

1. Improved understanding of the predictive ability of the OMPSQ questionnaire will allow injured workers the most appropriate care at the most appropriate time, encouraging a safe and timely return to work.

2. Expanding upon the body of scientific evidence around the predictive ability of this questionnaire will add to the current understanding of whether the questionnaire is being appropriately being used within the clinical environment as a prediction tool and/or an outcome measure (assessing change over time).

**Statistical Analysis**

Descriptive statistics, tests of difference between Time 1 and Time 2 OMPSQ scores and Receiver Operator Characteristic curves were generated using SPSS version19. OMPSQ scores for Time 1 and Time 2, (non-parametric data) were compared using Related Samples Wilcoxon Signed Rank Test. The method of determining predictive ability of the OMPSQ at two points in time was by means of ROC analysis. The distribution of cut off points was created by the ROC curve with associated true positive rates (sensitivity) and false positive rates (1-specificity).

**Cut-off Point Determination**

The clinical end point (outcome variable) was delayed return to work, defined as workers not back to full duties and hours by 90 days post-injury. Ninety days or 3 months duration of ongoing pain and dysfunction as a result of soft tissue injuries is often considered the onset of a "chronic condtion".[4] The key outcome variable investigated in terms of its association with delayed RTW was the OMPSQ score. ROC analysis was used to evaluate discriminatory power of the OMPSQ scores within this population. It was established a priori that determining a cut-off score that would provide a balance between the best sensitivity and specificity rating in order to detect delayed return to work would be used. The area under the ROC curve (AUC) is based on a plot of all possible cut-off scores, and provides a summary statistic of diagnostic accuracy. Perfect discrimination between those who have and those who have not returned to work in 90 days would be an AUC value of 1.0. This is considered as no overlap of values between the two groups and represents 100% sensitivity and specificity. An AUC of 0.5 would be non-informative.[11]

The most useful cut off point has high sensitivity and high specificity. This study used the same principle as Margeson et al (2007) in sacrificing sensitivity for specificity,[12] with the rationale that WCB would not want to impede a workers return to work by categorizing them inappropriately as a false positive. However, the consequence of low sensitivity would be that workers unable to RTW would be missed, and this might cost more in the long run.

**Table 3. Operationalization of Variables and Terms**

| **Variable** | Definition |
|---|---|
| Age | Working age is between 16 – 65 years. Calculation of age is rounded up to the nearest year and determined at time of the first assessment provided on the Form B. |
| Gender | Male or Female |
| Intake Date | Date of initial assessment and completion of Forms B and E. |
| Date of Injury | Date reported by worker, whereby mechanism described or the date that worker was no longer able to complete full hours and duties due to pain or functional limitation. |
| Duration of Injury | Number of days between injury date and intake date, classified as less than 21 days or greater. |
| Acute Phase of Soft Tissue Injury | Duration of Injury 21 days or less[8] |
| Delayed recovery | Clinical presentation that represents reduced work tolerance and chronic symptoms, longer than 3 months.[13] |
| Transitional duties available | Employer provide transitional duties for the worker, during recovery phas of injury and transitions back to full duties. This information provided by employer and recorded on Form B. |
| Working transitional duties | Worker reports still at work, performing duties within functional capabilities; this could be reduced hours, reduced material handling demands or both. |
| Work status | Not working, transitional duties or pre-injury level. |
| Return to work | Return to work was defined as number of days from injury onset to return to work full hours and full duties, as defined by their pre-injury job demands. |
| Work demands**:** | Sedentary, Light, Medium, Heavy or Very Heavy (Appendix C) |
| Included Diagnoses | Soft tissue injury to lumbar, cervical or thoracic spine, shoulder, upper extremity or lower extremity. Clinicians follow the MDA guidelines for diagnosis and disability duration time-lines.[4] |
| Soft tissue injury | Sprain or strain injury to the soft tissues of the body, related to excessive force, compression or over-use and involve stretching or tearing of tissue. The injury is defined by the amount of damage caused to the ligament or muscle and its attached tendons. Sprains are injuries to ligaments, fibrous bands that connect bones to bones and stabilize joints. Strains are injuries to muscles or to tendons, fibrous bands that connect muscles to bones. Sprains and strains.[4] |

## Results

Workers compensation claim files were reviewed over a 2.5 year period (2008 January 1-2010 June 30). This included a total of 535 clinical files. Of those, 259 files were accepted for inclusion as Tier 1 cases, classified as soft tissue injuries, assessed by either a physiotherapist or a chiropractor. Of the 259 files reviewed 58.7% met the inclusion criteria as they were considered acute cases of less than 3 weeks duration and were found to be enrolled in treatment for at least 14 day. The total number of cases included within the external validation study was 152. With respect to treatment provider, 81.6% of the workers were assessed by physiotherapists, while 18.4% were reviewed by chiropractors.

### Patient characteristics

Descriptive statistics for demographic characteristics and baseline characteristics are given in Table 4. Patients were between the ages of 19 and 62 years of age, with the mean age being 41.9 years (SD 11.4). There were 102 men (67.1%) and 50 women (32.9%) in the study. The median number of days between injury and intake to treatment was 5 days, with 53.3 % not working and 46.7% at work, not working full duties (considered working transitional duties). The sample consisted of 50.7% of workers who had a primary injury of low back pain with 77% of those being men and 23% being female.

**Table 4. Study Population: Worker Characteristics for those with soft tissue injuries of less than 3 weeks duration**

| **Characteristic** | **N = 152** |
|---|---|
| Percent male | 67.1% |
| Mean age years(SD) | 41.9 (11.4 ) |
| **Site of primary injury** | |
| Low back | 50.7 % |
| Neck | 9.9 % |
| Thoracic spine | 7.2 % |
| Shoulder | 10.5 % |
| Upper extremity | 5.9 % |
| Lower extremity | 15.1 % |
| Other body area* | 0.7 % |
| Mean pain intensity 0-10 scale- (SD) | 6.4 (2.3 ) |
| Mean duration of injury before initial assessment (SD) | 6.5 days (5.6) |
| Mean duration of time to RTW - days (SD) | 48.4 (55.2) |
| Range of days between injury and RTW | 0 - 423 |
| Percent seen by physiotherapists/chiropractors | 81.6/18.4% |

* 1 thumb sprain

## Work and Function Characteristics

Study participants occupations included: Personal Support Workers or Nurses (11.8%), 9% Postal Workers and 9% Produce/Grocery Store Workers. There were a variety of other occupations represented (Table 5), with the majority of occupations (52.0%) considered "Medium" workload level and 28.3% considered "Heavy" workload level. With respect to function at entry into the study, most workers (45.4%) were one classification below their job demands, and 29.6% were 2 classifications below pre-injury workload demand. Transitional duties were recorded as "available" for 93.4% of the workers.

**Table 5. Distribution of Worker's Occupations within study sample**

| Occupation | Frequency |
|---|---|
| Personal Care Workers/Nurses | 18 |
| Postal Workers | 14 |
| Produce/Grocery worker | 13 |
| Truck Driver | 12 |
| Miscellaneous mechanics | 11 |
| Carpenters | 8 |
| Admin Clerk | 8 |
| Couriers | 7 |
| General Labourers | 6 |
| Roofers | 6 |
| Retail Sales | 6 |
| Millwright/tool die workers | 4 |
| Warehouse worker | 3 |
| Telecommunications technician | 3 |
| Garbage Collectors | 3 |
| Maintenance worker/janitor | 3 |
| Construction workers | 3 |
| Machine operators | 2 |
| Fork-lift operators | 2 |
| Mover | 2 |
| Production Line worker | 2 |
| Painter | 2 |
| Station Attendant/Baggage Agent | 2 |
| Engineer | 2 |
| Miscellaneous | 9 |

## OMPSQ Scores

With a possible range of scores of 0 - 211, the mean OMPSQ score at intake was 95.3 (SD 26.0) and at two weeks was 78.3 (SD 26.1). OMPSQ scores for Time 1 were compared to Time 2 for difference using Related Samples Wilcoxon Signed Rank Test. This test of difference is used for non-parametric data and is a repeated measurement on a single sample. This test showed a statistically significant difference ($p < 0.0001$) between the two scores from Time 1 (at entry into treatment) and Time 2 (after two weeks of treatment).

ROC curve analysis performed for OMPSQ scores at Time 1 determined a cut-off score of 99 with sensitivity of 72% and specificity of 61%, to predict delayed return to work beyond 3 months (Table 6). The area under the curve was 0.69 using confidence intervals (CI) of 95%. The CI is the interval in which the true population (in this case those with delayed recovery) is captured within 95% confidence of the area under the curve (Figure 1). This area of 0.69 would be classified as a "less accurate prediction" according to Greiner et al (2000).[11] OMPSQ scores for Time 2 were also examined by ROC curve analysis. The results found a cut-off score of 93 providing the optimal sensitivity of 78% and specificity of 78% for this population (Table 7). The area under the curve was determined at 0.81 (CI 95%) and this would be considered "moderately accurate"[11] in predicting delayed returned to work in this population (Figure 2)..

**Table 6. Example of the effect of different cut-off scores on the prediction of delay recovery (>90 days) OMPSQ Time 1.**

| Cut-off score | Sensitivity (%) | Specificity % |
|---|---|---|
| 91.50 | 83.3 | 47.0 |
| 92.50 | 83.3 | 49.3 |
| 93.50 | 83.3 | 51.5 |
| 94.50 | 83.0 | 52.2 |
| 95.50 | 83.3 | 54.5 |
| 96.50 | 72.2 | 58.2 |
| 97.50 | 72.2 | 59.7 |
| 98.50 | 72.2 | 61.2 |
| 99.50 | 66.7 | 61.9 |
| 100.50 | 66.7 | 63.4 |
| 101.50 | 61.1 | 63.4 |
| 102.50 | 55.6 | 63.4 |
| 103.50 | 50.0 | 64.2 |

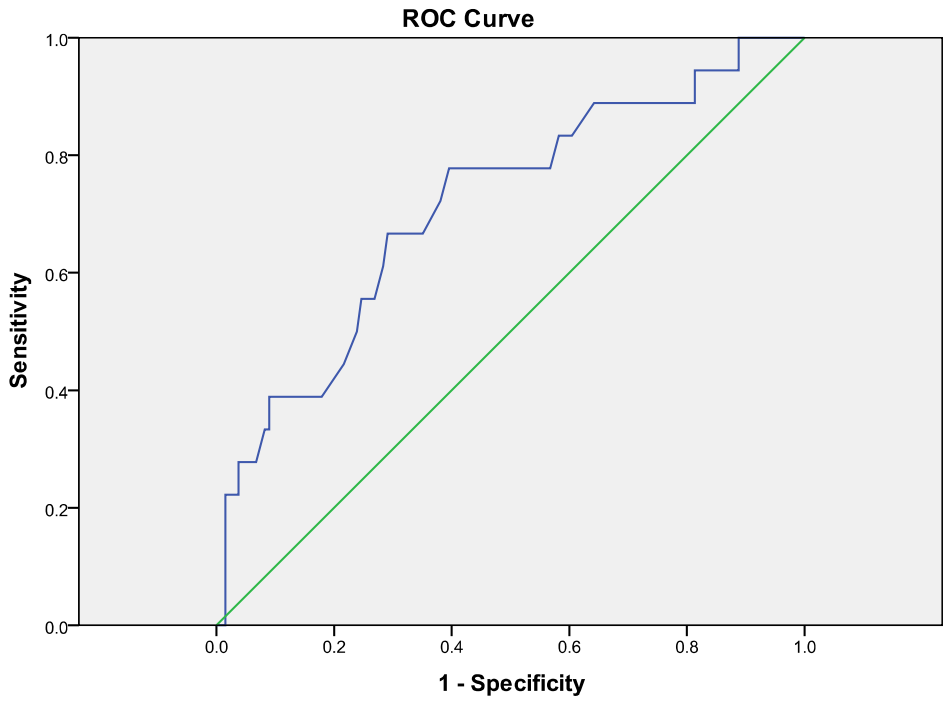


**Figure 1. ROC curve OMPSQ score Time 1. Cut-off score 99, Sensitivity 72%, Specificity 61% (CI 95%) to predict delayed return to work beyond 3 months**

**Table 7. Example of the effect of different cut-off scores on the prediction of delay recovery (>90 days) OMPSQ Time 2.**

| Cut-off score | Sensitivity (%) | Specificity (%) |
|---|---|---|
| 88.50 | 77.8 | 70.9 |
| 89.50 | 77.8 | 74.6 |
| 90.50 | 77.8 | 75.4 |
| 91.50 | 77.8 | 76.1 |
| 92.50 | 77.8 | 77.6 |
| 93.50 | 72.2 | 77.6 |
| 94.50 | 66.7 | 78.4 |
| 95.50 | 66.7 | 79.1 |
| 96.50 | 66.7 | 80.6 |
| 97.50 | 66.7 | 81.3 |
| 98.50 | 61.1 | 85.8 |
| 99.50 | 61.1 | 86.6 |

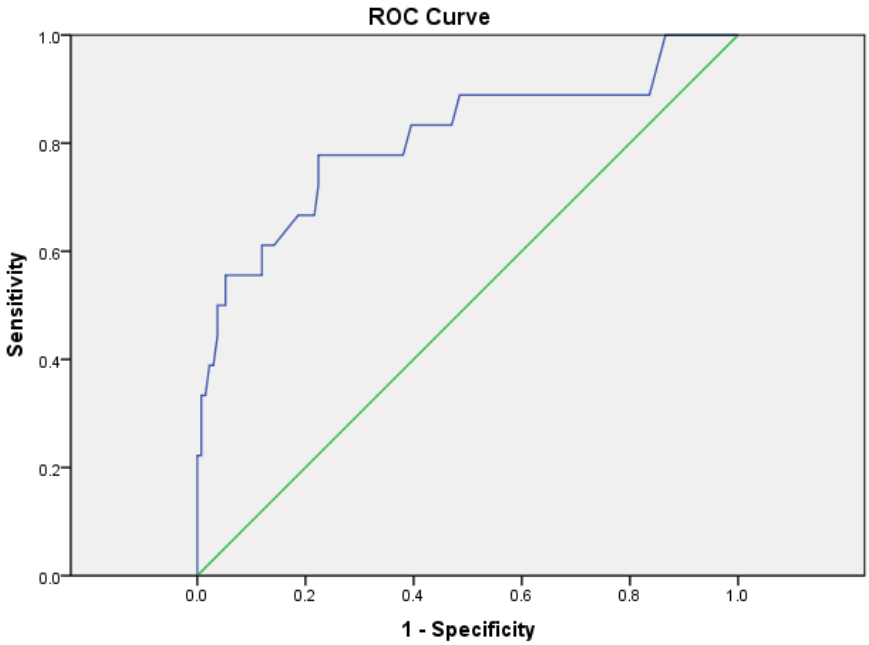


**Figure 2. ROC curve OMPSQ score Time 2. Cut-off score 93, Sensitivity 78%, Specificity 78% (CI 95%) to predict delayed return to work beyond 3 months**

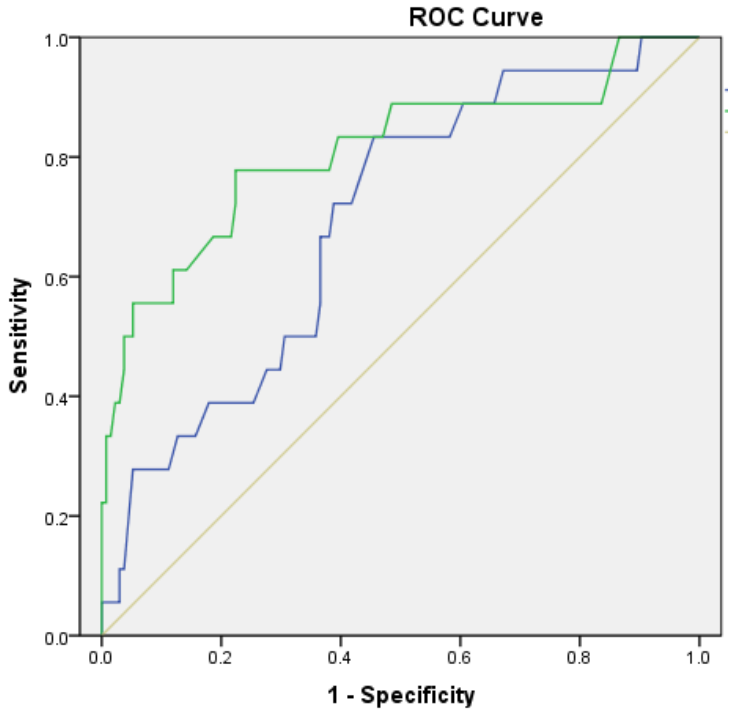


**Figure 3. ROC curves superimposed (area under the curve 0.69 for Time 1 vs. 0.81 for Time 2 (CI 95%)**

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# APPENDIX A

**Initial Assessment**
**Form B**

| WCB Claim Number: |
|---|
| Health Card Number: |

Date of Assessment: _____

**Worker Information**

| Worker's Last Name | First Name | Initial | Date of Birth (dd/mm/yyyy) |
|---|---|---|---|
| Date of Injury (dd/mm/yyyy): | Is the worker working? Yes ☐ No ☐ If yes, describe: transitional duties ☐ preinjury work ☐ | | |

**Employer Information** (to be completed by health care provider)

| Employer Name | Employer Contact Name | Employer contacted? Yes ☐ No Response ☐ |
|---|---|---|
| Worker's Job Title/Occupation | Job task information available? Yes ☐ No ☐ | Transitional duties available? Yes ☐ No ☐ |

**Injury Assessment Information** (to be completed by health care provider; attach additional page if necessary)

| MDA Diagnosis (specify body part): | | |
|---|---|---|
| Date of Referral (dd/mm/yyyy): | DDG Date (dd/mm/yyyy): | |
| Significant Objective: | Significant Subjective: | |
| Physical Abilities Report? Yes ☐ No ☐ | If no, why? | |
| Functional Abilities: | | |
| Are there flags that influence duration? Yes ☐ No ☐ | Orebro questionnaire score: | Expected RTW Date (dd/mm/yyyy) Transitional ☐ Pre-Injury ☐ |

**Job Match Summary**
(to be completed by health care provider; see over for definitions – complete if Physical Abilities Report *not* attached)

| | | | | | | |
|---|---|---|---|---|---|---|
| Describe preinjury job requirements: | Sedentary ☐ | Light ☐ | Medium ☐ | Heavy ☐ | Very Heavy ☐ | |
| Describe present work capability: | Sedentary ☐ | Light ☐ | Medium ☐ | Heavy ☐ | Very Heavy ☐ | N/a ☐ |
| **Describe transitional duties:** | **Sedentary ☐** | **Light ☐** | **Medium ☐** | **Heavy ☐** | **Very Heavy ☐** | |

**Recommended Treatment Plan** (to be completed by health care provider)

| Goals | Methodology | Recommended Time Frame (specific dates) |
|---|---|---|
| | . | From To |
| | | From To |
| | | From To |

**Health Care Provider Information** (to be completed by health care provider; please print)

| Name of Clinic: | | ID#: |
|---|---|---|
| Name of Practitioner: | *Phone:* | Fax: |

**WCB Response** (to be completed by WCB Case Worker)

| Yes – for treatment from to | | Screen 119 updated Yes ☐ Initials: |
|---|---|---|
| No – Reason: | | |
| WCB Case Worker (print): | Phone: | Date (dd/mm/yyyy): |

12/2008

**APPENDIX B**

## Work Capabilities — Definitions*

**Transitional Duties**

- A temporary change in or adaptation of the pre-injury work or schedule, based on the worker's capabilities.

**Suitable Work**

- A different job with duties within the worker's capabilities.

**Work Classifications**

The following are five work classifications used to describe the amount of physical effort required to perform a task or job. These classifications are referred to on various WCB forms, and are used by health care providers and the WCB to assist with planning treatments and return-to-work initiatives.

**SEDENTARY Work**

- Exerting up to 4.4 kg (10 lbs) of force occasionally and/or a negligible amount of force frequently.
  Example: An occupation where the worker sits most of the time, and only walks or stands for brief periods.

**LIGHT Work**

- Exerting up to 8.9 kg (20 lbs) of force occasionally and/or up to 4.4 kg (10 lbs) frequently and/or negligible amounts constantly.
  Example: Walking or standing to a significant degree, or sitting constantly but with arm and/or leg controls with exertion of force greater than sedentary.

**MEDIUM Work**

- Exerting up to 22.2 kg (50 lbs) of force occasionally and/or up to 8.9 kg (20 lbs) of force frequently and/or up to 4.4 kg (10 lbs) constantly.

**HEAVY Work**

- Exerting up to 44.4 kg (100 lbs) of force occasionally and/or up to 22.2 kg (50 lbs) of force frequently and/or up to 8.9 kg (20 lbs) of force constantly.

**VERY HEAVY Work**

- Exerting in excess of 44.4 kg (100 lbs) of force occasionally and/or in excess of 22.2 kg (50 lbs) of force frequently and/or up to 8.9 kg (20 lbs) of force constantly.

**Comparison of Ability Levels**

The National Institute of Occupational Safety and Health (NIOSH) set standards for evaluation of Physical Demand Capacity. These are used in both the Canadian National Occupational Classification system (NOC) and the American Directory of Occupational Titles (DOT).

**Frequent Weight**

A worker's demonstrated tolerance for **frequent weight (F)** is recognized as the weight at which they first report a change or increase in symptoms or the first pain behavior. It is estimated that the worker can safely handle this weight for up to 66% of their workday tolerance.

**Occasional Weight**

A worker's demonstrated tolerance for **occasional weight (O)** is recognized as the maximum weight they are able to lift, carry, or push/pull. It is estimated that the worker can safely handle this weight for up to 33% of their workday tolerance.

(*Adapted from The Medical Disability Advisor, Presley Reed, M.D., LRP Publications; and from the National Occupation Classification)

**Appendix C**

## Physical Abilities Report
## Form E

| WCB Claim Number: |
|---|
| Health Card Number: |

Initial Assessment:
Orebro Score:

Worker's Name: _____ Area of Injury: _____

Employer's Name: _____

Employer Contact Name: _____ Phone: _____

This report gives employers and injured workers the health care provider's opinion as to the type and degree of job activity the worker is safely able to perform after an injury has occurred. This form will assist the employer in placing the worker in transitional job tasks suited to their physical capabilities until they are able to return to their regular duties. **Medical Research indicates that an early and safe return to work speeds recovery.**

**Physical Abilities Assessment – To be completed by the health care provider**

**The worker is capable of returning to:** ☐ **Regular Duties** or ☐ **Transitional Duties**

**OR** ☐ **The worker is not capable of returning to work**

**Comparison of Ability Levels** *** Indicates that although a value may exist, it was not evidenced during the assessment
**F** = Frequent **O** = Occasional (see reverse side of form for details)

| **Ability** | **Weights:** ☒ **pounds** ☐ **kilograms** (dd/mm/yyyy) | | (dd/mm/yyyy) | | (dd/mm/yyyy) | | (dd/mm/yyyy) | | **Job Demands** As reported by: ☐ Worker ☐ Employer ☐ Other |
|---|---|---|---|---|---|---|---|---|---|
| **Lifting** | | | | | F | O | F | O | |
| Above Shoulder | | | | | | | | | |
| Horizontal | | | | | | | | | |
| Floor/Waist | | | | | | | | | |
| **Carrying** | | | | | | | | | |
| Right Hand | | | | | | | | | |
| Left Hand | | | | | | | | | |
| Both Hands | | | | | | | | | |
| **Pushing** | | | | | | | | | |
| **Pulling** | | | | | | | | | |
| **Grip Strength** | | | | | | | | | |
| **Tolerance** (length of time based on client report during the assessment) | | | | | | | | | |
| Standing | | | | | | | | | |
| Sitting | | | | | | | | | |
| Walking | | | | | | | | | |
| **Other Job Task:** | | | | | | | | | |

**Health Care Provider's Signature:** _____ **Phone:** _____

**Health Care Provider's Name (please print):** _____ **ID #:** _____

**Name of Clinic:** _____

**Initial Assessment Date:** (dd/mm/yyyy) _____ **Updated Assessment Date(s):** (dd/mm/yyyy) _____

**APPENDIX D**

## Discharge Report Form D

| WCB Claim Number: |
|---|
| Health Card Number: |

Date of final visit: _____

### Worker Information

| Worker's Last Name | First Name | Initial | Date of Birth (dd/mm/yyyy) |
|---|---|---|---|
| | | | |

| Date of Injury (dd/mm/yyyy): | Total Number of Treatments: |
|---|---|

### Injury Assessment Information (to be completed by health care provider)

MDA Diagnosis (specify body part):

Functional Update (Physical Abilities Report attached): _____

_____

### Job Match Summary

(to be completed by health care provider; see over for definitions)

| | | | | | | |
|---|---|---|---|---|---|---|
| Describe preinjury job requirements: | Sedentary ☐ | Light ☐ | Medium ☐ | Heavy ☐ | Very Heavy ☐ | |
| Describe present work capability: | Sedentary ☐ | Light ☐ | Medium ☐ | Heavy ☐ | Very Heavy ☐ | N/a ☐ |
| **Describe transitional duties:** | **Sedentary ☐** | **Light ☐** | **Medium ☐** | **Heavy ☐** | **Very Heavy ☐** | |

### Return to Work Outcome (to be completed by health care provider)

Return to Work Dates

Date of return to transitional duties: _____

Date of return to full duties: _____

Final Return to Work Outcome

- ☐ No time lost
- ☐ Return to preinjury work
- ☐ Return to suitable work (any work other than preinjury)
- ☐ Did not return to work (state reason below)

Comments: _____

_____

_____

_____

_____

### Health Care Provider Information (to be completed by health care provider; please print)

| Name of Clinic: | Phone: | ID#: |
|---|---|---|
| Name of Practitioner: | | |

## APPENDIX E

***DATA ABSTRACTION FORM (OREBRO QUESTIONNAIRE STUDY)*** Subject #_____

**FORM B #1**

**Worker Information**

| Date of first assessment | Gender (M 1, F2) | Age | Date of Injury | Working? (Y 1, N 2) | If Working, are they Transitional OR Preinjury? |
|---|---|---|---|---|---|
| | | | | | |

Not Working = 0 Trans =1, Pre-Injury =2

**Employer Information**

| Occupation | Transitional duties available? (Y 1, N 2) |
|---|---|
| | |

**Injury Assessment Information**

Site of Primary Injury: Low Back =1, Neck=2, Shoulder=3, U/E=4 L/E=5, Thoracic spine= 6, Other = 7

| Diagnosis | # Of pain sites | Site of primary injury | Pain intensity/10 (99 = not rated) | OMPQ score (time 1) | Date of Orebro (time 1) |
|---|---|---|---|---|---|
| | | | | | |

**Job Match Summary**

| Pre-injury Job Requirements | Present work capability |
|---|---|
| | |

Workload: S=1, L=2, M=3, H=4, VH=5

**Form C #2**

| OMPQ score (time 2) | Date of Orebro (time 2) |
|---|---|
| | |

**Form D**

| Date return (to full hours, full duties) | Secondary Services? | Chiro = 1, PT 2 |
|---|---|---|
| | | |

# External Validation of the Orebro Musculoskeletal Pain Screening Questionnaire within an Injured Worker Population: A Retrospective Cohort Study

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## Chapter 3. Discussion

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**Discussion**

This study determined that the OMPSQ is moderately predictive of failure to achieve timely return to work (RTW) in a population of injured workers with acute musculoskeletal soft tissue injuries, when assessed two-weeks after treatment is initiated, and less predictive at the initial intake into treatment. Delayed RTW was defined as those workers who had not returned to their pre-injury job full time by 90 days, due to reduced functional ability as it related to their pre-injury occupation.

The two time points were available for study and interesting to examine, because the Nova Scotia WCB RTW model of care and case management process, requires that an OMPSQ be completed by workers once every two weeks. Although the questionnaire was not originally intended to be administered to evaluate response to treatment, it has been collected in the manner described since 2006. Since that time, clinical decisions regarding streaming patients into augmented services (Tier 2 or Tier 3) have been supported by noting the most current OMPSQ score. Examining whether the tool, when used at baseline, is a better predictor of return to work than when it is used two weeks after treatment is useful to know. If the tool has better prediction (i.e. fewer false positives) regarding delayed recovery when used after two weeks of therapy, then using it this way may optimize the use of resources by augmenting health services to those who are at risk of developing chronic conditions.

Our study found that for the 152 workers examined, the OMPSQ score changed significantly between Time 1 (at intake) and Time 2 (after 2 weeks of treatment). Scores at Time 2 also had better predictive ability than at Time 1 (intake into treatment). Since the two-week OMPSQ score was better able to predict failure to achieve timely RTW, it might be better to use this time point to make preliminary treatment or case management decisions. Further, since the baseline assessment was only weakly predictive, clinicians should

be cautioned against making firm conclusions about potential delays in return to work at the baseline assessment. This change in scores is interesting, as the questionnaire has traditionally been deemed as having acceptable temporal stability over a week period. [1]. Our study identifies that beyond a week and with associated treatment, the scores for this population reduce. The higher scores at intake may be explained by the "acute" nature of the injury itself, or perhaps by heightened anxiety about the potential outcome and recommendations related to the initial assessment, elevating the workers distress about their injury. These factors may have elevated the workers' concerns regarding their injury, and subsequently had an impact on the OMPSQ score. Over the two week period, symptoms settle down and the physical aspects of tissue healing and repair begin to take place. In addition, reassurance is typically provided by the healthcare provider. Psychosocial factors that influence the domains of pain, perceived function, fear-avoidance and anxiety may decrease as the worker re-initiates work and as their symptoms resolve. The decrease in the scores may be explained by this phenomenon.

Although the stability or the "test-retest score" of this instrument was not examined within this study, the results of our study suggest that further work to assess the stability of the OMPSQ may be needed. Such analysis is typically termed test-retest reliability and is assessed to measure the stability of measures administered at different times to the same individual.[2] Review of the literature on the OMPSQ, found that few of the studies examined test-retest reliability for individual populations. Many studies reference the early test-retest reliability study of Linton and Hallden in 1998 when they performed a pilot study of 27 acute or subacute back or neck pain patients with a test-retest interval of 1 week and demonstrated an acceptable association of 0.83 using Pearson Product Moment Correlations between the two scores.[1] Since Pearson Product Moment correlation assesses only the relationship between measures, not their consistency, we have little confidence in the stability of the OMPQS measures. The findings of this study suggest that patients are

not stable over a two-week interval and so a shorter test- retest might be needed in future reliability studies to assure a stable condition.

Since the Linton and Hallden study few others have addressed test-retest reliability of the OMPSQ apart from Vos et al. (2009). [3] Vos' study examined the OMPSQ within a sample of acute neck pain patients. They included a baseline questionnaire that captured the patients' neck pain severity on an 11 point numeric pain scale. One week later, half the study population was sent the OMPSQ again, including a seven point global rating of change scale that assessed degree of recovery. Of the 96 study participants who responded, 42 were classified as "improved" (close to half), 44 were "stable" and 3 "deteriorated". High reliability was demonstrated in the stable group (ICC= 0.85). For the 42 that had improved, the average OMPSQ scores had decreased from 63.5(SD 24.5) to 55.6(SD 27.0). Our study demonstrated a similar decrease in OMPSQ scores over a two-week time frame. Vos and colleagues (2009) did not comment on the potential impact of the change scores in the improved group on the predictive ability of the scale.

Given that, there has been insufficient examination of the short-term stability of the OMPSQ in stable patients, it is difficult to determine the extent to which score stability contributes to variations in predictive ability reported across different studies or disorders. Ideally, a single optimal cut-off score could be established that would be used across all clinical populations. However, it is also possible that the optimal score might demonstrate some variation between clinical populations or at different time points and recovery. Studies might also vary on how their outcome was defined which would also contribute to differences in cut-off scores. It would be important to establish which of these factors contribute to variations between studies reporting different scores. This may only become clear as a sufficient number of studies address the discriminative ability of the OMPSQ across different contexts and may ultimately require meta-analysis.

Meta-analysis with a sufficiently large number of studies with adequate sample sizes would inform our understanding of the importance of different subgroups including acuity of the condition, the type of disorder, compensated versus non-compensated injury, and the effect of definition and timing of outcomes. Given that there is a limited number of studies, at the current time, we are were uncertain whether differences in cut-offs between studies is related to these factors or simply represents random sampling error.

The ROC curve approach is designed to identify an optimal cut-off score. However, risk exists on a spectrum. Some of the variation across studies may reflect that there is a risk zone rather than a single optimal cut-off score. An approach that might be undertaken is to evaluate relative risk at different score intervals. Perhaps an approach that defines a range of scores for low, moderate, high, and very high risk of failure to achieve timely return to work. This would be more useful in making decisions and potentially more stable across conditions.

When the OMPSQ was used to predict on going problems (defined as sick leave and perceived health) in a population of 158 patients from a primary health care setting, a cut-off score of 117 was established as optimal.[5] This is somewhat higher than other studies which have tended to report a cut-off within the range of 105-112.[4,6] The authors attributed this to the chronic nature of their population since 70% of their study population had pain for greater than 6 months. These authors further support that the tool's predictive ability may indeed be predicated on the time or duration from inception of injury or pain to the time it is administered. However, this study looked at longer term follow-up of 3 years. Interestingly, our study showed a lower score as more predictive of delayed recovery beyond 3 months in an acute population. Again, this may be more specific to this particular population, highlighting the instruments population dependent specificity.

As discussed, there are potentially multiple factors that may contribute to the variation in cut-off scores across different studies. Although our study suggests that acuity may play a factor in how the questionnaire performs, there are a spectrum of factors that could contribute to differences between samples. Most notably various studies have do not consistently defined delayed recovery in the same manner. The outcomes that are used to set the cut-off scores include self-report functional disability, persisting pain, sick leave and global recovery. As Hockings et al (2008) note, these are defined differently within the various studies.[4] This difference may play a significant role in the variability of cut-off scores noted across studies.

**Strengths of this research study**

Strengths of this study relate to the consistency of the data collection, the fact that the OMPSQ was collected at to standardize time points and the fact that all of our participants were managed under a single compensation system. Data was processed, actively entered and quality checked. The fact that data was routinely sent to the funder in compliance with contractual obligations explains the high rate of completeness and accuracy of the data. The fact that the data included all participants, and that clear eligibility criteria were established reduces the potential for sampling bias.

**Limitations**

There are a number of limitations it should be considered when interpreting or applying the findings of this study. The study was a retrospective cohort study using data collected for clinical purposes. Thus, the standards of consistent methods for performing procedures typically available in prospective cohort research studies may not have been attained.[7] Sprains and strains is a label for a spectrum of conditions, not a specific disorder or diagnosis. Last, there is no gold standard test that can be used to make the diagnosis. This

increases the potential for misclassification.[7] We attempted to reduce misclassification by use of a consistent process and definition of sprains and strains. In addition, there were many assumptions made about the data collected. A number of the variables were decisions determined by clinicians using multiple pieces of information and their own judgment. For example assumptions include, that the clinical judgment related to diagnosis was valid; the recommendation to return to work full hours and duties was appropriate and associated to the workers level of recovery; and that the OMPSQ was scored accurately. Variability in either reliability or validity of the variables would contribute to sampling error or potential biases. These variations could have an impact on the status of RTW, the main outcome measure examined within this study. While the use of experienced clinicians in a structured clinical environment, with structured assessment guidelines and reporting tools should have minimized these, the consistency or validity of these judgments was undetermined.

It is also important to consider that the results of this sample of convenience were not derived from a randomized sample. In our case our sample was workers in Nova Scotia with acute soft tissue injuries. This may limit the generalizability of the study outside of this WCB jurisdiction. Another limitation that should be considered is the variation in diagnoses included in our study population, that makes our group less homogenous with respect to expected clinical recovery durations and functional limitations. Injured workers with soft tissue disorders classified as a sprain or strain includes a broad spectrum of patients. Some studies have focused on low back pain while these comprised a percentage of our study population. While low back pain remained our most common disorder location, neck, shoulder and lower extremity were also substantial. The inclusion of a variety of conditions may add confounders that are not clearly identified within the results of the analysis. However, from a clinical perspective, the OMPSQ score is used with a variety of clinical conditions, and therefore the results reflect "real life" application. Other limitations

include the fact that the data were only collected from one clinic and only one researcher abstracted the data, leading to the potential for researcher bias.

Another methodological issue is the limitation of the sample size. Although there was a sample size of 152 workers, there were only 18 cases that demonstrated delayed recovery beyond 90 days (11%). This may have influenced the stability of our findings since discrimination was based on a small subgroup. Considering our sample size and the number of cases, we did not have sufficient numbers to evaluate whether the cut-off scores varied across different subgroups. Although the purpose of this study was to define a cut-off score for the OMPSQ, in a larger sample we might have been able to look at combined predictability of the OMPSQ and other influential covariates. In potentially important factors that are not captured within the tool, such as the "gap" at intake between the worker's pre-injury job demands and the worker's demonstrated abilities, and whether these factors could influence or enhance the tools ability to predict outcome might be used to enhance the accuracy of predicting failure to achieve timely return to work.

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Despite the limitations in this study , it provides useful information about an appropriate cut-off score and timing (two weeks after treatment ) for predicting failure to achieve timely RTW in patients being managed for injured worker compensation claims diagnosed as sprains and strains. Future research should focus on identifying the optimal cut-off of the OMPSQ and whether cut-off scores vary across disorder type or timing, outcome definitions and healthcare contexts. In addition, future studies of predicting failure to achieve timely return to work might consider the use of this questionnaire in combination with other potential predictors that capture concepts not contained within the OMPSQ. Ideally, studies should be conducted as prospective cohort designs with rigorous definition and collection procedures for predictors and outcomes.

**Implications practice and policy**

This study suggests that the OMPSQ score at two weeks into treatment should be considered a better predictor of failure to achieve timely return to work in a broad spectrum of sprains and strains being treated within a compensation system. The cut-off score defined is 93 and is only moderately predictive. Therefore the overall decision about the risk of failing to achieve timely return to work should be made using this questionnaire as only one component of the decision-making process. Given that this analysis of data collection for administrative and clinical purposes was valuable in defining cut-offs , further consideration should be given to implementing standardized data collection that involves intermittent analysis of the potential for predicting important outcomes. This may be brought forward as a consistent policy used by decision-makers within the healthcare system or funding agencies to better inform their management of claims, healthcare services and outcomes. Funders should provide mechanisms for this analysis to be completed independently from the funder and published in peer review to increase the credibility and application of the findings.

**Recommendations for future research**

This study demonstrates that there is variability in cut-off scores across studies. Future research should attempt to define cut-off scores as they relate to the population , outcome, condition and time-frame of interest . As discussed perhaps having a continuum of "risk" may be more appropriate to better gage those at different levels of risk, in order to inform decision makers, by providing a more valid prediction of risk.

In addition, future studies should move beyond external validation of the tool and examine the OMPSQ's test-retest reliability in acute populations, to further examine the stability of the tool in this population. Additional research should also focus on the clinical impact and usefulness of the tool as it relates to recovery rates, time-loss days and cost-benefits.

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